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Nuclear Management Company, LLC
Prairie Island Nuclear Generating Plant
1717 Wakonade Dr. East • Welch MN 55089

May 15, 2002

Prairie Island Technical
Specification TS 6.6.C

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

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Docket Nos. 50-282 License Nos. DPR-42
50-306 DPR-60

Annual Radioactive Effluent and Waste Disposal
Report for January through December 2001

In accordance with the Prairie Island Technical Specifications, we are submitting one copy of the Radioactive Effluent and Waste Disposal Report covering 2001.

The documents included are as follows:

Off-Site Radiation Dose Assessment, covering January 2001 through December 2001.

Revision 0 of the Annual Radioactive Effluent Report, Supplemental Information, covering 1/1/00 through 1/6/02.

Effluent and Waste Disposal Annual Report Solid Waste and Irradiated Fuel Shipments, covering 1/1/00 through 12/31/00.

Summary of Changes to the Offsite Dose Calculation Manual and Revision 16 of the Offsite Dose Calculation Manual (ODCM).

In this letter we have made no new Nuclear Regulatory Commission commitments.

IE48
A009

Please contact Jack Leveille (651-388-1121, Ext. 4142) if you have any questions related to this letter.

Mano K. Nazar
Site Vice President
Prairie Island Nuclear Generating Plant

c: Regional Administrator - Region III, NRC
Senior Resident Inspector, NRC
NRR Project Manager, NRC
State of Minnesota
Attn: Tim Donakowski

Attachments:

1. Prairie Island Nuclear Generating Plant, Off-Site Radioactive Dose Assessment
2. Annual Radioactive Effluent Report
3. Effluent and Waste Disposal Annual Report Solid Waste and Irradiated Fuel Shipments
4. Summary of Changes to the Offsite Dose Calculation Manual and Revision 16 of the Offsite Dose Calculation Manual

Attachment 1

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Nuclear Management Company. LLC

OFF-SITE RADIATION DOSE ASSESSMENT

January through December 2001

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PRAIRIE ISLAND NUCLEAR GENERATING PLANT OFF-SITE RADIATION DOSE ASSESSMENT FOR

January through December 2001

An Assessment of the radiation dose due to releases from Prairie Island Nuclear Generating Plant during 2001 was performed in accordance with the Offsite Dose Calculations Manual as required by Technical Specifications. Computed doses were well below the 40 CFR Part 190 Standards and 10 CFR Part 50 Appendix I Guidelines.

Off-site dose calculation formulas and meteorological data from the Off-site Dose Calculation Manual were used in making this assessment. Source terms were obtained from the Annual Radioactive Effluent and Waste Disposal Report prepared for NRC review for the year of 2001.

Off-site Doses from Gaseous Release

Computed doses due to gaseous releases are reported in Table 1. Critical receptor location and pathways for organ doses are reported in Table 2. Doses are a small percentage of Appendix I Guidelines.

Off-site Doses from Liquid Release

Computed doses due to liquid releases are reported in Table 1. Critical receptor information is reported in Table 2. Doses, both whole body and organ, are a small percentage of Appendix I Guidelines.

Doses to Individuals Due to Activities Inside the Site Boundary

Occasionally sportsmen enter the Prairie Island site for recreational activities. These individuals are not expected to spend more than a few hours per year within the site boundary. Commercial and recreational river traffic exists through this area.

For purposes of estimating the dose due to recreational and river water transportation activities within the site boundary, it is assumed that the limiting dose within the site boundary would be received by an individual who spends a total of seven days per year on the river just off shore from the plant buildings (ESE at 0.2 miles). The gamma dose from noble gas releases and the whole body and organ doses from the inhalation pathway due to Iodine 131, Iodine-133, tritium and long-lived particulates were calculated for this location and occupancy time. These doses were reported in Table 1.

Doses to Individuals Due to Effluent Releases from the ISFSI

Two fuel casks were loaded and placed in the storage facility during the 2001 calendar year. The total number of casks in the ISFSI is fourteen. There has been no release of radioactive effluents from the ISFSI.

CURRENT ODCM REVISION

The Offsite Dose Calculations Manual was revised this year. The current revision is 16. The revision date is August 7, 2001. A copy is included with this report.

AIRBORNE ABNORMAL RELEASE

There were no abnormal airborne releases for the year 2001.

Radiation Effluent Monitoring Sampling Deviation

On July 15, 2001, 122 CVCS Monitor Tank was recirculating through an ion exchanger for clean up. It was last sampled at 08:30. The tank was removed from the ion exchanger and placed on recirculation, for sample, at 1430. Required recirculation time to obtain a representative sample is 3 hours. The tank should not have been sampled for release prior to 17:30. The tank was released at 15:56 based on the results of the 0830 sample taken while the tank was on recirculation through the ion exchanger.

Cause: 122 CVCS Monitor Tank had been placed on recirculation, through the ion exchanger, for further processing. The Rad Waste engineer requested the Chemistry Group sample the tank. His intent was to monitor the processing of the tank. The chemistry technician interpreted this direction as a request to sample the tank for release.

The intent of recirculation, prior to sampling for release, is to place a waste tank on recirculation, while not being processed through an ion exchanger. Processing through an ion exchanger may contribute or remove activity. The tank should have been placed on recirculation without an ion exchanger in line for the purpose of obtaining a representative sample.

The cause of this event was poor communication by the Rad Waste Engineer and lack of a questioning attitude by the chemistry technician.

Corrective Actions: The event was documented and assessed by Chemistry Management through the Condition Reporting System, Condition Report number 20015745.

The event was presented to all members of the chemistry group.

The importance of providing complete and specific instructions to both operations and chemistry group members was emphasized to the Radioactive Waste Engineer.

The Liquid Waste Tank Release procedures have been revised to specify that recirculation for sampling is to be completed with the tank recirculating to itself and not through an ion exchanger or filter.

Significance: When the event was discovered, a sample was taken from the water left in the bottom of the tank. This sample was analyzed and results were compared to results of the 08:30 sample upon which the release was based. The results indicated that the 08:30 sample was representative of the release. The additional results were attached to the release file paperwork. The actual release activity was the same as the release activity upon which permission to release the tank was based and did not impose upon the health and safety of the public.

Incorrect Efficiencies Generate Incorrect Tritium Values

Ventilation stack tritium samples are collected continuously by silica gel. The silica gel is changed monthly and analysis is by liquid scintillation on the Beckman LS5801. Data review indicated that the silica gel tritium program efficiency had change by a factor of seven to eight. This change had gone unnoticed for the months of May through October. Operation of the Beckman LS5801 and validity of the silica gel tritium results were investigated.

Analysis of silica gel is only performed once per month. The last documented calibration of the Beckman LS5801 stored a typical efficiency value. It was determined that some time between the May 6th silica gel samples and the June 2nd samples, the stored efficiency was changed to an incorrect value.

Cause: The event could not be traced to calibrations performed or a vendor visit. The Beckman LS5801 has two stored programs, one for tritium analysis of a water sample and one for silica gel samples. Data comparison between the water analysis program and the silica gel analysis program indicates that data was entered improperly during an attempt to perform a semi annual tritium in water analysis calibration. The tritium in water calibration data was applied to the silica gel program.

Corrective Actions: The event was documented and assessed by Chemistry Management through the Condition Reporting System, Condition Report number 200185078.

A new calibration curve was generated for the silica gel analysis program.

The airborne tritium values for the period of May through October were recalculated. Dose calculations and Rad Monitor Setpoints for the period were also recalculated.

The event was reviewed with chemistry personnel.

A standard will now be run with each silica gel analysis sample set, and reviewed by chemistry management to aid in flagging this type of event, as promptly as possible.

Significance: The silica gel analysis data for May to October was recalculated, based on a correct efficiency value. All release files for this period were revised appropriately. It was determined that the numbers generated were well within historical values and did not impose upon the health and safety of the public.

Discharge Piping Volume Discrepency Between the ODCM and Liquid Waste Tank Release Procedures

Several years ago the liquid discharge piping was extended the length of the discharge canal. Should the discharge of a Radioactive Waste Tank be of sufficient activity, the allowable release rate could be limited, to preclude exceeding Maximum Permissible Concentration (MPC). Due to the large volume of the discharge piping the higher activity tank water could remain in the discharge piping. Subsequent releases could potentially push the original, higher activity water out of the discharge piping at a rate, which could exceed the allowable discharge rate and exceed MPCs.

Procedural controls were written into the ODCM and the specific Radioactive Waste Tank release procedures, to flush the volume of the discharge piping, following the release of a higher activity tank, which could conceivably cause the situation described. The flush volume is based on calculations of the volume of the discharge piping performed at the time the discharge piping was installed.

The volume stated in the ODCM did not agree with the volume stated in the various Radioactive Waste Tank release procedures. The ODCM stated a number of 15,500 gallons and the Radioactive Waste Tank release procedures state a volume of 15,000 gallons.

There existed an apparent potential for an insufficient flush to create a situation in which MPC limits could have been exceeded.

Cause: The cause was determined to be a typographical error on the Radioactive Waste Tank procedures, which went undetected.

Corrective Actions: The event was documented and assessed by Chemistry Management, through the Condition Reporting System, Condition Report number 20014698.

Calculations were performed to verify the discharge piping volume. It was determined that the number of 15,500 gallons would remain in the ODCM. It was determined that the Radioactive Waste Tank procedures would be revised to use a conservative number of 17,000 gallons.

Procedural controls, requiring flushing, were implemented in 1991. An assessment of all waste tank releases since 1991 was performed. It was determined that there was no instance of insufficient flush which could have potentially caused the exceeding of MPC limits.

Significance: The assessment of Radioactive Waste Tank releases concluded that there was no instance in which MPC limits were exceeded. This event did not impose upon the health and safety of the public.

Unmonitored Release Path Identified

In the early 1980s' the Unit 1 and Unit 2 Air Ejector Exhaust was redirected from discharge directly to the environment to the Auxiliary Building Normal Ventilation System, via galvanized exhaust ductwork. The ductwork included a number of exhaust duct drains, located at low points, to prevent condensed moisture from entering the Auxiliary Building Ventilation System.

Various Turbine Building drains are directed to the Turbine Building Sump. The Turbine Building Sump is a monitored release path. In 2001, it was identified that the Unit 1 Air Ejector Exhaust duct drain effluent entered the DI water supply head tank overflow funnel, which directed it to the cooling water header. This is an unmonitored release path.

Cause: It is believed that the original modification directed the drain effluent to the Turbine Building Sump. This is borne out by the fact that the Unit 2 Air Ejector Exhaust duct drain, which was modified at the same time as Unit 1, is directed to the Turbine Building Sump. At some undetermined time, the piping was changed in association with a change to the DI water supply head tank overflow drain.

This was due to a lack of understanding, on the part of the parties performing this change.

Corrective Actions: This event was documented and assessed by Chemistry Management through the Condition Reporting System, Condition Report number 200187224.

This event was reviewed with chemistry personnel.

The drain effluent was redirected and is now being collected.

An evaluation of the impact of this event determined the following:

There were no significant Primary to Secondary leaks during this period.

No water has collected over the first 3 months of collection.

There has always been radiation monitors, continuously monitoring Air Ejector Discharge prior to entering the exhaust ductwork.

The most significant release monitored by the Air Ejector Radiation Monitor would have been insignificant compared to any detectable release in normal ventilation.

Isotopes, present in the condensed Air Ejector Exhaust, would predominately be radiogases. Radiogas isotopes in liquid releases do not contribute to offsite dose.

Significance: It is concluded that this event did not impose upon the health and safety of the public.

Table 1

OFF-SITE RADIATION DOSE ASSESSMENT - PRAIRIE ISLAND

PERIOD: JANUARY through DECEMBER 2001

		10 CFR Part 50 Appendix I Guidelines for a 2-unit site per year
Gaseous Releases		
Maximum Site Boundry Gamma Air Dose (mrad)	1.46E-02	20
Maximum Site Boundry Beta Air Dose (mrad)	1.16E-01	40
Maximum Off-site Dose to any organ (mrem)*	1.94E-01	30
Offshore Location		
Gamma Dose (mrad)	1.01E-03	
Total Body (mrem)*	5.14E-03	
Organ (mrad)*	5.94E-03	30
Liquid Releases		
Maximum Off-site Dose Total Body (mrem)	5.07E-03	6
Maximum Off-site Dose Organ - LIVER (mrem)	6.25E-03	20
Limiting Organ Dose Organ - TOTAL BODY (mrem)	5.07E-03	6

* Long-Lived Particulate, I-131, I-133 and Tritium

Table 2

OFF-SITE RADIATION DOSE ASSESSMENT - PRAIRIE ISLAND SUPPLEMENTAL INFORMATION

PERIOD: JANUARY through DECEMBER 2001

Gaseous Releases

Maximum Site Boundary
Dose Location
(From Building Vents)

Sector		WNW
Distance	(miles)	0.4

Offshore Location
Within Site Boundary

Sector		ESE
Distance	(miles)	0.2
Pathway		Inhalation

Maximum Off-site

Sector	SSE
Distance (miles)	0.6
Pathways	Plume, Ground, Inhalation, Vegetables
Age Group	Child

Liquid Releases

Maximum Off-site Dose
Location Downstream

Pathway	Fish

Attachment 2

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Nuclear Management Company, LLC

ANNUAL RADIOACTIVE EFFLUENT REPORT

January 1, 2001 through January 6, 2002
Supplemental Information

ANNUAL RADIOACTIVE EFFLUENT REPORT

01-JAN-01 THROUGH 06-JAN-02

SUPPLEMENTAL INFORMATION

Facility: Prairie Island Nuclear Generating Plant

Licensee: Northern States Power Company

License Numbers: DPR-42 & DPR-60

A. Regulatory Limits

1. **Liquid Effluents:**

   a. The dose or dose commitment to an individual from radioactive materials in liquid effluents released from the site shall be limited to:

for the quarter	3.0 mrem to the total body 10.0 mrem to any organ
for the year	6.0 mrem to the total body 20.0 mrem to any organ

2. **Gaseous Effluents:**

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

noble gases	≤ 500 mrem/year total body ≤3000 mrem/year skin
I-131, I-133, H-3, LLP	≤1500 mrem/year to any organ

   b. The dose due to radioactive gaseous effluents released from the site shall be limited to:

noble gases	≤10 mrad/quarter gamma ≤20 mrad/quarter beta ≤20 mrad/year gamma ≤40 mrad/year beta
I-131, I-133, H-3, LLP	≤15 mrem/quarter to any organ ≤30 mrem/year to any organ

B. **Maximum Permissible Concentration**

1. Fission and activation gases in gaseous releases:

   OLD 10 CFR 20, Appendix B, Table 2, Column 1

2. Iodine and particulates with half lives greater than 8 days in gaseous releases:

   OLD 10 CFR 20, Appendix B, Table 2, Column 1

3. Liquid effluents for radionuclides other than dissolved or entrained gases:

   OLD 10 CFR 20, Appendix B, Table 2, Column 2

4. Liquid effluent dissolved and entrained gases:

   2.0E-04 uCi/ml Total Activity

C. **Average Energy**

Not applicable to Prairie Island regulatory limits.

D. **Measurements and approximations of total activity**

1. Fission and activation gases in gaseous releases:	Total Nuclide	GeLi GeLi	±25%
2. Iodines in gaseous releases:	Total Nuclide	GeLi GeLi	±25%
3. Particulates in gaseous releases:	Total Nuclide	GeLi GeLi	±25%
4. Liquid effluents	Total Nuclide	GeLi GeLi	±25%

E. **Manual Revisions**

1. Offsite Dose Calculations Manual latest Revision number: 16

   Revision date : 4/7/01

1.0 BATCH RELEASES (LIQUID)

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
1.1 NUMBER OF BATCH RELEASES	8.10E+01	3.50E+01	4.70E+01	2.90E+01
1.2 TOTAL TIME PERIOD (HRS)	1.46E+02	6.18E+01	9.37E+01	5.37E+01
1.3 MAXIMUM TIME PERIOD (HRS)	3.20E+00	2.28E+00	3.68E+00	2.58E+00
1.4 AVERAGE TIME PERIOD (HRS)	1.81E+00	1.77E+00	1.99E+00	1.85E+00
1.5 MINIMUM TIME PERIOD (HRS)	3.17E-01	8.50E-01	1.50E+00	1.42E+00
1.6 AVERAGE MISSISSIPPI RIVER FLOW (CFS)	1.09E+04	8.28E+04	1.52E+04	1.15E+04

2.0 BATCH RELEASES (AIRBORNE)

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
2.1 NUMBER OF BATCH RELEASES	2.10E+01	2.50E+01	1.90E+01	8.00E+00
2.2 TOTAL TIME PERIOD (HRS)	2.93E+02	2.71E+02	1.73E+02	1.11E+02
2.3 MAXIMUM TIME PERIOD (HRS)	2.40E+01	2.40E+01	4.80E+01	2.41E+01
2.4 AVERAGE TIME PERIOD (HRS)	1.40E+01	1.08E+01	9.11E+00	1.39E+01
2.5 MINIMUM TIME PERIOD (HRS)	1.65E-01	1.67E-01	6.32E-01	2.12E+00

3.0 ABNORMAL RELEASES (LIQUID)

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
3.1 NUMBER OF BATCH RELEASES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.2 TOTAL ACTIVITY RELEASED (CI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3.3 TOTAL TRITIUM RELEASED (CI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00

4.0 ABNORMAL RELEASES (AIRBORNE)

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
4.1 NUMBER OF BATCH RELEASES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4.2 TOTAL ACTIVITY RELEASED (CI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1A

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
5.0 FISSION AND ACTIVATION GASES				
5.1 TOTAL RELEASE (CI)	3.65E+01	2.61E+00	1.70E+00	1.35E+00
5.2 AVERAGE RELEASE RATE (UCI/SEC)	4.64E+00	3.32E-01	2.17E-01	1.72E-01
5.3 GAMMA DOSE (MRAD)	1.42E-02	2.01E-04	1.25E-04	9.74E-05
5.4 BETA DOSE (MRAD)	6.94E-02	2.13E-02	1.39E-02	1.10E-02
5.5 PERCENT OF GAMMA TECH SPEC (%)	1.42E-01	2.01E-03	1.25E-03	9.74E-04
5.6 PERCENT OF BETA TECH SPEC (%)	3.47E-01	1.06E-01	6.94E-02	5.52E-02
6.0 IODINES				
6.1 TOTAL I-131 (CI)	6.18E-04	7.78E-07	0.00E+00	0.00E+00
6.2 AVERAGE RELEASE RATE (UCI/SEC)	7.87E-05	9.90E-08	0.00E+00	0.00E+00
7.0 PARTICULATES				
7.1 TOTAL RELEASE (CI)	3.82E-06	3.84E-06	7.27E-06	6.73E-06
7.2 AVERAGE RELEASE RATE (UCI/SEC)	4.85E-07	4.89E-07	9.25E-07	8.56E-07
8.0 TRITIUM				
8.1 TOTAL RELEASE (CI)	4.50E+00	1.93E+01	8.14E+00	5.84E+00
8.2 AVERAGE RELEASE RATE (UCI/SEC)	5.72E-01	2.46E+00	1.04E+00	7.44E-01
9.0 TOTAL IODINE, PARTICULATE AND TRITIUM (UCI/SEC)	5.72E-01	2.46E+00	1.04E+00	7.44E-01
10.0 DOSE FROM IODINE, LLP, AND TRITIUM (MREM)	4.84E-02	1.12E-01	1.62E-02	1.80E-02
11.0 PERCENT OF TECH SPEC (%)	3.23E-01	7.45E-01	1.08E-01	1.20E-01
12.0 GROSS ALPHA (CI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE 1C

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES (CI)

13.0 FISSION AND ACTIVATION GASES

		CONTINUOUS MODE				BATCH MODE			
NUCLIDE	UNITS	QTR: 01	QTR: 02	QTR: 03	QTR: 04	QTR: 01	QTR: 02	QTR: 03	QTR: 04
KR-85	CI	3.58E+00				2.65E+00	2.60E+00	1.70E+00	1.35E+00
XE-131M	CI	2.27E-01				4.70E-02			
XE-133	CI	2.76E+01				1.58E+00	9.26E-03	1.47E-03	
XE-133M	CI	3.64E-01				7.89E-03	1.68E-05	2.06E-05	
XE-135	CI	4.72E-01				1.39E-03			
TOTALS	CI	3.22E+01	0.00E+00	0.00E+00	0.00E+00	4.28E+00	2.61E+00	1.70E+00	1.35E+00

14.0 IODINES

		CONTINUOUS MODE				BATCH MODE			
NUCLIDE	UNITS	QTR: 01	QTR: 02	QTR: 03	QTR: 04	QTR: 01	QTR: 02	QTR: 03	QTR: 04
I-131	CI	6.18E-04	7.78E-07			3.87E-07			
I-133	CI	1.96E-05							
TOTALS	CI	6.37E-04	7.78E-07	0.00E+00	0.00E+00	3.87E-07	0.00E+00	0.00E+00	0.00E+00

TABLE 1C

GASEOUS EFFLUENTS - GROUND LEVEL RELEASES (CONTINUED)

15.0 **PARTICULATES**

NUCLIDE	UNITS	CONTINUOUS MODE QTR: 01	CONTINUOUS MODE QTR: 02	CONTINUOUS MODE QTR: 03	CONTINUOUS MODE QTR: 04	BATCH MODE QTR: 01	BATCH MODE QTR: 02	BATCH MODE QTR: 03	BATCH MODE QTR: 04
CO-58	CI	1.23E-06		3.04E-07		2.10E-06			
CS-134	CI		5.38E-07			2.54E-07		3.87E-06	
CS-137	CI		3.50E-07			2.29E-07	2.96E-06	3.10E-06	6.73E-06
TOTALS	CI	1.23E-06	8.88E-07	3.04E-07	0.00E+00	2.59E-06	2.96E-06	6.97E-06	6.73E-06

TABLE 1A

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

	QTR: 01	QTR: 02	QTR: 03	QTR: 04
16.0 VOLUME OF WASTE PRIOR TO DILUTION (LITERS)	6.67E+07	5.35E+07	6.95E+07	6.07E+07
17.0 VOLUME OF DILUTION WATER (LITERS)	1.25E+11	1.21E+11	2.28E+11	2.61E+11
18.0 FISSION AND ACTIVATION PRODUCTS				
18.1 TOTAL RELEASES W/O H-3, RADGAS, ALPHA (CI)	4.82E-02	2.02E-02	1.71E-02	5.53E-03
18.2 AVERAGE DILUTION CONCENTRATION (UCI/ML)	3.86E-10	1.67E-10	7.51E-11	2.11E-11
19.0 TRITIUM				
19.1 TOTAL RELEASE (CI)	9.32E+01	2.77E+02	2.09E+02	1.19E+02
19.2 AVERAGE DILUTION CONCENTRATION (UCI/ML)	7.46E-07	2.30E-06	9.17E-07	4.55E-07
20.0 DISSOLVED AND ENTRAINED GASES				
20.1 TOTAL RELEASE (CI)	4.11E-03	2.00E-03	1.78E-03	1.39E-03
20.2 AVERAGE DILUTION CONCENTRATION (UCI/ML)	3.29E-11	1.66E-11	7.82E-12	5.30E-12
21.0 GROSS ALPHA (CI)	0.00E+00	0.00E+00	0.00E+00	0.00E+00
22.0 TOTAL TRITIUM, FISSION & ACTIVATION PRODUCTS (UCI/ML)	7.47E-07	2.30E-06	9.17E-07	4.55E-07
23.0 TOTAL BODY DOSE (MREM)	1.73E-03	1.64E-03	1.23E-03	4.81E-04
24.0 CRITICAL ORGAN				
24.1 DOSE (MREM)	1.73E-03	1.64E-03	1.23E-03	4.81E-04
24.2 ORGAN	TOT BODY	TOT BODY	TOT BODY	TOT BODY
25.0 PERCENT OF TECHNICAL SPECIFICATIONS LIMIT (%)	5.75E-02	5.47E-02	4.08E-02	1.60E-02
26.0 PERCENT OF CRITICAL ORGAN TECH SPEC LIMIT (%)	5.75E-02	5.47E-02	4.08E-02	1.60E-02

TABLE 2A

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES (CI)

27.0 **INDIVIDUAL LIQUID EFFLUENT**

		CONTINUOUS MODE				BATCH MODE			
NUCLIDE	UNITS	QTR: 01	QTR: 02	QTR: 03	QTR: 04	QTR: 01	QTR: 02	QTR: 03	QTR: 04
AG-110M	CI					7.01E-04	1.07E-03	1.00E-03	4.62E-05
CO-57	CI					2.26E-05	3.70E-06	2.83E-07	5.15E-07
CO-58	CI					2.41E-02	3.49E-03	2.91E-03	1.78E-03
CO-60	CI					6.94E-04	5.53E-04	1.83E-04	1.00E-04
CR-51	CI					8.36E-04	4.53E-03	1.09E-04	
CS-134	CI			4.80E-05		1.89E-04	1.15E-04	4.28E-05	
CS-137	CI		2.20E-05	3.16E-05	6.28E-05	1.14E-04	8.33E-05	3.63E-05	6.45E-07
FE-55	CI			5.33E-03		6.85E-03	7.17E-03	3.40E-03	7.96E-04
FE-59	CI					2.61E-04	3.00E-04	3.98E-05	
I-131	CI	1.26E-05				3.49E-04			
I-132	CI					1.19E-05			
I-133	CI					9.74E-06			
I-134	CI					1.54E-05			
I-135	CI					1.51E-05			
LA-140	CI					6.65E-06			
MN-54	CI					3.29E-05	3.36E-05	2.07E-06	7.49E-07
NA-24	CI					5.96E-05	3.63E-07		
NB-95	CI					2.13E-04	1.93E-04	3.16E-05	
NB-97	CI					2.12E-06		6.00E-07	1.79E-06
RU-103	CI						2.58E-06		
SB-122	CI					8.05E-04			
SB-124	CI					7.61E-03	7.65E-04	9.15E-04	9.30E-04
SB-125	CI					5.12E-03	1.41E-03	2.40E-03	1.80E-03
SB-126	CI					4.78E-06			
SN-113	CI					4.83E-05	2.00E-04	3.62E-05	

(CONTINUED)

TABLE 2A

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES (CONTINUED)

27.0 **INDIVIDUAL LIQUID EFFLUENT**

		CONTINUOUS MODE				BATCH MODE			
NUCLIDE	UNITS	QTR: 01	QTR: 02	QTR: 03	QTR: 04	QTR: 01	QTR: 02	QTR: 03	QTR: 04
SR-85	CI					3.67E-06	8.37E-06	5.36E-06	4.47E-06
SR-92	CI					9.15E-06	2.37E-05	2.08E-05	
TE-123M	CI					4.98E-06	7.34E-05	1.95E-06	
TE-125M	CI							5.35E-04	
W-187	CI							1.63E-05	
ZR-95	CI					1.09E-04	1.05E-04	2.50E-05	
ZR-97	CI					4.53E-07			
TOTALS	CI	1.26E-05	2.20E-05	5.41E-03	6.28E-05	4.82E-02	2.01E-02	1.17E-02	5.46E-03

28.0 **DISSOLVED AND ENTRAINED GASES**

		CONTINUOUS MODE				BATCH MODE			
NUCLIDE	UNITS	QTR: 01	QTR: 02	QTR: 03	QTR: 04	QTR: 01	QTR: 02	QTR: 03	QTR: 04
KR-85	CI					8.48E-04	1.93E-03	1.23E-03	1.03E-03
XE-131M	CI					6.20E-05			
XE-133	CI					3.19E-03	7.00E-05	5.33E-04	3.55E-04
XE-135	CI					9.61E-06		1.72E-05	1.79E-06
TOTALS	CI	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.11E-03	2.00E-03	1.78E-03	1.39E-03

Attachment 3

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Nuclear Management Company, LLC

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

January 1, 2001 through December 31, 2001

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
NORTHERN STATES POWER

Period: 1/01/01 to 12/31/01
License No. DPR-42/60

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

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL)

1. Solid Waste Total Volumes and Total Curie Quantities:

TYPE OF WASTE	UNITS	PERIOD TOTALS (0.00 E00)	EST. TOTAL ERROR, % (0.00 E00)	CONTAINER DISPOSAL VOL (ft^3) (LIST)
A. Resins	m^3	3.85E+00		
	ft^3	1.36E+02		135.8
	Ci	7.11E+01	2.50E+01	
B. Dry-Compacted	m^3			
	ft^3			
	Ci			
C. Non-Compacted DAW (DAW/Metal/Wood)	m^3	7.93E+01		
	ft^3	2.80E+03		94
	Ci	5.73E-01	2.50E+01	
D. Filter Media	m^3			
	ft^3			
	Ci			
S. Other (furnish description) Combined package (resins/filters)	m^3	1.52E+01		
	ft^3	5.38E+02		179.4
	Ci	2.22E+01	2.50E+01	

NOTE:	The solid waste information provided in this report is the volume and activity of the low-level waste leaving the Prairie Island site. No allowance is made for off-site volume reduction prior to disposal.

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
NORTHERN STATES POWER

Period: 1/01/01 to 12/31/01
License No. DPR-42/60

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

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL) [continued]

2. Principal Radionuclide Composition by Type of Waste:
(Bold letter designation from Page 1)

TYPE		Nuclide	Percent % Abundance (0.00E0)
C		Mn-54	1.14E+00
		*Fe-55	6.47E+01
		Co-60	9.72E+00
		*Ni-63	8.84E+00
	Note: 1% cutoff	Co-58	5.51E+00
		Zr-95	2.97E+00
		Nb-95	2.04E+00
		Sb-125	1.09E+00
		Cs-134	2.04E+00
S		*C-14	4.21E+00
		*Fe-55	5.45E+01
		Co-60	1.61E+01
		*Ni-63	1.42E+01
	Note: 1% cutoff	Co-58	3.82E+00
		Cs-134	2.59E+00
		Cs-137	2.28E+00

* = Inferred - Not Measured on Site

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
NORTHERN STATES POWER

Period: 1/01/01 to 12/31/01
License No. DPR-42/60

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

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL) [continued]

2. Principal Radionuclide Composition by Type of Waste (Continuation):
(Bold letter designation from Page 1)

TYPE	Nuclide	Percent % Abundance (0.00E0)
A	*Fe-55	1.12E+01
	Co-58	3.03E+00
	Co-60	1.78E+01
	*Ni-63	3.86E+01
Note: 1% cutoff	Cs-134	1.50E+01
	Cs-137	1.32E+01

* = Inferred - Not Measured on Site

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
NORTHERN STATES POWER

Period: 1/01/01 to 12/31/01
License No. DPR-42/60

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

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (NOT IRRADIATED FUEL) [continued]

3. Solid Waste Disposition:

Number of Shipments	Mode	Destination
4	Truck	Barnwell Disposal Facility
2	Truck	Duratek, Inc.

Attachment 4

PRAIRIE ISLAND NUCLEAR GENERATING PLANT
Nuclear Management Company, LLC

Summary of Changes to the Offsite Dose Calculation Manual and Revision 16 of the Offsite Dose Calculation Manual

SUMMARY OF CHANGES TO OFFSITE DOSE CALCULATION MANUAL

REV 16

The Offsite Dose Calculations Manual ,ODCM, was revised to correct two Tech Spec reference that have been detected since the last revision. These references are wrong as a result of a revision to the Technical Specifications.
Those items are as follows:

1) ODCM section 2.5 incorrectly referenced Technical Specification T.S.6.5.H.6. The reference was changed to T.S.6.5.D.6.

2) ODCM section 2.7 incorrectly referenced Technical Specification T.S.6.5.H.1. The reference was changed to T.S.6.5.D.1.

An evaluation of the above listed changes resulted in the determination that the changes maintain the levels of radioactive effluent control required by 10 CFR 20.1301(a), 10 CFR 50.36a, 10 CFR 50, Appendix A (GDC 60 & 64) and Appendix I, 40 CFR 190, and do not adversely impact the accuracy or reliability of effluent dose or setpoint calculations at Prairie Island.

H	OFFSITE DOSE CALCULATION MANUAL (ODCM)	NUMBER: H4
		REV: 16
		Page 1 of 219

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

OFFSITE DOSE CALCULATION MANUAL (ODCM)

DOCKET NO. 50-282 AND 50-306

NORTHERN STATES POWER COMPANY

INFORMATION USE
▪ *Procedure may be performed from memory.*
▪ *User remains responsible for procedure adherence.*
▪ *Procedure should be available, but not necessarily at, the work location.*

O.C. REVIEW DATE:	OWNER:	EFFECTIVE DATE
7-25-01 SC	A. Johnson	7-25-01

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RECORD OF REVISIONS

Revision No.	Date	Reason for Revision
Original	June 7, 1979	
1	April 15, 1980	Incorporation of NRC Staff comments and corrections of miscellaneous errors.
2	August 6, 1982	Incorporation of NRC Staff comments.
3	February 21, 1983	Change in milk sampling location.
4	November 14, 1983	Change in milk sampling location and change in cooling tower blowdown.
5	March 27, 1984	Change Table 3.2-1
6	February 14, 1986	Change in location to collect cultivated crops (leafy green veg.) and removal of meat animals from land use census.
7	July 31, 1986	Retype and format ODCM. No change in content.
8	January 8, 1987	Addition of discharge Canal monitor setpoint calculation.
9	June 29, 1987	Change inhalation dose factor to child and address change in land use survey.
10	April 27, 1989	Change in method for calculating liquid effluent monitor setpoints. Fix of various typing errors. Change in location of two REMP sampling locations. Deletion of one REMP sampling location.
11	October 5, 1989	Change in Tables 3.3-6 thru 3.3-16. Appendix C equations corrected. Section 5 figures replaced. Sample point definitions corrected.
12	June 17, 1991	Change in REMP sampling locations Tables 5.1-1. Added text to address the increased volume of the new discharge pipe.
13	September 27, 1995	Incorporation of RETS as defined in PINGP Technical Specifications in accordance with GL 89-01 as directed by NUREG-1301. Change grab sampling frequency from 8 hours to 12 hours when required on line monitoring equipment is out of service. Define liquid and gaseous monitor calibration. Define radiological effluent and environmental reporting and records retention.
14	May 15, 1996	Correct typing errors and Tech. Spec. references. Update dose factor tables.

RECORD OF REVISIONS [CONTINUED]

Revision No.	Date	Reason for Revision
15	August 30, 1999	Revised Tech Spec references. Added reference to TBS Landlock. Changed environmental LLDs and reporting level values to reflect "Drinking Water Pathway." Consistent usage of Site Boundary and Unrestricted Area.
16	August 1, 2001	Reformatted to M.S. Word. References to Northern States Power Company removed.

OFFSITE DOSE CALCULATIONS MANUAL INTRODUCTION

The Offsite Dose Calculation Manual (ODCM) describes the methodologies and parameters used in: 1) the calculation of offsite doses resulting from radioactive gaseous and liquid effluents; 2) the calculation of gaseous and liquid effluent monitoring instrumentation Alarm/Trip Setpoints. The methodology stated in this manual is acceptable for use in demonstrating compliance with 10CFR 20.1301(a)(1), 10CFR 50.36A, 10CFR 50, Appendix A (GDC 60 & 64) and Appendix I, and 40 CFR 190.

The ODCM is based on "Radiological Effluent Technical Specification of PWR's (NUREG-0472, October 1978)", "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants (NUREG-0133, October 1978)", and "Offsite Dose Calculation Manual Guidance (NUREG-1301, April 1991). Specific plant procedures for implementation of this manual are provided in the Count Room Manual, (Radiation Protection Implementing Procedures 4000 Series).

Also included in this manual is information related to the RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP). Tables 7.1, 7.2 and 7.3 designate specific sample types, reporting levels and lower limits of detection currently used to satisfy the sampling requirements for the REMP.

Licensee initiated changes to the ODCM:

1. **SHALL** be documented and records of reviews performed shall contain:
   a. Sufficient information to support the change(s) together with the appropriate analyses or evaluations justifying the change(s).
   b. A determination that the change(s) maintain the level of radioactive effluent control required by 10CFR20.1301(a)(1), 10CFR50.36A, 40CFR190, 10CFR50, Appendix I, and not adversely impact the accuracy or reliability of effluent, dose or setpoint calculations.
2. **SHALL** become effective upon review and acceptance by the Operations Committee.
3. **SHALL** be submitted to the NRC in the form of a complete legible copy of the entire ODCM as a part of or concurrent with the Annual Radioactive Effluent Report for the period of the report in which the change in the ODCM was made. Each change **SHALL** be identified by markings in the margin of the affected pages clearly indicating the area of the page that was changed. The date (i.e., month and year) of the change **SHALL** be clearly indicated on the "Record of Revision" page.

DEFINITIONS

- **ABNORMAL RELEASE**

  An unplanned or uncontrolled release of radioactive material from the plant. A release which results from procedural or equipment inadequacies, or personnel errors, that could indicate a deficiency.

- **ACTION**

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

- **BATCH RELEASE**

  A BATCH RELEASE is a discharge of liquid or gaseous radioactive effluents of a discrete volume. Prior to release, each batch **SHALL** be isolated and thoroughly mixed for sampling and analysis.

- **CHANNEL CALIBRATION**

  A CHANNEL CALIBRATION **SHALL** be the adjustment, as necessary, of the channel such that it responds within the required range and accuracy to known values of input. The CHANNEL CALIBRATION **SHALL** encompass the entire channel including the sensors and alarm, interlock and/or trip functions and may be performed by any series of sequential, overlapping, or total channel steps such that the entire channel is calibrated.

- **CHANNEL CHECK**

  CHANNEL CHECK is a quantitative determination of acceptable operability by observation of channel behavior during operation. This determination **SHALL** include comparison of the channel with other independent channels measuring the same variable.

- **CHANNEL FUNCTIONAL TEST**

  A CHANNEL FUNCTIONAL TEST consists of injecting a simulated signal into the channel as close to the primary sensor as practicable to verify that it is OPERABLE, including alarm and/or trip initiating action.

- **CHANNEL RESPONSE TEST**

  A CHANNEL RESPONSE TEST consists of injecting a simulated signal into the channel as near the sensor as practicable to measure the time for electronics and relay actions, and trip functions.

- **CONTINUOUS RELEASE**

  A CONTINUOUS RELEASE is the discharge of liquid or gaseous radioactive effluents of a nondiscrete volume of a system that usually has makeup flow during the release. CONTINUOUS RELEASES are normally sampled and analyzed either during or following the release.

- **DOSE EQUIVALENT I-131**

  DOSE EQUIVALENT I-131 is that concentration of I-131 (μCi/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 dose conversion factors used for this calculation **SHALL** be the child thyroid factors listed in Table E-7 of NRC Regulatory Guide 1.109, Revision 1, October 1977.

- **EXCLUSION AREA BOUNDARY**

  The EXCLUSION AREA is the area encompassed by the EXCLUSION AREA BOUNDARY at a minimum distance of 715 meters from the center of either reactor.

- **GASEOUS RADWASTE TREATMENT SYSTEM**

  The GASEOUS RADWASTE TREATMENT SYSTEM **SHALL** be any system designated and installed to reduce radioactive effluents by collecting primary coolant system offgases from the primary system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.

- **LIQUID RADWASTE TREATMENT SYSTEM**

  The LIQUID RADWASTE TREATMENT SYSTEM **SHALL** be any system designated and installed to reduce radioactive effluents by holdup or collecting radioactive materials by means of filtering, evaporation, ion exchange or chemical reaction for the purpose of reducing the total radioactivity prior to release to the environment.

- **LONG TERM RELEASE**

  LONG TERM RELEASES are usually airborne CONTINUOUS RELEASES. The term "Long Term" comes from the reference to utilizing the long term dispersion factor (X/Q) from Table 5.1.

- **MEMBER OF THE PUBLIC**

  MEMBER OF THE PUBLIC means any individual except when that individual is receiving an occupational dose.

- **OPERABLE - OPERABILITY**

  As defined in the Technical Specifications.

- **PURGE - PURGING**

  PURGE - PURGING **SHALL** be any 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.

- **RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)**

  The RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM is established for monitoring the radiation and radionuclides in the environs of the plant. The program **SHALL** provide representative measurements of radioactivity in the highest potential exposure pathways and verification of the accuracy of potential exposure pathways and verification of the accuracy of the effluent monitoring program and modeling of the environmental exposure pathways. The current methodology used in the conduct of the specifications of the REMP described in the ODCM are defined in the RPIP 4700 series of Radiation Protection Implementing Procedures.

- **SHORT TERM RELEASE**

  SHORT TERM RELEASES usually refers to airborne BATCH RELEASES. The term "Short Term" comes from the reference to utilizing the short term dispersion factor (X/Q) from Table 5.1.

- **SITE BOUNDARY**

  The SITE BOUNDARIES for liquid and gaseous releases are defined in Figures 3.1 and 3.2.

- **SOURCE CHECK**

  A SOURCE CHECK **SHALL** be the quantitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

- **UNRESTRICTED AREA**

  An UNRESTRICTED AREA **SHALL** be any area, access to which is neither limited nor controlled by the licensee.

- **URANIUM FUEL CYCLE**

  The URANIUM FUEL CYCLE is defined in 40 CFR Part 190.02(b) as: "The operation of milling of uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel, and reprocessing of spent uranium fuel, to the extent that these directly support the production of electrical power for public use utilizing nuclear energy, but excludes mining operations, operations at waste disposal sites, transportation of any radioactive material in support of these operations, and the use of recovered non-uranium special nuclear and by-product materials from the cycle."

- **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 atmospheric cleanup systems are not considered to be VENTILATION EXHAUST TREATMENT SYSTEM components.

- **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. The release of air or gases via sampling equipment or instrumentation is not considered a controlled process.

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1.0 RADIOLOGICAL EFFLUENT SPECIFICATIONS AND SURVEILLANCE REQUIREMENTS

APPLICABILITY AND SURVEILLANCE REQUIREMENTS

1.1 Specifications

1.1.1 Compliance with the Controls contained within the succeeding text is required during the conditions specified. Upon failure to meet the specifications, the associated ACTION requirements **SHALL** be met.

1.1.2 Noncompliance with a specification **SHALL** exist when the requirements of the Control and associated ACTION requirements are not met within the specified time interval. If the Control is restored prior to expiration of the specified time interval, completion of the ACTION requirements is not required.

1.2 Surveillance Requirements

1.2.1 Surveillance Requirement **SHALL** be met during the conditions specified for individual specifications unless otherwise stated in an individual Surveillance Requirement.

1.2.2 Each Surveillance Requirement **SHALL** be performed within the specified time interval with the following exceptions:

A. Specified time intervals between tests may be adjusted plus or minus 25% to accommodate normal test schedules.

1.2.3 Failure to perform a Surveillance Requirement within the allowed surveillance interval, defined by Specification 1.2.2, **SHALL** constitute noncompliance with the OPERABILITY requirements for a Control for operation. 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.

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2.0 LIQUID EFFLUENTS

CONCENTRATION

SPECIFICATIONS

2.1 In accordance with T.S. 6.5.D.2 the concentration of liquid radioactive material released at any time to UNRESTRICTED AREAS **SHALL** be limited to the concentrations specified in OLD 10 CFR Part 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration **SHALL** be limited to 2×10^{-4} µCi/ml total activity.

APPLICABILITY

At all times.

ACTION

a. When the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeds the above limits, immediately restore the concentration to within the above limits.

b. Report all deviations in the Annual Radioactive Effluent Release Report.

2.2 SURVEILLANCE REQUIREMENTS

2.2.1 Radioactive liquid wastes **SHALL** be sampled and analyzed according to the sampling and analysis program of Table 2.1.

2.2.2 The results of radioactive analysis **SHALL** be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Specification 2.1.

DOSE

SPECIFICATIONS

2.3 In accordance with T.S. 6.5.D.4 the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to UNRESTRICTED AREAS shall be limited to:

a. During any calendar quarter to $\leq$3 mrem to the total body and to $\leq$10 mrem to any organ, and

b. During any calendar year to $\leq$6 mrem to the total body and to $\leq$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, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special Report that includes the following information:

1. Identifies the cause(s) for exceeding the limit(s).
2. Defines the corrective actions taken to reduce the release.
3. Defines the corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

2.4 Cumulative dose contributions for the current calendar quarter and current calendar year **SHALL** be determined monthly in accordance with the methodology and parameters in Section 4.0 of the ODCM.

LIQUID RADWASTE TREATMENT SYSTEMS

SPECIFICATIONS

2.5 In accordance with T.S. 6.5.D.6 the LIQUID RADWASTE TREATMENT SYSTEM **SHALL** be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses, due to the liquid effluent, to UNRESTRICTED AREAS would exceed 0.12 mrem to the whole body or 0.4 mrem to any organ in a monthly period.

APPLICABILITY

At all times.

ACTION

a. With radioactive liquid waste being discharged without treatment and in excess of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special Report that includes the following information:

   1. Explanation of why 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 recurrence.

2.6 SURVEILLANCE REQUIREMENTS

2.6.1 Doses due to liquid releases **SHALL** be projected at least once each month in accordance with the methodology and parameters in Section 4.0 of the ODCM.

2.6.2 The installed LIQUID RADWASTE TREATMENT SYSTEM **SHALL** be considered OPERABLE by meeting the Controls specified in 2.1 and 2.3.

RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

SPECIFICATIONS

2.7 In accordance with T.S. 6.5.D.1 the radioactive liquid effluent monitoring instrumentation channels shown in Table 2.2 **SHALL** be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 2.1 are not exceeded. The alarm/trip setpoints of these channels **SHALL** be determined in accordance with the methodology in Section 4.0 of the ODCM.

APPLICABILITY

During release via the monitored pathway.

ACTION

a. With a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive effluents monitored by the effected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

b. With less than the minimum required radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the Action shown in Table 2.2

c. Report all deviations in the Annual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

2.8 Each radioactive liquid effluent monitoring instrumentation channel **SHALL** be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 2.3.

LIQUID STORAGE TANKS

SPECIFICATIONS

2.9 In accordance with T.S. 6.5.J.3 the quantity of radioactive material contained in each of the following tanks **SHALL** be limited to 10 curies, excluding tritium and dissolved or entrained gases:

Condensate Storage Tanks
Outside Temporary Storage Tanks

APPLICABILITY

At all times.

ACTION

a. With the quantity of radioactive material contained in any of the above listed tanks exceeding the limit in 2.9 above, immediately suspend all additions of radioactive materials to the tank and within 48 hours reduce the contents to within the limit.

SURVEILLANCE REQUIREMENTS

2.10 The quantity of radioactive material contained in each of the tanks listed in specification 2.9 **SHALL** be determined to be within the limit by analyzing a representative sample of the tank's contents at least once per 7 days when radioactive materials are being added to the tank.

LANDLOCKED AREA

SPECIFICATIONS

2.11 In accordance with 10CFR20.2001 and NRC interpretations, soil removed from the landlocked area for free release to the UNRESTRICTED AREA **SHALL NOT** contain licensed radioactivity, i.e., radionuclides are detected when the soil sample analysis is analyzed to the LLDs listed in Table 7.3 for sediment.

APPLICABILITY

When the soil in the landlocked area is disturbed (construction occurs in the area or the soil is moved to a new location) and during plant decommissioning.

The landlocked area is located near the southwest corner of the Prairie Island reactor building proper. It is designed to distribute water, discharged from the turbine building sumps, over a large area as the water enters the soil. The landlocked area is fully contained within an area controlled by NSP. When high levels of suspended solids are expected or detected in the turbine building sumps, the sump discharge is directed to the landlocked area. Sump sampling is conducted per Tables 2.1 and 2.2 to verify that the radioactivity concentration limits in specification 2.1 are not exceeded.

ACTION

a. With the quantity of radioactive material contained in the soil exceeding the limit in 2.11 above, describe the landlocked location in the 10CFR50.75.g file, conduct a dose assessment, and remediate, as required by applicable regulation.

SURVEILLANCE REQUIREMENTS

2.12 The presence of licensed radioactive material described in specification 2.11 **SHALL** be determined by analyzing soil samples of the affected landlocked area when the area is disturbed and during plant decommissioning, as required by applicable regulations.

3.0 GASEOUS EFFLUENTS

DOSE RATE

SPECIFICATIONS

3.1 In accordance with T.S.6.5.D.7 the dose rate due to radioactive materials released in gaseous effluents from the site to areas at or beyond the gaseous SITE BOUNDARY (Figure 3.2) **SHALL** be limited to the following:

a. For Noble Gases: $\leq$500 mrem/yr to the whole body and $\leq$3000 mrem/yr to the skin, and

b. For Iodine-131, Iodine-133, Tritium, and Particulates with half-lives greater than 8 days: $\leq$1500 mrem/yr to any organ.

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(s).

b Report all deviations in the Annual Radioactive Effluent Report.

3.2 SURVEILLANCE REQUIREMENTS

3.2.1 The dose rate due to noble gases in effluents **SHALL** be determined to be within the above limits in accordance with the methodology and parameters in Section 5.0 of the ODCM.

3.2.2 The dose rate due to Iodine-131, Iodine-133, Tritium, and Particulates with half-lives greater than 8 days in gaseous effluents **SHALL** be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 3.1.

DOSE - NOBLE GASES

SPECIFICATIONS

3.3 In accordance with T.S.6.5.D.8 the air dose due to noble gases released in gaseous effluents to areas at or beyond the gaseous SITE BOUNDARY (Figure 3.2) **SHALL** be limited to the following:

a. During any calendar quarter: ≤10 mrad for gamma radiation and ≤20 mrad for beta radiation, and

b. During any calendar year: ≤20 mrad for gamma radiation and ≤40 mrad for beta radiation.

APPLICABILITY

At all times.

ACTION

a. With the calculated dose from the release of radioactive noble gases in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special Report that includes the following:

1. Identifies the cause(s) for exceeding the limit(s).
2. Defines the corrective actions taken to reduce the release.
3. Defines the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

3.4 Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases **SHALL** be determined monthly in accordance with the methodology and parameters in Section 5.0 of the ODCM.

DOSE - IODINE-131, IODINE-133, TRITIUM AND PARTICULATES

SPECIFICATIONS

3.5 In accordance with T.S.6.5.D.9 the dose to any organ of a MEMBER OF THE PUBLIC from Iodine-131, Iodine-133, Tritium, and all radioactive particulates with a half-life greater than 8 days in gaseous effluents released to areas at or beyond the gaseous SITE BOUNDARY (Figure 3.2) **SHALL** be limited to the following:

a. During any calendar quarter: ≤15 mrem to any organ, and

b. During any calendar year: ≤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 Particulates with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special Report that includes the following:

1. Identifies the cause(s) for exceeding the limit(s).
2. Defines the corrective actions taken to reduce the release.
3. Defines the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

SURVEILLANCE REQUIREMENTS

3.6 Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131, Iodine-133, Tritium, and Particulates with half-lives greater than 8 days **SHALL** be determined monthly in accordance with the methodology and parameters in Section 5.0 of the ODCM.

GASEOUS RADWASTE TREATMENT SYSTEMS

3.7 SPECIFICATIONS

3.7.1 In accordance with T.S.6.5.D.6 the Waste Gas Treatment System and the VENTILATION EXHAUST TREATMENT SYSTEM **SHALL** be used to reduce releases of radioactivity when the projected doses due to the gaseous effluents to areas at or beyond the gaseous SITE BOUNDARY (Figure 3.2) would exceed any of the following controls over a monthly period:

A. 0.4 mrad to air from gamma radiation, or

B. 0.8 mrad to air from beta radiation, or

C. 0.6 mrad to any organ of a MEMBER OF THE PUBLIC.

3.7.2 In accordance with T.S.6.5.J.2 the quantity of radioactivity contained in each gas storage tank **SHALL** be limited to ≤ 78,800 curies of noble gases (considered as dose equivalent Xe-133).

3.7.3 The radioactive gas contained in the Waste Gas Treatment System **SHALL NOT** be deliberately discharged to the environment during unfavorable wind conditions when the cooling towers are in operation. For purposes of this specification, unfavorable wind conditions are defined as wind from 5° West of North to 45° East of North at 10 miles per hour or less.

APPLICABILITY

At all times.

ACTION

a. With radioactive gaseous waste being discharged without treatment and in excess of the above limits of 3.7.1, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days a Special 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 recurrence.

b With the quantity of radioactive material in any gas storage tank exceeding the limits of 3.7.2, immediately suspend all additions of radioactive material to the tank and within 48 hours reduce the tank contents to within the limit.

3.8 SURVEILLANCE REQUIREMENTS

3.8.1 Doses due to gaseous releases at and beyond the SITE BOUNDARY **SHALL** be projected at least once each month in accordance with the methodology and parameters in the ODCM. A projected dose in excess of the limits of 3.7.1 indicates that additional components or subsystems of the GASEOUS RADWASTE TREATMENT SYSTEM must be placed in service to reduce radioactive materials in the gaseous effluents.

3.8.2 The installed Waste Gas Treatment System and the VENTILATION EXHAUST TREATMENT SYSTEM **SHALL** be considered OPERABLE by meeting the Controls specified in 3.1, 3.3 AND 3.5.

3.8.3 The quantity of radioactive material contained in each gas storage tank in use **SHALL** be determined to be within the limit specified in 3.7.2 monthly. If the inventory of any tank exceeds 10,000 curies, daily sampling when making additions **SHALL** be performed.

EXPLOSIVE GAS MONITORING INSTRUMENTATION

3.9 SPECIFICATIONS

3.9.1 In accordance with T.S.6.5.J.1 the explosive gas monitoring instrumentation channels shown in Table 3.2 **SHALL** be OPERABLE with their Alarm/Trip Setpoints set to ensure the limits of 3.9.2 are not exceeded.

3.9.2 The concentration of oxygen at the outlet of each operating recombiner **SHALL** be maintained to $\leq$2% by volume.

APPLICABILITY

As shown in Table 3.2.

ACTION

a. With an explosive gas monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above specification, declare the channel inoperable and take the ACTION shown in Table 3.2.

b. With less than the minimum required explosive gas monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 3.2. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, in lieu of a License Event Report, prepare and submit a Special Report to the Commission to explain why this inoperability was not corrected in a timely manner.

c. With the concentration of oxygen measured at the outlet of operating recombiner(s) >2% by volume but <4% by volume, restore the concentration of oxygen to $\leq$2% by volume within 48 hours.

d. With the concentration of oxygen measured at the outlet of operating recombiner(s) >4% by volume, immediately suspend all additions of waste gases to the system and reduce the concentration of oxygen to $\leq$2% within one hour.

SURVEILLANCE REQUIREMENTS

3.10 Each explosive gas monitoring instrumentation channel **SHALL** be demonstrated OPERABLE by performance of the CHANNEL CHECK, CHANNEL FUNCTIONAL TEST, and CHANNEL CALIBRATION at the frequencies shown in Table 3.3.

RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

SPECIFICATIONS

3.11 In accordance with T.S.6.5.D.1 the radioactive gaseous effluent monitoring instrumentation channels shown in Table 3.2 **SHALL** be OPERABLE with their alarm/trip setpoints set to ensure that the limits of Specification 3.1 are not exceeded. The alarm/trip setpoints of these channels **SHALL** be determined in accordance with the methodology in Section 5.0 of the ODCM.

APPLICABILITY

As shown in Table 3.2.

ACTION

a. With a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint less conservative than required by the above specification, immediately suspend the release of radioactive effluents monitored by the effected channel, or declare the channel inoperable, or change the setpoint so it is acceptably conservative.

b. With less than the minimum required radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the Action shown in Table 3.2.

c. Report all deviations in the Annual Radioactive Effluent Release Report.

SURVEILLANCE REQUIREMENTS

3.12 Each radioactive gaseous effluent monitoring instrumentation channel **SHALL** be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION, and CHANNEL FUNCTIONAL TEST at the frequencies shown in Table 3.3.

ATMOSPHERIC STEAM DUMP MONITORING

SPECIFICATIONS

3.13 The dose to a MEMBER OF THE PUBLIC from Iodine-131 released, via one steam dump operation, in gaseous effluents from the site at or beyond the gaseous SITE BOUNDARY (Figure 3.2) **SHALL NOT** be greater than twice the limit specified in 3.5.

APPLICABILITY

During atmospheric steam dump operations with detectable Iodine-131 activity in the Steam Generator bulk water.

ACTION

a. When the calculated dose from the release of Iodine-131 in gaseous effluents via steam dump operations exceeds the above limit:

1. The milk from dairy cows grazing in the downwind area **SHALL** be sampled and analyzed for a period of 5 days following the release. The downwind area shall include the 22 1/2 degree sector of a circle having it's center at the plant and a 2 mile radius.
2. The Iodine-131 concentration in the milk **SHALL** be determined daily utilizing instrumentation with a minimum Iodine-131 detection limit of 1.0 pCi/ml.

3.14 SURVEILLANCE REQUIREMENTS

The Iodine-131 activity released via atmospheric steam dumps **SHALL** be sampled and analyzed according to the sample and analysis program of Table 3.1.

4.0 LIQUID EFFLUENT CALCULATIONS

4.1 Monitor Alarm Setpoint Determination

This procedure determines the monitor alarm setpoint that indicates if the concentration of radionuclides in the liquid effluent released to UNRESTRICTED AREAS exceeds the specification defined in Section 2.1.

Since Fe-55, Sr-89, Sr-90, and alpha concentrations are determined from composite samples, the liquid monitor setpoint determinations should be completed using the most recent available composite sample results.

Monitor high alarm or isolation setpoints will be established by one of the following:

a. Monthly calculation of setpoints using the methodology of Sections 4.1.1 and 4.1.3.

b. Calculation of alarm setpoint based on analysis prior to discharge using methodology of Section 4.1.2.

c. Alarm setpoint determined using methodology of Section 4.1.1 and 4.1.3 assuming all radionuclides have an MPC of 1E-7 μCi/ml. No recalculation of setpoints is necessary unless an increase in alarm setpoint is desired.

PWR GALE Code source terms (Table 4.1) may be used if there were no detectable isotopes in the previous month or in the analysis prior to release. If the newly calculated setpoint is less than the existing monitor setpoint, the setpoint **SHALL** 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 increase to the new value.

4.1.1 Liquid Effluent Monitor Setpoints

The following method applies when determining the isolation setpoints for the Waste Effluent Liquid Monitor (R-18), Steam Generator Blowdown Liquid Monitor - Unit 1 (1R-19), and Steam Generator Blowdown Liquid Monitor - Unit 2 (2R-19) during all operational conditions when the radwaste discharge flow rate is maintained constant at the maximum design flow rate.

A. Determine the “mix” (radionuclides and composition) of the liquid effluent.

1. Determine the liquid source terms that are representative of the “mix” of the liquid effluent. Liquid source terms are the total curies of each isotope released during the previous month. Table 4.1 source terms may be used if there have been no liquid releases.

2. Determine the activity concentrations (AC_i) of all non-gamma emitters including H-3, Sr-89, Sr-90, Fe-55, and alpha activity.

3. Determine NGF (the total fraction of the MPC in the liquid effluent) for all non-gamma emitting nuclides.

$$NGF = \sum_i \frac{AC_i}{MPC_i} \quad (4.1\text{-}1)$$

where: AC_i = Activity concentration of nuclide 'i' in the liquid effluent (μCi/ml).

MPC_i The liquid effluent radioactivity concentration limit for radionuclide 'i' (μCi/ml) from Table 4.1 or Reference 3.

4. Determine Si (the fraction of the gamma emitting radioactivity in the liquid effluent comprised by radionuclides 'i') for each individual radionuclide in the liquid effluent.

$$S_i = \frac{A_i}{\sum_i A_i} \quad (4.1\text{-}2)$$

where: A_i = the radioactivity of gamma emitting radionuclide 'i' in the liquid effluent.

5. Determine WGF (the sum of fractional activities weighted by the MPC) for the gamma emitting nuclides in the liquid effluent.

$$WFG = \sum_i \frac{S_i}{MPC_i} \quad (4.1\text{-}3)$$

where: MPC_i = the liquid effluent radioactivity concentration limit for radionuclide 'i' (μCi/ml) from Table 4.1 or Reference 3.

B. Determine C_t (the maximum acceptable total radioactivity concentration of gamma emitting nuclides in the liquid effluent prior to dilution (μCi/ml).

$$C_t = \frac{1}{WGF} \times \left(\frac{F}{f} - NGF \right) \quad (4.1\text{-}4)$$

where: F = Dilution water flow rate (gpm)

= 67,300 gpm from cooling tower blowdown

f = The maximum attainable discharge flow rate prior to dilution (gpm)

= 60 gpm from the ADT tank pump

= 100 gpm from the CVCS tank pump

= 60 gpm from the SGBD tank pump

C. Determine C.R. (the calculated monitor count rate above background attributed to the radionuclides (ncpm)).

C.R. is obtained by using the applicable Effluent Monitor Efficiency Curve located in the Radiation Monitor Calibration file. C.R. is the count rate that corresponds to the "adjusted" total radioactivity concentration (C_t).

D. Determine HSP (the monitor high alarm setpoint above background (ncpm)).

$$HSP = T_m C.R. \quad (4.1\text{-}5)$$

T_m = Fraction of the radioactivity from the site that may be released via each release point to ensure that the unrestricted area limit is not exceeded due to simultaneous releases from several release points.

= 0.90 for the Waste Effluent Liquid Monitor (R-18)

= 0.05 for the Steam Generator Blowdown Liquid Monitor - Unit 1 (1R-19)

= 0.05 for the Steam Generator Blowdown Liquid Monitor - Unit 2 (2R-19)

T_m values may be revised from the values given above. The summation of all the T_m values for active release points **SHALL NOT** be greater than unity.

E. The monitor high alarm setpoint above background (ncpm), **SHALL** be set at or below the HSP value.

4.1.2 Setpoint Based on Analysis of Liquid Prior to Discharge (Optional)

This method may be used in lieu of the method in Section 4.1.1 to determine the setpoints for the maximum acceptable discharge flow rate prior to dilution and to determine the associated high alarm setpoint based on this flow rate for the Waste Effluent Liquid Monitor (R-18), Steam Generator Blowdown Liquid Monitor - Unit 1 (1R-19), and Steam Generator Blowdown Liquid Monitor - Unit 2 (2R-19), during all operational conditions.

A. Determine f (the maximum acceptable discharge flow rate prior to dilution (gpm)).

$$f = \frac{0.8\,FT_m}{\sum_i \frac{C_i}{MPC_i}} \qquad (4.1\text{-}6)$$

F = Dilution water flow rate (gpm)

= 67,300 gpm from cooling tower blowdown

C_i = Concentration of radionuclide "i" in the liquid effluent prior to dilution (μCi/ml) from analysis of the liquid effluent to be released.

MPC_i = The liquid effluent radioactivity concentration limit for radionuclide "i" (μCi/ml) from Table 4.3 or from Reference 3.

T_m = Fraction of the radioactivity from the site that may be released via each release point to ensure that the unrestricted area limit is not exceeded due to simultaneous releases from several release points. Refer to Section 4.1.1.D.

B. Determine the monitor setpoint based on the radionuclide mix of the liquid effluent.

1. Determine C.R. (the calculated monitor count rate above background attributed to the radionuclides (ncpm)).

   C.R. is obtained by using the applicable Effluent Monitor Efficiency Curve located in the Radiation Monitor Calibration file. C.R. is the count rate point that corresponds to the "adjusted" total radioactivity concentration (C_t).

   C_t=Total radioactivity concentration of the radionuclides (minus tritium and other radionuclides that are only beta emitters) in the liquid discharge prior to dilution (μCi/ml) as determined using Equation 4.1-4.

2. Determine HSP (the monitor high alarm setpoint above background (ncpm)).

$$HSP = \frac{C.R.}{0.8} \qquad (4.1\text{-}7)$$

   0.8 = A correction factor to increase the monitor setpoint to prevent spurious alarms caused by deviations in the mixture of radionuclides that affects monitor response.

3. The monitor high alarm setpoint above background **SHALL** be set at or below this HSP value when this optional method is selected. The maximum discharge flow **SHALL NOT** exceed the value of f as determined in Section 4.1.2.A. when this optional method is selected.

4.1.3 Discharge Canal Monitor

The following method determines the high alarm setpoint for the Discharge Canal Monitor (R-21) during all operational conditions.

A. Determine the "mix" (radionuclides and composition) of the liquid effluent.

1. Determine the liquid source terms that are representative of the "mix" of all liquids released into the discharge canal. Liquid source terms are the total curies of each isotope released during the previous month. Table 4.1 source terms may be used if there have been no liquid releases.

2. Determine the activity concentrations (AC_i) of all non-gamma emitters including H-3, Sr-89, Sr-90, Fe-55, and alpha activity.

3. Determine NGF (the total fraction of the MPC in the liquid released to the discharge canal) for all non-gamma emitting nuclides. The volume used to calculate the non-gamma emitting activity concentrations is the volume released via cooling tower blowdown during a one month period at the minimum flow rate of 67,300 gpm.

$$NGF = \sum_i \frac{AC_i}{MPC_i}$$

where: AC_i = Activity concentration of nuclide 'i' released to the discharge canal (μCi/ml)

MPC_i = The liquid effluent radioactivity concentration limit for radionuclide 'i' (μCi/ml) from Table 4.3 or Reference 3.

4. Determine Si (the fraction of the gamma emitting radioactivity in the liquid released to the discharge canal comprised by radionuclide 'i') for each individual radionuclide released to the discharge canal.

$$S_i = \frac{A_i}{\sum_i A_i}$$

where: A_i=The radioactivity of gamma emitting radionuclide "i" released to the discharge canal.

5. Determine WGF (the sum of fractional activities weighted by the MPC) for the gamma emitting nuclides released to the discharge canal.

$$WGF = \sum_i \frac{S_i}{MPC_i}$$

where: MPC_i =The liquid effluent radioactivity concentration limit for radionuclide "i" (μCi/ml) from Table 4.3 or Reference 3.

B. Determine C_t (the maximum acceptable total radioactivity concentration of gamma emitting nuclides released to the discharge canal (μCi/ml).

$$C_t = \frac{1-NGF}{WGF}$$

C. Determine C.R. (the calculated monitor count rate above background attributed to the radionuclides (ncpm)).

C.R. is obtained by using the applicable Effluent Monitor Efficiency Curve located in the Radiation Monitor Calibration file. C.R. is the count rate that corresponds to the "adjusted" total radioactivity concentration (C_t).

D. The monitor high alarm setpoint above background (ncpm) **SHALL** be set at or below the C.R. value.

4.1.4 Monitor Calibration

Liquid effluent monitors are calibrated periodically using a Cs-137 standard. Since the actual isotopic mixes of the liquids released may contain nuclides with different gamma energies and yields than the calibration standard, the response of the monitor varies with respect to the actual energies and abundances of the nuclides in the mix being monitored when compared to Cs-137.

Effluent release computer calculations that compute setpoint determinations or expected monitor readings during or prior to a release compensate for the difference in gamma energies and yields and adjust the monitor setpoint or predicted monitor reading according to the actual nuclide mix. The assumption is made that the monitor's response is directly proportional to the gamma energies.

The cumulative errors associated with the monitor calibration methodology are not accounted for in the determination of the individual monitor setpoints. There is sufficient conservatism built into the selection of the actual monitor setpoint; plus the fact that the monitor fractions used in the setpoint determination equation determine that it would be necessary for all of the effluent monitors to be in alarm before the limits of 10CFR Part 20 would be exceeded.

4.2 Compliance With 10CFR20

In order to comply with 10CFR20, the concentrations of radionuclides in liquid effluents will not exceed the maximum permissible concentrations (MPC) as defined in Appendix B, Table II of 10CFR20. For CONTINUOUS RELEASES, the alarm trip setpoints discussed in Section 4.1 will assure that these concentrations are not exceeded. For BATCH RELEASES, concentrations of radioactivity in effluents prior to dilution will be determined, providing protection in addition to the alarm trip setpoint discussed in Section 4.1. Concentration in diluted effluents will be calculated using these results.

4.2.1 Continuous Releases

Continuous liquid releases can occur from PINGP through steam generator blowdown. The alarm trip setpoints discussed in Section 4.1 will assure that releases from this pathway will not exceed the limits of 10CFR20.

Other minor releases of a continuous nature have occurred at PINGP through the turbine building sump system. These releases were minor and are not expected to occur in the future. However, a continuous composite sample will be maintained at the discharge from the turbine building sump with samples being taken and analyzed weekly. If these samples indicate detectable levels of radionuclides, the methodologies given in Section 4.2.2 will be applied to the turbine sump weekly releases and the limit in Equation 4.2-2 will be lowered to account for this source term. Doses from radionuclides contained in turbine building sump effluent diverted to the landlocked area are adequately accounted for since the calculations conservatively assume all the activity is dischargd to the river per Section 4.2.2.

4.2.2 Batch Releases

To further show compliance with 10CFR20, the radioactivity content of each BATCH RELEASE will be determined prior to release. The concentration of the various radionuclides in the BATCH RELEASE prior to dilution, is divided by the minimum dilution flow to obtain the concentration at the UNRESTRICTED AREA. This calculation is shown in the following equation:

$$Conc_i = \frac{C_i R}{MDF} \qquad (4.2\text{-}1)$$

where

$Conc_i$ = concentration of radionuclide i at the site boundary, μCi/ml;

C_i = concentration of radionuclide i in the potential batch release, μCi/ml;

R = release rate of the batch

MDF = minimum dilution flow (=67,300 gpm)

The projected concentration at the UNRESTRICTED AREA is compared to the MPCs in Appendix B, Table II of 10CFR20 which are given in Table 4.1. Before a release may occur, Equation 4.2-2 must be met for all isotopes.

$$\sum_i \frac{Conc_i}{MPC_i} \leq 0.9 \qquad (4.2\text{-}2)$$

MPC_i = Maximum permissible concentration of radionuclide I from Table 4.3 or Appendix B, Table II of 10CFR20. μCi/ml

The summation has been reduced from 1.0 to 0.9 to account for simultaneous CONTINUOUS RELEASES from steam generator blowdown as given in Section 4.1.1.E. As noted earlier, this fraction may be adjusted based on experience. The summation of all source terms **SHALL NOT** be greater than 1.0 of the 10CFR20 limit.

Since the volume of the discharge pipe will contain the volume of 2 to 3 waste batch tanks, to ensure compliance with 10CFR20 when the maximum acceptable discharge flow rate, as calculated in Section 4.1.2, is less than the maximum possible release rate from all release sources, the discharge pipe **SHALL** be flushed with a volume of at least the volume of the discharge pipe. The flush rate **SHALL NOT** exceed the maximum discharge flow rate and may be accomplished with water from other release paths. If more than one waste batch tank requiring flushing are to be released, the discharge pipe may be flushed following the final tank release.

Volume of discharge pipe = 15,500 gal.

4.3 Liquid Effluent Dose - Compliance with 10CFR50

Doses resulting from liquid effluents will be calculated monthly to show compliance with 10CFR50. A cumulative summation of total body and organ doses for each calendar quarter and calender year will be maintained as well as projected doses for the next month.

Since Fe-55, Sr-89, Sr-90, and alpha concentrations are determined from composite samples, the monthly liquid effluent dose calculations and comparisons to quarterly and annual limits should be completed using the most recent available composite sample results. The quarterly and annual dose calculations **SHALL** be completed using the actual composite sample results.

The limits of 10CFR50 are on a per reactor unit basis. The liquid radwaste system at PINGP is shared by both reactor units making it impossible to separate the releases of the two units. The releases that can be separated by unit, steam generator blowdown and turbine building sump releases, contribute a very small portion of the total liquid releases from PINGP. Therefore, for compliance with 10CFR50 the releases from both units will be summed and the limits of Appendix I will be doubled.

4.3.1 Determination of Liquid Effluent Dilution

To determine doses from liquid effluents the near field average dilution factor for the period of release must be calculated. This dilution factor must be calculated for each BATCH RELEASE and each CONTINUOUS RELEASE mode. The dilution factor is determined by:

$$F_k = \frac{R_k}{X\ ADF_k} \qquad (4.3\text{-}1)$$

where:

R_k = release rate of the batch or continuous release during the period, k, gpm.

ADF_k =average dilution flow during the time period of release k, gpm.

The value of X is the site specific factor for the mixing effect of the PINGP discharge structure. This value is 10 for PINGP while operating in the closed cycle cooling mode. The product of X and ADF_k is limited to 1000 cfs (4.5 x 10^5 gpm). Therefore, since blowdown flow in closed cycle is 150 cfs, the denominator of Equation 4.3-1 is always 4.5 x 10^5 in closed cycle. In once through or helper mode, the value if X is reduced to 1.0.

4.3.2 Dose Calculations

The dose contribution from the release of liquid effluents will be calculated monthly. The dose contribution will be calculated using the following:

where:

$$D_\tau = \sum_k \sum_i A_{i\tau} t_k C_{ik} F_k \qquad (4.3\text{-}2)$$

where:

D_τ = the dose commitment to the total body or any organ τ, from the liquid effluents for the period of release, mrem;

C_{ik} = the average concentration of radionuclide, i, in undiluted liquid effluent for liquid release k, μCi/ml;

$A_{i\tau}$ = the site related ingestion dose commitment factor to the total body or any organ τ for each identified principal gamma and beta emitter, mrem/hr per μCi/ml;

F_k = the near field average dilution factor for C_{ik} during liquid effluent release k,

t_k = the duration of release k, hours.

The dose factor $A_{i\tau}$ was calculated for an adult for each isotope using the following equation:

$$A_{i\tau} = 1.14 \times 10^5 [21 BF_i \; DF_{i\tau}] \qquad (4.3\text{-}3)$$

where:

$$1.14 \times 10^5 = 10^6 \frac{\text{pCi}}{\mu\text{Ci}} \times 10^3 \frac{\text{ml}}{\text{l}} \times \frac{1\,\text{yr}}{8760\,\text{hr}};$$

21 = adult fish consumption, Kg/yr;

BF_i = bio accumulation factor for radionuclide i in fish from Table A-1 of Regulatory Guide 1.109 Rev. 1 (5) pCi/Kg per pCi/l;

$DF_{i\tau}$ = dose conversion factor for radionuclide i for adults for a particular organ τ from Table E-11 of Regulatory Guide 1.109 Rev. 1, (5) mrem/pCi.

A table of $A_{j\tau}$ values for an adult at the PINGP are presented in Table 4.2. Mississippi River water is not used as a potable water supply within 300 miles downstream of the PINGP. Wells are used for irrigation downstream of the plant.

4.3.3 <u>Cumulation of Doses</u>

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results should be added to the doses cumulated from the other months in the quarter of interest and in the year of interest for the combined releases of both reactor units and compared to the limits given in Section 2.3.

The quarterly limits represent one half of the annual design objective. If these quarterly or annual limits are exceeded, a special report should be submitted to the USNRC identifying the cause and corrective action to be taken. If twice the quarterly or annual limits are exceeded, a special report **SHALL** be submitted showing compliance with 40CFR190.

4.3.4 Projection of Doses

Anticipated doses resulting from the release of liquid effluents will be projected monthly. If the projected doses for the month exceed 2 percent of the limit specified in Section 2.3.b, additional components of the liquid radwaste treatment system will be used to process waste. The projected doses will be calculated using Equation 4.3-2. The dilution factor, F_k, will be calculated by replacing the term ADF_k in Equation 4.3-1 with the term MDF from Equation 4.2-1. The total source term utilized for the most recent dose calculation should be used for the projections unless information exists indicating that actual releases could differ significantly in the next month. In this case, the source term would be adjusted to reflect this information and the justification for the adjustment noted. This adjustment should account for any radwaste equipment which was operated during the previous month that could be out of service in the coming month.

4.4 References

1. "Prairie Island Final Environmental Statement," USAEC, May, 1973, p. V-26.
2. "NSP - Prairie Island Nuclear Generating Plant, Appendix I Analysis - Supplement No. 1 - Docket No. 50-282 and 50-306," Table 2.1-1.
3. "Old 10CFR20," Appendix B, Table II, Column 2.
4. "NSP - Prairie Island Nuclear Generating Plant, Appendix I Analysis - Supplement No. 1 - docket 50-282 and 50-306," July 21, 1976, Table 2.1-2.
5. U.S. Nuclear Regulatory Commission, "Regulatory Guide 1.109 - Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Compliance with 10CFR50, Appendix I," Rev. 1, 1977.

5.0 GASEOUS EFFLUENT CALCULATIONS

5.1 Monitor Alarm Setpoint Determination

This procedure determines the monitor alarm setpoint that indicates if the dose rate beyond the SITE BOUNDARY due to noble gas radionuclides in the gaseous effluent released from the site exceeds 500 mrem/year to the whole body or exceeds 3000 mrem/year to the skin.

Monitor high alarm or isolation setpoints will be established in one of the following ways:

a. Monthly calculation of setpoint using the methodology of Section 5.1.1 for CONTINUOUS RELEASES using previous month releases as source term.

b. Prior to each containment PURGE, recalculation of the setpoint using the methodology of Section 5.1.1 based on the sample taken prior to PURGING.

c. In lieu of (5.1.a) and (5.1.b) above, alarm setpoints may be established using the methodology of Section 5.1.1 using conservative assumptions (e.g., 100% Kr-89). No recalculation of setpoints is necessary unless an increase is desired.

PWR GALE Code source terms (Table 5.2) may be used if there were no detectable isotopes in the previous month or in the analysis prior to PURGING. If the newly calculated setpoint is less than the existing monitor setpoint, the setpoint **SHALL** 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 increased to the new value.

5.1.1 Effluent Monitors

The following method applies when determining the isolation or high alarm setpoint for the monitors listed in Table 5.1.

A. Determine the "mix" (noble gas radionuclides and composition) of the gaseous effluent.

1. Determine the gaseous source terms that are representative of the gaseous effluent. Gaseous source terms are the total curies of each noble gas released during the previous month or a representative analysis of the gaseous effluent. Table 5.2 source terms may be used if the releases for the previous month were below the lower limits of detection (LLD).

2. Determine S_i (the fraction of the total radioactivity in the gaseous effluent comprised by noble gas radionuclide "i") for each individual noble gas radionuclide in the gaseous effluent.

$$S_i = \frac{A_i}{\Sigma_i A_i} \qquad (5.1\text{-}1)$$

A_i = The radioactivity of noble gas radionuclide "i" in the gaseous effluent from either the previous months releases or from Table 5.2 if there were no releases during the previous month.

B. Determine Q_t (the maximum acceptable total release rate of all noble gas radionuclides in the gaseous effluent (μCi/sec)) based upon the whole body exposure limit.

$$Q_t = \frac{500}{(\chi/Q)\ \Sigma_i\ K_i\ S_i} \qquad (5.1\text{-}2)$$

(χ/Q) = The highest calculated annual average relative concentration of effluents released via the plant vents for any area at or beyond the site boundary for all sectors (sec/m^3) from the "χ/Q" column in Table 5.1.

K_i = The total whole body dose factor due to gamma emissions from noble gas radionuclide "i" (mrem/year/μCi/m^3) from Table 5.4.

C. Determine Q_t based upon the skin exposure limit.

$$Q_t = \frac{3000}{(\chi/Q)\Sigma_i\ (L_i + 1.1 M_i)\ S_i} \qquad (5.1\text{-}3)$$

$L_i + 1.1\ M_i$ = The total skin dose factor due to gamma and beta emissions from noble gas radionuclide "i" (mrem/year/μCi/m^3) from Table 5.4.

D. Determine C_t (the maximum acceptable total radioactivity concentration of all noble gas radionuclides in the gaseous effluent (/µCi/cc)).

$$C_t = \frac{2.12\text{ E-3 } Q_t}{F} \qquad (5.1\text{-}4)$$

NOTE:	Use the lower of the Q_t values obtained in Section 5.1.1.B and 5.1.1.C.

F = The maximum effluent flow rate at the point of release (cfm) from the "Effluent Flow Rate" column in Table 5.1.

2.12 E-3 = Unit conversion constant to convert µCi/sec/cfm to µCi/cc.

E. Determine C.R. (the calculated monitor count rate above background attributed to the noble gas radionuclides (ncpm)).

C.R. is obtained by using the applicable Effluent Monitor Efficiency Curve located in the Radiation Monitor Calibration file.

C.R. is the count rate point that corresponds to the total radioactivity concentration (C_t).

F. Determine HSP (the monitor high alarm setpoint above background (ncpm)).

$$HSP = T_m \text{ C.R.} \qquad (5.1\text{-}5)$$

T_m = Fraction of the total radioactivity from the site that may be released via each release point to ensure that the SITE BOUNDARY limit is not exceeded due to simultaneous releases from several release points from the "Release Fraction" column in Table 5.1.

G. The isolation or high alarm setpoints above background (ncpm) for the monitors should be set at or below the HSP values.

5.1.2 Air Ejector Monitors

Radiation monitors 1R-15 and 2R-15 provide an indication of gross noble gas activity at the main condenser air ejector of Unit 1 and Unit 2, respectively. These monitors are provided to give rapid indication of steam generator tube leakage. They are not effluent monitors since the air ejectors are vented to the auxiliary building vents during normal plant operation and releases are monitored by the auxiliary building vent monitoring system.

5.1.3 Monitor Calibration

Gaseous effluent monitors are calibrated periodically using available gas mixes existing in plant systems. Since the available gas mixes vary in isotopic ratios and the energies of those isotopes span a range of energies, more than one gas mix is used during the calibration. One mix is predominantly Xe-133 with lower level beta and gamma energies and a second mix which contains a larger variety of longer lived plant gases that more accurately represent the higher beta energy range. The result of this method of calibration is two separate calibration curves for each monitor. One curve to be used when the isotopic mix being monitored is primarily Xe-133 and the other curve is for use when the mix is unknown or is known to contain a mixture of other fission and activation gases.

Effluent release computer calculations that compute setpoint determinations or expected monitor readings during or prior to a release utilize the correct calibration curves and adjust the monitor setpoint or predicted monitor reading according to the actual nuclide mix.

The cumulative errors associated with the monitor calibration methodology are not accounted for in the determination of the individual monitor setpoints. There is sufficient conservatism built into the selection of the actual monitor setpoint; plus the fact that the monitor fractions used in the setpoint determination equation determine that it would be necessary for all the effluent monitors to be in alarm before the limits of 10CFR Part 20 would be exceeded.

5.2 Gaseous Effluent Dose Rate - Compliance with 10CFR20

Dose rates resulting from the release of noble gases, and radioiodines and particulates must be calculated to show compliance with 10CFR20. The limits of 10CFR20 must be met on an instantaneous basis at the hypothetical worst case location, and apply on a per site basis.

Releases made via the shield building vents as a result of routine surveillance tests or scheduled short term maintenance/work activities of 2 hours or less do not require the sampling and analysis of shield building vent stack samples described in Table 3.1 for the following reasons:

a. Shield building effluent particulates and iodines are filtered through a PAC (Particulate Absolute Charcoal) system and the auxiliary building vent normal ventilation has no filtration.

b. The lower limit of detection limits specified in Table 3.1 can not be obtained on all the specified nuclides with normal sample flow and a sample duration of less than 2 hours.

c. Shield building vent releases are monitored via a noble gas monitor.

d. Auxiliary building normal ventilation flow is higher than the special ventilation fans that vent via the shield building vent stack.

Therefore, it is conservative to assume that the auxiliary building normal ventilation system would continue to run during the testing/maintenance period. The surveillance test or maintenance/work being performed should be evaluated to ensure the airborne activity in the affected areas will not increase during the evolution. If this evaluation indicates a possible increase in airborne effluents, or radiation monitors or continuous air monitors in the affected buildings indicate higher than normal background airborne activity before the evolution begins, the shield building vent stack sample **SHALL** be sampled and analyzed as described in Table 3.1.

Since Sr-89 and Sr-90 concentrations are determined from composite samples, the pre-release, weekly and monthly airborne dose calculations and comparisons to quarterly and annual limits should be completed using the most recent available composite sample results. The quarterly dose values and critical receptors reported to the USNRC **SHALL** be calculated using the actual composite results.

5.2.1 Noble Gases

To comply with the 10CFR20 dose limit of 100 mrem TEDE to MEMBERS OF THE PUBLIC, the dose rate at the SITE BOUNDARY resulting from noble gas effluents is limited to 500 mrem/yr to the total body and 3000 mrem/yr to the skin. The setpoint determinations discussed in the previous section are based on the dose calculational method presented in NUREG-0133. They represent a backward solution to the limiting dose equations in NUREG-0133. Setting alarm set trip points in this manner will assure that the limits of 10CFR20 are met for noble gas releases. Therefore, no routine dose calculations for noble gases will be needed to show compliance with this part. Routine calculations will be made for doses from noble gas releases to show compliance with 10CFR50, Appendix I as discussed in Section 5.3.1.

5.2.2 Radioiodine, Radioactive Particulates, and Other Radionuclides

For compliance with 10CFR20, the dose rate at the SITE BOUNDARY resulting from the release of radioiodines and particulates with half lives greater than 8 days is limited to 1500 mrem/yr to any organ. Calculations showing compliance with this dose rate limit will be performed for BATCH RELEASES prior to the release and weekly for all releases. To show compliance, Equations 5.2-1 will be evaluated for I-131, I-133, tritium, and radioactive particulates with half-lives greater than eight days.

$$\Sigma P_{i_I} \left[\left(\chi/_{Qv}\right) Q_{iv}\right] < 1500 \text{ mrem/yr} \qquad (5.2\text{-}1)$$

where:

P_{i_I} = child critical organ dose parameter for radionuclide i for the inhalation pathway, mrem/yr per $\mu Ci/m^3$ (Table 5.3);

(χ/Q_v) = annual average relative concentration for LONG-TERM release at the critical location, sec/m^3 (Appendix A, Table A-3);

Q_{iv} = the total release rate of radionuclide i from all vents form both units for the batch or week of interest, $\mu Ci/sec$;

Radioiodines, tritium, and radioactive particulates will be released form up to six individual vents all within 300 feet of each other. For showing compliance with 10CFR20, calculations based on Equation 5.2-1 will be made once per week. The source terms (Q_{iv}) will be determined from the results of analysis of vent particulate filters and charcoal canisters and vent flow rate. These source terms include all gaseous releases from PINGP.

Significant short-term BATCH RELEASES of long-lived radioactive particulates and tritium will result from containment PURGES. Calculations will be made for these releases separately to further assure compliance with 10CFR Part 20 prior to release. These calculations will be used only to determine whether or not the PURGE release will be allowed to occur. Source terms will be determined from the results of isotopic analyses of samples from containment prior to release. Equation 5.2.1 will be used in conjunction with the following relationship to demonstrate that the BATCH RELEASE does not exceed the dose rate limit:

$$BL = 1500 - (D_v - D_p) \qquad (5.2\text{-}2)$$

where:

BL = limiting dose rate for the batch, mrem/yr;

D_v = previous week's dose rate from all continuous and batch releases mrem/yr;

D_p = previous week's dose rate from all PURGE releases mrem/yr.

5.2.3 Critical Receptor Identification

Compliance with 10CFR20 radiation dose limits for individual MEMBERS OF THE PUBLIC will be demonstrated by identifying critical receptor locations based on 10CFR50 App I ALARA design objectives. Since the doses associated with 10CFR50 are more restrictive than the 10CFR20 limits, this method satisfies the 10CFR20 requirements.

5.3 Gaseous Effluents - Compliance with 10CFR50

Doses resulting from the release of noble gases, radioiodines and particulates must be calculated to show compliance with Appendix I of 10CFR50. The calculations will be performed monthly for all gaseous effluents.

The limits of 10CFR50 are on a per reactor unit basis. The GASEOUS RADWASTE TREATMENT SYSTEM and the auxiliary building at PINGP is shared by both reactor units making it impossible to separate the releases of the two units. The releases that can be separated by unit contribute a very small portion of the total gaseous releases form PINGP. Therefore, for compliance with 10CFR50 the releases from both units will be summed and the limits of Appendix I will be doubled.

Releases made via the shield building vents as a result of routine surveillance tests or scheduled short term maintenance/work activities of 2 hours or less do not require the sampling and analysis of shield building vent stack samples described in Table 3.1 for the following reasons:

a. Shield building effluent particulates and iodines are filtered through a PAC (Particulate Absolute Charcoal) system and the auxiliary building vent normal ventilation has no filtration.

b. The lower limit of detection limits specified in Table 3.1 can not be obtained on all the specified nuclides with normal sample flow and a sample duration of less than 2 hours.

c. Shield building vent releases are monitored via noble gas monitor.

d. Auxiliary building normal ventilation flow is higher than the special ventilation fans that vent via the shield building vent stack.

Therefore, it is conservative to assume that the auxiliary building normal ventilation system would continue to run during the testing/maintenance period. The surveillance test or maintenance/work being performed should be evaluated to ensure the airborne activity in the affected areas will not increase during the evolution. If this evaluation indicates a possible increase in airborne effluents, or radiation monitors or continuous air monitors in the affected buildings indicate higher than normal background airborne activity before the evolution begins, the shield building vent stack sampled **SHALL** be sampled and analyzed as described in Table 3.1.

Since Sr-89 and Sr-90 concentrations are determined from composite samples, the pre-release, weekly and monthly airborne dose calculations and comparisons to quarterly and annual limits should be completed using the most recent available composite sample results. The quarterly dose values and critical receptors reported to the USNRC **SHALL** be calculated using the actual composite results.

5.3.1 Noble Gas

A. Dose Equations

The air dose at the critical receptor due to noble gases released in gaseous effluents is determined by Equations 5.3-1 and 5.3-2. The critical receptor will be identified as described in Section 5.3.4.

For gamma radiation:

$$3.17 \times 10^{-8} \sum_i M_i \left[(\chi/Q)_v Q_{iv} + (\chi/q)_v q_{iv}\right]$$

< 10 mrad for any calendar quarter
< 20 mrad for any calendar year (5.3-1)

For beta radiation:

$$3.17 \times 10^{-8} \sum_i N_i \left[(\chi/Q)_v Q_{iv} + (\chi/q)_v q_{iv}\right]$$

< 20 mrad for any calendar quarter
< 40 mrad for any calendar year (5.3-2)

where:

M_i = The air dose factor due to gamma emission for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$; (Table 5.4)

N_i = The air dose factor due to beta emissions for each identified noble gas radionuclide i, mrad/yr per $\mu Ci/m^3$; (Table 5.4)

$(\chi/Q)_v$ = the annual average relative concentration for areas at or beyond the restricted area boundary for LONG-TERM vent releases (greater than 500 hr/year), sec/m^3 (Appendix A, Table A-4);

$(\chi/q)_v$ = The relative concentration for areas at or beyond the restricted area boundary for SHORT-TERM vent releases (equal to or less than 500 hrs/year), sec/m^3 (Appendix A, Table A-7);

q_{iv} = The total release of noble gas radionuclide i in gaseous effluents for SHORT-TERM vent releases from both units (equal to or less than 500 hrs/year), μCi;

Q_{iv} = the total release of noble gas radionuclide i in gaseous effluents for LONG-TERM vent releases from both units (greater than 500 hrs/yr), μCi;

3.17×10^{-8} = the inverse of the number of seconds in a year.

Noble gases will be released from PINGP from up to six vents.

LONG-TERM χ/Q's were given in Appendix A. SHORT-TERM χ/q's were calculated using the USNRC computer code "XOQDOQ" assuming 100 hours per year SHORT TERM RELEASES and are given in Appendix A (Table A-7). Values of M and N are taken directly from Reg Guide 1.109 and are given in Table 5.4.

B. Cumulation of Doses

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results will be added to the doses calculated from the other months in the quarter of interest and the year of interest and compared to the limits given in Section 3.3. If these limits are exceeded, a special report will be submitted to the USNRC. If twice the limits are exceeded, a special report showing compliance with 40CFR190 will be submitted.

5.3.2 Radioiodine, Particulates, and Other Radionuclides

A. Dose Equations

The worst case dose to an individual from I-131, I-133, tritium, and radioactive particulates with half-lives greater than eight days in gaseous effluents released beyond the SITE BOUNDARY is determined by the following expressions:

During any calendar quarter or year -

$$3.17 \times 10^{-8} \ \Sigma_j \Sigma_i R_{ijak} \left[W_v Q_{iv} + w_v q_{iv} \right] \qquad (5.3\text{-}3)$$

< 15 mrem (per quarter)
< 30 mrem (per calendar year)

where:

Q_{iv} = release of radionuclide i for LONG-TERM vent releases from both units (greater than 500 hrs/yr), μCi;

q_{iv} = release of radionuclide i for SHORT-TERM purge releases from both units (equal to or less than 500 hrs/yr); μCi;

W_v = the dispersion parameter for estimating the dose to an individual at the controlling location for LONG-TERM vent releases (greater than 500 hrs/yr);

w_v = the dispersion parameter for estimating the dose to an individual at the controlling location for SHORT-TERM vent releases (equal to or less than 500 hrs/yr);

3.17×10^{-8} = the inverse of the number of seconds in a year;

R_{ijak} = the dose factor for each identified radionuclide i, pathway j, age group a, and organ k, m^2 mrem/yr per μCi/sec or mrem/yr per μCi/m^3.

The above equation will be applied to each combination of age group and organ. Values of R_{ijak} have been calculated using the methodology given in NUREG-0133 and are given in Tables 5.5-1 through 5.5-19. Dose factors for isotopes not listed will be determined in accordance with the methodology in Appendix C. Equations 5.3-3 will be applied to a controlling location which will have one or more of the following: residence, vegetable garden and milk animal. The selection of the actual receptor is discussed in Section 5.3.4. The source terms and dispersion parameters in Equation 5.3-3 are obtained in the same manner as in Section 5.2. The W values are in terms of $\chi/Q(sec/m^3)$ for the inhalation pathways and for tritium (Tables A-4 and A-7) and in terms of $D/Q(1/m^2)$ for all other pathways (Tables A-5 and A-8).

B. Cumulation of Doses

Doses calculated monthly will be summed for comparison with quarterly and annual limits. The monthly results should be added to the doses cumulated from the other months in the quarter of interest and in the year of interest and compared with the limits in Section 3.5. If these limits are exceeded, a special report will be submitted to the USNRC. If twice the limits are exceeded, a special report showing compliance with 40CFR190 will be submitted.

5.3.3 Projection of Doses

Doses resulting from the release of gaseous effluents will be projected monthly. The doses calculated for the present month will be used as the projected doses unless information exists indicating that actual releases could differ significantly in the next month. In this case the source terms will be adjusted to reflect this information and the justification for the adjustment noted. If the projected release of noble gases for the month exceeds 2 percent of the calendar year limits of equation 5.3-1 or 5.3-2, additional waste gas treatment will be provided. If the projected release of I-131, I-133, tritium, and radioactive particulates with half-lives greater than 8 days exceeds 2 percent of the calendar year limit of equation 5.3-3, operation of the ventilation exhaust treatment equipment is required if not currently in use.

5.3.4 Critical Receptor Identification

For compliance with 10CFR50 App I ALARA design objectives, two critical receptor locations will be identified to demonstrate compliance with limits on dose to air or individual MEMBERS OF THE PUBLIC in unrestricted areas from plant effluents.

For noble gases the critical location will be based on the beta and gamma air doses only. This location will be the offsite location with the highest long term vent χ/Q values given in Appendix A, Table A-3. This location will remain the same unless meteorological data is reevaluated or the SITE BOUNDARY changes.

The critical location for the I-131, I-133, tritium, and long-lived particulate pathway will be selected once each year. The selection will follow the annual land use census performed within 5 miles of the PINGP. Each of the following locations will be evaluated as potential critical receptors.

1. Residence in each sector
2. Vegetable garden producing leafy green vegetables
3. All identified milk animal locations

Following the annual survey, doses will be calculated using Equation 5.3-3 for all new identified receptors and those receptors whose characteristics have changed significantly. The calculation will include appropriate information about each new location. The dispersion parameters given in this manual should be employed. The total releases reported for the previous calendar year should be used as the source terms.

5.4 References

"NSP-Prairie Island Nuclear Generating Plant, Appendix I Analysis - Supplement No. 1 - Docket No. 50-282 and 50-306", Table 2.1-4.

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6.0 TOTAL DOSE FROM RADIOACTIVE RELEASES AND URANIUM FUEL SOURCES

SPECIFICATIONS

6.1 In accordance with T.S.6.5.D.10 the annual dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from URANIUM FUEL CYCLE sources **SHALL** be limited to less than or equal to 25 mrems to the whole body or any organ, except the thyroid, which **SHALL** be limited to less than or equal to 75 mrems.

APPLICABILITY At all times.

ACTION

a. With the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Specification 2.3.a, 2.3.b, 3.3.a, 3.3.b, 3.5.a, or 3.5.b, calculations **SHALL** be made including direct radiation contributions from the reactor units (including outside storage tanks) to determine whether the above limits have been exceeded. If such is the case, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, a Special Report that includes the following:

1. Defines the corrective action(s) to be taken to reduce subsequent releases to prevent reoccurrence of exceeding the above limits.

2. Includes the schedule for achieving conformance with the above limits.

3. This special report as defined in 10CFR20.2203(a), **SHALL** include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report.

4. Describe levels of radiation and concentrations of radioactive material involved, and cause of the exposure levels and concentrations.

5. If the estimated dose(s) exceed the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the special 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.

SURVEILLANCE REQUIREMENTS

6.2 Cumulative dose contributions from liquid and gaseous effluents **SHALL** be determined in accordance with Surveillance Requirements 2.4, 3.4, and 3.6, and in accordance with the methodology and parameters in the ODCM.

6.3 Cumulative dose contributions from direct radiation from the reactor units **SHALL** be determined. This application is applicable only under conditions set forth in ACTION (a) of Specification 6.1 above.

7.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

MONITORING PROGRAM

SPECIFICATIONS

7.1 In accordance with T.S.6.5.A the Radiological Environmental Monitoring Program (REMP) **SHALL** be conducted as specified in Table 7.1.

APPLICABILITY At all times.

ACTION

a. Whenever the Radiological Environmental Monitoring Program is not being conducted as described in Table 7.1 the Annual Radiological Environmental Monitoring Report **SHALL** include a description of the reasons for not conducting the program as required and the plans for the prevention of a recurrence.

b. Deviations are permitted from the required sampling schedule if samples are unobtainable due to hazardous conditions, seasonable unavailability, or to malfunctions of automatic sampling equipment. If the latter occurs, 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 reported in the Annual Radiological Environmental Monitoring Report.

c. 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 7.2 when averaged over any calendar quarter, in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days from the end of the affected calendar quarter a Special Report that includes the following:

   1. Identifies the cause(s) for exceeding the limit(s).

   2. Defines the corrective actions that have been taken to reduce radioactive effluents so that the potential annual dose[1] to a MEMBER OF THE PUBLIC is less than the calendar year limits of Specifications 2.3, 3.3, or 3.5.

[1] The Methodology and parameters used to estimate the potential annual dose to a member of the public **SHALL** be indicated in the report.

When more than one of the nuclides in Table 7.2 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 nuclides other than those in Table 7.2 are detected and are the result of plant effluents, this report **SHALL** be submitted if the potential annual dose[2] to a MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Specifications 2.3, 3.3, or 3.5. This 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 Monitoring Report.

d. Although deviations from the sampling schedule are permitted under Paragraph b. above, whenever milk or leafy vegetation samples can no longer be obtained from the designated sample locations required by Table 7.1, the Annual Radiological Environmental Monitoring Report **SHALL** explain why the samples can no longer be obtained and identify the new locations added to and deleted from the monitoring program.

SURVEILLANCE REQUIREMENTS

7.2 The radiological environmental monitoring samples **SHALL** be collected pursuant to Table 7.1 from the specific locations of the radiological environmental monitoring sampling program described in the Radiation Protection Implementing Procedure (RPIP) 4700, and **SHALL** be analyzed pursuant to the requirements of Table 7.1 and the detection capabilities required by Table 7.3.

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

LAND USE CENSUS

SPECIFICATIONS

7.3 A Land Use Census **SHALL** be conducted and **SHALL** identify:

a. The location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 ft^2 producing fresh leafy vegetation in each of the 16 meteorological sectors within a distance of 5 miles.

b. Fields or gardens of greater than 500 ft^2 producing corn that are irrigated with water taken from the Mississippi River between the plant and a point 5 miles downstream.

APPLICABILITY

At all times.

ACTION

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated in Specification 3.6, in lieu of a Licensee Event Report, identify the new location(s) in the next Annual Radiological Environmental Monitoring Report.

b. With the 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 Specification 7.1, add the new location(s) to the Radiological Environmental Monitoring Program within 30 days. The sampling location(s) excluding the control station location, having a lower calculated dose or dose commitment (via the same exposure pathway) may be deleted from this monitoring program. Identify the new location(s) in the next Annual Radiological Environmental Monitoring Report.

c. If fields or gardens larger than 500 ft^2 producing corn are being irrigated with Mississippi River water, appropriate samples **SHALL** be collected and analyzed per Table 7.1.

SURVEILLANCE REQUIREMENTS

7.4 The Land Use Census **SHALL** be conducted at least once per 12 months between the dates of May 1 and October 31 by door to door survey, aerial survey, or by consulting local agricultural authorities or associations. A summary of the results of the land use census **SHALL** be included in the Annual Radiological Environmental Monitoring Report.

INTERLABORATORY COMPARISON PROGRAM

SPECIFICATIONS

7.5 An analysis **SHALL** be performed on radioactive materials, supplied by an NRC approved crosscheck program. This program involves the analyses of samples provided by a control laboratory as well as with other laboratories which receive portions of the same samples. Media used in this program (air, milk, water, etc.) **SHALL** be limited to those found in the radiation environmental monitoring program.

APPLICABILITY

At all times.

ACTION

a. When required analyses are not performed, corrective action **SHALL** be reported in the Annual Radiological Environmental Monitoring Report.

SURVEILLANCE REQUIREMENTS

7.6 The summary results of analyses performed as part of the above required Interlaboratory Comparison Program **SHALL** be included in the Annual Radiological Environmental Monitoring Report.

8.0 REPORTING REQUIREMENTS

8.1 Annual Radioactive Effluent Report

In accordance with T.S.6.6.C the Annual Radioactive Effluent Report covering the operation of the units **SHALL** be submitted in accordance with 10CFR50.36A and **SHALL** include:

a. The Annual Radioactive Effluent Report covering the operation of the plant during the previous calendar year **SHALL** be submitted by May 15 of each calendar year to the Administrator of the appropriate Regional NRC office or designee.

b. The Annual Radioactive Effluent Report **SHALL** include a summary of the quantities of radioactive liquid and gaseous effluents released from the plant as outlined in Appendix B of Regulatory Guide 1.21, Revision 1, June, 1974, with data summarized on a quarterly basis. In the event that some results are not available for inclusion with the report, the report **SHALL** be submitted noting and explaining the reasons for the missing results. The missing data **SHALL** be submitted as soon as possible in a supplementary report.

c. The Annual Radioactive Effluent Report **SHALL** include an assessment of the radiation doses from radioactive effluents released from the plant during the previous calendar year. The report **SHALL** also include an assessment of the radiation doses from radioactive liquids and gaseous effluents to individuals due to their activities inside the SITE BOUNDARY (Figures 3.1 and 3.2) during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) **SHALL** be included in the report.

d. The Annual Radioactive Effluent Report **SHALL** include the following information for solid waste shipped offsite during the report period.

   1. Container volume,
   2. Total curie quantity (specify whether determined by measurement or estimate),
   3. Principal radionuclides (specify whether determined by measurement or estimate),
   4. Type of waste (e.g., spent resin, compacted dry waste, evaporated bottoms),
   5. Type of container (e.g., LSA, Type A, Type B, Large Quantity), and
   6. Solidification agent (e.g., cement, urea formaldehyde).

e. The Annual Radioactive Effluent Report **SHALL** include ABNORMAL RELEASES from the site of radioactive materials in gaseous and liquid effluents on a quarterly basis.

f. If the calculated dose from the release of radioactive materials in liquid or gaseous effluents exceeds twice the limits of 10 CFR 50, Appendix I, the Annual Radioactive Effluent Report **SHALL** also include an assessment of radiation doses to the most likely exposed MEMBER OF THE GENERAL PUBLIC from reactor releases and other nearby uranium fuel cycle sources (including doses from primary effluent pathways and direct radiation) for the previous 12 consecutive months to show compliance with 40CFR190, Environmental Radiation Protection Standards for Nuclear Power Operation.

g. The Annual Radioactive Effluent Report **SHALL** include a description (including cause, response and prevention of reoccurrence) of occurrences when the sampling frequency, minimum analysis frequency, or lower limit of detection requirements specified in Tables 2.1 and 3.1 were exceeded.

h. The Annual Radioactive Effluent Report **SHALL** include a description of occurrences when less than the minimum required radioactive liquid and/or gaseous effluent monitoring instrumentation channels were operable as required in Tables 2.2 and 3.2.

i. The Annual Radioactive Effluent Report **SHALL** include a description of the circumstances which caused the failure to complete the minimum sample and/or analysis frequency required by Tables 2.1 and 3.1. The report **SHALL** include the actions taken to restore the sampler, actions taken to prevent recurrence, and a summary of the occurrences effect on the analysis validity.

j. The Annual Radioactive Effluent Report **SHALL** include a description of the circumstances which result in LLD's higher than those listed in Tables 2.1 and 3.1.

k. The Annual Radioactive Effluent Report **SHALL** include an assessment of the radiation doses from radioactive effluents released from the ISFSI during the previous calendar year.

l. Licensee initiated changes to the ODCM **SHALL** be submitted to the NRC in the form of a complete legible copy of the entire ODCM as a part of or concurrent with the Annual Radioactive Effluent Report for the period of the report in which the change in the ODCM was made. Each change **SHALL** be identified by markings in the margin of the affected pages clearly indicating the area of the page that was changed. The date (i.e., month and year) of the change **SHALL** be clearly indicated on the Record of Revisions page.

m. The Annual Radioactive Effluent Report **SHALL** include description of changes to the Process Control Program.

8.2 Annual Radiological Environmental Monitoring Report

In accordance with T.S.6.6.B the Annual Radiological Environmental Monitoring Report covering the operation of the offsite monitoring program **SHALL** include:

a. The Annual Radiological Environmental Monitoring Report covering the operation of the plant during the previous calendar year **SHALL** be submitted by May 15 of each year to the Administrator of the appropriate Regional NRC office or his designee.

b. The Annual Radiological Environmental Monitoring Report **SHALL** include summarized and tabulated results in the format of Regulatory Guide 4.8, December 1975 of all radiological environmental samples taken during the report period. In the event that some results are not available for inclusion with the report, the report **SHALL** be submitted noting and explaining the reasons for the missing results. The missing data **SHALL** be submitted as soon as possible in a supplementary report.

c. The Annual Radiological Environmental Monitoring Report **SHALL** include summaries, interpretations, and an analysis of trends of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, operational controls (as appropriate), and previous environmental surveillance reports and an assessment of the observed impacts of the plant operation on the environment. The report **SHALL** also include a summary of the results of the land use census. If harmful effects or evidence of irreversible damage are detected by the monitoring, the report **SHALL** provide an analysis of the problem and a planned course of action to alleviate the problem.

d. The Annual Radiological Environmental Monitoring Report **SHALL** also include the following: a summary description of the radiological environmental monitoring program; a map of sampling locations within a distance of five miles keyed to a table giving distances and directions from the reactor; and the results of licensee participation in the Interlaboratory Comparison Program.

e. The Annual Radiological Environmental Monitoring Report **SHALL** include reasons for all deviations from the REMP sampling program as specified in Table 7.1 and plans for the prevention of a recurrence, if applicable.

f. The Annual Radiological Environmental Monitoring Report **SHALL** contain a description of when and why milk or leafy vegetable samples specified in Table 7.1 cannot be obtained from the designated sample locations, and identify the new locations added to and deleted from the monitoring program.

g. If the level of radioactivity in an environmental sampling medium at a specified location exceeds the reporting levels of Table 7.2 for the sample type specified in Table 7.1 and is NOT the results of plant effluents, the condition **SHALL** be reported in the Annual Radiological Environmental Monitoring Report.

h. A summary of the Interlaboratory Comparison Program **SHALL** be included in the Annual Radiological Environmental Monitoring Report. If the required Interlaboratory Comparison Program analyses are NOT performed, corrective action **SHALL** be reported in the Annual Radiological Environmental Monitoring Report

i. The Annual Radiological Environmental Monitoring Report **SHALL NOT** include the Complete Analysis Data Tables. These contain the results of each sample analysis and **SHALL** be maintained by the licensee.

8.3 Annual Summary of Meteorological Data

An annual summary of meteorological data **SHALL** be submitted, at the request of the Commission, for the previous calendar year in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.

8.4 Record Retention

a. Records retained for Five Years:

1. Periodic checks, inspections, tests and calibrations of components and systems as related to the specifications and treatment systems defined in the ODCM.

2. Records of wind speed and direction.

b. The following records **SHALL** be retained for the Life of the Plant:

1. Liquid and airborne radioactive releases to the environment.

2. Off-site environmental monitoring surveys.

3. Records of reviews performed for changes made to the Offsite Dose Calculation Manual.

BASES

2.0 LIQUID EFFLUENTS

2.1/2.2 CONCENTRATION

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents from the site to UNRESTRICTED AREAS will be less than the concentration levels specified in 10CFR20, Appendix B, Table II, Column 2. This limitation provides additional assurance that the levels of radioactive materials in bodies of water outside the site will not result in exposures exceeding (1) the Section II.A design objectives of Appendix I, 10CFR Part 50, and (2) the limits of 10CFR Part 20.1301(a)(1). The concentration limit for dissolved or entrained noble gases is 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 International Commission on Radiological Protection (ICRP) Publication 2.

This control applies to the releases of radioactive materials in liquid effluents from all units at the site.

Secondary condenser drains were not included in the routine sampling requirements of Table 2.1. Operating experience has shown that the condenser activity during plant transients normally consists of very low levels of tritium. Condensers are normally only released directly to the environment during plant startups and shutdowns and these volumes combined with the low levels of activity are insignificant when compared to the waste tank activities. Condenser releases should be sampled and analyzed during a significant plant event (i.e. steam generator tube rupture, or steam dump to the condenser with a primary to secondary leak >725 gpd).

2.3/2.4 DOSE

Provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide 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 is reasonably achievable". Considering that the nearest drinking water supply using the river for drinking water is more than 300 miles downstream, there is reasonable assurance that the operation of the facility will not result in radioactive concentrations in the drinking water that are in excess of the 40CFR141 requirements.

2.5/2.6 LIQUID RADWASTE TREATMENT SYSTEMS

Provides assurance that the liquid radwaste treatment system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirements that appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents be kept "as low as reasonably achievable". This control implements the requirements of 10CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10CFR Part 50 and the design objective given in Section II.D of Appendix I to 10CFR Part 50. The limits governing the use of appropriate portions of the liquid radwaste system were specified as a suitable fraction of the guide set forth in Section II.A of Appendix I, 10CFR Part 50, for liquid effluents.

The liquid radwaste treatment system is shared by both units. It is not practical to determine the contribution from each unit to liquid radwaste releases. For this reason, liquid radwaste releases will be allocated equally to each unit.

2.7/2.8 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

The radioactive liquid effluent monitoring 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 Setpoint for these instruments **SHALL** be calculated and adjusted in accordance with the methodologies and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10CFR Part 50.

2.9/2.10 LIQUID STORAGE TANKS

Restricting the quantities of radioactive material contained in the specified tanks provides assurance that in the event of an uncontrolled release of the contents of the tank, the resulting concentrations would be less than the limits of 10CFR Part 20, Appendix B, Table II, Column 2, in an UNRESTRICTED AREA.

3.0 GASEOUS EFFLUENTS

3.1/3.2 DOSE RATE

This control is provided to ensure that the dose rate at any time at the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10CFR Part 20 for UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10CFR 20, Appendix B, Table II, Column 1. These limits provide reasonable assurance that the radioactive material discharged in gaseous effluents will not result in the exposure of an individual in an UNRESTRICTED AREA to annual average concentrations exceeding limits specified in Appendix B, Table II of 10CFR Part 20. For individuals who may at times be within the SITE BOUNDARY, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to an individual at or beyond the SITE BOUNDARY to 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 less than or equal to 1500 mrem/year at or beyond the SITE BOUNDARY.

This control applies to the release of radioactive materials in gaseous effluent from all units at the site.

3.3/3.4 DOSE FROM NOBLE GAS

This control is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10CFR Part 50. The Limiting Conditions for Operation implement the guides set forth in Section II.B of Appendix I. The ACTION statement provides the required operating flexibility and at the same time implements the guides set forth in Section IV.A of Appendix I to assure that the release of radioactive material in gaseous effluents will be kept "as low as reasonably achievable".

3.5/3.6 DOSE FROM IODINE 131, IODINE 133, TRITIUM & PARTICULATES

Implements the requirements of Section II.C, III.A and IV.A of Appendix I, 10CFR Part 50. The Limiting Conditions for Operation are the guides set forth in Section II.C of Appendix I. The ACTIONS statement provides the required operating flexibility and at the same time implements 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 reasonable achievable". The release rate specifications for I-131, I-133, tritium and radioactive particulates with half-lives greater than eight days are dependent on the existing radionuclide pathways to MEMBERS OF THE PUBLIC in the UNRESTRICTED AREA, using child dose conversion factors. The pathways which are examined in the development of these calculations are: 1) individual inhalation of airborne radionuclides, 2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, 3) deposition onto grassy areas where milk animals and meat producing animals graze with consumption of the milk and meat by man, and 4) deposition on the ground with subsequent exposure of man.

3.7/3.8 GASEOUS RADWASTE TREATMENT SYSTEMS

This control provides assurance that the Waste Gas Treatment System and the VENTILATION EXHAUST TREATMENT SYSTEMS will be available for use whenever gaseous wastes are released to the environment. The requirement that the appropriate portions of the Waste Gas Treatment System be used when specified provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable". This specification implements the requirements of 10CFR 50.36a, General Design Criterion 60 of Appendix A to 10CFR Part 50, and the design objective given in Section II.D of Appendix I to 10CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the guide set forth in Sections II.B and II.C of Appendix I, 10CFR Part 50, for gaseous effluents.

The Waste Gas Treatment System, containment purge release vent, and spent fuel pool are shared by both units. Experience has also shown that contributions from both units are released from each auxiliary building vent. For these reasons, it is not practical to allocate releases to a specific unit. All releases will be allocated equally in determining conformance to the design objectives of 10CFR Part 50, Appendix I.

Restricting the quantities of radioactivity which can be stored in one decay tank provides assurance that in the event of an uncontrolled release of the tank's contents, the resulting total body exposure to an individual at the nearest EXCLUSION AREA BOUNDARY will not exceed 0.5 rem.

The cooling towers at Prairie Island are located to the south of the plant and are within 500 to 2000 feet from the point of release. At low wind velocities (below 10 mph) the gaseous activity released from the gaseous radwaste system could be at or near ground level near the cooling towers and remain long enough to be drawn into the circulating water in the tower. This control minimizes the possibility of releases of gaseous effluents from entering the river from cooling tower scrubbing.

3.9/3.10 EXPLOSIVE GAS MONITORING INSTRUMENTATION

To ensure the concentration of potentially explosive gas mixtures contained in the waste gas treatment system is maintained below the flammability limits of hydrogen and oxygen. Automatic control features are included in the system to prevent the hydrogen and oxygen concentrations from reaching these flammability limits. Maintaining the concentrations below the flammability limit provides assurance that the releases of radioactive materials will be controlled in conformance with the requirements of General Design Criterion 60 of Appendix A to 10CFR Part 50.

The waste gas treatment system is a pressurized system with two potential sources of oxygen: 1) oxygen added for recombiner operation, and 2) placing tanks vented for maintenance back on the system. The system is operated with flow through the recombiners and with excess hydrogen in the system. By verifying that oxygen is less than or equal to 2% at the recombiner outlet, there will be no explosive mixtures in the system. Waste gas system oxygen is monitored by the two recombiner oxygen analyzers and the 121 gas analyzer. The 121 gas analyzer only monitors the low level loop of the waste gas system. If the required gas analyzers are not operable, the oxygen to the recombiner will be isolated to prevent oxygen from entering the system from this source. Tanks that may undergo maintenance are normally purged with nitrogen before placing them in service to eliminate this as a source of oxygen.

3.11/3.12 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The radioactive gaseous effluent monitoring 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 Setpoint for these instruments **SHALL** be calculated and adjusted in accordance with the methodologies and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10CFR Part 50.

6.0 TOTAL DOSE

This control is provided to meet the dose limitations of 10CFR Part 190 that have been incorporated into 10CFR 20 by FR 18525. The control 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 mrems to the whole body or to any organ, except the thyroid, which SHALL be limited to less than or equal to 75 mrems. 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 40CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses 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 40CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40CFR Part 190 have not already been corrected), in accordance with the provisions of 40CFR 190.11 & 10CFR 20.405c, is considered to be a timely request and fulfills the requirements of 40CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10CFR Part 20, as addressed in Specification 2.1 and 3.1. 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.

7.0 RADIOLOGICAL ENVIRONMENTAL MONITORING

7.1/7.2 MONITORING PROGRAM

Provides measurements of radiation and radioactive materials in those exposure pathways and for those radionuclides which lead to the highest potential radiation exposures of individuals resulting from the plant operation. This program thereby supplements the radiological effluent monitoring by verifying that the measurable concentrations of radioactive materials and levels are not higher than expected in the bases of the effluent measurements and modeling of the environmental exposure pathways.

The detection capabilities required by Table 7.1 are state-of-the art for routine environmental measurements in industrial laboratories and the LLDs for drinking water meet the requirement of 40CFR Part 141.

7.3/7.4 LAND USE CENSUS

This control is provided to ensure that changes in the use of off site areas are identified and that modifications to the monitoring program are made if required by the results of the census. The best survey information from door-to-door, aerial or consulting with local agricultural authorities **SHALL** be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10CFR 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 leaf vegetation (i.e., similar to lettuce and cabbage), and 2) a vegetation yield of 2 kg/square meter.

7.5/7.6 INTERLABORATORY COMPARISON PROGRAM

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

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Table 1.1 Operational Modes

MODE	TITLE	REACTIVITY CONDITION	%RATED THERMAL POWER	AVERAGE COOLANT TEMPERATURE	REACTOR VESSEL HEAD CLOSURE BOLTS FULLY TENSIONED
1	POWER OPERATION	Critical	> 2%	NA	YES
2	HOT STANDBY**	Critical	≤ 2%	NA	YES
3	HOT SHUTDOWN**	Subcritical	NA	≥ 350°F	YES
4	INTERMEDIATE SHUTDOWN**	Subcritical	NA	< 350°F ≥ 200°F	YES
5	COLD SHUTDOWN	Subcritical	NA	< 200°F	YES
6	REFUELING	NA*	NA	NA	NO

* Boron concentration of the reactor coolant system and the refueling cavity sufficient to ensure that the more restrictive of the following conditions is met:

a. $K_{eff} \leq 0.95$, or

b. Boron concentration ≥ 2000 ppm.

** Prairie Island specific MODE title, not consistent with Standard Technical Specification MODE titles. MODE numbers are consistent with Standard Technical Specification MODE numbers.

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Table 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) (μCi/ml)[a,d]
Batch Releases[g]: Waste Tanks	Each Batch (Prior to Release)	Each Batch (Prior to Release)	Principal Gamma Emitters[c]	5×10^{-7}
			I-131	1×10^{-6}
	One Batch Each Month	One Batch Each Month	Dissolved and Entrained Gases	1×10^{-5}
	Each Batch	Monthly Composite[b]	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
	Each Batch	Quarterly Composite[b]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
Continuous Release[e]: Turbine Building Sumps	Continuous[j,h,k]	Weekly Composite[f]	Principal Gamma Emitters[c]	5×10^{-7}
			I-131	1×10^{-6}
	Weekly Grab Sample	Each Sample	Dissolved and Entrained Gases	1×10^{-5}
	Continuous[j,k]	Monthly Composite[f]	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous[j,k]	Quarterly Composite[f]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}
Continuous Release[e]: Steam Generator Blowdown	Weekly Grab Sample During Releases[i]	Each Sample Composite[b]	Principal Gamma Emitters[c]	5×10^{-7}
			I-131	1×10^{-6}
	Grab Sample Each Month During Releases	Each Sample	Dissolved and Entrained Gases	1×10^{-5}
	Weekly Grab Sample During Releases[i]	Monthly Composite[b]	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Weekly Grab Sample During Releases[i]	Quarterly Composite[b]	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

Table 2.1 Radioactive Liquid Waste Sampling and Analysis Program

Table Notations

a. 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 d 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:

$$LLD = \frac{4.66 s_b}{E \bullet V \bullet 2.22 X 10^6 \bullet Y \bullet \exp(-\lambda \Delta \tau)}$$

where:

LLD = the "a priori" lower limit of detection (microCurie per unit mass or volume),

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

E = the counting efficiency (counts per disintegration),

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

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

$\Delta\tau$ = the elapsed time between the midpoint of sample collection and the time of counting (sec).

Typical values of E, V, Y, and $\Delta\tau$ should be used in the calculation.

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

Table 2.1 Radioactive Liquid Waste Sampling and Analysis Program

Table Notations [Cont'd]

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

c. The principal gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only the nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, **SHALL** also be identified and reported.

d. Nuclides which are below the LLD for the analyses should not be reported as being present at the LLD level. When unusual circumstances result in LLDs higher than required, the reasons **SHALL** be documented in the Annual Radioactive Effluent Report.

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

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

g. 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.

h. Daily grab samples from the turbine building sumps **SHALL** be collected and analyzed for principal gamma emitters, including I-131, whenever primary to secondary leakage exceeds 150 gpd in any steam generator. This sampling is provided in lieu of continuous monitoring with automatic isolation.

i. Grab samples **SHALL** be collected at least once per 12 hours when steam generator blowdown releases are being made and the specific activity of the secondary coolant is $\geq$0.01 µCi/gram DOSE EQUIVALENT I-131 or primary to secondary leakage exceeds 150 gpd.

Table 2.1 Radioactive Liquid Waste Sampling and Analysis Program

Table Notations [Cont'd]

j. A continuous sample is one in which the sampling media is in place at all times during the release period, with the exception of periods necessary to change sampling media and scheduled short term equipment maintenance. If the sample media is not in place during the entire release period, an explanation of the occurrence, actions taken to restore the sampler and to prevent recurrence, and a summary description to explain the occurrence's effect on the analysis validity **SHALL** be included in the Annual Radioactive Effluent Report.

k. Continuous samples of the Turbine Building Sumps are collected via on-line composite samplers. These samplers function on timers and collect a predetermined volume of effluent whenever the TBS pumps are in operation. Samples from these compositors are collected daily and saved for the preparation of a weekly composite prepared utilizing volumes proportional to the sample volumes collected daily by the compositor. If the use of a submersible pump is necessary to maintain sump level, that pump should be positioned above the normal TBS pump controlling level and include a timer to allow the calculation of the additional release volume.

Table 2.2 Radioactive Liquid Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. Gross Radioactivity Monitors Providing Automatic Termination of Release			
a. Liquid Radwaste Effluent Line	1	During releases	1
b. Steam Generator Blowdown Effluent Line	1/Unit	During releases	2
2. Flow Rate Measurement Devices			
a. Liquid RadwasteEffluent Line	1	During releases requiring throttling of flow	4
b. Steam Generator Blowdown Flow	1/Gen	During releases	4
3. Continuous Composite Samplers			
a. Each Turbine Building Sump Effluent Line	1/Unit	During releases	3
4. Discharge Canal Monitor	1	At all times	6
5. Tank Level Monitor			
a. Condensate Storage Tanks	1/Unit	When tanks are in use	5
b. Temporary Outdoor Tanks Holding Radioactive Liquid	1/Tank	When tanks are in use	5
6. Discharge Canal Flow System (Daily determination and following changes in flow)	NA	At all times	

Table 2.2 Radioactive Liquid Effluent Monitoring Instrumentation Table Notations

ACTION 1 With the number of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases may continue for up to 14 days provided that prior to each release:

a. At least two independent samples are analyzed in accordance with Specification 2.2.1, 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 2 With the number of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are analyzed for gross radioactivity (beta or gamma) at a limit of detection of at least 10^{-7} μCi/gram:

1. At least once per 12 hours when the specific activity of the secondary coolant is ≥0.01 μCi/gram DOSE EQUIVALENT I-131, or
2. At least once per 24 hours when the specific activity of the secondary coolant is <0.01 μCi/gram DOSE EQUIVALENT I-131.

ACTION 3 With the numbers of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided that, at least once per 12 hours, grab samples are collected and saved for weekly composition and analysis in accordance with Table 2.1.

ACTION 4 With the number of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 4 hours during actual releases. Pump curves may be used to estimate flow.

ACTION 5 With the number of channels Operable less than required by the Minimum Channels Operable requirement, liquid additions to the tank may continue for up to 30 days provided the tank liquid level is estimated during all liquid additions.

ACTION 6 With the numbers of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided that, at least once per 12 hours, grab samples are collected and analyzed for gamma emitters.

Table 2.3 Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	CHANNEL CHECK Frequency (4)	SOURCE CHECK Frequency	FUNCTIONAL TEST Frequency	CALIBRATION Frequency
Liquid Radwaste Effluent Line Gross Radioactivity Monitor	Daily during releases	Prior to each release	Quarterly(1)	At least once every 18 months(3)
Liquid Radwaste Effluent Line Flow Instrument	Daily during releases	----	----	At least once every 18 months
Steam Generator Blowdown Gross Radioactivity Monitors	Daily during releases	Monthly	Quarterly(1)	At least once every 18 months(3)
Steam Generator Blowdown Flow	Daily during releases	----	----	At least once every 18 months
Turbine Building Sump Continuous Composite Samplers	Daily during releases (Includes sample volume check)	----	----	----
Discharge Canal Monitor	Daily during releases	Monthly	Quarterly(2)	At least once every 18 months(3)
Discharge Canal Flow Instruments	Daily during releases	----	----	At least once every 18 months
Condensate Storage Tank Level Monitors	Daily	----	Quarterly	At least once every 18 months
Level Monitors for Temporary Outdoor Tanks Holding Radioactive Liquid	Daily when in use	----	Quarterly when in use	At least once every 18 months when in use

Table 2.3 Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Table Notations

1. The CHANNEL FUNCTIONAL TEST **SHALL** also demonstrate that automatic isolation of this pathway and control room annunciation occurs if any of the following conditions exists:

   a. Instrument indicates measured levels above the alarm/trip setpoint.

   b. Circuit failure (if provided).

   c. Instrument indicates a downscale failure (if provided).

   d. Instrument controls not set in operate mode (if provided).

2. The CHANNEL FUNCTIONAL TEST **SHALL** also demonstrate that alarm annunciation occurs if any of the following conditions exists:

   a. Instrument indicates measured levels above the alarm/trip setpoint.

   b. Circuit failure (if provided).

   c. Instrument indicates a downscale failure (if provided).

   d. Instrument controls not set in operate mode (if provided).

3. The initial CHANNEL CALIBRATION **SHALL** be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using sources traceable to NIST standards. These standards **SHALL** permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATIONS, sources that have been related to the initial calibration **SHALL** be used.

4. The CHANNEL CHECK **SHALL** consist of verifying indication of flow during periods of release. A CHANNEL CHECK **SHALL** be made at least once daily on any day on which continuous, periodic, or batch releases are made.

TABLE 3.1 Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit[a,f] of Detection (LLD)(μCi/ml)
CONTINUOUS RELEASE Points:	Weekly [b,i] Gas Grab Sample	Weekly	Principal Gamma Emitters [e]	1×10^{-4}
Plant Vents:	Continuous [g,i,h]	Weekly [c] Charcoal Sample	I-131, I-133	1×10^{-12}
Unit 1 Aux Bldg. Unit 2 Aux Bldg. Radwaste Bldg.	Continuous [g,i,h]	Weekly [c] Particulate Sample	Principal Gamma Emitters [e]	1×10^{-11}
Spent Fuel Pool Unit 1 Shield Bldg. Unit 2 Shield Bldg.	Continuous [g,i,h]	Monthly Silica Gel Sample	H-3	1×10^{-6}
	Continuous [g,i,h]	Each Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous [g,i,h]	Quarterly [d] Particulate Composite	Sr-89, Sr-90	1×10^{-11}
	Continuous [g]	Noble Gas Monitor	Noble Gases, Gross beta and gamma	1×10^{-4}
Atmospheric Steam Releases [k]	Daily [j] Grab Sample During Release	Each Sample	Principal Gamma Emitters [e]	5×10^{-7}
			I-131, I-133	1×10^{-6}
	Daily [j] Grab Sample During Release	Monthly [l] Composite	H-3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Daily [j] Grab Sample During Release	Quarterly [l] Composite	Sr-89, Sr-90	5×10^{-8}

Table 3.1 Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit[a,f] of Detection (LLD)(μCi/ml)
Containment Purge[m]	Gas Grab Sample Prior to each Purge	Each Sample (Prior to Release)	Principal Gamma Emitters[e]	1×10^{-4}
	Grab[g, h, m] Prior to Release and Continuous	Each Sample	H-3	1×10^{-6}
	Grab[g,h, m] Prior to Release and Continuous	Charcoal Sample	I-131, I-133	1×10^{-12}
	Grab[g, h, m] Prior to Release and Continuous	Particulate Sample	Principal Gamma Emitters[e]	1×10^{-11}
	Grab[g, h, m] Prior to Release and Continuous	Each Particulate Sample	Gross Alpha	1×10^{-11}
	Grab[g, h, m] Prior to Release and Continuous	Quarterly[d] Particulate Composite	Sr-89, Sr-90	1×10^{-11}
Waste Gas Storage Tanks	Gas Grab Sample Prior to each Release	Each Sample (Prior to Release)	Principal Gamma Emitters[e]	1×10^{-4}
	Grab Sample Prior to each Release	Each Sample (Prior to Release)	H-3	1×10^{-6}

Table 3.1 - Radioactive Gaseous Waste Sampling and Analysis Program

Table Notations

a. 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:

$$LLD = \frac{4.66 s_b}{E \bullet V \bullet 2.22 X 10^6 \bullet Y \bullet \exp(-\lambda \Delta t)}$$

where:

LLD = the "a priori" lower limit of detection (microCurie per unit mass or volume.

s_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute).

E = the counting efficiency (counts per disintegration),

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

2.22×10^6 = the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

Δt = the elapsed time between the midpoint of sample collection and the time of counting (sec).

Typical values of E, V, Y, and $\Delta \tau$ should be used in the calculation.

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 a posteriori (after the fact) limit for a particular measurement.

Table 3.1 - Radioactive Gaseous Waste Sampling and Analysis Program

Table Notations [Cont'd]

b. Grab samples taken at the ventilation exhausts are generally below minimum detectable levels for most nuclides with existing analytical equipment. If this is the case, PWR GALE Code noble gas isotopic ratios may be assumed.

c. With >1 μCi/gm DOSE EQUIVALENT I-131 in either Unit 1 or Unit 2 reactor coolant system, the iodine and particulate collection devices for all release points **SHALL** be removed and analyzed daily until it is shown that a pattern exists which can be used to predict the release rate. Sampling may then revert to weekly. When samples collected for one day are analyzed, the corresponding LLD's may be increased by a factor of 10. Samples **SHALL** be analyzed within 48 hours after removal.

d. To be representative of the average quantities and concentrations of radioactive materials in particulate form in gaseous effluents, samples should be collected in proportion to the rate of flow of the effluent streams.

e. The principal gamma emitters for which the LLD control applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for noble gas analysis and Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144 in iodine and particulate analysis. 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 detected and reported.

f. Nuclides which are below the LLD for analyses should not be reported as being present at the LLD level for that nuclide. When unusual circumstances result in LLD's higher than reported, the reasons **SHALL** be documented in the Annual Radioactive Effluent Report.

g. For continuous samples, the ratio of the sample flow rate to the samples stream flow rate **SHALL** be known for the time period sampled (Conservative assumptions may be used). Design flow rates may be used for building exhaust vent flow rates.

h. A continuous sample is one in which the sampling media is in place at all times during the release period, with the exception of periods necessary to change sampling media and scheduled short term equipment maintenance of two hours or less. If the sample media is not in place during the entire release period (except as described above), an explanation of the occurrence, actions taken to restore the sampler and to prevent reoccurrence, and a summary description to explain the occurrence's effect on the analysis validity **SHALL** be included in the Annual Radioactive Effluent Report.

Table 3.1 Radioactive Gaseous Waste Sampling and Analysis Program

Table Notations [Cont'd]

i. Releases are made via the shield building vents only during PURGING, or operation of special ventilation systems. When ventilation fans in any vent path are not in service for the entire sample period, in lieu of weekly removal and analysis of iodine and particulate collection devices, these devices may be removed and analyzed following each release provided that the release lasts less than one week. Releases made via the plant ventilation paths as a result of routine surveillance tests, operational testing or scheduled short term maintenance activities of 2 hours or less do not require special sampling and analysis provided that plant conditions do not indicate the completion of these activities would cause an increase in the release of activity. Removal and analysis of collection devices is not required if releases are not being made.

j. Grab samples for atmospheric steam releases are representative liquid grab samples from the respective steam generator.

k. Atmospheric steam releases are the timed releases of steam from the steam generators to the atmosphere via either the power operated reliefs, steam dump valves or flash tank vents. It does not include steam dumped via the condenser.

l. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of steam released and in which the method of sampling employed results in a specimen which is representative of the total steam released form the respective steam generator.

m. Containment Purges includes PURGE releases with either the Inservice Purge or Containment Purge Fans and also VENTING of containment utilizing the Post Loca Vent System. When the release is completed via the Post Loca Vent, the pre-release tritium, particulate and charcoal samples should be used for all analyses, and continuous samples collected during the release are not required. During Cold Shutdown periods, the availability of ventilation systems and the position of containment air-lock doors may require that portions of the required samples be collected with installed continuous monitors or portable sampling equipment.

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Table 3.2 Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. Waste Gas Holdup System Explosive Gas (Oxygen) Monitors	2	During system operation	2
2. Effluent Release Points Unit 1 Aux Bldg. Unit 2 Aux Bldg. Rad Waste Bldg. Spent Fuel Pool Unit 1 Shield Bldg. Unit 2 Shield Bldg.			
a. Noble Gas Activity Monitor*	1	During releases	4, 5, 7
b. Iodine Sampler Cartridge	1	During releases	3
c. Particulate Sampler Filter	1	During releases	3
d. Sampler Flow Integrator	1	During releases	1
3. Air Ejector Noble Gas Monitors (Each Unit)	1	During power operation	6

* Noble gas activity monitors providing automatic termination of releases (except the Radwaste Building which has no automatic isolation function).

Table 3.2 Radioactive Gaseous Effluent Monitoring Instrumentation

Table Notations

ACTION 1 With the number of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once per 12 hours.

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 2 With the number of channels Operable less than required by the Minimum Channels Operable requirement, operating of this system may continue for up to 14 days. With two channels inoperable, manually isolate the oxygen addition line.

ACTION 3 With the numbers of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided samples are collected with auxiliary sampling equipment as required in Table 3.1.

ACTION 4 With the number of channels Operable less than required by the Minimum Channels Operable requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 5 With the number of channels Operable less than required by the Minimum Channels Operable requirement, immediately suspend Purging of radioactive effluents via this pathway during periods when containment integrity is required or the primary system is initially opened to the atmosphere. (applicable to Reactor Building Vents)

ACTION 6 With the number of channels Operable less than required by the Minimum Channels Operable requirement, air ejector operation may continue for up to 30 days provided grab samples are taken at least once per 24 hours and these samples are analyzed for gross activity within 24 hours.

ACTION 7 With the number of channels operable less than required by the Minimum Channels operable requirement, the contents of the waste gas decay tanks may be released to the environment for up to 14 days provided that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed, and
b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge valve lineup;

Otherwise, suspend release of radioactive effluents via this pathway (applicable to Unit 2 Auxiliary Building Vent).

Table 3.3 - Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	CHANNEL CHECK Frequency	SOURCE CHECK Frequency	FUNCTIONAL TEST Frequency	CALIBRATION Frequency
Waste Gas Holdup System Explosive Gas (Oxygen) Monitors	Daily during system operation	----	Monthly(2)	Quarterly(5)
Effluent Release Points Unit 1 Aux Bldg. Unit 2 Aux Bldg. Rad Waste Bldg. Spent Fuel Pool Unit 1 Shield Bldg. Unit 2 Shield Bldg.				
Noble Gas Activity Monitor (4) (Except Radwaste Building)	Daily during releases	Monthly*	Quarterly(1)	At least once every 18 months(3)
Noble Gas Activity Monitor Radwaste Building (4)	Daily during releases	Monthly	Quarterly(2)	At least once every 18 months(3)
Iodine and Particulate Samplers	Weekly	----		----
Sampler Flow Rate Monitor	Weekly	----	----	At least once every 18 months
Air Ejector Noble Gas Monitors (Each Unit)	Daily during releases	Monthly	Quarterly(2)	At least once every 18 months(3)

* A SOURCE CHECK of the applicable nobles gas monitor **SHALL** be conducted prior to each waste gas decay tank or containment purge release.

Table 3.3 - Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

Table Notations

1. The CHANNEL FUNCTIONAL TEST **SHALL** also demonstrate that automatic isolation of this pathway and control room alarm annunciation occurs if any of the following exists.

    a. Instrument indicates measured levels above the alarm/trip setpoint.

    b. Circuit failure (if provided).

    c. Instrument indicates a downscale failure (if provided).

    d. Instrument controls not set in operate mode (if provided).

2. The CHANNEL FUNCTIONAL TEST **SHALL** also demonstrate that alarm annunciation occurs if any of the following conditions exists:

    a. Instrument indicates measured levels above the alarm/trip setpoint.

    b. Circuit failure (if provided).

    c. Instrument indicates a downscale failure (if provided).

    d. Instrument controls not set in operate mode (if provided).

3. The initial CHANNEL CALIBRATION **SHALL** be performed using one or more of the reference standards certified by the National Institute of Standards and Technology or using sources traceable to NIST standards. These standards **SHALL** permit calibrating the system over its intended range of energy and measurement range. For subsequent CHANNEL CALIBRATIONS, sources that have been related to the initial calibration **SHALL** be used.

4. Noble gas monitor in the Radwaste Building vent not provided with automatic isolation trip.

5. The CHANNEL CALIBRATION **SHALL** include the use of a nitrogen zero gas and an oxygen span gas with a nominal concentration suitable for the range of the instrument.

Table 4.1 Liquid Source Terms

RADIONUCLIDE	MPC (µCi/ml)	WASTE EFFLUENT (A$_i$)(Ci/Yr)	SGBD (A$_i$)(Ci/Yr)
Mo-99	4E-5	6.42E-3	1.415E-2
I-131	3E-7	3.061E-2	4.11E-2
Te-132	2E-5	2.12E-3	3.61E-3
I-132	8E-6	2.83E-3	1.88E-2
I-133	1E-6	2.365E-2	4.856E-2
Cs-134	9E-6	1.464E-1	4.047E-2
I-135	4E-6	4.84E-3	1.792E-2
Cs-136	6E-5	5.743E-2	1.862E-2
Cs-137	2E-5	8.214E-2	2.69E-2
All Others	1E-7	0	2E-5
H-3	3E-3	1.89E2	1.41E2
Noble gases	2E-4	---	---
TOTAL		1.894E2	1.412E2

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Table 4.2 - Adult Ingestion Dose Values (A_{it}) for the Prairie Island Nuclear Generating Plant (Mrem/Hr Per μCi/ml)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
H-3	0.00E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01	2.26E-01
C-14	3.13E 04	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03	6.26E 03
NA-24	4.07E 02	4.07E 02	4.07E 02	4.07E 02	4.07E 02	4.07E 02	4.07E 02
CR-51	0.00E-01	0.00E-01	1.27E 00	7.61E-01	2.81E-01	1.69E 00	3.20E 02
MN-54	0.00E-01	4.38E 03	8.35E 02	0.00E-01	1.30E 03	0.00E-01	1.34E 04
MN-56	0.00E-01	1.10E 02	1.95E 01	0.00E-01	1.40E 02	0.00E-01	3.51E 03
FE-55	6.58E 02	4.55E 02	1.06E 02	0.00E-01	0.00E-01	2.54E 02	2.61E 02
FE-59	1.04E 03	2.44E 03	9.36E 02	0.00E-01	0.00E-01	6.82E 02	8.14E 03
CO-57	0.00E-01	2.10E 01	3.48E 01	0.00E-01	0.00E-01	0.00E-01	5.32E 02
CO-58	0.00E-01	8.92E 01	2.00E 02	0.00E-01	0.00E-01	0.00E-01	1.81E 03
CO-60	0.00E-01	2.56E 02	5.65E 02	0.00E-01	0.00E-01	0.00E-01	4.81E 03
NI-63	3.11E 04	2.16E 03	1.04E 03	0.00E-01	0.00E-01	0.00E-01	4.50E 02
NI-65	1.26E 02	1.64E 01	7.49E 00	0.00E-01	0.00E-01	0.00E-01	4.17E 02
CU-64	0.00E-01	9.97E 00	4.68E 00	0.00E-01	2.51E 01	0.00E-01	8.50E 02
ZN-65	2.32E 04	7.37E 04	3.33E 04	0.00E-01	4.93E 04	0.00E-01	4.64E 04
ZN-69	4.93E 01	9.43E 01	6.56E 00	0.00E-01	6.13E 01	0.00E-01	1.42E 01
BR-83	0.00E-01	0.00E-01	4.04E 01	0.00E-01	0.00E-01	0.00E-01	5.82E 01
BR-84	0.00E-01	0.00E-01	5.24E 01	0.00E-01	0.00E-01	0.00E-01	4.11E-04
BR-85	0.00E-01	0.00E-01	2.15E 00	0.00E-01	0.00E-01	0.00E-01	1.01E-15
RB-86	0.00E-01	1.01E 05	4.71E 04	0.00E-01	0.00E-01	0.00E-01	1.99E 04
RB-88	0.00E-01	2.90E 02	1.54E 02	0.00E-01	0.00E-01	0.00E-01	4.00E-09
RB-89	0.00E-01	1.92E 02	1.35E 02	0.00E-01	0.00E-01	0.00E-01	1.12E-11
SR-89	2.21E 04	0.00E-01	6.35E 02	0.00E-01	0.00E-01	0.00E-01	3.55E 03
SR-90	5.44E 05	0.00E-01	1.34E 05	0.00E-01	0.00E-01	0.00E-01	1.57E 04
SR-91	4.07E 02	0.00E-01	1.64E 01	0.00E-01	0.00E-01	0.00E-01	1.94E 03
SR-92	1.54E 02	0.00E-01	6.68E 00	0.00E-01	0.00E-01	0.00E-01	3.06E 03
Y-90	5.76E-01	0.00E-01	1.54E-02	0.00E-01	0.00E-01	0.00E-01	6.10E 03
Y-91M	5.44E-03	0.00E-01	2.11E-04	0.00E-01	0.00E-01	0.00E-01	1.60E-02
Y-91	8.44E 00	0.00E-01	2.26E-01	0.00E-01	0.00E-01	0.00E-01	4.64E 03
Y-92	5.06E-02	0.00E-01	1.48E-03	0.00E-01	0.00E-01	0.00E-01	8.86E 02
Y-93	1.60E-01	0.00E-01	4.43E-03	0.00E-01	0.00E-01	0.00E-01	5.09E 03
ZR-95	2.40E-01	7.70E-02	5.21E-02	0.00E-01	1.21E-01	0.00E-01	2.44E 02
ZR-97	1.33E-02	2.68E-03	1.22E-03	0.00E-01	4.04E-03	0.00E-01	8.30E 02
NB-95	4.47E 02	2.48E 02	1.34E 02	0.00E-01	2.46E 02	0.00E-01	1.51E 04
NB-97	3.76E 00	9.48E-01	3.46E-01	0.00E-01	1.11E 00	0.00E-01	3.50E 03
MO-99	0.00E-01	1.03E 02	1.96E 01	0.00E-01	2.34E 02	0.00E-01	2.39E 02
TC-99M	8.87E-03	2.51E-02	3.19E-01	0.00E-01	3.81E-01	1.23E-02	1.48E 01
TC-101	9.12E-03	1.31E-02	1.29E-01	0.00E-01	2.37E-01	6.72E-03	3.95E-14
RU-103	4.43E 00	0.00E-01	1.91E 00	0.00E-01	1.69E 01	0.00E-01	5.17E 02
RU-105	3.69E-01	0.00E-01	1.46E-01	0.00E-01	4.76E 00	0.00E-01	2.26E 02
RU-106	6.58E 01	0.00E-01	8.33E 00	0.00E-01	1.27E 02	0.00E-01	4.26E 03
RH-105	2.92E 00	2.12E 00	1.40E 00	0.00E-01	9.00E 00	0.00E-01	3.38E 02

Table 4.2 - Adult Ingestion Dose Values (A_{it}) for the Prairie Island Nuclear Generating Plant (Mrem/Hr Per μCi/ml)

NUCLIDE	BONE	LIVER	T. BODY	THYROID	KIDNEY	LUNG	GI-LLI
AG-110M	8.81E-01	8.15E-01	4.84E-01	0.00E-01	1.60E 00	0.00E-01	2.9E 02
SB-124	6.74E 00	1.27E-01	2.66E-01	1.63E-02	0.00E-01	5.23E 00	1.91E 02
SB-125	5.34E 00	5.75E-02	1.07E 00	4.74E-03	0.00E-01	5.58E 02	4.72E 01
SB-126	2.75E 00	5.60E-02	9.94E-01	1.69E-02	0.00E-01	1.69E 00	2.25E 02
TE-125M	2.57E 03	9.30E 02	3.44E 02	7.72E 02	1.04E 04	0.00E-01	1.02E 04
TE-127M	6.48E 03	2.32E 03	7.90E 02	1.66E 03	2.63E 04	0.00E-01	2.17E 04
TE-127	1.05E-02	3.78E 01	2.28E 01	7.80E 01	4.29E 02	0.00E-01	8.31E 03
TE-129M	1.10E 04	4.11E 03	1.74E 03	3.78E 03	4.60E 04	0.00E-01	5.54E 04
TE-129	3.01E 01	1.13E 01	7.33E 00	2.31E 01	1.26E 02	0.00E-01	2.27E 01
TE-131M	1.66E 03	8.10E 02	6.75E 02	1.28E 03	8.21E 03	0.00E-01	8.04E 04
TE-131	1.89E 01	7.88E 00	5.96E 00	1.55E 01	8.26E 01	0.00E-01	2.67E 00
5TE-132	2.41E 03	1.56E 03	1.47E 03	1.72E 03	1.50E 04	0.00E-01	7.38E 04
I-130	2.71E 01	8.01E 01	3.16E 01	6.79E 03	1.25E 02	0.00E-01	6.89E 01
I-131	1.49E 02	2.14E 02	1.22E 02	7.00E 04	3.66E 02	0.00E-01	5.64E 01
I-132	7.29E 00	1.95E 01	6.82E 00	6.82E 02	3.11E 01	0.00E-01	3.66E 00
I-133	5.10E 01	8.87E 01	2.70E 01	1.30E 04	1.55E 02	0.00E-01	7.97E 01
I-134	3.81E 00	1.03E 01	3.70E 00	1.79E 02	1.64E 01	0.00E-01	9.01E-03
I-135	1.59E 01	4.17E 01	1.54E 01	2.75E 03	6.68E 01	0.00E-01	4.70E 01
CS-134	2.98E 05	7.09E 05	5.79E 05	0.00E-01	2.29E 05	7.61E 04	1.24E 04
CS-136	3.12E 04	1.23E 05	8.86E 04	0.00E-01	6.85E 04	9.38E 03	1.40E 04
CS-137	3.82E 05	5.22E 05	3.42E 05	0.00E-01	1.77E 05	5.89E 04	1.01E 04
CS-138	2.64E 02	5.22E 02	2.59E 02	0.00E-01	3.84E 02	3.79E 01	2.23E-03
BA-139	9.29E-01	6.62E-04	2.72E-02	0.00E-01	6.19E-04	3.75E-04	1.65E 00
BA-140	1.94E 02	2.44E-01	1.27E 01	0.00E-01	8.30E-02	1.40E-01	4.00E 02
BA-141	4.51E-01	3.41E-0.4	1.52E-02	0.00E-01	3.17E-04	1.93E-04	2.13E-10
BA-142	2.04E-01	2.10E-04	1.28E-02	0.00E-01	1.77E-04	1.19E-04	2.37E-19
LA-140	1.50E-01	7.54E-02	1.99E-02	0.00E-01	0.00E-01	0.00E-01	5.54E 03
LA-142	7.66E-03	3.48E-03	8.68E-04	0.00E-01	0.00E-01	0.00E-01	2.54E 01
CE-141	2.24E-02	1.52E-02	1.72E-03	0.00E-01	7.04E-03	0.00E-01	5.79E 01
CE-143	3.95E-03	2.92E 00	3.23E-04	0.00E-01	1.29E-03	0.00E-01	1.09E 02
CE-144	1.17E 00	4.88E-01	6.27E-02	0.00E-01	2.90E-01	0.00E-01	3.95E 02
PR-143	5.51E-01	2.21E-01	2.73E-02	0.00E-01	1.27E-01	0.00E-01	2.41E 03
PR-144	1.80E-03	7.48E-04	9.16E-05	0.00E-01	4.22E-04	0.00E-01	2.59E-10
ND-147	3.76E-01	4.35E-01	2.60E-02	0.00E-01	2.54E-01	0.00E-01	2.09E 03
W-187	2.96E 02	2.47E 02	8.65E 01	0.00E-01	0.00E-01	0.00E-01	8.10E 04
NP-239	2.85E-02	2.80E-03	1.54E-03	0.00E-01	8.74E-03	0.00E-01	5.75E 02

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Actinium (89)	Ac 227	S	2×10^{-12}	6×10^{-5}	8×10^{-14}	2×10^{-6}
		I	3×10^{-11}	9×10^{-3}	9×10^{-13}	3×10^{-4}
	Ac 228.......	S	8×10^{-8}	3×10^{-3}	3×10^{-9}	9×10^{-5}
		I	2×10^{-8}	3×10^{-3}	6×10^{-10}	9×10^{-5}
Americium (95)	Am 241	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Am 242m .	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-5}
		I	3×10^{-10}	3×10^{-3}	9×10^{-12}	9×10^{-3}
	Am 242	S	4×10^{-8}	4×10^{-3}	1×10^{-9}	1×10^{-4}
		I	5×10^{-8}	4×10^{-3}	2×10^{-9}	1×10^{-4}
	Am 243	S	6×10^{-12}	1×10^{-4}	2×10^{-13}	4×10^{-6}
		I	1×10^{-10}	8×10^{-4}	4×10^{-12}	3×10^{-5}
	Am 244	S	4×10^{-6}	1×10^{-1}	1×10^{-7}	5×10^{-3}
		I	2×10^{-5}	1×10^{-1}	8×10^{-7}	5×10^{-3}
Antimony	Sb 122	S	2×10^{-7}	8×10^{-4}	6×10^{-9}	3×10^{-5}
		I	1×10^{-7}	8×10^{-4}	5×10^{-9}	3×10^{-5}
	Sb 124	S	2×10^{-7}	7×10^{-4}	5×10^{-9}	2×10^{-5}
		I	2×10^{-8}	7×10^{-4}	7×10^{-10}	2×10^{-5}
	Sb 125	S	5×10^{-7}	3×10^{-3}	2×10^{-8}	1×10^{-4}
		I	3×10^{-8}	3×10^{-3}	9×10^{-10}	1×10^{-4}
Argon (18)	A 37	Sub[2]	6×10^{-3}	....	1×10^{-4}	....
	A 41	Sub	2×10^{-6}	....	4×10^{-8}	....
Arsenic (33)	As 73	S	2×10^{-6}	1×10^{-2}	7×10^{-8}	5×10^{-4}
		I	4×10^{-7}	1×10^{-2}	1×10^{-8}	5×10^{-4}
	As 74	S	3×10^{-7}	2×10^{-3}	1×10^{-8}	5×10^{-5}
		I	1×10^{-7}	2×10^{-3}	4×10^{-9}	5×10^{-5}
	As 76	S	1×10^{-7}	6×10^{-4}	4×10^{-9}	2×10^{-5}
		I	1×10^{-7}	6×10^{-4}	3×10^{-9}	2×10^{-5}
	As 77	S	5×10^{-7}	2×10^{-3}	2×10^{-8}	8×10^{-5}
		I	4×10^{-7}	2×10^{-3}	1×10^{-8}	8×10^{-5}
Astatine (85)	At 211	S	7×10^{-9}	5×10^{-5}	2×10^{-10}	2×10^{-6}
		I	3×10^{-8}	2×10^{-3}	1×10^{-9}	7×10^{-5}
Bariun (56)	Ba 131	S	1×10^{-6}	5×10^{-3}	4×10^{-8}	2×10^{-4}
		I	4×10^{-7}	5×10^{-3}	1×10^{-8}	2×10^{-4}
	Ba 140	S	1×10^{-7}	8×10^{-4}	4×10^{-9}	3×10^{-5}
		I	4×10^{-8}	7×10^{-4}	1×10^{-9}	2×10^{-5}
Berkeliun (97)	Bk 249	S	9×10^{-10}	2×10^{-2}	3×10^{-11}	6×10^{-4}
		I	1×10^{-7}	2×10^{-2}	4×10^{-9}	6×10^{-4}
	Bk 250	S	1×10^{-7}	6×10^{-3}	5×10^{-9}	2×10^{-4}
		I	1×10^{-6}	6×10^{-3}	4×10^{-8}	2×10^{-4}
Beryllium (4)	Be 7	S	6×10^{-6}	5×10^{-2}	2×10^{-7}	2×10^{-3}
		I	1×10^{-6}	5×10^{-2}	4×10^{-8}	2×10^{-3}

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Bismuth (83)	Bi 206	S	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
		I	$1x10^{-7}$	$1x10^{-3}$	$5x10^{-9}$	$4x10^{-5}$
	Bi 207	S	$2x10^{-7}$	$2x10^{-3}$	$6x10^{-9}$	$6x10^{-5}$
		I	$1x10^{-8}$	$2x10^{-3}$	$5x10^{-10}$	$6x10^{-5}$
	Bi 210	S	$6x10^{-9}$	$1x10^{-3}$	$2x10^{-10}$	$4x10^{-5}$
		I	$6x10^{-9}$	$1x10^{-3}$	$2x10^{-10}$	$4x10^{-5}$
	Bi 212	S	$1x10^{-7}$	$1x10^{-2}$	$3x10^{-9}$	$4x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-2}$	$7x10^{-9}$	$4x10^{-4}$
Bromine (35)	Br 82	S	$1x10^{-6}$	$8x10^{-3}$	$4x10^{-8}$	$3x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
Cadmium (48)	Cd 109	S	$5x10^{-8}$	$5x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
		I	$7x10^{-8}$	$5x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
	Cd 115m	S	$4x10^{-8}$	$7x10^{-4}$	$1x10^{-9}$	$3x10^{-5}$
		I	$4x10^{-8}$	$7x10^{-4}$	$1x10^{-9}$	$3x10^{-5}$
	Cd 115	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$3x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
Calcium (20)	Ca 45	S	$3x10^{-8}$	$3x10^{-4}$	$1x10^{-9}$	$9x10^{-6}$
		I	$1x10^{-7}$	$5x10^{-3}$	$4x10^{-9}$	$2x10^{-4}$
	Ca 47	S	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$5x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$3x10^{-5}$
Californium (98)	Cf 249	S	$2x10^{-12}$	$1x10^{-4}$	$5x10^{-14}$	$4x10^{-6}$
		I	$1x10^{-10}$	$7x10^{-4}$	$3x10^{-12}$	$2x10^{-5}$
	Cf 250	S	$5x10^{-12}$	$4x10^{-4}$	$2x10^{-13}$	$1x10^{-5}$
		I	$1x10^{-10}$	$7x10^{-4}$	$3x10^{-12}$	$3x10^{-5}$
	Cf 251	S	$2x10^{-12}$	$1x10^{-4}$	$6x10^{-14}$	$4x10^{-6}$
		I	$1x10^{-10}$	$8x10^{-4}$	$3x10^{-12}$	$3x10^{-5}$
	Cf 252	S	$6x10^{-12}$	$2x10^{-4}$	$2x10^{-13}$	$7x10^{-6}$
		I	$3x10^{-11}$	$2x10^{-4}$	$1x10^{-12}$	$7x10^{-6}$
	Cf 253	S	$8x10^{-10}$	$4x10^{-3}$	$3x10^{-11}$	$1x10^{-4}$
		I	$8x10^{-10}$	$4x10^{-3}$	$3x10^{-11}$	$1x10^{-4}$
	Cf 254	S	$5x10^{-12}$	$4x10^{-6}$	$2x10^{-13}$	$1x10^{-7}$
		I	$5x10^{-12}$	$4x10^{-6}$	$2x10^{-13}$	$1x10^{-7}$
Carbon (6)	C14	S	$4x10^{-6}$	$2x10^{-2}$	$1x10^{-7}$	$8x10^{-4}$
	(CO_2)	Sub	$5x10^{-5}$	....	$1x10^{-6}$	....
Cerium (58)	Ce 141	S	$4x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
		I	$2x10^{-7}$	$3x10^{-3}$	$5x10^{-9}$	$9x10^{-5}$
	Ce 143	S	$3x10^{-7}$	$1x10^{-3}$	$9x10^{-9}$	$4x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$7x10^{-9}$	$4x10^{-5}$
	Ce 144	S	$1x10^{-8}$	$3x10^{-4}$	$3x10^{-10}$	$1x10^{-5}$
		I	$6x10^{-9}$	$3x10^{-4}$	$2x10^{-10}$	$1x10^{-5}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Cesium (55)	Cs 131	S	$1x10^{-5}$	$7x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
		I	$3x10^{-6}$	$3x10^{-2}$	$1x10^{-7}$	$9x10^{-4}$
	Cs 134m	S	$4x10^{-5}$	$2x10^{-1}$	$1x10^{-6}$	$6x10^{-3}$
		I	$6x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$1x10^{-3}$
	Cs 134	S	$4x10^{-8}$	$3x10^{-4}$	$1x10^{-9}$	$9x10^{-6}$
		I	$1x10^{-8}$	$1x10^{-3}$	$4x10^{-10}$	$4x10^{-5}$
	Cs 135	S	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$9x10^{-8}$	$7x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
	Cs 136	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$9x10^{-5}$
		I	$2x10^{-7}$	$2x10^{-3}$	$6x10^{-9}$	$6x10^{-5}$
	Cs 137	S	$6x10^{-8}$	$4x10^{-4}$	$2x10^{-9}$	$2x10^{-5}$
		I	$1x10^{-8}$	$1x10^{-3}$	$5x10^{-10}$	$4x10^{-5}$
Chlorine (17)	Cl 36	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$8x10^{-5}$
		I	$2x10^{-8}$	$2x10^{-3}$	$8x10^{-10}$	$6x10^{-5}$
	Cl 38	S	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$7x10^{-8}$	$4x10^{-4}$
Chromium (24)	Cr 51	S	$1x10^{-5}$	$5x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
		I	$2x10^{-6}$	$5x10^{-2}$	$8x10^{-8}$	$2x10^{-3}$
Cobalt (27)	Co 57	S	$3x10^{-6}$	$2x10^{-2}$	$1x10^{-7}$	$5x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-2}$	$6x10^{-9}$	$4x10^{-4}$
	Co 58m	S	$2x10^{-5}$	$8x10^{-2}$	$6x10^{-7}$	$3x10^{-3}$
		I	$9x10^{-6}$	$6x10^{-2}$	$3x10^{-7}$	$2x10^{-3}$
	Co 58	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-8}$	$3x10^{-3}$	$2x10^{-9}$	$9x10^{-5}$
	Co 60	S	$3x10^{-7}$	$1x10^{-3}$	$1x10^{-8}$	$5x10^{-5}$
		I	$9x10^{-9}$	$1x10^{-3}$	$3x10^{-10}$	$3x10^{-5}$
Copper (29)	Cu 64	S	$2x10^{-6}$	$1x10^{-2}$	$7x10^{-8}$	$3x10^{-4}$
		I	$1x10^{-6}$	$6x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
Curium (96)	Cm 242	S	$1x10^{-10}$	$7x10^{-4}$	$4x10^{-12}$	$2x10^{-5}$
		I	$2x10^{-10}$	$7x10^{-4}$	$6x10^{-12}$	$2x10^{-5}$
	Cm 243	S	$6x10^{-12}$	$1x10^{-4}$	$2x10^{-13}$	$5x10^{-6}$
		I	$1x10^{-10}$	$7x10^{-4}$	$3x10^{-12}$	$2x10^{-5}$
	Cm 244	S	$9x10^{-12}$	$2x10^{-4}$	$3x10^{-13}$	$7x10^{-6}$
		I	$1x10^{-10}$	$8x10^{-4}$	$3x10^{-12}$	$3x10^{-5}$
	Cm 245	S	$5x10^{-12}$	$1x10^{-4}$	$2x10^{-13}$	$4x10^{-6}$
		I	$1x10^{-10}$	$8x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	Cm 246	S	$5x10^{-12}$	$1x10^{-4}$	$2x10^{-13}$	$4x10^{-6}$
		I	$1x10^{-10}$	$8x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	Cm 247	S	$5x10^{-12}$	$1x10^{-4}$	$2x10^{-13}$	$4x10^{-6}$
		I	$1x10^{-10}$	$6x10^{-4}$	$4x10^{-12}$	$2x10^{-5}$
	Cm 248	S	$6x10^{-13}$	$1x10^{-5}$	$2x10^{-14}$	$4x10^{-7}$
		I	$1x10^{-11}$	$4x10^{-5}$	$4x10^{-13}$	$1x10^{-6}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I		Table II	
			Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)
	Cm 249	S	$1x10^{-5}$	$6x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
		I	$1x10^{-5}$	$6x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
Dysprosium (66)	Dy 165	S	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$7x10^{-8}$	$4x10^{-4}$
	Dy 166	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$4x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$7x10^{-9}$	$4x10^{-5}$
Einsteinium (99)	Es 253	S	$8x10^{-10}$	$7x10^{-4}$	$3x10^{-11}$	$2x10^{-5}$
		I	$6x10^{-10}$	$7x10^{-4}$	$2x10^{-11}$	$2x10^{-5}$
	Es 254m ...	S	$5x10^{-9}$	$5x10^{-4}$	$2x10^{-10}$	$2x10^{-5}$
		I	$6x10^{-9}$	$5x10^{-4}$	$2x10^{-10}$	$2x10^{-5}$
	Es 254	S	$2x10^{-11}$	$4x10^{-4}$	$6x10^{-13}$	$1x10^{-5}$
		I	$1x10^{-10}$	$4x10^{-4}$	$4x10^{-12}$	$1x10^{-5}$
	Es 255	S	$5x10^{-10}$	$8x10^{-4}$	$2x10^{-11}$	$3x10^{-5}$
		I	$4x10^{-10}$	$8x10^{-4}$	$1x10^{-11}$	$3x10^{-5}$
Erbium (68)	Er 169	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
		I	$4x10^{-7}$	$3x10^{-3}$	$1x10^{-8}$	$9x10^{-5}$
	Er 171	S	$7x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Europium (63)	Eu 152	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
	(T/2=9.2 hrs)	I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
	Eu 152	S	$1x10^{-8}$	$2x10^{-3}$	$4x10^{-10}$	$8x10^{-5}$
	(T/2=13 yrs)	I	$2x10^{-8}$	$2x10^{-3}$	$6x10^{-10}$	$8x10^{-5}$
	Eu 154	S	$4x10^{-9}$	$6x10^{-4}$	$1x10^{-10}$	$2x10^{-5}$
		I	$7x10^{-9}$	$6x10^{-4}$	$2x10^{-10}$	$2x10^{-5}$
	Eu 155	S	$9x10^{-8}$	$6x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
		I	$7x10^{-8}$	$6x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
Fermium (100)	Fm 254	S	$6x10^{-8}$	$4x10^{-3}$	$2x10^{-9}$	$1x10^{-4}$
		I	$7x10^{-8}$	$4x10^{-3}$	$2x10^{-9}$	$1x10^{-4}$
	Fm 255	S	$2x10^{-8}$	$1x10^{-3}$	$6x10^{-10}$	$3x10^{-5}$
		I	$1x10^{-8}$	$1x10^{-3}$	$4x10^{-10}$	$3x10^{-5}$
	Fm 256	S	$3x10^{-9}$	$3x10^{-5}$	$1x10^{-10}$	$9x10^{-7}$
		I	$2x10^{-9}$	$3x10^{-5}$	$6x10^{-11}$	$9x10^{-7}$
Fluorine (9)	F 18	S	$5x10^{-6}$	$2x10^{-2}$	$2x10^{-7}$	$8x10^{-4}$
		I	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$5x10^{-4}$
Gadolinium (64)	Gd 153	S	$2x10^{-7}$	$6x10^{-3}$	$8x10^{-9}$	$2x10^{-4}$
		I	$9x10^{-8}$	$6x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
	Gd 159	S	$5x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$8x10^{-5}$
		I	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$8x10^{-5}$
Gallium (31)	Ga 72	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$4x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
Germanium (32)	Ge 71	S	$1x10^{-5}$	$5x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
		I	$6x10^{-6}$	$5x10^{-2}$	$2x10^{-7}$	$2x10^{-3}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I		Table II	
			Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)
Gold (79)	Au 196	S	$1x10^{-6}$	$5x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
		I	$6x10^{-7}$	$4x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
	Au 198	S	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$5x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$5x10^{-5}$
	Au 199	S	$1x10^{-6}$	$5x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
		I	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
Hafnium (72)	Hf 181	S	$4x10^{-8}$	$2x10^{-3}$	$1x10^{-9}$	$7x10^{-5}$
		I	$7x10^{-8}$	$2x10^{-3}$	$3x10^{-9}$	$7x10^{-5}$
Holmium (67)	Ho 166	S	$2x10^{-7}$	$9x10^{-4}$	$7x10^{-9}$	$3x10^{-5}$
		I	$2x10^{-7}$	$9x10^{-4}$	$6x10^{-9}$	$3x10^{-5}$
Hydrogen (1)	H3	S	$5x10^{-6}$	$1x10^{-1}$	$2x10^{-7}$	$3x10^{-3}$
		I	$5x10^{-6}$	$1x10^{-1}$	$2x10^{-7}$	$3x10^{-3}$
		Sub	$2x10^{-3}$		$4x10^{-5}$	
Indium (49)	In 113m	S	$8x10^{-6}$	$4x10^{-2}$	$3x10^{-7}$	$1x10^{-3}$
		I	$7x10^{-6}$	$4x10^{-2}$	$2x10^{-7}$	$1x10^{-3}$
	In 114m	S	$1x10^{-7}$	$5x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
		I	$2x10^{-8}$	$5x10^{-4}$	$7x10^{-10}$	$2x10^{-5}$
	In 115m	S	$2x10^{-6}$	$1x10^{-2}$	$8x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$6x10^{-8}$	$4x10^{-4}$
	In 115	S	$2x10^{-7}$	$3x10^{-3}$	$9x10^{-9}$	$9x10^{-5}$
		I	$3x10^{-8}$	$3x10^{-3}$	$1x10^{-9}$	$9x10^{-5}$
Iodine (53)	I 125	S	$5x10^{-9}$	$4x10^{-5}$	$8x10^{-11}$	$2x10^{-7}$
		I	$2x10^{-7}$	$6x10^{-3}$	$6x10^{-9}$	$2x10^{-4}$
	I 126	S	$8x10^{-9}$	$5x10^{-5}$	$9x10^{-11}$	$3x10^{-7}$
		I	$3x10^{-7}$	$3x10^{-3}$	$1x10^{-8}$	$9x10^{-5}$
	I 129	S	$2x10^{-9}$	$1x10^{-5}$	$2x10^{-11}$	$6x10^{-8}$
		I	$7x10^{-8}$	$6x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
	I 131	S	$9x10^{-9}$	$6x10^{-5}$	$1x10^{-10}$	$3x10^{-7}$
		I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
	I 132	S	$2x10^{-7}$	$2x10^{-3}$	$3x10^{-9}$	$8x10^{-6}$
		I	$9x10^{-7}$	$5x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
	I 133	S	$3x10^{-8}$	$2x10^{-4}$	$4x10^{-10}$	$1x10^{-6}$
		I	$2x10^{-7}$	$1x10^{-3}$	$7x10^{-9}$	$4x10^{-5}$
	I 134	S	$5x10^{-7}$	$4x10^{-3}$	$6x10^{-9}$	$2x10^{-5}$
		I	$3x10^{-6}$	$2x10^{-2}$	$1x10^{-7}$	$6x10^{-4}$
	I 135	S	$1x10^{-7}$	$7x10^{-4}$	$1x10^{-9}$	$4x10^{-6}$
		I	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$7x10^{-5}$
Indium (77)	Ir 190	S	$1x10^{-6}$	$6x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
		I	$4x10^{-7}$	$5x10^{-3}$	$1x10^{-8}$	$2x10^{-4}$
	Ir 192	S	$1x10^{-7}$	$1x10^{-3}$	$4x10^{-9}$	$4x10^{-5}$
		I	$3x10^{-8}$	$1x10^{-3}$	$9x10^{-10}$	$4x10^{-5}$
	Ir 194	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$3x10^{-5}$
		I	$2x10^{-7}$	$9x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$

Table 4.3 Old 10CFR20 Appendix B (April 1992]

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Iron (26)	Fe 55	S	$9x10^{-7}$	$2x10^{-2}$	$3x10^{-8}$	$8x10^{-4}$
		I	$1x10^{-6}$	$7x10^{-2}$	$3x10^{-8}$	$2x10^{-3}$
	Fe 59	S	$1x10^{-7}$	$2x10^{-3}$	$5x10^{-9}$	$6x10^{-5}$
	....	I	$5x10^{-8}$	$2x10^{-3}$	$2x10^{-9}$	$5x10^{-5}$
Krypton (36)	Kr 85m	Sub	$6x10^{-6}$	....	$1x10^{-7}$	....
	Kr 85	Sub	$1x10^{-5}$	....	$3x10^{-7}$	....
	Kr 87	Sub	$1x10^{-6}$	....	$2x10^{-8}$	....
	Kr 88	Sub	$1x10^{-6}$	....	$2x10^{-8}$	....
Lanthanum (57)	La 140	S	$2x10^{-7}$	$7x10^{-4}$	$5x10^{-9}$	$2x10^{-5}$
		I	$1x10^{-7}$	$7x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
Lead (82)	Pb 203	S	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$6x10^{-8}$	$4x10^{-4}$
	Pb 210	S	$1x10^{-10}$	$4x10^{-6}$	$4x10^{-12}$	$1x10^{-7}$
		I	$2x10^{-10}$	$5x10^{-3}$	$8x10^{-12}$	$2x10^{-4}$
	Pb 212	S	$2x10^{-8}$	$6x10^{-4}$	$6x10^{-10}$	$2x10^{-5}$
		I	$2x10^{-8}$	$5x10^{-4}$	$7x10^{-10}$	$2x10^{-5}$
Lutetium (71)	Lu 177	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Manganese (25)	Mn 52	S	$2x10^{-7}$	$1x10^{-3}$	$7x10^{-9}$	$3x10^{-5}$
		I	$1x10^{-7}$	$9x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$
	Mn 54	S	$4x10^{-7}$	$4x10^{-3}$	$1x10^{-8}$	$1x10^{-4}$
		I	$4x10^{-8}$	$3x10^{-3}$	$1x10^{-9}$	$1x10^{-4}$
	Mn 56	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Mercury (80)	Hg 197m ...	S	$7x10^{-7}$	$6x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
		I	$8x10^{-7}$	$5x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
	Hg 197	S	$1x10^{-6}$	$9x10^{-3}$	$4x10^{-8}$	$3x10^{-4}$
		I	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$5x10^{-4}$
	Hg 203	S	$7x10^{-8}$	$5x10^{-4}$	$2x10^{-9}$	$2x10^{-5}$
		I	$1x10^{-7}$	$3x10^{-3}$	$4x10^{-9}$	$1x10^{-4}$
Molybdenum (42)	Mo 99	S	$7x10^{-7}$	$5x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-3}$	$7x10^{-9}$	$4x10^{-5}$
Neodymium (60)	Nd 144	S	$8x10^{-11}$	$2x10^{-3}$	$3x10^{-12}$	$7x10^{-5}$
		I	$3x10^{-10}$	$2x10^{-3}$	$1x10^{-11}$	$8x10^{-5}$
	Nd 147	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
		I	$2x10^{-7}$	$2x10^{-3}$	$8x10^{-9}$	$6x10^{-5}$
	Nd 149	S	$2x10^{-6}$	$8x10^{-3}$	$6x10^{-8}$	$3x10^{-4}$
		I	$1x10^{-6}$	$8x10^{-3}$	$5x10^{-8}$	$3x10^{-4}$
Neptunium (93)	Np 237	S	$4x10^{-12}$	$9x10^{-5}$	$1x10^{-13}$	$3x10^{-6}$
		I	$1x10^{-10}$	$9x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	Np 239	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$7x10^{-7}$	$4x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Nickel (28)	Ni 59	S	$5x10^{-7}$	$6x10^{-3}$	$2x10^{-8}$	$2x10^{-4}$
		I	$8x10^{-7}$	$6x10^{-2}$	$3x10^{-8}$	$2x10^{-3}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I		Table II	
			Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)
	Ni 63	S	$6x10^{-8}$	$8x10^{-4}$	$2x10^{-9}$	$3x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-2}$	$1x10^{-8}$	$7x10^{-4}$
	Ni 65	S	$9x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Niobium (Columbium) (41)	Nb 93m	S	$1x10^{-7}$	$1x10^{-2}$	$4x10^{-9}$	$4x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-2}$	$5x10^{-9}$	$4x10^{-4}$
	Nb 95	S	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$1x10^{-7}$	$3x10^{-3}$	$3x10^{-9}$	$1x10^{-4}$
	Nb 97	S	$6x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$9x10^{-4}$
		I	$5x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$9x10^{-4}$
Osmium (76)	Os 185	S	$5x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$7x10^{-5}$
		I	$5x10^{-8}$	$2x10^{-3}$	$2x10^{-9}$	$7x10^{-5}$
	Os 191m ..	S	$2x10^{-5}$	$7x10^{-2}$	$6x10^{-7}$	$3x10^{-3}$
		I	$9x10^{-6}$	$7x10^{-2}$	$3x10^{-7}$	$2x10^{-3}$
	Os 191	S	$1x10^{-6}$	$5x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
		I	$4x10^{-7}$	$5x10^{-3}$	$1x10^{-8}$	$2x10^{-4}$
	Os 193	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-3}$	$9x10^{-9}$	$5x10^{-5}$
Palladium (46)	Pd 103	S	$1x10^{-6}$	$1x10^{-2}$	$5x10^{-8}$	$3x10^{-4}$
		I	$7x10^{-7}$	$8x10^{-3}$	$3x10^{-8}$	$3x10^{-4}$
	Pd 109	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
		I	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$7x10^{-5}$
Phosphorus (15)	P 32	S	$7x10^{-8}$	$5x10^{-4}$	$2x10^{-9}$	$2x10^{-5}$
		I	$8x10^{-8}$	$7x10^{-4}$	$3x10^{-9}$	$2x10^{-5}$
Platinum (78)	Pt 191	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
	Pt 193m ...	S	$7x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$1x10^{-3}$
		I	$5x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$1x10^{-3}$
	Pt 193	S	$1x10^{-6}$	$3x10^{-2}$	$4x10^{-8}$	$9x10^{-4}$
		I	$3x10^{-7}$	$5x10^{-2}$	$1x10^{-8}$	$2x10^{-3}$
	Pt 197m ...	S	$6x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$1x10^{-3}$
		I	$5x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$9x10^{-4}$
	Pt 197	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Plutonium (94)	Pu 238	S	$2x10^{-12}$	$1x10^{-4}$	$7x10^{-14}$	$5x10^{-6}$
		I	$3x10^{-11}$	$8x10^{-4}$	$1x10^{-12}$	$3x10^{-5}$
	Pu 239	S	$2x10^{-12}$	$1x10^{-4}$	$6x10^{-14}$	$5x10^{-6}$
		I	$4x10^{-11}$	$8x10^{-4}$	$1x10^{-12}$	$3x10^{-5}$
	Pu 240	S	$2x10^{-12}$	$1x10^{-4}$	$6x10^{-14}$	$5x10^{-6}$
		I	$4x10^{-11}$	$8x10^{-4}$	$1x10^{-12}$	$3x10^{-5}$
	Pu 241	S	$9x10^{-11}$	$7x10^{-3}$	$3x10^{-12}$	$2x10^{-4}$
		I	$4x10^{-8}$	$4x10^{-2}$	$1x10^{-9}$	$1x10^{-3}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
	Pu 242	S	$2x10^{-12}$	$1x10^{-4}$	$6x10^{-14}$	$5x10^{-6}$
		I	$4x10^{-11}$	$9x10^{-4}$	$1x10^{-12}$	$3x10^{-5}$
	Pu 243	S	$2x10^{-6}$	$1x10^{-2}$	$6x10^{-8}$	$3x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$8x10^{-8}$	$3x10^{-4}$
	Pu 244	S	$2x10^{-12}$	$1x10^{-4}$	$6x10^{-14}$	$4x10^{-6}$
		I	$3x10^{-11}$	$3x10^{-4}$	$1x10^{-12}$	$1x10^{-5}$
Polonium (84)	Po 210	S	$5x10^{-10}$	$2x10^{-3}$	$2x10^{-11}$	$7x10^{-7}$
		I	$2x10^{-10}$	$8x10^{-4}$	$7x10^{-12}$	$3x10^{-5}$
Potassium (19)	K 42	S	$2x10^{-6}$	$9x10^{-3}$	$7x10^{-8}$	$3x10^{-4}$
		I	$1x10^{-7}$	$6x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
Praseodymium (59)	Pr 142	S	$2x10^{-7}$	$9x10^{-4}$	$7x10^{-9}$	$3x10^{-5}$
		I	$2x10^{-7}$	$9x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$
	Pr 143	S	$3x10^{-7}$	$1x10^{-3}$	$1x10^{-8}$	$5x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$5x10^{-5}$
Promethium (61)	Pm 147	S	$6x10^{-8}$	$6x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
		I	$1x10^{-7}$	$6x10^{-3}$	$3x10^{-9}$	$2x10^{-4}$
	Pm 149	S	$3x10^{-7}$	$1x10^{-3}$	$1x10^{-8}$	$4x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$4x10^{-5}$
Protoactinium (91)	Pa 230	S	$2x10^{-9}$	$7x10^{-3}$	$6x10^{-11}$	$2x10^{-4}$
		I	$8x10^{-10}$	$7x10^{-3}$	$3x10^{-11}$	$2x10^{-4}$
	Pa 231	S	$1x10^{-12}$	$3x10^{-5}$	$4x10^{-14}$	$9x10^{-7}$
		I	$1x10^{-10}$	$8x10^{-4}$	$4x10^{-12}$	$2x10^{-5}$
	Pa 233	S	$6x10^{-7}$	$4x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$2x10^{-7}$	$3x10^{-3}$	$6x10^{-9}$	$1x10^{-4}$
Radium (88)	Ra 223	S	$2x10^{-9}$	$2x10^{-5}$	$6x10^{-11}$	$7x10^{-7}$
		I	$2x10^{-10}$	$1x10^{-4}$	$8x10^{-12}$	$4x10^{-6}$
	Ra 224	S	$5x10^{-9}$	$7x10^{-5}$	$2x10^{-10}$	$2x10^{-6}$
		I	$7x10^{-10}$	$2x10^{-4}$	$2x10^{-11}$	$5x10^{-6}$
	Ra 226 ...	S	$3x10^{-11}$	$4x10^{-7}$	$3x10^{-12}$	$3x10^{-8}$
		I	$5x10^{-11}$	$9x10^{-4}$	$2x10^{-12}$	$3x10^{-5}$
	Ra 228	S	$7x10^{-11}$	$8x10^{-7}$	$2x10^{-12}$	$3x10^{-8}$
			$4x10^{-11}$	$7x10^{-4}$	$1x10^{-12}$	$3x10^{-5}$
Radon (86)	Rn 220	S	$3x10^{-7}$	....	$1x10^{-8}$	....
	Rn 222[3]	I	$3x10^{-8}$	....	$3x10^{-9}$	....
Rhenium (75)	Re 183	S	$3x10^{-6}$	$2x10^{-2}$	$9x10^{-8}$	$6x10^{-4}$
		I	$2x10^{-7}$	$8x10^{-3}$	$5x10^{-9}$	$3x10^{-4}$
	Re 186	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$5x10^{-5}$
	Re 187	S	$9x10^{-6}$	$7x10^{-2}$	$3x10^{-7}$	$3x10^{-3}$
		I	$5x10^{-7}$	$4x10^{-2}$	$2x10^{-8}$	$2x10^{-3}$
	Re 188	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
		I	$2x10^{-7}$	$9x10^{-4}$	$6x10^{-9}$	$3x10^{-5}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Rhodium (45)	Rh 103m	S	$8x10^{-5}$	$4x10^{-1}$	$3x10^{-6}$	$1x10^{-2}$
		I	$6x10^{-5}$	$3x10^{-1}$	$2x10^{-6}$	$1x10^{-2}$
	Rh 105	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Rubidium (37)	Rb 86	S	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$7x10^{-5}$
		I	$7x10^{-8}$	$7x10^{-4}$	$2x10^{-9}$	$2x10^{-5}$
	Rb 87	S	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$7x10^{-8}$	$5x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
Ruthenium (44)	Ru 97	S	$2x10^{-6}$	$1x10^{-2}$	$8x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-6}$	$1x10^{-2}$	$6x10^{-8}$	$3x10^{-4}$
	Ru 103	S	$5x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$8x10^{-5}$
		I	$8x10^{-8}$	$2x10^{-3}$	$3x10^{-9}$	$8x10^{-5}$
	Ru 105	S	$7x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
	Ru 106	S	$8x10^{-8}$	$4x10^{-4}$	$3x10^{-9}$	$1x10^{-5}$
		I	$6x10^{-9}$	$3x10^{-4}$	$2x10^{-10}$	$1x10^{-5}$
Samarium (62)	Sm 147	S	$7x10^{-11}$	$2x10^{-3}$	$2x10^{-12}$	$6x10^{-5}$
		I	$3x10^{-10}$	$2x10^{-3}$	$9x10^{-12}$	$7x10^{-5}$
	Sm 151	S	$6x10^{-8}$	$1x10^{-2}$	$2x10^{-9}$	$4x10^{-4}$
		I	$1x10^{-7}$	$1x10^{-2}$	$5x10^{-9}$	$4x10^{-4}$
	Sm 153	S	$5x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$8x10^{-5}$
		I	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$8x10^{-5}$
Scandium (21)	Sc 46	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$4x10^{-5}$
		I	$2x10^{-8}$	$1x10^{-3}$	$8x10^{-10}$	$4x10^{-5}$
	Sc 47	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
		I	$5x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$9x10^{-5}$
	Sc 48	S	$2x10^{-7}$	$8x10^{-4}$	$6x10^{-9}$	$3x10^{-5}$
		I	$1x10^{-7}$	$8x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$
Selenium (34)	Se 75	S	$1x10^{-6}$	$9x10^{-3}$	$4x10^{-8}$	$3x10^{-4}$
		I	$1x10^{-7}$	$8x10^{-3}$	$4x10^{-9}$	$3x10^{-4}$
Silicon (14)	Si 31	S	$6x10^{-6}$	$3x10^{-2}$	$2x10^{-7}$	$9x10^{-4}$
		I	$1x10^{-6}$	$6x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
Silver (47)	Ag 105	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$8x10^{-8}$	$3x10^{-3}$	$3x10^{-9}$	$1x10^{-4}$
	Ag 110m	S	$2x10^{-7}$	$9x10^{-4}$	$7x10^{-9}$	$3x10^{-5}$
		I	$1x10^{-8}$	$9x10^{-4}$	$3x10^{-10}$	$3x10^{-5}$
	Ag 111	S	$3x10^{-7}$	$1x10^{-3}$	$1x10^{-8}$	$4x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$4x10^{-5}$
Sodium (11)	Na 22	S	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
		I	$9x10^{-9}$	$9x10^{-4}$	$3x10^{-10}$	$3x10^{-5}$
	Na 24	S	$1x10^{-6}$	$6x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
		I	$1x10^{-7}$	$8x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I		Table II	
			Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)
Strontium (38)	Sr 85m	S	$4x10^{-5}$	$2x10^{-1}$	$1x10^{-6}$	$7x10^{-3}$
		I	$3x10^{-5}$	$2x10^{-1}$	$1x10^{-6}$	$7x10^{-3}$
	Sr 85	S	$2x10^{-7}$	$3x10^{-3}$	$8x10^{-9}$	$1x10^{-4}$
		I	$1x10^{-7}$	$5x10^{-3}$	$4x10^{-9}$	$2x10^{-4}$
	Sr 89	S	$3x10^{-8}$	$3x10^{-4}$	$3x10^{-10}$	$3x10^{-6}$
		I	$4x10^{-8}$	$8x10^{-4}$	$1x10^{-9}$	$3x10^{-5}$
	Sr 90	S	$1x10^{-9}$	$1x10^{-5}$	$3x10^{-11}$	$3x10^{-7}$
		I	$5x10^{-9}$	$1x10^{-3}$	$2x10^{-10}$	$4x10^{-5}$
	Sr 91	S	$4x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$7x10^{-5}$
		I	$3x10^{-7}$	$1x10^{-3}$	$9x10^{-9}$	$5x10^{-5}$
	Sr 92	S	$4x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$7x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
Sulfur (16)	S 35	S	$3x10^{-7}$	$2x10^{-3}$	$9x10^{-9}$	$6x10^{-5}$
		I	$3x10^{-7}$	$8x10^{-3}$	$9x10^{-9}$	$3x10^{-4}$
Tantalum (73)	Ta 182	S	$4x10^{-8}$	$1x10^{-3}$	$1x10^{-9}$	$4x10^{-5}$
		I	$2x10^{-8}$	$1x10^{-3}$	$7x10^{-10}$	$4x10^{-5}$
Technetium (43)	Tc 96m	S	$8x10^{-5}$	$4x10^{-1}$	$3x10^{-6}$	$1x10^{-2}$
		I	$3x10^{-5}$	$3x10^{-1}$	$1x10^{-6}$	$1x10^{-2}$
	Tc 96	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$5x10^{-5}$
	Tc 97m	S	$2x10^{-6}$	$1x10^{-2}$	$8x10^{-8}$	$4x10^{-4}$
		I	$2x10^{-7}$	$5x10^{-3}$	$5x10^{-9}$	$2x10^{-4}$
	Tc 97	S	$1x10^{-5}$	$5x10^{-2}$	$4x10^{-7}$	$2x10^{-3}$
		I	$3x10^{-7}$	$2x10^{-2}$	$1x10^{-8}$	$8x10^{-4}$
	Tc 99m	S	$4x10^{-5}$	$2x10^{-1}$	$1x10^{-6}$	$6x10^{-3}$
		I	$1x10^{-5}$	$8x10^{-2}$	$5x10^{-7}$	$3x10^{-3}$
	Tc 99	S	$2x10^{-6}$	$1x10^{-2}$	$7x10^{-8}$	$3x10^{-4}$
		I	$6x10^{-8}$	$5x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
Tellurium (52)	Te 125m ...	S	$4x10^{-7}$	$5x10^{-3}$	$1x10^{-8}$	$2x10^{-4}$
		I	$1x10^{-7}$	$3x10^{-3}$	$4x10^{-9}$	$1x10^{-4}$
	Te 127m ..	S	$1x10^{-7}$	$2x10^{-3}$	$5x10^{-9}$	$6x10^{-5}$
		I	$4x10^{-8}$	$2x10^{-3}$	$1x10^{-9}$	$5x10^{-5}$
	Te 127	S	$2x10^{-6}$	$8x10^{-3}$	$6x10^{-8}$	$3x10^{-4}$
		I	$9x10^{-7}$	$5x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
	Te 129m ...	S	$8x10^{-8}$	$1x10^{-3}$	$3x10^{-9}$	$3x10^{-5}$
		I	$3x10^{-8}$	$6x10^{-4}$	$1x10^{-9}$	$2x10^{-5}$
	Te 129	S	$5x10^{-6}$	$2x10^{-2}$	$2x10^{-7}$	$8x10^{-4}$
		I	$4x10^{-6}$	$2x10^{-2}$	$1x10^{-7}$	$8x10^{-4}$
	Te 131m ..	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$4x10^{-5}$
	Te 132	S	$2x10^{-7}$	$9x10^{-4}$	$7x10^{-9}$	$3x10^{-5}$
		I	$1x10^{-7}$	$6x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
Terbium (65)	Tb 160	S	$1x10^{-7}$	$1x10^{-3}$	$3x10^{-9}$	$4x10^{-5}$
		I	$3x10^{-8}$	$1x10^{-3}$	$1x10^{-9}$	$4x10^{-5}$
Thallium (81)	Tl 200	S	$3x10^{-6}$	$1x10^{-2}$	$9x10^{-8}$	$4x10^{-4}$
		I	$1x10^{-6}$	$7x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
	Tl 201	S	$2x10^{-6}$	$9x10^{-3}$	$7x10^{-8}$	$3x10^{-4}$
		I	$9x10^{-7}$	$5x10^{-3}$	$3x10^{-8}$	$2x10^{-4}$
	Tl 202	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$2x10^{-7}$	$2x10^{-3}$	$8x10^{-9}$	$7x10^{-5}$
	Tl 204	S	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$3x10^{-8}$	$2x10^{-3}$	$9x10^{-10}$	$6x10^{-5}$
Thorium (90)	Th 227	S	$3x10^{-10}$	$5x10^{-4}$	$1x10^{-11}$	$2x10^{-5}$
		I	$2x10^{-10}$	$5x10^{-4}$	$6x10^{-12}$	$2x10^{-5}$
	Th 228	S	$9x10^{-12}$	$2x10^{-4}$	$3x10^{-13}$	$7x10^{-6}$
		I	$6x10^{-12}$	$4x10^{-4}$	$2x10^{-13}$	$1x10^{-5}$
	Th 230	S	$2x10^{-12}$	$5x10^{-5}$	$8x10^{-14}$	$2x10^{-6}$
		I	$1x10^{-11}$	$9x10^{-4}$	$3x10^{-13}$	$3x10^{-5}$
	Th 231	S	$1x10^{-6}$	$7x10^{-3}$	$5x10^{-8}$	$2x10^{-4}$
		I	$1x10^{-6}$	$7x10^{-3}$	$4x10^{-8}$	$2x10^{-4}$
	Th 232	S	$3x10^{-11}$	$5x10^{-5}$	$1x10^{-12}$	$2x10^{-6}$
		I	$3x10^{-11}$	$1x10^{-3}$	$1x10^{-12}$	$4x10^{-5}$
	Th natural .	S	$6x10^{-11}$	$6x10^{-5}$	$2x10^{-12}$	$2x10^{-6}$
		I	$6x10^{-11}$	$6x10^{-4}$	$2x10^{-12}$	$2x10^{-5}$
	Th 234	S	$6x10^{-8}$	$5x10^{-4}$	$2x10^{-9}$	$2x10^{-5}$
		I	$3x10^{-8}$	$5x10^{-4}$	$1x10^{-9}$	$2x10^{-5}$
Thulium (69)	Tm 170	S	$4x10^{-8}$	$1x10^{-3}$	$1x10^{-9}$	$5x10^{-5}$
		I	$3x10^{-8}$	$1x10^{-3}$	$1x10^{-9}$	$5x10^{-5}$
	Tm 171	S	$1x10^{-7}$	$1x10^{-2}$	$4x10^{-9}$	$5x10^{-4}$
		I	$2x10^{-7}$	$1x10^{-2}$	$8x10^{-9}$	$5x10^{-4}$
Tin (50)	Sn 113	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$9x10^{-5}$
	....	I	$5x10^{-8}$	$2x10^{-3}$	$2x10^{-9}$	$8x10^{-5}$
	Sn 125	S	$1x10^{-7}$	$5x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
		I	$8x10^{-8}$	$5x10^{-4}$	$3x10^{-9}$	$2x10^{-5}$
Tungsten (Wolfram) (74)	W 181	S	$2x10^{-6}$	$1x10^{-2}$	$8x10^{-8}$	$4x10^{-4}$
		I	$1x10^{-7}$	$1x10^{-2}$	$4x10^{-9}$	$3x10^{-4}$
	W 185	S	$8x10^{-7}$	$4x10^{-3}$	$3x10^{-8}$	$1x10^{-4}$
		I	$1x10^{-7}$	$3x10^{-3}$	$4x10^{-9}$	$1x10^{-4}$
	W 187	S	$4x10^{-7}$	$2x10^{-3}$	$2x10^{-8}$	$7x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
Uranium (92)	U 230	S	$3x10^{-10}$	$1x10^{-4}$	$1x10^{-11}$	$5x10^{-6}$
	....	I	$1x10^{-10}$	$1x10^{-4}$	$4x10^{-12}$	$5x10^{-6}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I Col. 1 - Air (μCi/ml)	Table I Col. 2 - Water (μCi/ml)	Table II Col. 1 - Air (μCi/ml)	Table II Col. 2 - Water (μCi/ml)
	U 232	S	$1x10^{-10}$	$8x10^{-4}$	$3x10^{-12}$	$3x10^{-5}$
	....	I	$3x10^{-11}$	$8x10^{-4}$	$9x10^{-13}$	$3x10^{-5}$
	U 233	S	$5x10^{-10}$	$9x10^{-4}$	$2x10^{-11}$	$3x10^{-5}$
		I	$1x10^{-10}$	$9x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	U 234	S[4]	$6x10^{-10}$	$9x10^{-4}$	$2x10^{-11}$	$3x10^{-5}$
		I	$1x10^{-10}$	$9x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	U 235	S[4]	$5x10^{-10}$	$8x10^{-4}$	$2x10^{-11}$	$3x10^{-5}$
		I	$1x10^{-10}$	$8x10^{-4}$	$4x10^{-12}$	$3x10^{-5}$
	U 236	S	$6x10^{-10}$	$1x10^{-3}$	$2x10^{-11}$	$3x10^{-5}$
		I	$1x10^{-10}$	$1x10^{-3}$	$4x10^{-12}$	$3x10^{-5}$
	U 238	S[4]	$7x10^{-11}$	$1x10^{-3}$	$3x10^{-12}$	$4x10^{-5}$
		I	$1x10^{-10}$	$1x10^{-3}$	$5x10^{-12}$	$4x10^{-5}$
	U 240	S	$2x10^{-7}$	$1x10^{-3}$	$8x10^{-9}$	$3x10^{-5}$
		I	$2x10^{-7}$	$1x10^{-3}$	$6x10^{-9}$	$3x10^{-5}$
	U-natural ..	S[4]	$1x10^{-10}$	$1x10^{-3}$	$5x10^{-12}$	$3x10^{-5}$
		I	$1x10^{-10}$	$1x10^{-3}$	$5x10^{-12}$	$3x10^{-5}$
Vanadium (23)	V 48	S	$2x10^{-7}$	$9x10^{-4}$	$6x10^{-9}$	$3x10^{-5}$
	....	I	$6x10^{-8}$	$8x10^{-4}$	$2x10^{-9}$	$3x10^{-5}$
Xenon (54)	Xe 131m ..	Sub	$2x10^{-5}$	....	$4x10^{-7}$	....
	Xe 133	Sub	$1x10^{-5}$	....	$3x10^{-7}$	....
	Xe 133m ..	Sub	$1x10^{-5}$	....	$3x10^{-7}$	....
	Xe 135	Sub	$4x10^{-6}$	....	$1x10^{-7}$	....
Ytterbium (70)	Yb 175	S	$7x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
		I	$6x10^{-7}$	$3x10^{-3}$	$2x10^{-8}$	$1x10^{-4}$
Yttrium (39)	Y 90	S	$1x10^{-7}$	$6x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
		I	$1x10^{-7}$	$6x10^{-4}$	$3x10^{-9}$	$2x10^{-5}$
	Y 91m	S	$2x10^{-5}$	$1x10^{-1}$	$8x10^{-7}$	$3x10^{-3}$
		I	$2x10^{-5}$	$1x10^{-1}$	$6x10^{-7}$	$3x10^{-3}$
	Y 91	S	$4x10^{-8}$	$8x10^{-4}$	$1x10^{-9}$	$3x10^{-5}$
		I	$3x10^{-8}$	$8x10^{-4}$	$1x10^{-9}$	$3x10^{-5}$
	Y 92	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
	Y 93	S	$2x10^{-7}$	$8x10^{-4}$	$6x10^{-9}$	$3x10^{-5}$
		I	$1x10^{-7}$	$8x10^{-4}$	$5x10^{-9}$	$3x10^{-5}$
Zinc (30)	Zn 65	S	$1x10^{-7}$	$3x10^{-3}$	$4x10^{-9}$	$1x10^{-4}$
		I	$6x10^{-8}$	$5x10^{-3}$	$2x10^{-9}$	$2x10^{-4}$
	Zn 69m	S	$4x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$7x10^{-5}$
		I	$3x10^{-7}$	$2x10^{-3}$	$1x10^{-8}$	$6x10^{-5}$
	Zn 69	S	$7x10^{-6}$	$5x10^{-2}$	$2x10^{-7}$	$2x10^{-3}$
		I	$9x10^{-6}$	$5x10^{-2}$	$3x10^{-7}$	$2x10^{-3}$
Zirconium (40)	Zr 93	S	$1x10^{-7}$	$2x10^{-2}$	$4x10^{-9}$	$8x10^{-4}$
		I	$3x10^{-7}$	$2x10^{-2}$	$1x10^{-8}$	$8x10^{-4}$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background
[See footnotes at end of Appendix B]

Element (atomic number)	Isotope[1]		Table I		Table II	
			Col. 1 - Air (µCi/ml)	Col. 2 - Water (µCi/ml)	Col. 1 - Air (µCi/ml)	Col. 2 - Water (µCi/ml)
	Zr 95	S	$1x10^{-7}$	$2x10^{-3}$	$4x10^{-9}$	$6x10^{-5}$
		I	$3x10^{-8}$	$2x10^{-3}$	$1x10^{-9}$	$6x10^{-5}$
	Zr 97	S	$1x10^{-7}$	$5x10^{-4}$	$4x10^{-9}$	$2x10^{-5}$
		I	$9x10^{-8}$	$5x10^{-4}$	$3x10^{-9}$	$2x10^{-5}$
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life less than 2 hours.	....	Sub	$1x10^{-6}$	....	$3x10^{-8}$	....
Any single radionuclide not listed above with decay mode other than alpha emission or spontaneous fission and with radioactive half-life greater than 2 hours.	....		$3x10^{-9}$	$9x10^{-5}$	$1x10^{-10}$	$3x10^{-6}$
Any single radionuclide not listed above, which decays by alpha emission or spontaneous fission.	....		$6x10^{-13}$	$4x10^{-7}$	$2x10^{-14}$	$3x10^{-8}$

[1] Soluble (S): Insoluble (1).

[2] "Sub" means that values given are for submersion in a semispherical infinite cloud of airborne material.

[3] These radon concentrations are appropriate for protection from radon-222 combined with its short-lived daughters. Alternatively, the value in Table 1 may be replaced by one-third (1/3) "working level." (A "working level" is defined as any combination of short-lived radon-222 daughters, polonium-218, lead-214, bismuth-214 and polonium-214, in one liter of air, without regard to the degree of equilibrium, that will result in the ultimate emission of 1.3×10^5 MeV of alpha particle energy.) The Table II value may be replaced by one-thirtieth (1/30) of a "working level." The limit on radon-222 concentrations in restricted areas may be based on an annual average.

[4] For soluble mixtures of U-238, U-234 and U-235 in air chemical toxicity may be the limiting factor. If the percent by weight-enrichment of U-235 is less than 5, the concentration value for a 40-hour workweek, Table I is 0.2 milligrams uranium per cubic meter of air average. For any enrichment, the product of the average concentration and time of exposure during a 40-hour workweek **SHALL NOT** exceed 8×10^3 SA µCi-hr/ml, where SA is the specific activity of the uranium inhaled. The concentration value for Table II is 0.007 milligrams uranium per cubic meter of air. The specific activity for natural uranium is 6.77×10^{-7} curies per gram U. The specific activity for other mixtures of U-238, U-235 and U-234, if not known **SHALL** be:

SA=3.6×10^{-7} curies/gram U	U-depleted
SA=$(0.4 + 0.38\,E + 0.0034\,E^2)\,10^{-6}$	E≥0.72

where E is the percentage by weight of U-235, expressed as percent.

NOTE: **In any case where there is a mixture in air or water of more than one radionuclide, the limiting values for purposes of this Appendix should be determined as follows:**

1. If the identity and concentration of each radionuclide in the mixture are known, the limiting values should be derived as follows: Determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the limit otherwise established in Appendix B for the specific radionuclide when not in a mixture. The sum of such ratios for all the radionuclides in the mixture may not exceed "1" (i.e., "unity") EXAMPLE: If radionuclides A, B, and C are present in concentrations C_A, C_B and C_C, and if the applicable MPC's, are MPC_A, and MPC_B and MPC_C respectively, then the concentrations SHALL be limited so that the following relationship exists:
$(C_A/MPC_A)+(C_B/MPC_B)+(C_C/MPC_C) \leq 1$

Table 4.3 Old 10CFR20 Appendix B (April 1992)

Appendix B - Concentrations in Air and Water Above Natural Background

[See footnotes at end of Appendix B]

2. If either the identity or the concentration of any radionuclide in the mixture is not known, the limiting values for purposes of Appendix B **SHALL** be:

   a. For purposes of Table I, Col. 1-6 x 10^{-13}
   b. For purposes of Table I, Col. 2-4 x 10^{-7}
   c. For purposes of Table II, Col. 1-2 x 10^{-14}
   d. For purposes of Table II, Col. 2-3 x 10^{-8}

3. If any of the conditions specified below are met, the corresponding values specified below may be used in lieu of those specified in paragraph 2 above.

   a. If the identity of each radionuclide in the mixture is known but the concentration of one or more of the radionuclides in the mixture is not known the concentration limit for the mixture is the limit specified in Appendix "B" for the radionuclide in the mixture having the lowest concentration limit; or

   b. If the identity of each radionuclide in the mixture is known, but it is known that certain radionuclides specified in Appendix "B" are not present in the mixture, the concentration limit for the mixture is the lowest concentration limit specified in Appendix "B" for any radionuclide which is not known to be absent from the mixture; or

c. Element (atomic number) and isotope	Table I		Table II	
	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)	Col. 1 - Air (μCi/ml)	Col. 2 - Water (μCi/ml)
If it is known that Sr 90, I 125, I 126, I 129, I 131 (I 133, Table II only), Pb 210, Po 210, At 211, Ra 223, Ra 224, Ra 226, Ac 227, Ra 228, Th 230, Pa 231, Th232, Th-nat, Cm 248, Cf254, and Fm 256 are not present	....	9x10^{-5}	....	3x10^{-6}
If it is known that Sr 90, I 125, I 126, I 129 (I 131, I 133, Table II only), Pb 210, Po 210, Ra 223, Ra 226, Ra 228, Pa 231, Th-nat, Cm 248, Cf 254, and Fm 256 are not present	....	6x10^{-5}	....	2x10^{-6}
If it is known that Sr 90, I 129 (I 125, I 126, I 131, Table II only), Pb 210, Ra 226, Ra 228, Cm 248, and Cf 254 are not present	....	2x10^{-5}	....	6x10^{-7}
If it is known that (I 129, Table II only), Ra 226, and Ra 228 are not present	....	3x10^{-6}	....	1x10^{-7}
If it is known that alpha-emitters and Sr 90, I 129, Pb 210, Ac 227, Ra 228, Pa 230, Pu 241, and Bk 249 are not present	3x10^{-9}	....	1x10^{-10}	....
If it is known that alpha-emitters and Pb 210, Ac 227, Ra 228, and Pu 241 are not present	3x10^{-10}	....	1x10^{-11}	....
If it is known that alpha-emitters and Ac 227 are not present...........................	3x10^{-11}	....	1x10^{-12}	....
If it is known that Ac 227, Th 230, Pa 231, Pu 238, Pu 239, Pu 240, Pu 242, Pu 244, Cm 248, Cf 249 and Cf 251 are not present	3x10^{-12}	....	1x10^{-13}	....

4. If a mixture of radionuclides consists of uranium and its daughters in ore dust prior to chemical separation of the uranium from the ore, the values specified below may be used for uranium and its daughters through radium-226, instead of those from paragraphs 1, 2, or 3 above.

   a. For purposes of Table I, Col. 1-1x10^{-10} μCi/ml gross alpha activity: or 5x10^{-11} μCi/ml natural uranium or 75 micrograms per cubic meter of air natural uranium.

   b. For purposes of Table II, Col. 1-3x10^{-12} μCi/ml gross alpha activity: 2x10^{-12} μCi/ml natural uranium or 3 micrograms per cubic meter of air natural uranium.

5. For purposes of this note, a radionuclide may be considered as not present in a mixture if (a) the ratio of the concentration of that radionuclide in the mixture (C_A) to the concentration limit for that radionuclide specified in Table II of Appendix "B" (MPC_A) does not exceed 1/10, (i.e. $C_A IMPC_A \leq 1/10$) and (b) the sum of such ratios for all the radionuclides considered a not present in the mixture does not exceed 1/4 i.e. ($C_A IMPC_A + C_B IMPC_B$ ....+ $\leq$ 1/4).

Table 5.1 - Monitor Alarm Setpoint Determination for PINGP

MONITOR	RELEASE POINT	SOURCE OF RELEASE	SOURCE TERMS (A_i) (TABLE 5.2)	X/Q (sec/m³)	EFFLUENT FLOW RATE (F) (cfm)	RELEASE FRACTION (Tm)
1R-30 and 1R-37	Aux. Bldg. Vent - Unit 1	Aux. Bldg. Unit 1 Exhaust	Aux. Bldg.	3.38E-5	2.9E+4	0.2
		Air Ejector Unit 1	Air Ejector	3.38E-5	2.9E+4	
2R-30 and 2R-37	Aux. Bldg. Vent - Unit 2	Aux. Bldg. - Unit 2 Exhaust	Aux. Bldg.	3.38E-5	4.1E+4	0.3
		Gas Decay Tanks	Xe-133 (100%)	1.32E-4	4.1E+4	
		Air Ejector Unit 2	Air Ejector	3.38E-5	4.1E+4	
1R-12 and 1R-22	Shield Bldg. Vent - Unit 1	Cont. - Units 1&2 Purge, Unit 1 Inservice Purge	Shield Bldg.	1.32E-4	3.2E+4 (Note 2)	0.3
2R-12 and 2R-22	Shield Bldg. Vent - Unit 2	Cont. - Unit 2 Inservice Purge	Shield Bldg.	1.32E-4	4.6E+3	0.3
R-35	Radwaste Bldg. Vent	Radwaste Bldg. Exhaust	Aux. Bldg.	3.38E-5	6.1E+3	0.1
R-25 and R-31	Spent Fuel Pool Air Vent	Spent Fuel Pool Air Exhaust	Aux. Bldg.	3.38E-5	1.8E+4	0.1

NOTE: Values listed for T_m are nominal values only. They may be adjusted as necessary to allow a reasonable margin to the monitor setpoint. Duplicate values of T_m are assigned to both Shield Building vents since only one containment will be purged at any one time. The assigned T_m values of all active release points SHALL NOT be greater than unity.

NOTE: When purging the Unit 1 containment via the inservice purge system, the monitor setpoints may be based on 4.6E+3 cfm for the duration of the release.

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Table 5.2 Gaseous Source Terms

RADIONUCLIDE	AUX. BLDG (A_i) (Ci/Yr)	SHIELD BLDG. (A_i) (Ci/Yr)	AIR EJECTOR (A_i) (Ci/Yr)
Kr-85m	3EO	-	2EO
Kr-85	2EO	2.2E1	-
Kr-87	1EO	-	-
Kr-88	5EO	1EO	3EO
Xe-131m	2EO	2.1E1	1EO
Xe-133m	5EO	2E1	3EO
Xe-133	3.7E2	2.7E3	2.3E2
Xe-135	8EO	6EO	5EO
Xe-138	1EO	-	-
TOTAL	3.97E2	2.77E3	2.44E2

"-" indicates that the release is less than 1 Ci/yr.

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Table 5.3 Critical Organ Dose Values (P_{il}) for Child

ISOTOPE	P_{il} $\frac{mrem/yr}{\mu Ci/m^3}$
H-3	1.12 E 3
Cr-51	1.70 E 4
Mn-54	1.58 E 6
Fe-59	1.27 E 6
Co-58	1.11 E 6
Co-60	7.07 E 6
Zn-65	9.95 E 5
Rb-86	1.98 E 5
Sr-89	2.16 E 6
Sr-90	1.01 E 8
Y-91	2.63 E 6
Zr-95	2.23 E 6
Nb-95	6.14 E 5
Ru-103	6.62 E 5
Ru-106	1.43 E 7
Ag-110m	5.48 E 6
Te-127m	1.48 E 6
Te-129m	1.76 E 6
Cs-134	1.01 E 6
Cs-136	1.71 E 5
Cs-137	9.07 E 5
Ba-140	1.74 E 6
Ce-141	5.44 E 5
Ce-144	1.20 E 7
I-131	1.62 E 7

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Table 5.4 Dose Factors for Noble Gases *

Radionuclide	Total Body Dose Factor Ki (mrem/yr per $\mu Ci/m^3$)	Skin Dose Factor Li (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor Mi (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor Ni (mrad/yr per $\mu Ci/m^3$)
Kr-83m	7.56E-02	----	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	163E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

* The listed dose factors are for radionuclides that may be detected in gaseous effluents. All others are 0.

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Table 5.5-1 R Values for the Prairie Island Nuclear Generating Plant* - Ground, All Ages

PATHWAY = GROUND

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
MN 54	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.34E 09	1.57E 09
FE 59	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	2.75E 08	3.23E 08
CO 58	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	3.79E 08	4.44E 08
CO 60	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.15E 10	2.52E 10
SR 89	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.23E 04	2.58E 04
I 131	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	1.72E 07	2.09E 07
CS134	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	6.82E 09	7.96E 09
CS137	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.03E 10	1.20E 10
I-133	2.45E 06	2.45E 06	2.45E 06	2.45E 06	2.45E 06	2.45E 06	2.45E 06	2.98E 06
NB-95	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.36E 08	1.61E 08
ZR-95	2.45E 08	2.45E 08	2.45E 08	2.45E 08	2.45E 08	2.45E 08	2.45E 08	2.84E 08
CS-136	1.51E 08	1.51E 08	1.51E 08	1.51E 08	1.51E 08	1.51E 08	1.51E 08	1.71E 08
AG-110M	3.44E 09	3.44E 09	3.44E 09	3.44E 09	3.44E 09	3.44E 09	3.44E 09	4.01E 09

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-2 R Values for the Prairie Island Nuclear Generating Plant* - Vegetable, Adult

PATHWAY = VEGET
AGE GROUP EQUALS ADULT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.28E 03	2.28E 03	0.00E 00	2.28E 03	2.28E 03	2.28E 03	2.28E 03	2.28E 03
MN 54	5.83E 07	9.36E 08	0.00E 00	3.05E 08	9.09E 07	0.00E 00	0.00E 00	0.00E 00
FE 59	1.12E 08	9.75E 08	1.24E 08	2.93E 08	0.00E 00	0.00E 00	8.17E 07	0.00E 00
CO 58	6.71E 07	6.07E 08	0.00E 00	2.99E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	3.67E 08	3.12E 09	0.00E 00	1.66E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	2.87E 08	1.60E 09	1.00E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.64E 11	1.93E 10	6.70E 11	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	6.61E 07	3.04E 07	8.07E 07	1.15E 08	1.98E 08	3.78E 10	0.00E 00	0.00E 00
CS134	8.83E 09	1.89E 08	4.54E 09	1.08E 10	3.49E 09	0.00E 00	1.16E 09	0.00E 00
CS137	5.94E 09	1.76E 08	6.63E 09	9.07E 09	3.08E 09	0.00E 00	1.02E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-3 R Values for the Prairie Island Nuclear Generating Plant* - Vegetable, Teen

PATHWAY = VEGET
AGE GROUP EQUALS TEEN

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.61E 03	2.61E 03	0.00E 00	2.61E 03	2.61E 03	2.61E 03	2.61E 03	2.61E 03
MN 54	8.79E 07	9.09E 08	0.00E 00	4.43E 08	1.32E 08	0.00E 00	0.00E 00	0.00E 00
FE 59	1.60E 08	9.78E 08	1.77E 08	4.14E 08	0.00E 00	0.00E 00	1.30E 08	0.00E 00
CO 58	9.79E 07	5.85E 08	0.00E 00	4.25E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	5.57E 08	3.22E 09	0.00E 00	2.47E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	4.36E 08	1.81E 09	1.52E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	2.05E 11	2.33E 10	8.32E 11	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	5.77E 07	2.13E 07	7.68E 07	1.07E 08	1.85E 08	3.14E 10	0.00E 00	0.00E 00
CS134	7.54E 09	2.02E 08	6.90E 09	1.62E 10	5.16E 09	0.00E 00	1.97E 09	0.00E 00
CS137	4.90E 09	2.00E 08	1.06E 10	1.41E 10	4.78E 09	0.00E 00	1.86E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-4 R Values for the Prairie Island Nuclear Generating Plant* - Vegetable, Child

PATHWAY = VEGET
AGE GROUP EQUALS CHILD

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.04E 03	4.04E 03	0.00E 00	4.04E 03	4.04E 03	4.04E 03	4.04E 03	4.04E 03
MN 54	1.73E 08	5.44E 08	0.00E 00	6.49E 08	1.82E 08	0.00E 00	0.00E 00	0.00E 00
FE 59	3.17E 08	6.62E 08	3.93E 08	6.36E 08	0.00E 00	0.00E 00	1.84E 08	0.00E 00
CO 58	1.92E 08	3.66E 08	0.00E 00	6.27E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	1.11E 09	2.08E 09	0.00E 00	3.76E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	1.03E 09	1.40E 09	3.62E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	3.49E 11	1.86E 10	1.38E 12	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	8.16E 07	1.28E 07	1.43E 08	1.44E 08	2.36E 08	4.75E 10	0.00E 00	0.00E 00
CS134	5.40E 09	1.38E 08	1.56E 10	2.56E 10	7.93E 09	0.00E 00	2.84E 09	0.00E 00
CS137	3.52E 09	1.50E 08	2.49E 10	2.39E 10	7.78E 09	0.00E 00	2.80E 09	0.00E 00
I-133	1.65E 06	1.76E 06	3.53E 06	4.37E 06	7.28E 06	8.12E 08	0.00E 00	0.00E 00
NB-95	1.12E 05	2.91E 08	4.04E 05	1.57E 05	1.48E 05	0.00E 00	0.00E 00	0.00E 00
ZR-95	7.35E 05	8.61E 08	3.75E 06	8.25E 05	1.18E 06	0.00E 00	0.00E 00	0.00E 00
CS-136	1.46E 08	7.95E 06	8.23E 07	2.26E 08	1.21E 08	0.00E 00	1.80E 07	0.00E 00
AG-110M	1.86E 07	2.77E 09	3.45E 07	2.33E 07	4.34E 07	0.00E 00	0.00E 00	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-5 R Values for the Prairie Island Nuclear Generating Plant* - Meat, Adult

PATHWAY = MEAT
AGE GROUP EQUALS ADULT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.25E 02	3.25E 02	0.00E 00	3.25E 02	3.25E 02	3.25E 02	3.25E 02	3.25E 02
MN 54	9.46E 05	1.52E 07	0.00E 00	4.96E 06	1.47E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	1.14E 08	9.93E 08	1.27E 08	2.98E 08	0.00E 00	0.00E 00	8.32E 07	0.00E 00
CO 58	1.99E 07	1.80E 08	0.00E 00	8.90E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	9.37E 07	7.98E 08	0.00E 00	4.25E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	4.21E 06	2.35E 07	1.47E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.86E 09	2.19E 08	7.57E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	4.34E 06	2.00E 06	5.30E 06	7.58E 06	1.30E 07	2.48E 09	0.00E 00	0.00E 00
CS134	7.04E 08	1.51E 07	3.62E 08	8.61E 08	2.79E 08	0.00E 00	9.25E 07	0.00E 00
CS137	4.57E 08	1.35E 07	5.10E 08	6.98E 08	2.37E 08	0.00E 00	7.88E 07	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-6 R Values for the Prairie Island Nuclear Generating Plant* - Meat, Teen

PATHWAY = MEAT
AGE GROUP EQUALS TEEN

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.94E 02	1.94E 02	0.00E 00	1.94E 02	1.94E 02	1.94E 02	1.94E 02	1.94E 02
MN 54	7.50E 05	7.75E 06	0.00E 00	3.78E 06	1.13E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	9.13E 07	5.59E 08	1.01E 08	2.36E 08	0.00E 00	0.00E 00	7.46E 07	0.00E 00
CO 58	1.58E 07	9.45E 07	0.00E 00	6.86E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	7.42E 07	4.29E 08	0.00E 00	3.30E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	3.55E 06	1.47E 07	1.24E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.21E 09	1.37E 08	4.90E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	3.31E 06	1.22E 06	4.40E 06	6.16E 06	1.06E 07	1.80E 09	0.00E 00	0.00E 00
CS134	3.14E 08	8.42E 06	2.88E 08	6.77E 08	2.15E 08	0.00E 00	8.22E 07	0.00E 00
CS137	1.96E 08	8.02E 06	4.24E 08	5.64E 08	1.92E 08	0.00E 00	7.46E 07	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-7 R Values for the Prairie Island Nuclear Generating Plant* - Meat, Child

PATHWAY = MEAT
AGE GROUP EQUALS CHILD

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.34E 02	2.34E 02	0.00E 00	2.34E 02	2.34E 02	2.34E 02	2.34E 02	2.34E 02
MN 54	1.15E 06	3.63E 06	0.00E 00	4.33E 06	1.21E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	1.45E 08	3.03E 08	1.80E 08	2.91E 08	0.00E 00	0.00E 00	8.43E 07	0.00E 00
CO 58	2.45E 07	4.67E 07	0.00E 00	8.01E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	1.15E 08	2.17E 08	0.00E 00	3.91E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	6.69E 06	9.07E 06	2.34E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.60E 09	8.52E 07	6.33E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	4.66E 06	7.31E 05	8.16E 06	8.21E 06	1.35E 07	2.71E 09	0.00E 00	0.00E 00
CS134	1.76E 08	4.49E 06	5.07E 08	8.33E 08	2.58E 08	0.00E 00	9.26E 07	0.00E 00
CS137	1.10E 08	4.68E 06	7.81E 08	7.47E 08	2.43E 08	0.00E 00	8.76E 07	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-8 R Values for the Prairie Island Nuclear Generating Plant* - Cow Milk, Adult

PATHWAY = COW MILK
AGE GROUP EQUALS ADULT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	7.63E 02	7.63E 02	0.00E 00	7.63E 02	7.63E 02	7.63E 02	7.63E 02	7.63E 02
MN 54	8.67E 05	1.39E 07	0.00E 00	4.54E 06	1.35E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	1.27E 07	1.10E 08	1.41E 07	3.31E 07	0.00E 00	0.00E 00	9.26E 06	0.00E 00
CO 58	5.15E 06	4.66E 07	0.00E 00	2.30E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	2.04E 07	1.74E 08	0.00E 00	9.27E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	2.00E 07	1.12E 08	6.99E 08	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	6.99E 09	8.22E 08	2.85E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	1.19E 08	5.50E 07	1.46E 08	2.08E 08	3.57E 08	6.83E 10	0.00E 00	0.00E 00
CS134	6.05E 09	1.30E 08	3.11E 09	7.40E 09	2.40E 09	0.00E 00	7.95E 08	0.00E 00
CS137	3.87E 09	1.14E 08	4.32E 09	5.91E 09	2.01E 09	0.00E 00	6.67E 08	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-9 R Values for the Prairie Island Nuclear Generating Plant* - Cow Milk, Teen

PATHWAY = COW MILK
AGE GROUP EQUALS TEEN

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	9.94E 02	9.94E 02	0.00E 00	9.94E 02	9.94E 02	9.94E 02	9.94E 02	9.94E 02
MN 54	1.50E 06	1.55E 07	0.00E 00	7.57E 06	2.26E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	2.22E 07	1.36E 08	2.46E 07	5.74E 07	0.00E 00	0.00E 00	1.81E 07	0.00E 00
CO 58	8.91E 06	5.33E 07	0.00E 00	3.87E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	3.54E 07	2.05E 08	0.00E 00	1.57E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	3.69E 07	1.53E 08	1.29E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	9.93E 09	1.13E 09	4.02E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	1.99E 08	7.32E 07	2.64E 08	3.70E 08	6.37E 08	1.08E 11	0.00E 00	0.00E 00
CS134	5.90E 09	1.58E 08	5.40E 09	1.27E 10	4.04E 09	0.00E 00	1.54E 09	0.00E 00
CS137	3.63E 09	1.48E 08	7.83E 09	1.04E 10	3.55E 09	0.00E 00	1.38E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-10 R Values for the Prairie Island Nuclear Generating Plant* - Cow Milk, Child

PATHWAY = COW MILK
AGE GROUP EQUALS CHILD

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.57E 03	1.57E 03	0.00E 00	1.57E 03	1.57E 03	1.57E 03	1.57E 03	1.57E 03
MN 54	3.02E 06	9.50E 06	0.00E 00	1.13E 07	3.17E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	4.60E 07	9.61E 07	5.70E 07	9.23E 07	0.00E 00	0.00E 00	2.68E 07	0.00E 00
CO 58	1.81E 07	3.45E 07	0.00E 00	5.91E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	7.19E 07	1.35E 08	0.00E 00	2.44E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	9.10E 07	1.23E 08	3.19E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.72E 10	9.15E 08	6.80E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	3.66E 08	5.74E 07	6.41E 08	6.45E 08	1.06E 09	2.13E 11	0.00E 00	0.00E 00
CS134	4.13E 09	1.10E 08	1.25E 10	2.04E 10	6.34E 09	0.00E 00	2.27E 09	0.00E 00
CS137	2.67E 09	1.13E 08	1.89E 10	1.81E 10	5.89E 09	0.00E 00	2.12E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-11 R Values for the Prairie Island Nuclear Generating Plant* - Cow Milk, Infant

PATHWAY = COW MILK
AGE GROUP EQUALS INFANT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.38E 03	2.38E 03	0.00E 00	2.38E 03	2.38E 03	2.38E 03	2.38E 03	2.38E 03
MN 54	4.77E 06	7.73E 06	0.00E 00	2.11E 07	4.67E 06	0.00E 00	0.00E 00	0.00E 00
FE 59	7.33E 07	8.88E 07	1.06E 08	1.86E 08	0.00E 00	0.00E 00	5.50E 07	0.00E 00
CO 58	2.95E 07	2.94E 07	0.00E 00	1.18E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	1.18E 08	1.18E 08	0.00E 00	4.98E 07	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	1.74E 08	1.25E 08	6.06E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.88E 10	9.23E 08	7.40E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	6.93E 08	5.63E 07	1.34E 09	1.58E 09	1.84E 09	5.18E 11	0.00E 00	0.00E 00
CS134	3.78E 09	1.02E 08	2.01E 10	3.74E 10	9.64E 09	0.00E 00	3.95E 09	0.00E 00
CS137	2.50E 09	1.10E 08	3.01E 10	3.53E 10	9.46E 09	0.00E 00	3.83E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-12 R Values for the Prairie Island Nuclear Generating Plant* - Goat Milk, Adult

PATHWAY = GOATMILK
AGE GROUP EQUALS ADULT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.56E 03	1.56E 03	0.00E 00	1.56E 03	1.56E 03	1.56E 03	1.56E 03	1.56E 03
MN 54	1.04E 05	1.67E 06	0.00E 00	5.45E 05	1.62E 05	0.00E 00	0.00E 00	0.00E 00
FE 59	1.65E 05	1.44E 06	1.83E 05	4.31E 05	0.00E 00	0.00E 00	1.20E 05	0.00E 00
CO 58	6.18E 05	5.59E 06	0.00E 00	2.76E 05	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	2.45E 06	2.09E 07	0.00E 00	1.11E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	4.21E 07	2.35E 08	1.47E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	1.47E 10	1.73E 09	5.98E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	1.43E 08	6.60E 07	1.75E 08	2.50E 08	4.29E 08	8.20E 10	0.00E 00	0.00E 00
CS134	1.82E 10	3.89E 08	9.33E 09	2.22E 10	7.19E 09	0.00E 00	2.39E 09	0.00E 00
CS137	1.16E 10	3.43E 08	1.30E 10	1.77E 10	6.02E 09	0.00E 00	2.00E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-13 R Values for the Prairie Island Nuclear Generating Plant* - Goat Milk, Teen

PATHWAY = GOATMILK
AGE GROUP EQUALS TEEN

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	2.03E 03	2.03E 03	0.00E 00	2.03E 03	2.03E 03	2.03E 03	2.03E 03	2.03E 03
MN 54	1.80E 05	1.86E 06	0.00E 00	9.08E 05	2.71E 05	0.00E 00	0.00E 00	0.00E 00
FE 59	2.88E 05	1.76E 06	3.20E 05	7.46E 05	0.00E 00	0.00E 00	2.35E 05	0.00E 00
CO 58	1.07E 06	6.40E 06	0.00E 00	4.64E 05	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	4.24E 06	2.45E 07	0.00E 00	1.88E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	7.74E 07	3.22E 08	2.70E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	2.09E 10	2.37E 09	8.45E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	2.39E 08	8.79E 07	3.17E 08	4.44E 08	7.65E 08	1.30E 11	0.00E 00	0.00E 00
CS134	1.77E 10	4.74E 08	1.62E 10	3.81E 10	1.21E 10	0.00E 00	4.63E 09	0.00E 00
CS137	1.09E 10	4.45E 08	2.35E 10	3.13E 10	1.06E 10	0.00E 00	4.13E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M³ FOR INHALATION AND TRITIUM, AND IN UNITS OF M² -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-14 R Values for the Prairie Island Nuclear Generating Plant*
- Goat Milk, Child

PATHWAY = GOATMILK
AGE GROUP EQUALS CHILD

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	3.20E 03	3.20E 03	0.00E 00	3.20E 03	3.20E 03	3.20E 03	3.20E 03	3.20E 03
MN 54	3.62E 05	1.14E 06	0.00E 00	1.36E 06	3.81E 05	0.00E 00	0.00E 00	0.00E 00
FE 59	5.98E 05	1.25E 06	7.42E 05	1.20E 06	0.00E 00	0.00E 00	3.48E 05	0.00E 00
CO 58	2.17E 06	4.14E 06	0.00E 00	7.09E 05	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	8.63E 06	1.62E 07	0.00E 00	2.93E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	1.91E 08	2.59E 08	6.69E 09	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	3.62E 10	1.92E 09	1.43E 11	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	4.40E 08	6.89E 07	7.70E 08	7.74E 08	1.27E 09	2.56E 11	0.00E 00	0.00E 00
CS134	1.29E 10	3.31E 08	3.74E 10	6.13E 10	1.90E 10	0.00E 00	6.82E 09	0.00E 00
CS137	8.00E 09	3.39E 08	5.66E 10	5.42E 10	1.77E 10	0.00E 00	6.35E 09	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER µCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER µCI/SEC FOR ALL OTHERS.

Table 5.5-15 R Values for the Prairie Island Nuclear Generating Plant* - Goat Milk, Infant

PATHWAY = GOATMILK
AGE GROUP EQUALS INFANT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	4.86E 03	4.86E 03	0.00E 00	4.86E 03	4.86E 03	4.86E 03	4.86E 03	4.86E 03
MN 54	5.73E 05	9.28E 05	0.00E 00	2.53E 06	5.60E 05	0.00E 00	0.00E 00	0.00E 00
FE 59	9.53E 05	1.15E 06	1.38E 06	2.42E 06	0.00E 00	0.00E 00	7.15E 05	0.00E 00
CO 58	3.54E 06	3.53E 06	0.00E 00	1.42E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
CO 60	1.41E 07	1.42E 07	0.00E 00	5.97E 06	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 89	3.65E 08	2.62E 08	1.27E 10	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
SR 90	3.95E 10	1.94E 09	1.55E 11	0.00E 00	0.00E 00	0.00E 00	0.00E 00	0.00E 00
I 131	8.32E 08	6.76E 07	1.61E 09	1.89E 09	2.21E 09	6.22E 11	0.00E 00	0.00E 00
CS134	1.13E 10	3.05E 08	6.02E 10	1.12E 11	2.89E 10	0.00E 00	1.19E 10	0.00E 00
CS137	7.50E 09	3.31E 08	9.04E 10	1.06E 11	2.84E 10	0.00E 00	1.15E 10	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-16 R Values for the Prairie Island Nuclear Generating Plant* - Inhalation, Adult

PATHWAY = INHAL
AGE GROUP EQUALS ADULT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.26E 03	1.26E 03	0.00E 00	1.26E 03	1.26E 03	1.26E 03	1.26E 03	1.26E 03
MN 54	6.29E 03	7.72E 04	0.00E 00	3.95E 04	9.83E 03	0.00E 00	1.42E 06	0.00E 00
FE 59	1.05E 04	1.88E 05	1.17E 04	2.77E 04	0.00E 00	0.00E 00	1.01E 06	0.00E 00
CO 58	2.07E 03	1.06E 05	0.00E 00	1.58E 03	0.00E 00	0.00E 00	9.27E 05	0.00E 00
CO 60	1.48E 04	2.84E 05	0.00E 00	1.15E 04	0.00E 00	0.00E 00	5.96E 06	0.00E 00
SR 89	8.71E 03	3.49E 05	3.04E 05	0.00E 00	0.00E 00	0.00E 00	1.40E 06	0.00E 00
SR 90	6.09E 06	7.21E 05	9.91E 07	0.00E 00	0.00E 00	0.00E 00	9.59E 06	0.00E 00
I 131	2.05E 04	6.27E 03	2.52E 04	3.57E 04	6.12E 04	1.19E 07	0.00E 00	0.00E 00
CS134	7.27E 05	1.04E 04	3.72E 05	8.47E 05	2.87E 05	0.00E 00	9.75E 04	0.00E 00
CS137	4.27E 05	8.39E 03	4.78E 05	6.20E 05	2.22E 05	0.00E 00	7.51E 04	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-17 R Values for the Prairie Island Nuclear Generating Plant* - Inhalation, Teen

PATHWAY = INHAL
AGE GROUP EQUALS TEEN

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.27E 03	1.27E 03	0.00E 00	1.27E 03	1.27E 03	1.27E 03	1.27E 03	1.27E 03
MN 54	8.39E 03	6.67E 04	0.00E 00	5.10E 04	1.27E 04	0.00E 00	1.98E 06	0.00E 00
FE 59	1.43E 04	1.78E 05	1.59E 04	3.69E 04	0.00E 00	0.00E 00	1.53E 06	0.00E 00
CO 58	2.77E 03	9.51E 04	0.00E 00	2.07E 03	0.00E 00	0.00E 00	1.34E 06	0.00E 00
CO 60	1.98E 04	2.59E 05	0.00E 00	1.51E 04	0.00E 00	0.00E 00	8.71E 06	0.00E 00
SR 89	1.25E 04	3.71E 05	4.34E 05	0.00E 00	0.00E 00	0.00E 00	2.41E 06	0.00E 00
SR 90	6.67E 06	7.64E 05	1.08E 08	0.00E 00	0.00E 00	0.00E 00	1.65E 07	0.00E 00
I 131	2.64E 04	6.48E 03	3.54E 04	4.90E 04	8.39E 04	1.46E 07	0.00E 00	0.00E 00
CS134	5.48E 05	9.75E 03	5.02E 05	1.13E 06	3.75E 05	0.00E 00	1.46E 05	0.00E 00
CS137	3.11E 05	8.47E 03	6.69E 05	8.47E 05	3.04E 05	0.00E 00	1.21E 05	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-18 R Values for the Prairie Island Nuclear Generating Plant* - Inhalation, Child

PATHWAY = INHAL
AGE GROUP EQUALS CHILD

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	1.12E 03	1.12E 03	0.00E 00	1.12E 03	1.12E 03	1.12E 03	1.12E 03	1.12E 03
MN 54	9.50E 03	2.29E 04	0.00E 00	4.29E 04	1.00E 04	0.00E 00	1.57E 06	0.00E 00
FE 59	1.67E 04	7.06E 04	2.07E 04	3.34E 04	0.00E 00	0.00E 00	1.27E 06	0.00E 00
CO 58	3.16E 03	3.43E 04	0.00E 00	1.77E 03	0.00E 00	0.00E 00	1.10E 06	0.00E 00
CO 60	2.26E 04	9.61E 04	0.00E 00	1.31E 04	0.00E 00	0.00E 00	7.06E 06	0.00E 00
SR 89	1.72E 04	1.67E 05	5.99E 05	0.00E 00	0.00E 00	0.00E 00	2.15E 06	0.00E 00
SR 90	6.43E 06	3.43E 05	1.01E 08	0.00E 00	0.00E 00	0.00E 00	1.47E 07	0.00E 00
I 131	2.72E 04	2.84E 03	4.80E 04	4.80E 04	7.87E 04	1.62E 07	0.00E 00	0.00E 00
CS134	2.24E 05	3.84E 03	6.50E 05	1.01E 06	3.03E 05	0.00E 00	1.21E 05	0.00E 00
CS137	1.28E 05	3.61E 03	9.05E 05	8.24E 05	2.82E 05	0.00E 00	1.04E 05	0.00E 00
I-133	7.70E 03	5.48E 03	1.66E 04	2.03E 04	3.38E 04	3.85E 06	0.00E 00	0.00E 00
NB-95	6.55E 03	3.70E 04	2.35E 04	9.18E 03	8.62E 03	0.00E 00	6.14E 05	0.00E 00
ZR-95	3.70E 04	6.11E 04	1.90E 05	4.18E 04	5.96E 04	0.00E 00	2.23E 06	0.00E 00
CS-136	1.16E 05	4.18E 03	6.51E 04	1.71E 05	9.55E 04	0.00E 00	1.45E 04	0.00E 00
AG-110M	9.14E 03	1.00E 05	1.69E 04	1.14E 04	2.12E 04	0.00E 00	5.48E 06	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 5.5-19 R Values for the Prairie Island Nuclear Generating Plant* - Inhalation, Infant

PATHWAY = INHAL
AGE GROUP EQUALS INFANT

NUCLIDE	T. BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
H 3	6.46E 02	6.46E 02	0.00E 00	6.46E 02	6.46E 02	6.46E 02	6.46E 02	6.46E 02
MN 54	4.98E 03	7.05E 03	0.00E 00	2.53E 04	4.98E 03	0.00E 00	9.98E 05	0.00E 00
FE 59	9.46E 03	2.47E 04	1.35E 04	2.35E 04	0.00E 00	0.00E 00	1.01E 06	0.00E 00
CO 58	1.82E 03	1.11E 04	0.00E 00	1.22E 03	0.00E 00	0.00E 00	7.76E 05	0.00E 00
CO 60	1.18E 04	3.19E 04	0.00E 00	8.01E 03	0.00E 00	0.00E 00	4.50E 06	0.00E 00
SR 89	1.14E 04	6.39E 04	3.97E 05	0.00E 00	0.00E 00	0.00E 00	2.03E 06	0.00E 00
SR 90	2.59E 06	1.31E 05	4.08E 07	0.00E 00	0.00E 00	0.00E 00	1.12E 07	0.00E 00
I 131	1.96E 04	1.06E 03	3.79E 04	4.43E 04	5.17E 04	1.48E 07	0.00E 00	0.00E 00
CS134	7.44E 04	1.33E 03	3.96E 05	7.02E 05	1.90E 05	0.00E 00	7.95E 04	0.00E 00
CS137	4.54E 04	1.33E 03	5.48E 05	6.11E 05	1.72E 05	0.00E 00	7.12E 04	0.00E 00

* R VALUES IN UNITS OF MREM/YR PER μCI/M^3 FOR INHALATION AND TRITIUM, AND IN UNITS OF M^2 -MREM/YR PER μCI/SEC FOR ALL OTHERS.

Table 7.1 Radiological Environmental Monitoring Program Sample Collection and Analysis

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
1. AIRBORNE Radioiodine and Particulates	Samples from 5 locations: 3 samples from offsite locations (in different sectors) of the highest calculated annual average ground level D/Q, 1 sample from the vicinity of a community having the highest calculated annual average ground-level D/Q, and 1 sample from a control location specified in the ODCM	Continuous Sampler operation with sample collection weekly	Radioiodine analysis weekly for I-131 Particulate: Gross beta activity on each filter weekly*. Analysis **SHALL** be performed more than 24 hours following filter change. Perform gamma isotopic analysis on composite (by location) sample quarterly.
2. DIRECT RADIATION	32 TLD stations established with duplicate dosimeters placed at the following locations: 1. Using the 16 meteorological wind sectors as guidelines, an inner ring of stations in the general area of the site boundary is established and an outer ring of stations in the 4 to 5 mile distance from the plant site is established. Because of inaccessibility, seven sectors in the inner and outer rings are not covered	Quarterly	Gamma dose quarterly

* If Gross beta activity in any indictor sample exceeds 10 times the yearly average of the control sample, a gamma isotopic analysis is required.

** Sample locations are further described by the REMP.

Table 7.1 Radiological Environmental Monitoring Program Sample Collection and Analysis

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
2. DIRECT RADIATION [Cont'd]			
	2. Seven dosimeters are established at special interest areas and a control station.		
3. WATERBORNE			
a. Surface	Upstream & downstream locations	Monthly Composite of weekly samples (water & ice conditions permitting)	Gamma isotopic analysis of each monthly composite Tritium analysis of quarterly composites of monthly composites
b. Ground	3 samples from wells within 5 miles of the plant site and 1 sample from a well greater than 10 miles from the plant site	Quarterly	Gamma isotopic and tritium analyses of each sample
c. Drinking	1 sample from the City of Red Wing water supply	Monthly Composite of weekly samples	I-131 Analysis and Gross beta and gamma isotopic analyses of each monthly composite Tritium analysis of quarterly composites of monthly composites

** Sample locations are further described by the REMP.

Table 7.1 Radiological Environmental Monitoring Program Sample Collection and Analysis

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE [Cont'd]			
d. Sediment from shoreline	One sample upstream of plant, one sample downstream of plant, and one from shoreline of recreational area.	Semiannually	Gamma isotopic analysis of each sample
4. INGESTION			
a. Milk	One sample from dairy farm having highest D/Q, one sample from each of three dairy farms calculated to have doses from I-131 > 1 mRem/yr, and one sample from 10-20 miles	Monthly or biweekly if animals are on pasture	Gamma isotopic and I-131 analysis of each sample
b. Fish and Invertebrates	One sample of one game specie of fish located upstream and downstream of the plant site One sample of Invertebrates upstream and downstream of the plant site	Semiannually	Gamma isotopic analyses on each sample (edible portion only on fish)

** Sample locations are further described by the REMP.

Table 7.1 Radiological Environmental Monitoring Program Sample Collection and Analysis

Exposure Pathway and/or Sample	Number of Samples and Sample Locations**	Sampling and Collection Frequency	Type and Frequency of Analysis
4. INGESTION [Cont'd]			
c. Food Products	One sample of corn from any field that is irrigated by water into which liquid plant wastes have been discharged***	At time of harvest	Gamma isotopic analysis of edible portion of each sample
	One sample of broad leaf vegetation from highest D/Q garden and one sample from 10-20 miles	At time of harvest	I-131 analyses of edible portion of each sample

** Sample locations are further described by the REMP.
*** As determined by methods outlined in the ODCM.

Table 7.2 - Reporting Levels for Radioactivity Concentration in Environmental Samples

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[(a)]				
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[(b)]				
I-131	2[(a)]	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[(b)]			300[(b)]	

(a) Drinking water pathway level.

(b) Total for parent and daughter.

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Table 7.3 - Detection Capabilities for Environmental Sample Analysis Lower Limit of Detection (LLD)[(a)]

ANALYSIS	WATER (pCi/l)	AIRBORN 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				30,000[(a)]
H-3	2,000[(b)]					
Mn-54	15		130			
Fe-9	30		260			
Co-58, 60	15		130			
Zm-65	30		260			
Zr-Nb-95	15 [(c)]					
1-131[(d)]	1[(b)]	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15[(c)]			15[(c)]		

Table 7.3 - Table Notation

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

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

$$LLD = \frac{4.66 s_b}{E.V.2.22.Y.\exp(-\lambda \Lambda \tau)}$$

Where:

LLD is the apriori lower limit of detection as defined above (as picocurie per unit mass or volume), s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute). In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background **SHALL** include the typical contributing of other radionuclides normally present in the samples (e.g., potassium-40 in milk samples). Typical values of E, V, Y and Δt **SHALL** be used in the calculations.

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

2.22 is the number of transformation per minute per picocurie,

Y is the fractional radiochemical yield (when applicable),

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

$\Delta\tau$ is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

b - Drinking water pathway limit.

c - Total for parent and daughter

d - These LLDs apply only where "^{131}I analysis" is specified.

e - Where "Gamma Isotopic Analysis" is specified, the LLD specification applies to the following radionuclides: ^{54}Mn, ^{59}Fe, ^{58}Co, ^{60}Co, ^{65}Zn, ^{95}Zr-Nb, ^{137}Cs, ^{134}Cs, and ^{140}Ba-La. Other peaks which are measurable and identifiable, together with the above nuclides, **SHALL** also be identified and reported.

Figure 3.1 - Prairie Island Nuclear Generating Plant Site Boundary For Liquid Effluents

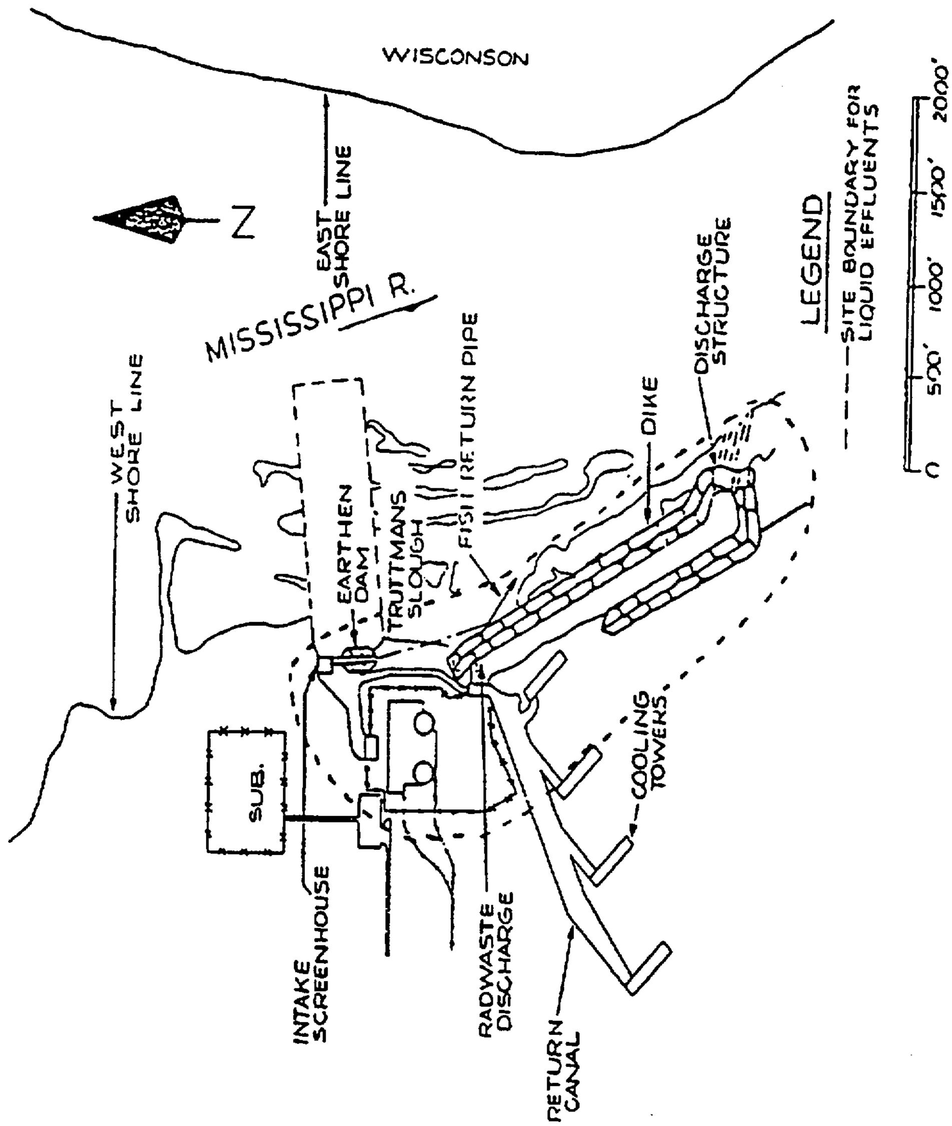

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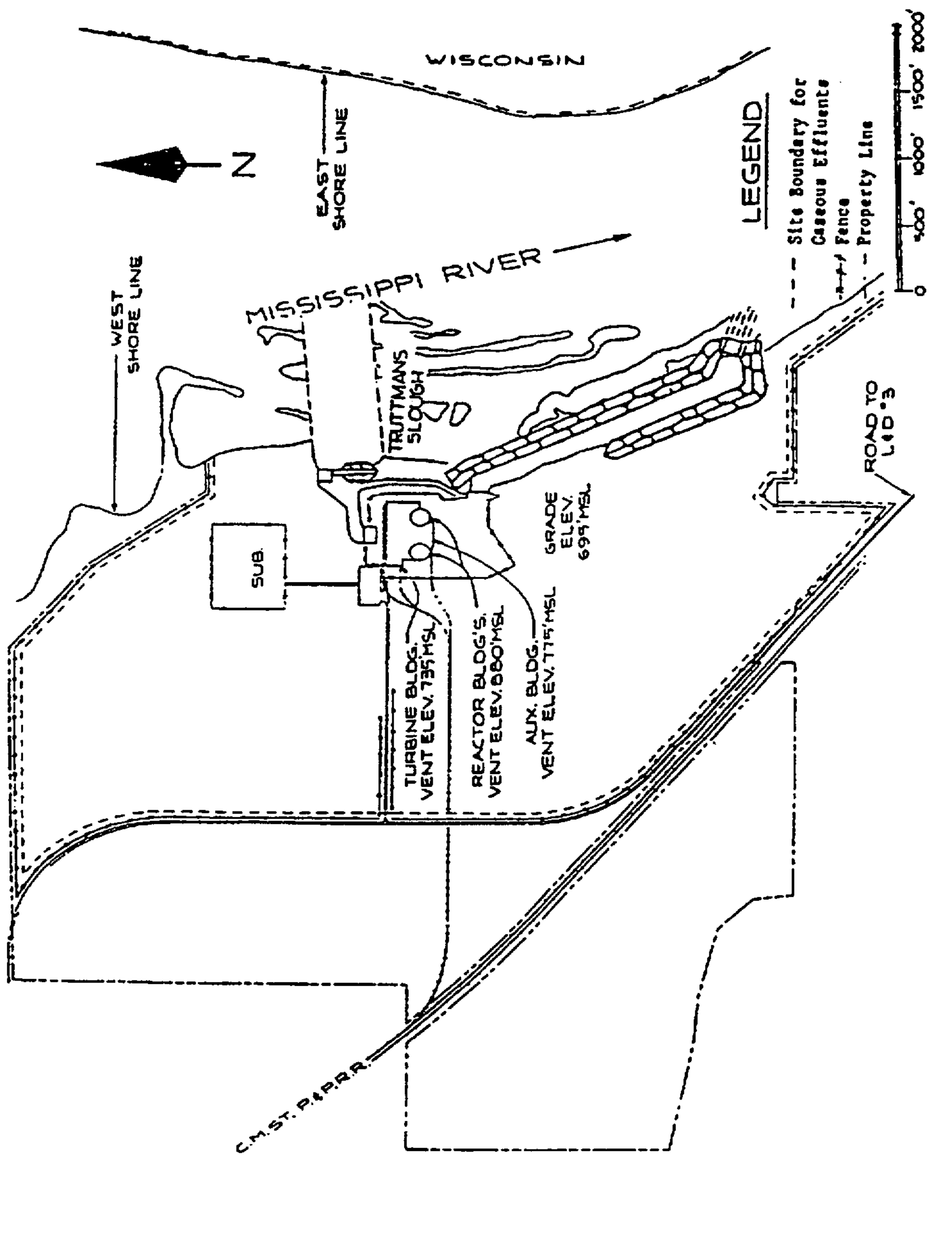
Figure 3.2 - Prairie Island Nuclear Generating Plant Site Boundary For Gaseous Effluents



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Appendix A Meteorological Analyses

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Appendix A

Summary of Dispersion Calculational Procedures

Undepleted, undecayed dispersion parameters were computed using the computer program XOQDOQ (Sagendorf and Goll, 1977). Specifically, sector average χ/Q and D/Q values were obtained for a sector width of 22.5 degrees. Building wake corrections were used to adjust calculations for ground-level releases. Standard open terrain recirculation correction factors were also applied as available as default values in XOQDOQ.

Dispersion calculations were based on ground level releases for the shield buildings, turbine buildings, and auxiliary building (hereafter referred to as the plant complex). A summary of release conditions used as input to XOQDOQ is presented in Table A-1 and controlling site boundary distances are defined in Table A-2. Computed χ/Q and D/Q values for site boundary locations (relative to release points) and for standard distances (to five miles from the source in 0.1mile increments) are presented in Tables A-3 through A-8.

Onsite meteorological data for the period April 1, 1977 through March 31, 1978 (as presented in Appendix B) were used as input to XOQDOQ. Data were collected and ΔT stability classes were defined in conformance with NRC Regulatory Guide 1.23. DIspersion calculations for the plant complex were based on ΔT 42.7-12.2m and 12.2 meter wind data (joint data recovery of 96 percent).

REFERENCES

1. Sagendorf, J.F. and Goll, J.T., XOQDOQ Program for the Evaluation of Routine Effluent Releases at Nuclear Power Stations, NUREG-0324, U.S. Nuclear Regulatory Commission, September 1977.

Table A-1 - Prairie Island Release Conditions

	Shield Buildings	Auxiliary Building	Turbine Building
Type Release	**Ground Level (Long Term and Short Term)**	**Ground Level (Long Term)**	**Ground Level (Long Term)**
Release Point Height (m)	56.4	24.4	33.6, 12.2
Adjacent Building Height	62.2	62.2*	62.2*
Relative Location to Adjacent Structures	Adjacent to Auxiliary Building	Adjacent to Auxiliary Building	Adjacent to Auxiliary Building
Exit Velocity (m/sec)	N.A.	N.A.	N.A.
Internal Stack Diameter (m)	N.A.	N.A.	N.A.
Building Cross-Sectional Area (m^2)	2,170	2,170**	2,170**
Purge Frequency *** (times/yr)	20	N.A.	N.A.
Purge Duration*** (hours/release)	5	N.A.	N.A.

* Height of Shield Buildings
** Shield Building cross-sectional area
*** Applied to short-term calculations only

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Table A-2 Distances (Miles) to Controlling Site Boundary Locations

As Measured from Edge of Plant Complex

Sector	Distance
N	0.28
NNE	0.26
NE	0.84*
ENE	0.62*
E	0.59*
ESE	0.61*
SE	0.67
SSE	0.43
S	0.43
SSW	0.40
SW	0.40
WSW	0.37
W	0.36
WNW	0.36
NW	0.43
NNW	0.48

*Over-water distances

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Table A-3 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Site Boundary Locations (identified in Table A-2)

Site Boundary Sector	χ/Q (sec/m^3)	D/Q (1/m^2)
N	1.82E-05	1.18E-07
NNE	1.52E-05	8.55E-08
NE	1.83E-06	7.74E-09
ENE	3.25E-06	1.84E-08
E	1.05E-05	4.23E-08
ESE	1.86E-05	7.30E-08
SE	1.67E-05	6.80E-08
SSE	1.95E-05	6.81E-08
S	8.12E-06	3.19E-08
SSW	7.08E-06	2.55E-08
SW	7.66E-06	2.77E-08
WSW	1.13E-05	3.53E-08
W	2.66E-05	7.63E-08
WNW	3.38E-05	1.42E-07
NW	2.13E-05	9.02E-08
NNW	1.11E-05	5.43E-08

Period of Record: 4/1/77 - 3/31/78

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Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7
N	1.20E-04	3.44E-05	1.66E-05	1.02E-05	7.04E-06	5.29E-06	4.13E-06
NNE	8.53E-05	2.44E-05	1.18E-05	7.20E-06	4.93E-06	3.67E-06	2.83E-06
NE	8.18E-05	2.35E-05	1.14E-05	6.87E-06	4.69E-06	3.49E-06	2.69E-06
ENE	7.88E-05	2.26E-05	1.10E-05	6.70E-06	4.62E-06	3.46E-06	2.69E-06
E	2.40E-04	6.89E-05	3.34E-05	2.02E-05	1.38E-05	1.02E-05	7.88E-06
ESE	4.52E-04	1.30E-04	6.28E-05	3.80E-05	2.59E-05	1.92E-05	1.48E-05
SE	4.85E-04	1.39E-04	6.74E-05	4.07E-05	2.77E-05	2.04E-05	1.56E-05
SSE	2.59E-04	7.44E-05	3.60E-05	2.17E-05	1.48E-05	1.10E-05	8.44E-06
S	1.08E-04	3.09E-05	1.46E-05	9.06E-06	6.20E-06	4.62E-06	3.58E-06
SSW	8.60E-05	2.46E-05	1.19E-05	7.19E-06	4.91E-06	3.66E-06	2.83E-06
SW	9.19E-05	2.62E-05	1.26E-05	7.72E-06	5.31E-06	3.98E-06	3.09E-06
WSW	1.17E-04	3.35E-05	1.61E-05	9.80E-06	6.70E-06	4.97E-06	3.83E-06
W	2.64E-04	7.56E-05	3.66E-05	2.22E-05	1.51E-05	1.12E-05	8.61E-06
WNW	3.42E-04	9.80E-05	4.75E-05	2.88E-05	1.98E-05	1.47E-05	1.14E-05
NW	2.91E-04	8.35E-05	4.05E-05	2.46E-05	1.68E-05	1.25E-05	9.67E-06
NNW	1.76E-04	5.04E-05	2.45E-05	1.50E-05	1.03E-05	7.70E-06	5.99E-06

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	0.8	0.9	1.0	1.1	1.2	1.3	1.4
N	3.18E-06	2.39E-06	1.87E-06	1.51E-06	1.24E-06	1.04E-06	8.80E-07
NNE	2.17E-06	1.62E-06	1.27E-06	1.02E-06	8.33E-07	6.95E-07	5.90E-07
NE	2.06E-06	1.54E-06	1.20E-06	9.60E-07	7.86E-07	6.56E-07	5.56E-07
ENE	2.07E-06	1.55E-06	1.21E-06	9.72E-07	7.98E-07	6.66E-07	5.65E-07
E	6.02E-06	4.51E-06	3.52E-06	2.82E-06	2.31E-06	1.93E-06	1.64E-06
ESE	1.13E-05	8.44E-06	6.58E-06	5.28E-06	4.33E-06	3.62E-06	3.07E-06
SE	1.19E-05	8.92E-06	6.96E-06	5.58E-06	4.58E-06	3.82E-06	3.25E-06
SSE	6.45E-06	4.82E-06	3.76E-06	3.01E-06	2.47E-06	2.06E-06	1.75E-06
S	2.74E-06	2.06E-06	1.61E-06	1.29E-06	1.06E-06	8.88E-07	7.54E-07
SSW	2.17E-06	1.63E-06	1.27E-06	1.02E-06	8.36E-07	6.99E-07	5.93E-07
SW	2.38E-06	1.78E-06	1.39E-06	1.12E-06	9.17E-07	7.66E-07	6.50E-07
WSW	2.93E-06	2.19E-06	1.71E-06	1.37E-06	1.12E-06	9.35E-07	7.93E-07
W	6.57E-06	4.91E-06	3.83E-06	3.07E-06	2.51E-06	2.10E-06	1.78E-06
WNW	8.77E-06	6.58E-06	5.14E-06	4.13E-06	3.39E-06	2.83E-06	2.41E-06
NW	7.40E-06	5.56E-06	4.35E-06	3.50E-06	2.88E-06	2.41E-06	2.05E-06
NNW	4.60E-06	3.46E-06	2.71E-06	2.18E-06	1.79E-06	1.50E-06	1.28E-06

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	1.5	1.6	1.7	1.8	1.9	2.0	2.1
N	7.57E-07	6.59E-07	5.79E-07	5.13E-07	4.59E-07	4.14E-07	3.76E-07
NNE	5.07E-07	4.41E-07	3.87E-07	3.43E-07	3.07E-07	2.77E-07	2.52E-07
NE	4.77E-07	4.15E-07	3.64E-07	3.23E-07	2.89E-07	2.61E-07	2.38E-07
ENE	4.86E-07	4.23E-07	3.71E-07	3.29E-07	2.94E-07	2.65E-07	2.41E-07
E	1.41E-06	1.23E-06	1.08E-06	9.55E-07	8.56E-07	7.75E-07	7.05E-06
ESE	2.64E-06	2.30E-06	2.02E-06	1.79E-06	1.61E-06	1.46E-06	1.32E-06
SE	2.79E-06	2.43E-06	2.14E-06	1.90E-06	1.70E-06	1.54E-06	1.40E-06
SSE	1.50E-06	1.31E-06	1.15E-06	1.02E-06	9.12E-07	8.25E-07	7.51E-07
S	6.49E-07	5.65E-07	4.97E-07	4.41E-07	3.95E-07	3.56E-07	3.24E-07
SSW	5.10E-07	4.44E-07	3.90E-07	3.46E-07	3.10E-07	2.80E-07	2.54E-07
SW	5.59E-07	4.87E-07	4.27E-07	3.79E-07	3.39E-07	3.06E-07	2.78E-07
WSW	6.82E-07	5.93E-07	5.21E-07	4.61E-07	4.13E-07	3.74E-07	3.40E-07
W	1.53E-06	1.33E-06	1.17E-06	1.04E-06	9.29E-07	8.40E-07	7.64E-07
WNW	2.07E-06	1.80E-06	1.59E-06	1.41E-06	1.26E-06	1.14E-06	1.03E-06
NW	1.76E-06	1.54E-06	1.35E-06	1.20E-06	1.08E-06	9.72E-06	8.83E-07
NNW	1.10E-06	9.59E-07	8.43E-07	7.47E-07	6.69E-07	6.04E-07	5.49E-07

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.2	2.3	2.4	2.5	2.6	2.7	2.8
N	3.42E-07	3.14E-07	2.89E-07	2.67E-07	2.47E-07	2.30E-07	2.15E-07
NNE	2.30E-07	2.11E-07	1.94E-07	1.80E-07	1.67E-07	1.56E-07	1.45E-07
NE	2.17E-07	1.99E-07	1.84E-07	1.70E-07	1.58E-07	1.47E-07	1.38E-07
ENE	2.20E-07	2.01E-07	1.85E-07	1.71E-07	1.59E-07	1.48E-07	1.38E-07
E	6.44E-07	5.92E-07	5.46E-07	5.05E-07	4.70E-07	4.38E-07	4.09E-07
ESE	1.21E-06	1.11E-06	1.03E-06	9.51E-07	8.84E-07	8.25E-07	7.71E-07
SE	1.28E-06	1.18E-06	1.09E-06	1.01E-06	9.37E-07	8.74E-07	8.17E-07
SSE	6.86E-07	6.31E-07	5.82E-07	5.39E-07	5.01E-07	4.67E-07	4.37E-07
S	2.96E-07	2.71E-07	2.50E-07	2.31E-07	2.15E-07	2.00E-07	1.87E-07
SSW	2.32E-07	2.13E-07	1.96E-07	1.82E-07	1.69E-07	1.57E-07	1.47E-07
SW	2.53E-07	2.32E-07	2.14E-07	1.98E-07	1.83E-07	1.71E-07	1.59E-07
WSW	3.11E-07	2.85E-07	2.63E-07	2.43E-07	2.26E-07	2.11E-07	1.97E-07
W	6.99E-07	6.42E-07	5.93E-07	5.49E-07	5.10E-07	4.76E-07	4.45E-07
WNW	9.44E-07	8.67E-07	7.99E-07	7.39E-07	6.86E-07	6.39E-07	5.97E-07
NW	8.07E-07	7.41E-07	6.83E-07	6.32E-07	5.87E-07	5.47E-07	5.12E-07
NNW	5.01E-07	4.59E-07	4.23E-07	3.91E-07	3.63E-07	3.38E-07	3.15E-07

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	2.9	3.0	3.1	3.2	3.3	3.4	3.5
N	2.01E-07	1.88E-07	1.77E-07	1.67E-07	1.58E-07	1.49E-07	1.42E-07
NNE	1.36E-07	1.28E-07	1.20E-07	1.14E-07	1.07E-07	1.02E-07	9.65E-08
NE	1.29E-07	1.21E-07	1.14E-07	1.08E-07	1.02E-07	9.69E-08	9.20E-08
ENE	1.29E-07	1.21E-07	1.14E-07	1.07E-07	1.01E-07	9.60E-08	9.11E-08
E	3.84E-07	3.61E-07	3.40E-07	3.21E-07	3.04E-07	2.88E-07	2.74E-07
ESE	7.23E-07	6.80E-07	6.41E-07	6.05E-07	5.73E-07	5.43E-07	5.16E-07
SE	7.67E-07	7.21E-07	6.80E-07	6.42E-07	6.08E-07	5.77E-07	5.48E-07
SSE	4.10E-07	3.85E-07	3.63E-07	3.43E-07	3.24E-07	3.08E-07	2.92E-07
S	1.75E-07	1.64E-07	1.55E-07	1.46E-07	1.38E-07	1.31E-07	1.24E-07
SSW	1.38E-07	1.29E-07	1.22E-07	1.15E-07	1.09E-07	1.03E-07	9.77E-08
SW	1.49E-07	1.40E-07	1.32E-07	1.24E-07	1.17E-07	1.11E-07	1.05E-07
WSW	1.85E-07	1.74E-07	1.64E-07	1.54E-07	1.46E-07	1.39E-07	1.32E-07
W	4.17E-07	3.92E-07	3.70E-07	3.49E-07	3.30E-07	3.13E-07	2.98E-07
WNW	5.60E-07	5.26E-07	4.95E-07	4.67E-07	4.42E-07	4.19E-07	3.98E-07
NW	4.79E-07	4.50E-07	4.24E-07	4.00E-07	3.79E-07	3.59E-07	3.41E-07
NNW	2.95E-07	2.77E-07	2.61E-07	2.46E-07	2.32E-07	2.20E-07	2.09E-07

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	3.6	3.7	3.8	3.9	4.0	4.1	4.2
N	1.35E-07	1.28E-07	1.22E-07	1.16E-07	1.11E-07	1.07E-07	1.02E-07
NNE	9.18E-08	8.74E-08	8.34E-08	7.97E-08	7.62E-08	7.30E-08	7.00E-08
NE	8.75E-08	8.34E-08	7.96E-08	7.61E-08	7.28E-08	6.98E-08	6.70E-08
ENE	8.66E-08	8.24E-08	7.86E-08	7.50E-08	7.17E-08	6.86E-08	6.58E-08
E	2.60E-07	2.48E-07	2.37E-07	2.26E-07	2.17E-07	2.08E-07	1.99E-07
ESE	4.91E-07	4.68E-07	4.47E-07	4.27E-07	4.09E-07	3.92E-07	3.76E-07
SE	5.22E-07	4.97E-07	4.75E-07	4.54E-07	4.35E-07	4.17E-07	4.00E-07
SSE	2.78E-07	2.65E-07	2.53E-07	2.42E-07	2.32E-07	2.22E-07	2.13E-07
S	1.18E-07	1.12E-07	1.07E-07	1.02E-07	9.79E-08	9.38E-08	8.99E-08
SSW	9.29E-08	8.85E-08	8.44E-08	8.07E-08	7.72E-08	7.39E-08	7.09E-08
SW	1.00E-07	9.54E-08	9.10E-08	8.69E-08	8.31E-08	7.95E-08	7.62E-08
WSW	1.25E-07	1.19E-07	1.14E-07	1.09E-07	1.04E-07	9.98E-08	9.57E-08
W	2.83E-07	2.70E-07	2.58E-07	2.47E-07	2.36E-07	2.26E-07	2.17E-07
WNW	3.78E-07	3.60E-07	3.44E-07	3.28E-07	3.14E-07	3.01E-07	2.89E-07
NW	3.24E-07	3.09E-07	2.95E-07	2.82E-07	2.70E-07	2.58E-07	2.48E-07
NNW	1.99E-07	1.89E-07	1.80E-07	1.72E-07	1.65E-07	1.58E-07	1.51E-07

Period of Record: 4/1/77 - 3/31/78

Table A-4 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/Q), SEC/M^3, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
N	9.79E-08	9.41E-08	9.04E-08	8.71E-08	8.39E-08	8.09E-08	7.81E-08	7.54E-08
NNE	6.72E-08	6.46E-08	6.22E-08	5.99E-08	5.77E-08	5.57E-08	5.38E-08	5.20E-08
NE	6.43E-08	6.18E-08	5.95E-08	5.74E-08	5.53E-08	5.34E-08	5.16E-08	4.99E-08
ENE	6.31E-08	6.06E-08	5.83E-08	5.62E-08	5.41E-08	5.22E-08	5.04E-08	4.87E-08
E	1.91E-07	1.84E-07	1.77E-07	1.71E-07	1.65E-07	1.59E-07	1.54E-07	1.49E-07
ESE	3.62E-07	3.48E-07	3.35E-07	3.23E-07	3.11E-07	3.01E-07	2.91E-07	2.81E-07
SE	3.85E-07	3.70E-07	3.56E-07	3.44E-07	3.31E-07	3.20E-07	3.09E-07	2.99E-07
SSE	2.05E-07	1.97E-07	1.90E-07	1.83E-07	1.76E-07	1.70E-07	1.65E-07	1.59E-07
S	8.63E-08	8.30E-08	7.98E-08	7.69E-08	7.41E-08	7.15E-08	6.91E-08	6.68E-08
SSW	6.81E-08	6.55E-08	6.30E-08	6.07E-08	5.85E-08	5.65E-08	5.46E-08	5.27E-08
SW	7.32E-08	7.03E-08	6.76E-08	6.51E-08	6.28E-08	6.06E-08	5.85E-08	5.65E-08
WSW	9.19E-08	8.84E-08	8.51E-08	8.20E-08	7.91E-08	7.64E-08	7.38E-08	7.14E-08
W	2.09E-07	2.01E-07	1.93E-07	1.86E-07	1.80E-07	1.73E-07	1.68E-07	1.62E-07
WNW	2.77E-07	2.66E-07	2.56E-07	2.47E-07	2.38E-07	2.30E-07	2.22E-07	2.15E-07
NW	2.38E-07	2.29E-07	2.20E-07	2.12E-07	2.05E-07	1.97E-07	1.91E-07	1.84E-07
NNW	1.45E-07	1.39E-07	1.34E-07	1.29E-07	1.24E-07	1.20E-07	1.16E-07	1.12E-07

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m², for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7
N	5.38E-07	2.01E-07	1.09E-07	6.97E-08	4.87E-08	3.62E-08	2.81E-08
NNE	3.39E-07	1.27E-07	6.87E-08	4.39E-08	3.07-08	2.28E-08	1.77E-08
NE	2.21E-07	8.28E-08	4.49E-08	2.87E-08	2.01E-08	1.49E-08	1.16E-08
ENE	2.88E-07	1.08E-07	5.85E-08	3.73E-08	2.61E-08	1.94E-08	1.51E-08
E	6.15E-07	2.30E-07	1.25E-07	7.97E-08	5.57E-08	4.14E-08	3.22E-08
ESE	1.12E-06	4.19E-07	2.27E-07	1.45E-07	1.02E-07	7.54E-08	5.86E-08
SE	1.22E-06	4.55E-07	2.47E-07	1.58E-07	1.10E-07	8.19E-08	6.36E-08
SSE	5.81E-07	2.17E-07	1.18E-07	7.53E-08	5.27E-08	3.91E-08	3.04E-08
S	2.72E-07	1.02E-07	5.53E-08	3.53E-08	2.47E-08	1.83E-08	1.42E-08
SSW	2.00E-07	7.47E-08	4.06E-08	2.59E-08	1.81E-08	1.34E-08	1.04E-08
SW	2.16E-07	8.06E-08	4.38E-08	2.79E-08	1.95E-08	1.45E-08	1.13E-08
WSW	2.39E-07	8.93E-08	4.85E-08	3.09E-08	2.16E-08	1.61E-08	1.25E-08
W	5.00E-07	1.87E-07	1.01E-07	6.47E-08	4.53E-08	3.36E-08	2.61E-08
WNW	9.50E-07	3.55E-07	1.93E-07	1.23E-07	8.60E-08	6.39E-08	4.96E-08
NW	7.95E-07	2.97E-07	1.61E-07	1.03E-07	7.20E-08	5.35E-08	4.15E-08
NNW	5.54E-07	2.07E-07	1.12E-07	7.17E-08	5.02E-08	3.72E-08	2.89E-08

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m², for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	0.8	0.9	1.0	1.1	1.2	1.3	1.4
N	2.13E-08	1.56E-08	1.19E-08	9.32E-09	7.47E-09	6.10E-09	5.07E-09
NNE	1.34E-08	9.84E-09	7.49E-09	5.87E-09	4.70E-09	3.84E-09	3.19E-09
NE	8.76E-09	6.43E-09	4.90E-09	3.83E-09	3.07E-09	2.51E-09	2.09E-09
ENE	1.14E-08	8.37E-09	6.37E-09	4.99E-09	4.00E-09	3.27E-09	2.72E-09
E	2.43E-08	1.79E-08	1.36E-08	1.07E-08	8.54E-09	6.98E-09	5.80E-09
ESE	4.43E-08	3.26E-08	2.48E-08	1.94E-08	1.56E-08	1.27E-08	1.06E-08
SE	4.81E-08	3.54E-08	2.69E-08	2.11E-08	1.69E-08	1.38E-08	1.15E-08
SSE	2.30E-08	1.69E-08	1.29E-08	1.01E-08	8.07E-09	6.59E-09	5.48E-09
S	1.08E-08	7.92E-09	6.03E-09	4.72E-09	3.78E-09	3.09E-09	2.57E-09
SSW	7.91E-09	5.81E-09	4.42E-09	3.46E-09	2.77E-09	2.27E-09	1.88E-09
SW	8.53E-09	6.26E-09	4.77E-09	3.73E-09	2.99E-09	2.45E-09	2.03E-09
WSW	9.45E-09	6.94E-08	5.28E-09	4.14E-09	3.32E-09	2.71E-09	2.25E-09
W	1.98E-08	1.45E-08	1.10E-08	8.65E-09	6.93E-09	5.67E-09	4.71E-09
WNW	3.76E-08	2.76E-08	2.10E-08	1.64E-08	1.32E-08	1.08E-08	8.95E-09
NW	3.14E-08	2.31E-08	1.76E-08	1.38E-08	1.10E-08	9.02E-09	7.49E-09
NNW	2.19E-08	1.61E-08	1.22E-08	9.59E-09	7.68E-09	6.28E-09	5.22E-09

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m^2, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	1.5	1.6	1.7	1.8	1.9	2.0	2.1
N	4.27E-09	3.65E-09	3.14E-09	2.73E-09	2.40E-09	2.12E-09	1.89E-09
NNE	2.69E-09	2.30E-09	1.98E-09	1.72E-09	1.51E-09	1.33E-09	1.19E-09
NE	1.76E-09	1.50E-09	1.29E-09	1.13E-09	9.87E-10	8.72E-10	7.76E-10
ENE	2.29E-09	1.95E-09	1.68E-09	1.46E-09	1.28E-09	1.14E-09	1.01E-09
E	4.88E-09	4.17E-09	3.59E-09	3.13E-09	2.74E-09	2.42E-09	2.16E-09
ESE	8.90E-09	7.59E-09	6.54E-09	5.69E-09	4.99E-09	4.41E-09	3.93E-09
SE	9.66E-09	8.25E-09	7.11E-09	6.18E-09	5.43E-09	4.79E-09	4.27E-09
SSE	4.61E-09	3.94E-09	3.39E-09	2.95E-09	2.59E-09	2.29E-09	2.04E-09
S	2.16E-09	1.85E-09	1.59E-09	1.38E-09	1.21E-09	1.07E-09	9.55E-10
SSW	1.59E-09	1.35E-09	1.17E-09	1.02E-09	8.91E-10	7.87E-10	7.00E-10
SW	1.71E-09	1.46E-09	1.26E-09	1.10E-09	9.61E-10	8.49E-10	7.56E-10
WSW	1.90E-09	1.62E-09	1.40E-09	1.21E-09	1.06E-09	9.41E-10	8.37E-10
W	3.97E-09	3.39E-09	2.92E-09	2.54E-09	2.23E-09	1.97E-09	1.75E-09
WNW	7.54E-09	6.44E-09	5.55E-09	4.83E-09	4.23E-09	3.74E-09	3.33E-09
NW	6.31E-09	5.39E-09	4.64E-09	4.04E-09	3.54E-09	3.13E-09	2.79E-09
NNW	4.40E-09	3.75E-09	3.23E-09	2.81E-09	2.47E-09	2.18E-09	1.94E-09

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m^2, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.2	2.3	2.4	2.5	2.6	2.7	2.8
N	1.69E-09	1.52E-09	1.37E-09	1.25E-09	1.14E-09	1.04E-09	9.58E-10
NNE	1.06E-09	9.56E-10	8.65E-10	7.86E-10	7.17E-10	6.57E-10	6.03E-10
NE	6.95E-10	6.25E-10	5.65E-10	5.13E-10	4.69E-10	4.29E-10	3.94E-10
ENE	9.40E-10	8.14E-10	7.36E-10	6.68E-10	6.10E-10	5.59E-10	5.13E-10
E	1.93E-09	1.74E-09	1.57E-09	1.43E-09	1.30E-09	1.19E-09	1.10E-09
ESE	3.51E-09	3.16E-09	2.86E-09	2.60E-09	2.37E-09	2.17E-09	2.00E-09
SE	3.82E-09	3.44E-09	3.11E-09	2.82E-09	2.58E-09	2.36E-09	2.17E-09
SSE	1.82E-09	1.64E-09	1.48E-09	1.35E-09	1.23E-09	1.13E-09	1.04E-09
S	8.55E-10	7.69E-10	6.95E-10	6.32E-10	5.77E-10	5.28E-10	4.85E-10
SSW	6.27E-10	5.64E-10	5.10E-10	4.63E-10	4.23E-10	3.87E-10	3.56E-10
SW	6.76E-10	6.09E-10	5.50E-10	5.00E-10	4.56E-10	4.18E-10	3.84E-10
WSW	7.49E-10	6.74E-10	6.10E-10	5.54E-10	5.06E-10	4.63E-10	4.26E-10
W	1.57E-09	1.41E-09	1.28E-09	1.16E-09	1.06E-09	9.68E-10	8.90E-10
WNW	2.98E-09	2.68E-09	2.42E-09	2.20E-09	2.01E-09	1.84E-09	1.69E-09
NW	2.49E-09	2.24E-09	2.03E-09	1.84E-09	1.68E-09	1.54E-09	1.42E-09
NNW	1.74E-09	1.56E-09	1.41E-09	1.28E-09	1.17E-09	1.07E-09	9.86E-10

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m^2, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.9	3.0	3.1	3.2	3.3	3.4	3.5
N	8.84E-10	8.17E-10	7.58E-10	7.05E-10	6.57E-10	6.14E-10	5.75E-10
NNE	5.56E-10	5.15E-10	4.77E-10	4.44E-10	4.14E-10	3.87E-10	3.62E-10
NE	3.64E-10	3.36E-10	3.12E-10	2.90E-10	2.70E-10	2.53E-10	2.37E-10
ENE	4.73E-10	4.38E-10	4.06E-10	3.78E-10	3.52E-10	3.29E-10	3.08E-10
E	1.01E-09	9.34E-10	8.67E-10	8.06E-10	7.51E-10	7.02E-10	6.57E-10
ESE	1.84E-09	1.70E-09	1.58E-09	1.47E-09	1.37E-09	1.28E-09	1.20E-09
SE	2.00E-09	1.85E-09	1.71E-09	1.59E-09	1.49E-09	1.39E-09	1.30E-09
SSE	9.55E-10	8.83E-10	8.19E-10	7.61E-10	7.10E-10	6.63E-10	6.21E-10
S	4.47E-10	4.14E-10	3.84E-10	3.57E-10	3.33E-10	3.11E-10	2.91E-10
SSW	3.28E-10	3.04E-10	2.82E-10	2.62E-10	2.44E-10	2.28E-10	2.14E-10
SW	3.54E-10	3.27E-10	3.04E-10	2.82E-10	2.63E-10	2.46E-10	2.30E-10
WSW	3.92E-10	3.63E-10	3.37E-10	3.13E-10	2.92E-10	2.73E-10	2.55E-10
W	8.20E-10	7.59E-10	7.04E-10	6.54E-10	6.10E-10	5.70E-10	5.34E-10
WNW	1.56E-09	1.44E-09	1.34E-09	1.24E-09	1.16E-09	1.08E-09	1.01E-09
NW	1.31E-09	1.21E-09	1.12E-09	1.04E-09	9.71E-10	9.07E-10	8.49E-10
NNW	9.09E-10	8.41E-10	7.80E-10	7.25E-10	6.76E-10	6.32E-10	5.92E-10

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), 1/m², for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	3.6	3.7	3.8	3.9	4.0	4.1	4.2
N	5.40E-10	5.07E-10	4.78E-10	4.51E-10	4.26E-10	4.03E-10	3.82E-10
NNE	3.40E-10	3.19E-10	3.01E-10	2.84E-10	2.68E-10	2.54E-10	2.41E-10
NE	2.22E-10	2.09E-10	1.97E-10	1.86E-10	1.75E-10	1.66E-10	1.57E-10
ENE	2.89E-10	2.72E-10	2.56E-10	2.42E-10	2.28E-10	2.16E-10	2.05E-10
E	6.17E-10	5.80E-10	5.46E-10	5.16E-10	4.87E-10	4.61E-10	4.37E-10
ESE	1.12E-09	1.06E-09	9.95E-10	9.39E-10	8.87E-10	8.40E-10	7.96E-10
SE	1.22E-09	1.15E-09	1.08E-09	1.02E-09	9.64E-10	9.12E-10	8.65E-10
SSE	5.83E-10	5.48E-10	5.16E-10	4.87E-10	4.60E-10	4.36E-10	4.13E-10
S	2.73E-10	2.57E-10	2.42E-10	2.28E-10	2.16E-10	2.04E-10	1.94E-10
SSW	2.00E-10	1.88E-10	1.78E-10	1.67E-10	1.58E-10	1.50E-10	1.42E-10
SW	2.16E-10	2.03E-10	1.92E-10	1.81E-10	1.71E-10	1.62E-10	1.53E-10
WSW	2.40E-10	2.25E-10	2.12E-10	2.00E-10	1.89E-10	1.79E-10	1.70E-10
W	5.01E-10	4.71E-10	4.44E-10	4.19E-10	3.96E-10	3.75E-10	3.55E-10
WNW	9.53E-10	8.96E-10	8.44E-10	7.96E-10	7.52E-10	7.12E-10	6.75E-10
NW	7.97E-10	7.50E-10	7.06E-10	6.66E-10	6.29E-10	5.96E-10	5.65E-10
NNW	5.55E-10	5.22E-10	4.92E-10	4.64E-10	4.38E-10	4.15E-10	3.93E-10

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Table A-5 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/Q), $1/m^2$, for Long Term Ground Level Releases
> 500 Hrs/Yr or > 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5.0
N	3.63E-10	3.45E-10	3.28E-10	3.13E-10	2.99E-10	2.85E-10	2.73E-10	2.61E-10
NNE	2.29E-10	2.17E-10	2.07E-10	1.97E-10	1.88E-10	1.80E-10	1.72E-10	1.64E-10
NE	1.49E-10	1.42E-10	1.35E-10	1.29E-10	1.23E-10	1.17E-10	1.12E-10	1.07E-10
ENE	1.94E-10	1.85E-10	1.76E-10	1.68E-10	1.60E-10	1.53E-10	1.46E-10	1.40E-10
E	4.15E-10	3.94E-10	3.75E-10	3.58E-10	3.41E-10	3.26E-10	3.12E-10	2.98E-10
ESE	7.56E-10	7.18E-10	6.84E-10	6.52E-10	6.22E-10	5.94E-10	5.68E-10	5.43E-10
SE	8.21E-10	7.80E-10	7.45E-10	7.08E-10	6.75E-10	6.45E-10	6.17E-10	5.90E-10
SSE	3.92E-10	3.73E-10	3.55E-10	3.38E-10	3.23E-10	3.08E-10	2.94E-10	2.82E-10
S	1.84E-10	1.75E-10	1.66E-10	1.58E-10	1.51E-10	1.44E-10	1.38E-10	1.32E-10
SSW	1.35E-10	1.28E-10	1.22E-10	1.16E-10	1.11E-10	1.06E-10	1.01E-10	9.69E-11
SW	1.45E-10	1.38E-10	1.32E-10	1.25E-10	1.20E-10	1.14E-10	1.09E-10	1.05E-10
WSW	1.61E-10	1.53E-10	1.46E-10	1.39E-10	1.33E-10	1.27E-10	1.21E-10	1.16E-10
W	3.37E-10	3.20E-10	3.05E-10	2.91E-10	2.77E-10	2.65E-10	2.53E-10	2.42E-10
WNW	6.41E-10	6.09E-10	5.80E-10	5.52E-10	5.27E-10	5.03E-10	4.81E-10	4.61E-10
NW	5.36E-10	5.10E-10	4.85E-10	4.62E-10	4.41E-10	4.21E-10	4.03E-10	3.85E-10
NNW	3.75E-10	3.55E-10	3.38E-10	3.22E-10	3.07E-10	2.93E-10	2.80E-10	2.68E-10

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Table A-6 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Site Boundary Locations (identified in Table A-2)

Site Boundary Sector Sector	χ/q (sec/m^3)	D/q ($1/m^2$)
N	7.09E-05	4.60E-07
NNE	7.32E-05	4.11E-07
NE	1.60E-05	6.77E-08
ENE	1.97E-05	1.11E-07
E	4.92E-05	1.99E-07
ESE	6.40E-05	2.52E-07
SE	5.98E-05	2.43E-07
SSE	8.79E-05	3.08E-07
S	5.18E-05	2.04E-07
SSW	5.26E-05	1.89E-07
SW	5.25E-05	1.90E-07
WSW	7.83E-05	2.44E-07
W	1.32E-04	3.78E-07
WNW	1.10E-04	4.61E-07
NW	7.67E-05	3.25E-07
NNW	4.79E-05	2.34E-07

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7
N	3.76E-04	1.13E-04	6.59E-05	4.39E-05	3.15E-05	2.47E-05	1.90E-05
NNE	3.35E-04	1.05E-04	5.94E-05	3.93E-05	2.77E-05	2.19E-05	1.65E-05
NE	4.38E-04	1.33E-04	7.71E-05	4.94E-05	3.39E-05	2.68E-05	2.12E-05
ENE	3.27E-04	1.02E-04	5.93E-05	4.01E-05	2.80E-05	2.19E-05	1.69E-05
E	8.12E-04	2.43E-04	1.39E-04	8.80E-05	6.16E-05	4.84E-05	3.78E-05
ESE	1.17E-03	3.52E-04	1.98E-04	1.27E-04	8.80E-05	6.84E-05	5.32E-05
SE	1.27E-03	3.85E-04	2.06E-04	1.31E-04	9.32E-05	7.34E-05	5.67E-05
SSE	5.30E-04	2.82E-04	1.57E-04	9.85E-05	6.75E-05	5.39E-05	4.30E-05
S	5.01E-04	1.57E-04	8.75E-05	5.74E-05	3.97E-05	3.11E-05	2.51E-05
SSW	4.54E-04	1.43E-04	8.26E-05	5.34E-05	3.60E-05	2.85E-05	2.31E-05
SW	4.46E-04	1.44E-04	8.25E-05	5.30E-05	3.58E-05	2.85E-05	2.35E-05
WSW	6.10E-04	1.95E-04	1.08E-04	6.78E-05	4.59E-05	3.67E-05	3.05E-05
W	1.00E-03	3.10E-04	1.74E-04	1.10E-04	7.59E-05	6.07E-05	4.89E-05
WNW	8.70E-04	2.65E-04	1.50E-04	9.70E-05	6.86E-05	5.33E-05	4.17E-05
NW	8.41E-04	2.50E-04	1.38E-04	8.89E-05	6.37E-05	4.97E-05	3.84E-05
NNW	5.69E-04	1.71E-04	9.73E-05	6.28E-05	4.54E-05	3.55E-05	2.78E-05

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	0.8	0.9	1.0	1.1	1.2	1.3	1.4
N	1.57E-05	1.26E-05	1.06E-05	8.97E-06	7.73E-06	6.76E-06	5.91E-06
NNE	1.35E-05	1.11E-05	9.26E-06	7.87E-06	6.81E-06	5.96E-06	5.27E-06
NE	1.74E-05	1.44E-05	1.21E-05	1.02E-05	8.57E-06	7.50E-06	6.63E-06
ENE	1.39E-05	1.14E-05	9.46E-06	8.04E-06	6.83E-06	5.97E-06	5.27E-06
E	3.11E-05	2.51E-05	2.11E-05	1.80E-05	1.53E-05	1.33E-05	1.18E-05
ESE	4.35E-05	3.58E-05	2.98E-05	2.54E-05	2.19E-05	1.91E-05	1.71E-05
SE	4.65E-05	3.79E-05	3.18E-05	2.71E-05	2.32E-05	2.03E-05	1.81E-05
SSE	3.53E-05	2.87E-05	2.41E-05	2.05E-05	1.72E-05	1.51E-05	1.35E-05
S	2.05E-05	1.66E-05	1.38E-05	1.17E-05	1.01E-05	8.83E-06	7.81E-06
SSW	1.89E-05	1.54E-05	1.29E-05	1.10E-05	9.05E-06	7.93E-06	7.02E-06
SW	1.95E-05	1.54E-05	1.30E-05	1.12E-05	9.19E-06	8.05E-06	7.21E-06
WSW	2.51E-05	2.05E-05	1.72E-05	1.47E-05	1.21E-05	1.06E-05	9.41E-06
W	4.01E-05	3.24E-05	2.70E-05	2.30E-05	1.89E-05	1.65E-05	1.46E-05
WNW	3.44E-05	2.75E-05	2.31E-05	1.96E-05	1.68E-05	1.48E-05	1.31E-05
NW	3.15E-05	2.57E-05	2.17E-05	1.85E-05	1.60E-05	1.40E-05	1.24E-05
NNW	2.28E-05	1.86E-05	1.54E-05	1.31E-05	1.12E-05	9.85E-06	8.82E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	1.5	1.6	1.7	1.8	1.9	2.0	2.1
N	5.27E-06	4.74E-06	4.30E-06	3.91E-06	3.59E-06	3.32E-06	3.07E-06
NNE	4.70E-06	4.22E-06	3.82E-06	3.47E-06	3.18E-06	2.97E-06	2.75E-06
NE	5.89E-06	5.30E-06	4.80E-06	4.37E-06	4.01E-06	3.69E-06	3.42E-06
ENE	4.67E-06	4.21E-06	3.80E-06	3.45E-06	3.16E-06	2.91E-06	2.70E-06
E	1.06E-05	9.52E-06	8.66E-06	7.90E-06	7.25E-06	6.74E-06	6.25E-06
ESE	1.52E-05	1.38E-05	1.25E-05	1.13E-05	1.04E-05	9.72E-06	9.03E-06
SE	1.62E-05	1.46E-05	1.33E-05	1.21E-05	1.11E-05	1.03E-05	9.59E-06
SSE	1.20E-05	1.09E-05	9.84E-06	8.96E-06	8.23E-06	7.58E-06	7.04E-06
S	6.97E-06	6.27E-06	5.68E-06	5.18E-06	4.75E-06	4.36E-06	4.04E-06
SSW	6.28E-06	5.66E-06	5.14E-06	4.69E-06	4.31E-06	3.92E-06	3.64E-06
SW	8.43E-06	5.78E-06	5.24E-06	4.77E-06	4.37E-06	3.90E-06	3.62E-06
WSW	8.41E-06	7.58E-06	6.87E-06	6.27E-06	5.77E-06	5.17E-06	4.80E-06
W	1.30E-05	1.17E-05	1.06E-05	9.62E-06	8.83E-06	8.33E-06	7.73E-06
WNW	1.17E-05	1.05E-05	9.65E-06	8.80E-06	8.08E-06	7.42E-06	6.89E-06
NW	1.11E-05	1.00E-05	9.09E-06	8.30E-06	7.63E-06	7.13E-06	6.62E-06
NNW	7.89E-06	7.11E-06	6.47E-06	5.89E-06	5.41E-06	5.01E-06	4.64E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m³, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.2	2.3	2.4	2.5	2.6	2.7	2.8
N	2.87E-06	2.67E-06	2.50E-06	2.32E-06	2.27E-06	1.94E-06	1.84E-06
NNE	2.56E-06	2.39E-06	2.24E-06	2.09E-06	2.03E-06	1.76E-06	1.66E-06
NE	3.19E-06	2.98E-06	2.79E-06	2.63E-06	2.57E-06	2.24E-06	2.11E-06
ENE	2.51E-06	2.34E-06	2.19E-06	2.05E-06	1.97E-06	1.74E-06	1.64E-06
E	5.82E-06	5.44E-06	5.10E-06	4.89E-06	4.75E-06	4.14E-06	3.92E-06
ESE	8.41E-06	7.87E-06	7.38E-06	7.16E-05	7.09E-06	6.11E-06	5.78E-06
SE	8.93E-06	8.35E-06	7.82E-06	7.70E-05	7.60E-06	6.62E-06	6.26E-06
SSE	6.56E-06	6.14E-06	5.76E-06	5.55E-06	5.36E-06	4.73E-06	4.47E-06
S	3.76E-06	3.51E-06	3.29E-06	3.18E-06	3.06E-06	2.73E-06	2.59E-06
SSW	3.39E-06	3.16E-06	2.96E-06	2.89E-06	2.75E-06	2.42E-06	2.28E-06
SW	3.37E-06	3.15E-06	2.95E-06	2.84E-06	2.70E-06	2.44E-06	2.30E-06
WSW	4.47E-06	4.18E-06	3.92E-06	3.85E-06	3.67E-06	3.28E-06	3.10E-06
W	7.21E-06	6.74E-06	6.32E-06	6.45E-06	6.03E-06	5.30E-06	5.02E-06
WNW	6.42E-06	6.00E-06	5.65E-06	5.32E-06	5.23E-06	4.55E-06	4.30E-06
NW	6.16E-06	5.76E-06	5.40E-06	5.16E-06	5.03E-06	4.37E-06	4.13E-06
NNW	4.31E-06	4.02E-06	3.76E-06	3.57E-06	3.46E-06	3.00E-06	2.83E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
$\leq$ 500 Hrs/Yr or $\leq$ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.9	3.0	3.1	3.2	3.3	3.4	3.5
N	1.74E-06	1.66E-06	1.58E-06	1.50E-06	1.43E-06	1.37E-06	1.31E-06
NNE	1.57E-06	1.50E-06	1.43E-06	1.36E-06	1.30E-06	1.24E-06	1.19E-06
NE	2.00E-06	1.90E-06	1.81E-06	1.73E-06	1.65E-06	1.58E-06	1.51E-06
ENE	1.55E-06	1.48E-06	1.40E-06	1.33E-06	1.27E-06	1.21E-06	1.16E-06
E	3.71E-06	3.51E-06	3.34E-06	3.19E-06	3.04E-06	2.91E-06	2.79E-06
ESE	5.48E-06	5.18E-06	4.93E-06	4.70E-05	4.49E-06	4.29E-06	4.11E-06
SE5	5.93E-06	5.63E-06	5.36E-06	5.11E-05	4.87E-06	4.66E-06	4.46E-06
SSE	4.24E-06	3.97E-06	3.78E-06	3.60E-06	3.44E-06	3.29E-06	3.15E-06
S	2.45E-06	2.25E-06	2.14E-06	2.04E-06	1.94E-06	1.85E-06	1.77E-06
SSW	2.16E-06	1.96E-06	1.87E-06	1.78E-06	1.70E-06	1.63E-06	1.56E-06
SW	2.18E-06	2.03E-06	1.93E-06	1.84E-06	1.75E-06	1.67E-06	1.60E-06
WSW	2.94E-06	2.70E-06	2.57E-06	2.45E-06	2.34E-06	2.24E-06	2.14E-06
W	4.76E-06	4.34E-06	4.13E-06	3.95E-06	3.77E-06	3.61E-06	3.47E-06
WNW	4.07E-06	3.86E-06	3.67E-06	3.50E-06	3.34E-06	3.20E-06	3.06E-06
NW	3.92E-06	3.69E-06	3.51E-06	3.35E-06	3.20E-06	3.06E-06	2.94E-06
NNW	2.68E-06	2.53E-06	2.40E-06	2.28E-06	2.18E-06	2.08E-06	1.99E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	3.6	3.7	3.8	3.9	4.0	4.1	4.2
N	1.25E-06	1.20E-06	1.15E-06	1.10E-06	1.06E-06	1.02E-06	9.88E-07
NNE	1.14E-06	1.09E-06	1.05E-06	1.01E-06	9.73E-07	9.37E-07	9.04E-07
NE	1.45E-06	1.39E-06	1.34E-06	1.29E-06	1.24E-06	1.20E-06	1.16E-06
ENE	1.11E-06	1.07E-06	1.02E-06	9.83E-07	9.46E-07	9.11E-07	8.79E-07
E	2.67E-06	2.57E-06	2.47E-06	2.38E-06	2.29E-06	2.21E-06	2.13E-06
ESE	3.94E-06	3.78E-06	3.64E-06	3.50E-06	3.38E-06	3.26E-06	3.15E-06
SE5	4.27E-06	4.10E-06	3.94E-06	3.79E-06	3.65E-06	3.52E-06	3.39E-06
SSE	3.02E-06	2.90E-06	2.79E-06	2.68E-06	2.59E-06	2.50E-06	2.41E-06
S	1.70E-06	1.63E-06	1.57E-06	1.51E-06	1.45E-06	1.40E-06	1.35E-06
SSW	1.50E-06	1.44E-06	1.38E-06	1.33E-06	1.29E-06	1.24E-06	1.20E-06
SW	1.53E-06	1.47E-06	1.41E-06	1.36E-06	1.29E-06	1.25E-06	1.20E-06
WSW	2.06E-06	1.98E-06	1.90E-06	1.83E-06	1.76E-06	1.70E-06	1.64E-06
W	3.33E-06	3.20E-06	3.08E-06	2.97E-06	2.87E-06	2.77E-06	2.68E-06
WNW3	2.93E-06	2.81E-06	2.70E-06	2.60E-06	2.51E-06	2.42E-06	2.33E-06
NW	2.82E-06	2.71E-06	2.60E-06	2.50E-06	2.41E-06	2.32E-06	2.24E-06
NNW	1.91E-06	1.83E-06	1.76E-06	1.69E-06	1.63E-06	1.57E-06	1.52E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	4.3	4.4	4.5	4.6	4.7	4.8	4.9
N	9.59E-07	9.27E-07	8.97E-07	8.68E-07	8.41E-07	8.16E-07	7.92E-07
NNE	8.73E-07	8.44E-07	8.16E-07	7.90E-07	7.65E-07	7.42E-07	7.20E-07
NE	1.12E-06	1.08E-06	1.05E-06	1.01E-06	9.18E-07	9.51E-07	9.23E-07
ENE	8.47E-07	8.18E-07	7.91E-07	7.66E-07	7.41E-07	7.18E-07	6.97E-07
E	2.06E-06	2.00E-06	1.93E-06	1.87E-06	1.82E-06	1.76E-06	1.71E-06
ESE	3.04E-06	2.94E-06	2.85E-06	2.76E-06	2.67E-06	2.60E-06	2.52E-06
SE5	3.27E-06	3.16E-06	3.06E-06	2.97E-06	2.88E-06	2.79E-06	2.70E-06
SSE	2.34E-06	2.26E-06	2.19E-06	2.12E-06	2.07E-06	2.01E-06	1.95E-06
S	1.30E-06	1.26E-06	1.22E-06	1.18E-06	1.15E-06	1.11E-06	1.08E-06
SSW	1.16E-06	1.12E-06	1.09E-06	1.05E-06	1.02E-06	9.94E-07	9.66E-07
SW	1.16E-06	1.12E-06	1.09E-06	1.05E-06	1.02E-06	9.91E-07	9.62E-07
WSW	1.59E-06	1.54E-06	1.49E-06	1.44E-06	1.39E-06	1.35E-06	1.31E-06
W	2.59E-06	2.51E-06	2.43E-06	2.36E-06	2.29E-06	2.23E-06	2.17E-06
WNW3	2.25E-06	2.18E-06	2.11E-06	2.04E-06	1.98E-06	1.92E-06	1.86E-06
NW	2.16E-06	2.09E-06	2.01E-06	1.95E-06	1.89E-06	1.84E-06	1.79E-06
NNW	1.46E-06	1.41E-06	1.36E-06	1.32E-06	1.28E-06	1.24E-06	1.20E-06

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Table A-7 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (χ/q), sec/m^3, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

	Miles
Sector	5.0
N	7.67E-07
NNE	6.99E-07
NE	8.97E-07
ENE	6.76E-07
E	1.67E-06
ESE	2.45E-06
SE	2.62E-06
SSE	1.89E-06
S	1.05E-06
SSW	9.39E-07
SW	9.35E-07
WSW	1.27E-06
W	2.11E-06
WNW	1.81E-06
NW	1.74E-06
NNW	1.17E-06

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Table A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), $1/m^2$, for Short Term Ground Level Releases
$\leq$ 500 Hrs/Yr or $\leq$ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7
N	1.68E-06	6.63E-07	4.32E-07	3.00E-07	2.18E-07	1.69E-07	1.29E-07
NNE	1.33E-06	5.43E-07	3.46E-07	2.40E-07	1.72E-07	1.36E-07	1.03E-07
NE	1.19E-06	4.68E-07	3.05E-07	2.06E-07	1.45E-07	1.14E-07	9.10E-08
ENE	1.20E-06	4.86E-07	3.17E-07	2.23E-07	1.58E-07	1.23E-07	9.49E-08
E	2.08E-06	8.09E-07	5.21E-07	3.46E-07	2.49E-07	1.96E-07	1.54E-07
ESE	2.90E-06	1.14E-06	7.17E-07	4.85E-07	3.45E-07	2.69E-07	2.11E-07
SE	3.20E-06	1.26E-06	7.54E-07	5.08E-07	3.71E-07	2.94E-07	2.31E-07
SSE	2.09E-06	8.24E-07	5.16E-07	3.41E-07	2.40E-07	1.92E-07	1.55E-07
S	1.27E-06	5.18E-07	3.24E-07	2.23E-07	1.58E-07	1.23E-07	1.00E-07
SSW	1.06E-06	4.33E-07	2.82E-07	1.92E-07	1.33E-07	1.05E-07	8.51E-08
SW	1.05E-06	4.42E-07	2.85E-07	1.91E-07	1.31E-07	1.04E-07	8.55E-08
WSW	1.24E-06	5.19E-07	3.24E-07	2.14E-07	1.48E-07	1.19E-07	1.94E-08
W	1.90E-06	7.65E-07	4.83E-07	3.22E-07	2.27E-07	1.82E-07	1.48E-07
WNW	2.42E-06	9.62E-07	6.10E-07	4.14E-07	2.99E-07	2.31E-07	1.81E-07
NW	2.30E-06	8.91E-07	5.49E-07	3.72E-07	2.73E-07	2.12E-07	1.65E-07
NNW	1.79E-06	7.01E-07	4.46E-07	3.01E-07	2.21E-07	1.72E-07	1.34E-07

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Table A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), $1/m^2$, for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	0.8	0.9	1.0	1.1	1.2	1.3	1.4
N	1.05E-07	8.25E-08	6.73E-08	5.55E-08	4.66E-08	3.99E-08	3.41E-08
NNE	8.35E-08	6.76E-08	5.48E-08	4.55E-08	3.85E-08	3.29E-08	2.85E-08
NE	7.39E-08	5.99E-08	4.95E-08	4.08E-08	3.35E-08	2.87E-08	2.49E-08
ENE	7.67E-08	6.15E-08	4.97E-08	4.13E-08	3.42E-08	2.93E-08	2.53E-08
E	1.25E-07	9.96E-08	8.17E-08	6.79E-08	5.63E-08	4.82E-08	4.18E-08
ESE	1.71E-07	1.38E-07	1.12E-07	9.32E-08	7.87E-08	6.71E-08	5.86E-08
SE	1.88E-07	1.50E-07	1.23E-07	1.02E-07	8.55E-08	7.34E-08	6.38E-08
SSE	1.26E-07	1.01E-07	8.26E-08	6.86E-08	5.63E-08	4.83E-08	4.22E-08
S	8.06E-08	6.40E-08	5.16E-08	4.29E-08	3.60E-08	3.07E-08	2.66E-08
SSW	6.87E-08	5.49E-08	4.50E-08	3.73E-08	3.00E-08	2.57E-08	2.23E-08
SW	7.00E-08	5.41E-08	4.47E-08	3.73E-08	3.00E-08	2.57E-08	2.25E-08
WSW	8.11E-08	6.49E-08	5.32E-08	4.44E-08	3.59E-08	3.08E-08	2.67E-08
W	1.21E-07	9.57E-08	7.80E-08	6.48E-08	5.22E-08	4.46E-08	3.86E-08
WNW	1.47E-07	1.15E-07	9.45E-08	7.80E-08	6.54E-08	5.61E-08	4.86E-08
NW	1.34E-07	1.07E-07	8.78E-08	7.30E-08	6.13E-08	5.23E-08	4.53E-08
NNW	1.08E-07	8.62E-08	6.96E-08	5.74E-08	4.82E-08	4.12E-08	3.60E-08

Period of Record: 4/1/77 - 3/31/78

TABLE A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), 1/m^2, for Short Term Ground Level Releases
$\leq$ 500 Hrs/Yr or $\leq$ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	1.5	1.6	1.7	1.8	1.9	2.0	2.1
N	2.98E-08	2.62E-08	2.33E-08	2.08E-08	1.87E-08	1.70E-08	1.54E-08
NNE	2.49E-08	2.20E-08	1.95E-08	1.74E-08	1.56E-08	1.43E-08	1.30E-08
NE	2.17E-08	1.92E-08	1.70E-08	1.52E-08	1.37E-08	1.23E-08	1.12E-08
ENE	2.20E-08	1.94E-08	1.72E-08	1.54E-08	1.38E-08	1.25E-08	1.13E-08
E	3.66E-08	3.24E-08	2.89E-08	2.58E-08	2.32E-08	2.11E-08	1.91E-08
ESE	5.12E-08	4.53E-08	4.03E-08	3.60E-08	3.23E-08	2.95E-08	2.68E-08
SE	5.61E-08	4.96E-08	4.41E-08	3.95E-08	3.55E-08	3.21E-08	2.92E-08
SSE	3.70E-08	3.27E-08	2.91E-08	2.60E-08	2.34E-08	2.10E-08	1.91E-08
S	2.32E-08	2.05E-08	1.82E-08	1.63E-08	1.46E-08	1.31E-08	1.19E-08
SSW	1.95E-08	1.73E-08	1.54E-08	1.38E-08	1.24E-08	1.10E-08	1.00E-08
SW	1.97E-08	1.74E-08	1.54E-08	1.38E-08	1.24E-08	1.08E-08	9.86E-09
WSW	2.34E-08	2.07E-08	1.84E-08	1.65E-08	1.49E-08	1.30E-08	1.18E-08
W	3.37E-08	2.97E-08	2.64E-08	2.36E-08	2.12E-08	1.95E-08	1.77E-08
WNW	4.26E-08	3.76E-08	3.38E-08	3.02E-08	2.72E-08	2.44E-08	2.22E-08
NW	3.97E-08	3.51E-08	3.12E-08	2.80E-08	2.52E-08	2.30E-08	2.09E-08
NNW	3.15E-08	2.78E-08	2.48E-08	2.22E-08	1.99E-08	1.81E-08	1.64E-08

Period of Record: 4/1/77 - 3/31/78

Table A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), 1/m^2, for Short Term Ground Level Releases ≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.2	2.3	2.4	2.5	2.6	2.7	2.8
N	1.41E-08	1.29E-08	1.19E-08	1.09E-08	1.05E-08	8.80E-09	8.23E-09
NNE	1.18E-08	1.08E-08	9.96E-09	9.12E-09	8.70E-09	7.42E-09	6.90E-09
NE	1.02E-08	9.34E-09	8.58E-09	7.92E-09	7.61E-09	6.51E-09	6.05E-09
ENE	1.03E-08	9.45E-09	8.69E-09	7.99E-09	7.58E-09	6.56E-09	6.10E-09
E	1.74E-08	1.60E-08	1.47E-08	1.38E-08	1.32E-08	1.13E-08	1.05E-08
ESE	2.44E-08	2.24E-08	2.05E-08	1.96E-08	1.90E-08	1.61E-08	1.50E-08
SE	2.66E-08	2.43E-08	2.24E-08	2.16E-08	2.09E-08	1.79E-08	1.66E-08
SSE	1.74E-08	1.60E-08	1.47E-08	1.39E-08	1.32E-08	1.14E-08	1.06E-08
S	1.09E-08	9.97E-09	9.17E-09	8.70E-09	8.23E-09	7.22E-09	6.73E-09
SSW	9.14E-09	8.37E-09	7.70E-09	7.37E-09	6.91E-09	5.96E-09	5.54E-09
SW	9.00E-09	8.25E-09	7.60E-09	7.18E-09	6.72E-09	5.98E-09	5.56E-09
WSW	1.08E-08	9.89E-09	9.09E-09	8.77E-09	8.21E-09	7.20E-09	6.69E-09
W	1.62E-08	1.48E-08	1.36E-08	1.36E-08	1.25E-08	1.08E-08	1.00E-08
WNW	2.02E-08	1.86E-08	1.71E-08	1.59E-08	1.53E-08	1.31E-08	1.22E-08
NW	1.90E-08	1.74E-08	1.60E-08	1.51E-08	1.44E-08	1.23E-08	1.14E-08
NNW	1.50E-08	1.37E-08	1.26E-08	1.17E-08	1.12E-08	9.53E-09	8.86E-09

Period of Record: 4/1/77 - 3/31/78

Table A-8 - Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), 1/m², for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	2.9	3.0	3.1	3.2	3.3	3.4	3.5
N	7.68E-09	7.22E-09	6.76E-09	6.35E-09	5.97E-09	5.63E-09	5.31E-09
NNE	6.44E-09	6.04E-09	5.66E-09	5.32E-09	5.00E-09	4.72E-09	4.46E-09
NE	5.64E-09	5.27E-09	4.94E-09	4.64E-09	4.36E-09	4.11E-09	3.89E-09
ENE	5.69E-09	5.33E-09	5.00E-09	4.69E-09	4.41E-09	4.16E-09	3.92E-09
E	9.78E-09	9.10E-09	8.52E-09	8.00E-09	7.52E-09	7.09E-09	6.69E-09
ESE	1.39E-08	1.30E-08	1.21E-08	1.14E-08	1.07E-08	1.01E-08	9.53E-09
SE	1.55E-08	1.44E-08	1.35E-08	1.27E-08	1.19E-08	1.12E-08	1.06E-08
SSE	9.88E-09	9.11E-09	8.52E-09	8.00E-09	7.52E-09	7.08E-09	6.69E-09
S	6.27E-09	5.67E-09	5.31E-09	4.98E-09	4.68E-09	4.41E-09	4.16E-09
SSW	5.16E-09	4..61E-09	4.32E-09	4.06E-09	3.82E-09	3.61E-09	3.41E-09
SW	5.18E-09	4.74E-09	4.45E-09	4.17E-09	3.93E-09	3.70E-09	3.50E-09
WSW	6.24E-09	5.64E-09	5.28E-09	4.96E-09	4.67E-09	4.40E-09	4.16E-09
W	9.36E-09	8.39E-08	7.87E-09	7.40E-09	6.97E-09	6.58E-09	6.22E-09
WNW	1.13E-08	1.06E-08	9.92E-09	9.31E-09	8.76E-09	8.27E-09	7.81E-09
NW	1.07E-08	9.88E-09	9.26E-09	8.70E-09	8.19E-09	7.72E-09	7.31E-09
NNW	8.26E-09	7.66E-09	7.17E-09	6.73E-09	6.33E-09	5.97E-09	5.63E-09

Period of Record: 4/1/77 - 3/31/78

Table A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), 1/m², for Short Term Ground Level Releases
≤ 500 Hrs/Yr or ≤ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)
Miles

Sector	3.6	3.7	3.8	3.9	4.0	4.1	4.2
N	5.01E-09	4.75E-09	4.50E-09	4.28E-09	4.07E-09	3.88E-09	3.70E-09
NNE	4.22E-09	4.00E-09	3.79E-09	3.60E-09	3.42E-09	3.26E-09	3.11E-09
NE	3.68E-09	3.49E-09	3.31E-09	3.15E-09	3.00E-09	2.85E-09	2.72E-09
ENE	3.71E-09	3.51E-09	3.33E-09	3.17E-09	3.01E-09	2.87E-09	2.74E-09
E	6.33E-09	6.00E-09	5.69E-09	5.41E-09	5.15E-09	4.91E-09	4.68E-09
ESE	9.02E-09	8.54E-09	8.10E-09	7.70E-09	7.32E-09	6.98E-09	6.66E-09
SE	9.99E-09	9.46E-09	8.96E-09	8.51E-09	8.09E-09	7.70E-09	7.33E-09
SSE	6.33E-09	5.99E-09	5.68E-09	5.40E-09	5.14E-09	4.90E-09	4.67E-09
S	3.94E-09	3.73E-09	3.54E-09	3.36E-09	3.20E-09	3.05E-09	2.91E-09
SSW	3.23E-09	3.06E-09	2.91E-09	2.77E-09	2.64E-09	2.51E-09	2.40E-09
SW	3.31E-09	3.14E-09	2.98E-09	2.83E-09	2.66E-09	2.53E-09	2.42E-09
WSW	3.94E-09	3.73E-09	3.54E-09	3.37E-09	3.21E-09	3.06E-09	2.92E-09
W	5.89E-09	5.59E-09	5.31E-09	5.05E-09	4.81E-09	4.59E-09	4.38E-09
WNW	7.39E-09	7.00E-09	6.64E-09	6.31E-09	6.00E-09	5.72E-09	5.45E-09
NW	6.93E-09	6.56E-09	6.23E-09	5.92E-09	5.63E-09	5.36E-09	5.11E-09
NNW	5.33E-09	5.05E-09	4.79E-09	4.58E-09	4.34E-09	4.13E-09	3.94E-09

Period of Record: 4/1/77 - 3/31/78

Table A-8 Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), $1/m^2$, for Short Term Ground Level Releases
$\leq$ 500 Hrs/Yr or $\leq$ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	4.3	4.4	4.5	4.6	4.7	4.8	4.9
N	3.55E-09	3.40E-09	3.26E-09	3.12E-09	2.99E-09	2.87E-09	2.76E-09
NNE	2.97E-09	2.84E-09	2.71E-09	2.60E-09	2.49E-09	2.39E-09	2.30E-09
NE	2.60E-09	2.48E-09	2.37E-09	2.27E-09	2.18E-09	2.09E-09	2.01E-09
ENE	2.61E-09	2.49E-09	2.39E-09	2.29E-09	2.19E-09	2.10E-09	2.02E-09
E	4.48E-09	4.28E-09	4.10E-09	3.93E-09	3.77E-09	3.62E-09	3.47E-09
ESE	6.35E-09	6.07E-09	5.81E-09	5.57E-09	5.34E-09	5.13E-09	4.92E-09
SE	6.99E-09	6.68E-09	6.38E-09	6.12E-09	5.86E-09	5.62E-09	5.38E-09
SSE	4.48E-09	4.28E-09	4.10E-09	3.93E-09	3.78E-09	3.63E-09	3.48E-09
S	2.78E-09	2.65E-09	2.54E-09	2.43E-09	2.34E-09	2.24E-09	2.15E-09
SSW	2.30E-09	2.20E-09	2.11E-09	2.02E-09	1.94E-09	1.86E-09	1.79E-09
SW	2.31E-09	2.21E-09	2.12E-09	2.03E-09	1.95E-09	1.87E-09	1.80E-09
WSW	2.79E-09	2.67E-09	2.55E-09	2.45E-09	2.33E-09	2.24E-09	2.15E-09
W	4.19E-09	4.01E-09	3.84E-09	3.69E-09	3.54E-09	3.40E-09	3.27E-09
WNW	5.20E-09	4.98E-09	4.76E-09	4.57E-09	4.38E-09	4.21E-09	4.04E-09
NW	4.88E-09	4.66E-09	4.44E-09	4.25E-09	4.08E-09	3.92E-09	3.77E-09
NNW	3.76E-09	3.60E-09	3.43E-09	3.29E-09	3.16E-09	3.03E-09	2.9-1E-09

Period of Record: 4/1/77 - 3/31/78

Table A-8 - Prairie Island Dispersion Parameters

Prairie Island Dispersion Parameters (D/q), $1/m^2$, for Short Term Ground Level Releases $\leq$ 500 Hrs/Yr or $\leq$ 150 Hrs/QTR for Standard Distances (As Measured from Edge of Plant Complex)

Miles

Sector	5.0
N	2.65E-09
NNE	2.21E-09
NE	1.93E-09
ENE	1.94E-09
E	3.34E-09
ESE	4.73E-09
SE	5.17E-09
SSE	3.35E-09
S	2.07E-09
SSW	1.73E-09
SW	1.73E-09
WSW	2.07E-09
W	3.15E-09
WNW	3.89E-09
NW	3.63E-09
NNW	2.80E-09

Period of Record: 4/1/77 - 3/31/78

Appendix B Prairie Island 12.2m Wind and ΔT 42.7-12.2m Stability Joint Frequency Distributions (4/1/77 - 3/31/78)

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS A
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	1 TO 3	4 TO 7	8 TO 12	13 TO 18	19 TO 24	ABOVE 24	TOTAL
N	7	22	29	11	0	0	69
NNE	13	19	20	4	0	0	56
NE	11	35	16	1	0	0	63
ENE	11	33	20	0	0	0	64
E	14	37	24	0	0	0	75
ESE	4	45	49	7	2	0	107
SE	4	10	22	13	1	0	50
SSE	1	7	19	12	2	0	41
S	2	23	45	27	0	0	97
SSW	1	22	39	14	0	0	76
SW	2	17	30	3	0	0	52
WSW	0	21	25	11	0	0	57
W	1	29	46	18	2	0	96
WNW	6	34	64	56	20	1	181
NW	12	42	72	53	20	0	199
NNW	11	43	49	20	2	0	125
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS 1408
HOURS OF CALM THIS CLASS 0
PERCENT OF ALL DATA THIS CLASS 16.81

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS B
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	1 TO 3	4 TO 7	8 TO 12	13 TO 18	19 TO 24	ABOVE 24	TOTAL
N	0	3	5	1	0	0	9
NNE	1	2	1	1	0	0	5
NE	0	2	0	0	0	0	2
ENE	0	3	2	0	0	0	5
E	0	1	1	0	0	0	2
ESE	1	5	10	6	1	0	23
SE	2	2	8	4	0	0	16
SSE	0	3	4	3	0	0	10
S	1	0	7	9	0	0	17
SSW	0	1	7	0	0	0	8
SW	0	4	1	0	0	0	5
WSW	1	2	5	1	0	0	9
W	0	8	7	3	0	0	18
WNW	1	5	8	6	3	0	23
NW	2	4	11	10	1	0	28
NNW	1	5	3	1	0	1	11
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS	191
HOURS OF CALM THIS CLASS	0
PERCENT OF ALL DATA THIS CLASS	2.28

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS C
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	1 TO 3	4 TO 7	8 TO 12	13 TO 18	19 TO 24	ABOVE 24	TOTAL
N	2	4	4	1	0	0	11
NNE	2	3	1	0	0	0	6
NE	1	5	1	0	0	0	7
ENE	0	3	1	0	0	0	4
E	1	8	3	0	0	0	12
ESE	0	7	11	2	0	0	20
SE	0	2	5	6	0	0	13
SSE	0	2	6	7	1	0	16
S	0	2	10	4	0	0	16
SSW	1	6	4	0	0	0	11
SW	2	2	3	2	0	0	9
WSW	1	6	5	1	2	0	15
W	0	2	11	4	1	0	18
WNW	1	3	6	7	1	0	18
NW	2	7	11	16	6	1	43
NNW	3	5	7	3	3	0	21
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS 240
HOURS OF CALM THIS CLASS 0
PERCENT OF ALL DATA THIS CLASS 2.87

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS D
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	1 TO 3	4 TO 7	8 TO 12	13 TO 18	19 TO 24	ABOVE 24	TOTAL
N	9	24	11	8	0	0	52
NNE	6	22	9	0	0	0	37
NE	16	26	4	0	0	0	46
ENE	11	41	4	0	0	0	56
E	11	95	27	0	0	0	133
ESE	8	57	154	19	0	0	238
SE	10	30	90	38	5	0	173
SSE	8	40	59	51	10	0	168
S	1	51	72	17	4	0	145
SSW	5	29	30	12	0	0	76
SW	4	15	17	4	0	0	40
WSW	5	23	31	21	3	4	87
W	6	53	61	28	6	1	155
WNW	14	57	76	75	21	0	243
NW	14	44	72	110	41	0	281
NNW	16	22	41	25	13	0	117
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS	2051
HOURS OF CALM THIS CLASS	4
PERCENT OF ALL DATA THIS CLASS	24.49

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS E
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	1 TO 3	4 TO 7	8 TO 12	13 TO 18	19 TO 24	ABOVE 24	TOTAL
N	22	30	9	11	1	0	73
NNE	18	29	7	0	0	0	54
NE	22	26	7	1	0	0	56
ENE	19	30	5	1	0	0	55
E	25	96	10	0	0	0	131
ESE	28	144	140	27	0	0	349
SE	24	107	125	41	2	0	299
SSE	21	67	74	23	0	0	185
S	11	56	73	29	1	0	170
SSW	3	26	29	40	1	0	99
SW	14	22	17	12	0	0	65
WSW	14	24	24	11	1	0	74
W	26	73	48	18	1	0	166
WNW	46	136	127	44	4	0	357
NW	46	98	101	62	8	0	315
NNW	43	53	48	10	3	0	157
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS 2612
HOURS OF CALM THIS CLASS 7
PERCENT OF ALL DATA THIS CLASS 31.18

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS F
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	**1 TO 3**	**4 TO 7**	**8 TO 12**	**13 TO 18**	**19 TO 24**	**ABOVE 24**	**TOTAL**
N	18	8	3	0	0	0	29
NNE	11	6	1	0	0	0	18
NE	11	5	2	0	0	0	18
ENE	13	7	0	0	0	0	20
E	29	33	2	0	0	0	64
ESE	39	61	9	1	0	0	110
SE	38	69	36	3	0	0	146
SSE	27	32	17	2	1	0	79
S	12	16	21	7	0	0	56
SSW	6	11	17	6	0	0	40
SW	5	3	9	4	0	0	21
WSW	8	8	8	0	0	0	24
W	25	39	12	2	0	0	78
WNW	56	63	12	0	0	0	131
NW	66	71	16	3	0	0	156
NNW	29	19	6	2	0	0	56
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS	1053
HOURS OF CALM THIS CLASS	7
PERCENT OF ALL DATA THIS CLASS	12.57

NORTHERN STATES POWER COMPANY PRAIRIE ISLAND NUCLEAR GENERATING PLANT
SITE METEOROLOGY - FREQUENCY DISTRIBUTION TABLES
HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD: 4/1/77 THROUGH 3/31/78

STABILITY CLASS G
ELEVATION 40 FT.

	WIND SPEED (MPH) AT 40 FT LEVEL						
DIRECTION	**1 TO 3**	**4 TO 7**	**8 TO 12**	**13 TO 18**	**19 TO 24**	**ABOVE 24**	**TOTAL**
N	14	5	0	0	0	0	19
NNE	13	2	1	0	0	0	16
NE	12	2	1	0	0	0	15
ENE	22	1	2	0	0	0	25
E	52	8	2	0	0	0	62
ESE	50	17	1	0	0	0	68
SE	37	23	8	1	0	0	69
SSE	18	8	7	2	0	0	35
S	11	4	4	0	0	0	19
SSW	13	2	2	0	0	0	17
SW	15	5	1	0	0	0	21
WSW	10	1	1	0	0	0	12
W	41	19	1	0	0	0	61
WNW	75	50	0	0	0	0	125
NW	80	66	3	0	0	0	149
NNW	47	19	5	0	0	0	71
VAR	0	0	0	0	0	0	0

TOTAL HOURS THIS CLASS	821
HOURS OF CALM THIS CLASS	37
PERCENT OF ALL DATA THIS CLASS	9.80

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Appendix C - Dose Parameters for Radioiodines, Particulates and Tritium

This appendix contains the methodology which was used to calculate the dose parameters for radioiodines, particulates, and tritium to show compliance with 10CFR20 and Appendix I of 10CFR50 for gaseous effluents. These dose parameters, P_i and R_i, were calculated using the methodology outlines in NUREG-0133 along with Regulatory Guide 1.109 Revision 1. The following sections provide the specific methodology which was utilized in calculating the P_i and R_i values for the various exposure pathways.

C.1 Calculation of P_i

The parameter, P_i, contained in the radioiodine and particulates portion of Section 5.2, includes pathway transport parameters of the ith radionuclide, the receptor's usage of the pathway media and the dosimetry of the exposure. Pathway usage rates and the internal dosimetry are functions of the receptor's age: however, the child age group, will always receive the maximum dose under the exposure conditions assumed.

C.1.1 Inhalation Pathway

$$P_{i_I} = K' (BR) DFA_i \qquad (C.1-1)$$

where:

P_{i_I} = dose parameter for radionuclide i for the inhalation pathway, mrem/yr per μci/m^3;

K' = a constant of unit conversion:

= 10^6 pCi/μCi;

BR = the breathing rate of the child age group, m^3/yr;

DFA_i = the maximum organ inhalation dose factor for the child age group for radionuclide i, mrem/pCi.

The age group considered is the child group. The child's breathing rate is taken as 3700 m^3/yr from Table E-5 of Regulatory Guide 1.109 Revision 1. The inhalation dose factors for the child DFA_i, are presented in Table E-9 of Regulatory Guide 1.109 in units of mrem/pCi. The total body is considered as an organ in the selection of DFA_i. The incorporation of breathing rate of the child and the unit conversion factor results in the following:

$$P_{i_I} = 3.7 \times 10^9 \, DFA_i \qquad \text{(C.1-2)}$$

C.2 Calculation of R_i

The radioiodine and particulate specification is applicable to the location in the unrestricted area where the combination of existing pathways and receptor age groups indicates the maximum potential exposure occurs. The inhalation and ground plane exposure pathways **SHALL** be considered to exist at all locations. The grass-goat-milk, the grass-cow-milk, grass-cow-meat, and vegetation pathways are considered based on their existence at the various locations. R_i values have been calculated for the adult, teen, child, and infant age groups for the ground plane, cow milk, goat milk, vegetable and beef ingestion pathways. The methodology which was utilized to calculate these values is presented below.

C.2.1 Inhalation Pathway

$$R_{i_I} = K' \, (BR)_a \, (DFA_i)_a \qquad \text{(C.2-1)}$$

where:

R_{i_I} = dose factor for each identified radionuclide I of the organ of interest, mrey/yr per μCi/m^3

K' = a constant of unit conversion:

= 10^6 pCi/μCi;

$(BR)_a$ = breathing rate of the receptor of age group a, m^3/yr;

$(DFA_i)_a$ = organ inhalation dose factor for radionuclide i for the receptor of age group a, mrem/pCi.

The breathing rates $(BR)_a$ for the various age groups are tabulated below, as given in Table E-5 of the Regulatory Guide 1.109 Revision 1.

Age Group (a)	Breathing Rate (m^3/yr)
Infant	1400
Child	3700
Teen	8000
Adult	8000

Inhalation dose factors $(DFA_i)_a$ for the various age groups are given in Tables E-7 through E-10 of Regulatory Guide 1.109 Revision 1.

C.2.2 Ground Plane Pathway

$$R_{i_G} = I_i K'K'' (SF) DFG_i \ (1-e^{-\lambda i t}) / \lambda_i \qquad \text{(C.2-2)}$$

where:

R_{i_G} = dose factor for the ground plane pathway for each identified radionuclide i for the organ of interest, m^2 -mrem/yr per μCi/sec per;

K′ = a constant of unit conversion;

= 10^6 pCi/μCi;

K″ = a constant of unit conversion;

= 8760 mr/year;

λ_i = the radiological decay constant for radionuclide i, sec^{-1};

t = the exposure time, sec;

= 4.73×10^8 sec (5 years)'

DFG_i = the ground plant dose conversion factor for radionuclide i; mrem/hr per pCi/m^2;

SF = the shielding factor (dimensionless)

I_i = factor to account for fractional deposition of radionuclide i.

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Table 5.5-1.

A shielding factor of 0.7 from Table E-15 of Regulatory Guide 1.109 Revision 1 is used. A tabulation of DFG_i values is presented in Table E-6 of Regulatory Guide 1.109 Revision 1.

C.2.3 Grass-Cow or Goat-Milk Pathway

$$R_{i_M} = I_i K' Q_F U_{ap} F_m (DFL_i)_a e^{-\lambda_i t_f} \left[f_p f_s \left[\frac{r(1-e^{-\lambda_{E_i} t_{ep}})}{Y_p \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P \lambda_i} \right] + (1 - f_p f_s) \left[\frac{r(1-e^{-\lambda_{E_i} t_{es}})}{Y_S \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P \lambda_i} \right] e^{-\lambda_i t_h} \right] \quad \text{(C.2-3)}$$

where:

R_{i_M}	=	dose factor for the cow milk or goat milk pathway, for each identified radionuclide i for the organ of interest, m^2 - mrey/yr per μCi/sec;
K′	=	a constant of unit conversion;
	=	10^6 pCi/μCi;
Q_F	=	the cow's or goat's feed consumption rate, kg/day (wet weight);
U_{ap}	=	the receptor's milk consumption rate for age group a, liters/yr;
Y_P	=	the agricultural productivity by unit area of pasture feed grass, kg/m^2 ;
Y_S	=	the agricultural productivity by unit areas of stored feed, kg/m^2;
F_m	=	the stable element transfer coefficients, pCi/liter per pCI/day;
r	=	fraction of deposited activity retained on cow's feed grass;

$(DFL_i)_a$ = the organ ingestion dose factor for radionuclide I for the receptor in age group a, mrem/pCI;

λ_E = $\lambda_i + \lambda_w$;

λ_i = the readiological decay constant for radionuclide I, sec^{-1};

λ_w = the decay constant for removal of activity on leaf and plant surfaces by weathering, sec^{-1};

= 5.73×10^{-7} sec^{-1} (corresponding to a 14 day half-lift);

t_f = the transport time from feed to cow or goat to milk to receptor, sec;

t_h = the transport time from harvest, to cow or goat, to consumption, sec;

t_b = period of time that activity builds up in soil, sec;

B_{iv} = concentration factor for uptake of radionuclide i from the soil by the edible parts of crops, pCi/kg (wet weight) per PCi/kg (dry soil);

P = effective surface density for soil, (dry weight) kg/m^2;

f_p = fraction of the year that the cow or goat is on pasture;

f_s = fraction of the cow feed that is pasture grass while the cow is on pasture;

t_{ep} = period of pasture grass exposure during the growing season, sec;

t_{es} = period of crop exposure during the growing season, sec;

I_i = factor to account for fractional deposition of radionuclide i.

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values Tables 5.5-8 through 5.5-15.

Milk cattle and goats are considered to be fed from two potential sources, pasture grass and stored feeds. Following the development in Regulatory Guide 1.109 Revision 1, the value of f_s was considered unity in lieu of site-specific information. The value of f_p was 0.5 based upon a 6-month grazing period.

Table C-1 contains the appropriate parameter values and their source in Regulatory Guide 1.109 Revision 1.

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q:

$$R_{T_M} = K'K''' F_m Q_F U_{ap} (DFL_i)_a \ 0.75\ (0.5/H) \qquad \text{(C.2-4)}$$

where:

R_{T_M} = dose factor for the cow or goat milk pathway for tritium for the organ of interest, mrem/yr per μCi/m^3;

K''' = a constant of unit conversion;

= 10^3 gm/kg;

H = absolute humidity of the atmosphere, gm/m^3;

0.75 = the fraction of total feed that is water;

0.5 = the ratio of the specific activity of the feed grass to the atmospheric water.

and other parameters and values are given below. A value of H of 8 grams/meter^3, was used in lieu of site-specific information.

C.2.4 Grass-Cow-Meat Pathway

The integrated concentration in meat follows in a similar manner to the development for the milk pathway, therefore:

$$R_{i_B} = I_i K' Q_F U_{ap} F_f (DFL_i)_a e^{-\lambda_i t_s} \left[f_p f_s \left[\frac{r(1-e^{-\lambda_{E_i} t_{ep}})}{Y_{p} \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P \lambda_i} \right] + (1 - f_p f_s) \left[\frac{r(1-e^{-\lambda_{E_i} t_{es}})}{Y_s \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P \lambda_i} \right] e^{-\lambda_i t_h} \right] \qquad \text{(C.2-5)}$$

where:

R_{i_B} = dose factor for the meat ingestion pathway for radionuclide i for any organ of interst, m^2 - mrem/yr per µCi/sec;

F_f = the stable element transfer coefficients, pCi/Kg per pCi/day;

U_{ap} = the receptor's meat consumption rate for age group a, kg/yr;

t_s = the transport time from slaughter to consumption, sec;

t_h = the transport time from harvest to animal consumption, sec;

t_{ep} = period of pasture grass exposure during the growing season, sec;

t_{es} = period of crop exposure during the growing season, sec;

I_i = factor to account for fractional desposition of radionuclide i.

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in Tables 5.5-5 through 5.5-7.

All other terms remain the same as defined in Equation C.2-3. Table C-2 contains the values which were used in calculating R_i for the meat pathway.

The concentration of tritium in meat is based on its airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q.

$$R_{T_B} = K'K''' F_f Q_F U_{ap} (DFL_i)_a \ \ 0.75\ (0.5/H) \qquad \text{(C.2-6)}$$

where:

R_{T_B} = dose factor for the meat ingestion pathway for tritium for any organ of interest, mrem/yr per µCi/m^3.

All other terms are defined in Equation C.2-4 and C.2-5, above.

C.2.5 Vegetation Pathway

The integrated concentration in vegetation consumed by man follows the expression developed in the derivation of the milk factor. Man is considered to consume two types of vegetation (fresh and stored) that differ only in the time period between harvest and consumption, therefore:

$$R_{i_V} = I_i K'(DFL_i)_a \left[U_a^L f_L e^{-\lambda_i t_L} \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_V \lambda_{E_i}} + \frac{B_{iv}(1-e^{-\lambda_i t_b})}{P_{\lambda i}} \right] + \right.$$

$$\left. (U_a^S f_g e^{-\lambda_i t_h} \left[\frac{r(1-e^{-\lambda_{E_i} t_e})}{Y_V \lambda_{E_i}} + \frac{B_{iv}\ (1-e^{-\lambda_i t_b})}{P_{\lambda i}} \right] \right] \quad \text{(C.2-7)}$$

where:

R_{T_V} = dose factor for vegetable pathway for radionuclide i for organ of interest, m^2 - mrem/yr per μCi/sec;

K' = a constant of unit conversion;

= 10^6 pCi/μCi;

U_a^L = the consumption rate of fresh leafy vegetation by the receptor in age group a, kg/yr;

U_a^S = the consumption the or stored vegetation by the receptor in age group a, kg/yr;

f_L = the fraction of the annual intake of fresh leafy vegetation grown locally;

f_g = the fraction of the annual intake of stored vegetation grown locally;

t_L = the average time between harvest of leafy vegetation and its consumption, sec;

t_h = the average time between harvest of stored vegetation and its consumption, sec;

Y_V = the vegetation areal density, kg/m^2;

t_e = period of leafy vegetable exposure during growing season, sec;

I_i = factor to account for fractional deposition of radionuclide i.

For radionuclides other than iodine, the factor I_i is equal to one. For radioiodines, the value of I_i may vary. However, a value of 1.0 was used in calculating the R values in tables 5.5-2 through 5.5-4.

All other factors were defined above.

Table C-3 presents the appropriate parameter values and their source in Regulatory Guide 1.109 Revision 1.

In lieu of site-specific data default values for f_L and f_g, 1.0 and 0.76, respectively were used in the calculation of R_i. These values were obtained from Table E-15 of Regulatory Guide 1.109 Revision 1.

The concentration of tritium in vegetation is based on the airborne concentration rather than the deposition. Therefore, the R_i is based on X/Q:

$$R_{Tv} = K'K''' \left[U_a^L f_L + U_a^S f_g \right] (DFL_i)_a \; 0.75 \; (0.5/H) \qquad \text{(C.2-8)}$$

where:

R_{Tv} = dose factor for the vegetable pathway for tritium for any organ of interest, m^2 - mrem/yr per μCi/m^3.

All other terms remain the same as those in Equations C.2-4 and C.2-7.

Table C-1 - Parameters for Cow and Goat Milk Pathways

Parameter	Value	Reference (Reg. Guide 1.109 Rev. 1)
Q_F (kg/day)	50 (cow) 6 (goat)	Table E-3 Table E-3
Y_P (kg/m^2)	0.7	Table E-15
t_f (seconds)	1.73×10^5 (2 days)	Table E-15
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
F_m (pCi/day per pCi/liter)	Each stable element	Table E-1 (cow) Table E-2 (goat)
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
Y_s (kg/m^2)	2.0	Table E-15
Y_p (kg/m^2)	0.7	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
U_{ap} (liters/yr)	330 infant 330 child 400 teen 310 adult	Table E-5 Table E-5 Table E-5 Table E-5
t_{ep} (seconds)	2.59×10^6 (30 days)	Table E-15
t_{es} (seconds)	5.18×10^6 (60 days)	Table E-15
B_{iv} (pCi/Kg (wet weight) per pCi/Kg (dry soil))	Each stable element	Table E-1
P (Kg/m^2 (dry weight))	240	Table E-15

Table C-2 Parameters for the Meat Pathway

Parameter	Value	Reference (Reg. Guide 1.109 Rev. 1)
r	1.0 (radioiodines) 0.2 (particulates)	Table E-15 Table E-15
F_f (pCi/Kg per pCi/day)	Each stable element	Table E-1
U_{ap} (Kg/yr)	0 infant 41 child 65 teen 110 adult	Table E-5 Table E-5 Table E-5 Table E-5
$(DFL_i)_a$ (mrem/pCi)	Each radionuclide	Tables E-11 to E-14
Y_p (kg/m^2)	0.7	Table E-15
Y_s (kg/m^2)	2.0	Table E-15
t_b (seconds)	4.73×10^8 (15 yr)	Table E-15
t_s (seconds)	1.73×10^6 (20 days)	Table E-15
t_h (seconds)	7.78×10^6 (90 days)	Table E-15
t_{ep} (seconds)	2.59×10^6 (30 days)	Table E-15
t_{es} (seconds)	5.18×10^6 (60 days)	Table E-15
Q_f (kg/day)	50	Table E-3
B_{iv} (pCi/Kg (wet weight) per pCi/Kg (dry soil))	Each stable element	Table E-1
P (Kg/m^2 (dry weight))	240	Table E-15

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Table C-3 - Parameters for the Vegetable Pathway

Parameter		Value	Reference (Reg. Guide 1.109 Rev. 1)
r (dimensionless)		1.0 (radioiodines)	Table E-1
		2.0 (particulates)	Table E-1
$(DFL_i)_a$ (mrem/pCi)		Each radionuclide	Tables E-11 to E-14
U_a^L (kg/yr)	- Infant	0	Table E-5
	- Child	26	Table E-5
	- Teen	42	Table E-5
	- Adult	64	Table E-5
U_a^S (kg/yr)	- Infant	0	Table E-5
	- Child	520	Table E-5
	- Teen	630	Table E-5
	- Adult	520	Table E-5
t_L (seconds)		8.6×10^4 (1 day)	Table E-15
t_h (seconds)		5.18×10^6 (60 days)	Table E-15
Y_v (kg/m^2)		2.0	Table E-15
t_e (seconds)		5.18×10^6 (60 days)	Table E-15
t_b (seconds)		4.73×10^8 (15 yr)	Table E-15
P(Kg/m^2 (dry weight))		240	Table E-15
B_{iv} (pCi/Kg (wet weight) per pCi/kg (dry soil))		Each stable element	Table E-1