VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 2, 2016

United States Nuclear Regulatory Commission
Attention: Document Control Desk
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Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Enclosed is the Surry Power Station Annual Radioactive Effluent Release Report for January 1, 2015 through December 31, 2015. The report, submitted pursuant to Surry Power Station Technical Specification 6.6.B.3, includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released during the 2015 calendar year, as outlined in Regulatory Guide 1.21, Revision 1, June 1974.

If you have any further questions, please contact Jason Eggart at 757-365-2010.

Sincerely,

Douglas C. Lawrence
Director Safety & Licensing
Surry Power Station

Attachment

Commitments made in this letter: None

cc: U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector
Surry Power Station

IE48
NRR

ATTACHMENT 1

2015 Annual Radioactive Effluent Release Report

SURRY POWER STATION UNITS 1 AND 2
VIRGINIA ELECTRIC AND POWER COMPANY

Surry Power Station

2015 Annual Radioactive Effluent Release Report

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ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

SURRY POWER STATION

January 1, 2015 through December 31, 2015

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ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR THE

SURRY POWER STATION

January 1, 2015 through December 31, 2015

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FORWARD

This report is submitted as required by Appendix A to Operating License Nos. DPR-32 and DPR-37, Technical Specifications for Surry Power Station, Units 1 and 2, Virginia Electric and Power Company, Docket Nos. 50-280, 50-281, Section 6.6.B.3.

EXECUTIVE SUMMARY
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

The Annual Radioactive Effluent Release Report describes the radiological effluent control program conducted at Surry Power Station during the 2015 calendar year. This document summarizes the quantities of radioactive liquid and gaseous effluents and solid waste released from Surry Power Station in accordance with Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants", Revision 1, June 1974. The report also includes an assessment of radiation doses to the maximum exposed member of the public due to the radioactive liquid and gaseous effluents.

During this reporting period, there were no unplanned liquid or gaseous effluent releases as classified according to the criteria in the Offsite Dose Calculation Manual.

Based on the 2015 effluent release data, 10CFR50 Appendix I dose calculations were performed in accordance with the Offsite Dose Calculation Manual. The dose calculations are as follows:

1. The total body dose due to liquid effluents was 3.43E-04 mrem, which is 5.72-03% of the 6 mrem dose limit. The critical organ doses due to liquid effluents, GI-LLI and Liver respectively, were 1.08E-03 mrem and 2.96E-04 mrem. These doses are 5.40E-03% and 1.48E-03% of the respective 20 mrem dose limit.

2. The air dose due to noble gases in gaseous effluents was 5.05E-05 mrad gamma, which is 2.53E-04% of the 20 mrad gamma dose limit, and 1.33E-04 mrad beta, which is 3.33E-04% of the 40 mrad beta dose limit.

3. The critical organ dose from gaseous effluents due to I-131, I-133, H-3, and particulates with half-lives greater than 8 days is 1.08E-01 mrem, which is 3.60E-01% of the 30 mrem dose limit.

There were no major changes to the radioactive liquid, gaseous or solid waste treatment systems during this reporting period.

There were two changes made to VPAP-2103S, Offsite Dose Calculation Manual, during this reporting period. Attachment 3 provides the changes to VPAP-2103S.

In accordance with the Nuclear Energy Institute (NEI) Industry Ground Water Protection Initiative, analysis results of ground water monitoring locations not included in the Radiological Environmental Monitoring Program (REMP), will be included in this report. Ground water monitoring well sample results are provided in Attachment 8.

Based on the radioactivity measured and the dose calculations performed during this reporting period, the operation of Surry Power Station has resulted in negligible radiation dose consequences to the maximum exposed member of the public in unrestricted areas.

Purpose and Scope

Attachment 1 includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste as outlined in Regulatory Guide 1.21, with data summarized on a quarterly or annual basis following the format of Tables 1, 2 and 3 of Appendix B, thereof. Attachment 2 of this report includes an assessment of radiation doses to the maximum exposed member of the public due to radioactive liquid and gaseous effluents released from the site during 2015.

As required by Technical Specification 6.8.B, changes to the Offsite Dose Calculation Manual (ODCM) for the time period covered by this report are included in Attachment 3. Major changes to the radioactive liquid, gaseous and solid waste treatment systems are reported in Attachment 4, as required by the ODCM, Section 6.7.2. If changes are made to these systems, the report shall include information to support the reason for the change and a summary of the 10CFR50.59 evaluation. In lieu of reporting major changes in this report, major changes to the radioactive waste treatment systems may be submitted as part of the annual FSAR update.

As required by the ODCM, Sections 6.2.2 and 6.3.2, a list and explanation for the inoperability of radioactive liquid and/or gaseous effluent monitoring instrumentation is provided in Attachment 5 of this report. Additionally, a list of unplanned releases during the reporting period is included in Attachment 6.

Attachment 7 provides the typical lower limit of detection (LLD) capabilities of the radioactive effluent analysis instrumentation.

As required by the ODCM, Section 6.7.5, a summary of on-site radioactive spills or leaks that were communicated in accordance with the Industry Ground Water Protection Initiative reporting protocol, and sample analyses from ground water wells that are not part of the Radiological Environmental Monitoring Program are provided in Attachment 8. In 2015, no on-site radioactive spills or leaks were communicated in accordance with the Industry Ground Water Protection Initiative.

Discussion

The basis for the calculation of the percent of technical specification for the critical organ in Table 1A of Attachment 1 is the ODCM, Section 6.3.1, which requires that the dose rate for iodine-131, iodine-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days shall be less than or equal to 1500 mrem/yr to the critical organ at or beyond the site boundary. The critical receptor was the child for the first two quarters, the teen for the last two quarters; both via the inhalation pathway.

The basis for the calculation of the percent of technical specification for the total body and skin in Table 1A of Attachment 1 is the ODCM, Section 6.3.1, which requires that the dose rate for noble gases to areas at or beyond site boundary shall be less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

The basis for the calculation of the percent of technical specification in Table 2A of Attachment 1 is the ODCM, Section 6.2.1, which states that the concentration of radioactive material released in liquid effluents to unrestricted areas shall not exceed ten times the concentrations specified in 10CFR20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.00E-04 microcuries/mL.

Percent of technical specification calculations are based on the total gaseous or liquid effluents released for the respective quarter.

The annual and quarterly doses, as reported in Attachment 2, were calculated according to the methodology presented in the ODCM. The beta and gamma air doses due to noble gases released from the site were calculated at the site boundary. The maximum exposed member of the public from the release of airborne iodine-131, iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days, was a child at 2.05 miles with the critical organ being the bone via the ingestion pathway. The maximum exposed member of the public from radioactive materials in liquid effluents in unrestricted areas was an adult, exposed by either the invertebrate or fish pathway, with the critical organ typically being the gastrointestinal-lower large intestine. The total body dose was also determined for this individual.

Presented in Attachment 6 is a list of unplanned gaseous and liquid releases as required by the ODCM, Section 6.7.2.

The typical lower limit of detection (LLD) capabilities of the radioactive effluent analysis instrumentation are presented in Attachment 7. These LLD values are based upon conservative conditions (i.e., minimum sample volumes and maximum delay time prior to analysis). Actual LLD values may be lower. If a radioisotope was not detected when effluent samples were analyzed, then the activity of the radioisotope was reported as Not Detected (N/D) on Attachment 1 of this report. When all isotopes listed on Attachment 1 for a particular quarter and release mode are less than the lower limit of detection, then the totals for this period will be designated as Not Applicable (N/A).

Supplemental Information

Section 6.6.1 of the ODCM requires the identification of the cause(s) for the unavailability of milk, or if required, leafy vegetation samples, and the identification for obtaining replacement samples. As milk was available for collection during this reporting period, leafy vegetation sampling was not required.

As required by the ODCM, Section 6.6.2, evaluation of the Land Use Census is made to determine if new sample location(s) must be added to the Radiological Environmental Monitoring Program. Evaluation of the Land Use Census conducted for this reporting period identified no change in sample locations for the Radiological Environmental Monitoring Program.

Attachment 1

EFFLUENT RELEASE DATA

January 1, 2015 through December 31, 2015

This attachment includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste as outlined in Regulatory Guide 1.21, Appendix B.

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENT-SUMMATION OF ALL RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	FIRST QUARTER	SECOND QUARTER	% EST. ERROR
A. FISSION & ACTIVATION GASES				
1. TOTAL RELEASE	Ci	1.25E-02	6.49E-01	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	1.60E-03	8.25E-02	
B. IODINE				
1. TOTAL I-131	Ci	N/D	N/D	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	N/A	N/A	
C. PARTICULATE				
1. HALF-LIFE >8 DAYS	Ci	N/D	2.65E-05	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	N/A	3.37E-06	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	8.34E+00	1.04E+01	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	1.07E+00	1.32E+00	
E. CARBON-14				
1. TOTAL RELEASE	Ci	1.42E-01	7.39E+00	
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	1.83E-02	9.40E-01	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	1.62E-03	1.32E-02	
TOTAL BODY DOSE RATE	%	2.44E-08	3.12E-05	
SKIN DOSE RATE	%	9.63E-09	1.20E-05	

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENT-SUMMATION OF ALL RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	THIRD QUARTER	FOURTH QUARTER	% EST. ERROR
A. FISSION & ACTIVATION GASES				
1. TOTAL RELEASE	Ci	2.24E-01	4.80E-01	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	2.82E-02	6.04E-02	
B. IODINE				
1. TOTAL I-131	Ci	N/D	N/D	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	N/A	N/A	
C. PARTICULATE				
1. HALF-LIFE >8 DAYS	Ci	4.93E-06	7.15E-06	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	6.20E-07	9.00E-07	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	4.42E+00	8.43E+00	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	5.55E-01	1.06E+00	
E. CARBON-14				
1. TOTAL RELEASE	Ci	2.56E+00	5.47E+00	
2. AVE RELEASE RATE FOR PERIOD	µCi/sec	3.22E-01	6.96E-01	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	8.45E-04	1.65E-03	
TOTAL BODY DOSE RATE	%	1.73E-06	3.54E-06	
SKIN DOSE RATE	%	5.29E-07	1.05E-06	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENTS-MIXED MODE RELEASES

		CONTINUOUS MODE		BATCH MODE	
SURRY POWER STATION UNITS 1&2	UNIT	FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
1. FISSION & ACTIVATION GASES					
Kr-85	Ci	N/D	N/D	N/D	N/D
Kr-85m	Ci	N/D	N/D	N/D	1.30E-03
Kr-87	Ci	N/D	N/D	N/D	N/D
Kr-88	Ci	N/D	N/D	N/D	N/D
Xe-133	Ci	1.03E-02	N/D	2.16E-03	3.69E-01
Xe-135	Ci	N/D	N/D	N/D	6.21E-02
Xe-135m	Ci	N/D	N/D	N/D	N/D
Xe-138	Ci	N/D	N/D	N/D	N/D
Xe-131m	Ci	N/D	N/D	N/D	N/D
Xe-133m	Ci	N/D	N/D	N/D	4.39E-03
Ar-41	Ci	N/D	N/D	N/D	3.45E-03
TOTAL FOR PERIOD	Ci	N/A	N/A	2.16E-03	4.40E-01
2. IODINES					
I-131	Ci	N/D	N/D	N/D	N/D
I-133	Ci	N/D	N/D	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	N/A
3. PARTICULATES					
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	N/D	2.43E-05	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	2.12E-06	N/D	N/D
Co-60	Ci	N/D	N/D	N/D	N/D
Mn-54	Ci	N/D	N/D	N/D	N/D
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
C-14	Ci	1.17E-01	N/D	2.46E-02	5.02E+00
TOTAL FOR PERIOD	Ci	1.17E-01	2.64E-05	2.46E-02	5.02E+00

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENTS-MIXED MODE RELEASES

		CONTINUOUS MODE		BATCH MODE	
SURRY POWER STATION UNITS 1&2	UNIT	THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. FISSION & ACTIVATION GASES					
Kr-85	Ci	N/D	N/D	N/D	N/D
Kr-85m	Ci	N/D	N/D	5.81E-04	6.44E-04
Kr-87	Ci	N/D	N/D	N/D	N/D
Kr-88	Ci	N/D	N/D	N/D	N/D
Xe-133	Ci	N/D	N/D	1.84E-01	4.38E-01
Xe-135	Ci	N/D	N/D	3.50E-02	2.83E-02
Xe-135m	Ci	N/D	N/D	N/D	N/D
Xe-138	Ci	N/D	N/D	N/D	N/D
Xe-131m	Ci	N/D	N/D	N/D	N/D
Xe-133m	Ci	N/D	N/D	2.93E-03	7.66E-03
Ar-41	Ci	N/D	N/D	9.00E-04	4.16E-03
TOTAL FOR PERIOD	Ci	N/A	N/A	2.24E-01	4.79E-01
2. IODINES					
I-131	Ci	N/D	N/D	N/D	N/D
I-133	Ci	N/D	N/D	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	N/A
3. PARTICULATES					
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	N/D	N/D	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	N/D	N/D	N/D
Co-60	Ci	N/D	N/D	N/D	N/D
Mn-54	Ci	N/D	N/D	N/D	N/D
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
C-14	Ci	N/D	N/D	2.55E+00	5.46E+00
TOTAL FOR PERIOD	Ci	N/A	N/A	2.55E+00	5.46E+00

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

		CONTINUOUS MODE		BATCH MODE	
SURRY POWER STATION UNITS 1&2	UNIT	FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
1. FISSION & ACTIVATION GASES					
Kr-85	Ci	N/D	N/D	N/D	N/D
Kr-85m	Ci	N/D	N/D	N/D	N/D
Kr-87	Ci	N/D	N/D	N/D	N/D
Kr-88	Ci	N/D	N/D	N/D	N/D
Xe-133	Ci	N/D	N/D	N/D	2.08E-01
Xe-135	Ci	N/D	N/D	N/D	N/D
Xe-135m	Ci	N/D	N/D	N/D	N/D
Xe-138	Ci	N/D	N/D	N/D	N/D
Xe-131m	Ci	N/D	N/D	N/D	N/D
Xe-133m	Ci	N/D	N/D	N/D	N/D
Ar-41	Ci	N/D	3.61E-04	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	3.61E-04	N/A	2.08E-01
2. IODINES					
I-131	Ci	N/D	N/D	N/D	N/D
I-133	Ci	N/D	N/D	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	N/A
3. PARTICULATES					
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	N/D	2.43E-05	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	2.12E-06	N/D	N/D
Co-60	Ci	N/D	N/D	N/D	N/D
Mn-54	Ci	N/D	N/D	N/D	N/D
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
C-14	Ci	N/D	4.11E-03	N/D	2.37E+00
TOTAL FOR PERIOD	Ci	N/A	4.14E-03	NA	2.37E+00

TABLE 1C

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. FISSION & ACTIVATION GASES					
Kr-85	Ci	N/D	N/D	N/D	N/D
Kr-85m	Ci	N/D	1.76E-06	N/D	N/D
Kr-87	Ci	N/D	1.66E-06	N/D	N/D
Kr-88	Ci	N/D	3.14E-06	N/D	N/D
Xe-133	Ci	N/D	1.25E-05	N/D	5.66E-04
Xe-135	Ci	N/D	2.28E-05	N/D	N/D
Xe-135m	Ci	N/D	4.26E-06	N/D	N/D
Xe-138	Ci	N/D	N/D	N/D	N/D
Xe-131m	Ci	N/D	N/D	N/D	N/D
Xe-133m	Ci	N/D	N/D	N/D	N/D
Ar-41	Ci	2.25E-04	4.93E-04	N/D	N/D
TOTAL FOR PERIOD	Ci	2.25E-04	5.40E-04	N/A	5.66E-04
2. IODINES					
I-131	Ci	N/D	N/D	N/D	N/D
I-132	Ci	N/D	1.31E-03	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	1.31E-03	N/A	N/A
3. PARTICULATES					
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	N/D	N/D	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	4.93E-06	6.89E-06	N/D	2.12E-07
Co-60	Ci	N/D	N/D	N/D	5.03E-08
Mn-54	Ci	N/D	N/D	N/D	N/D
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
C-14	Ci	2.56E-03	6.15E-03	N/D	6.45E-03
TOTAL FOR PERIOD	Ci	2.56E-03	6.16E-03	NA	6.45E-03

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	FIRST QUARTER	SECOND QUARTER	% EST. ERROR
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	Ci	5.03E-03	7.19E-03	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	7.91E-12	1.20E-11	
3. PERCENT OF APPLICABLE LIMIT	%	2.65E-05	4.15E-05	
B. TRITIUM				
1. TOTAL RELEASE	Ci	3.13E+02	2.87E+02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	4.93E-07	4.77E-07	
3. PERCENT OF APPLICABLE LIMIT	%	4.93E-03	4.77E-03	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	N/A	N/A	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	LITERS	5.48E+07	5.33E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD	LITERS	6.36E+11	6.01E+11	3.00E+00

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	THIRD QUARTER	FOURTH QUARTER	% EST. ERROR
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE (NOT INCLUDING TRITIUM, GASES, ALPHA)	Ci	1.36E-02	2.37E-02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	1.73E-11	4.36E-11	
3. PERCENT OF APPLICABLE LIMIT	%	2.76E-05	9.68E-05	
B. TRITIUM				
1. TOTAL RELEASE	Ci	3.35E+02	2.52E+02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	4.27E-07	4.63E-07	
3. PERCENT OF APPLICABLE LIMIT	%	4.27E-03	4.63E-03	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	Ci	4.67E-06	N/D	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	µCi/mL	5.95E-15	N/A	
3. PERCENT OF APPLICABLE LIMIT	%	2.98E-09	N/A	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)	LITERS	5.61E+07	5.46E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD	LITERS	7.84E+11	5.44E+11	3.00E+00

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
LIQUID EFFLUENTS

SURRY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Fe-55	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	4.16E-04	3.43E-04	7.93E-06	6.26E-05
I-131	Ci	N/D	N/D	N/D	1.14E-05
Co-58	Ci	N/D	N/D	5.29E-04	5.01E-04
Co-60	Ci	N/D	N/D	3.66E-03	6.14E-03
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mn-54	Ci	N/D	N/D	N/D	5.26E-05
Cr-51	Ci	N/D	N/D	N/D	N/D
Zr-95	Ci	N/D	N/D	N/D	N/D
Nb-95	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Tc-99m	Ci	N/D	N/D	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
Sb-124	Ci	N/D	N/D	N/D	N/D
Sb-125	Ci	N/D	N/D	4.17E-04	8.35E-05
Co-57	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	4.16E-04	3.43E-04	4.61E-03	6.85E-03
Xe-133	Ci	N/D	N/D	N/D	N/D
Xe-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	N/A

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/15 TO 12/31/15
LIQUID EFFLUENTS

SURRY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
Sr-89	Ci	N/D	N/D	N/D	N/D
Sr-90	Ci	N/D	N/D	N/D	N/D
Fe-55	Ci	N/D	N/D	N/D	N/D
Cs-134	Ci	N/D	N/D	N/D	N/D
Cs-137	Ci	1.97E-04	2.19E-04	5.18E-05	2.17E-05
I-131	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	N/D	1.17E-03	2.09E-03
Co-60	Ci	N/D	N/D	4.94E-03	1.41E-02
Fe-59	Ci	N/D	N/D	N/D	N/D
Zn-65	Ci	N/D	N/D	N/D	N/D
Mn-54	Ci	N/D	N/D	1.18E-05	2.07E-04
Cr-51	Ci	N/D	N/D	8.41E-04	7.20E-04
Zr-95	Ci	N/D	N/D	N/D	N/D
Nb-95	Ci	N/D	N/D	N/D	N/D
Mo-99	Ci	N/D	N/D	N/D	N/D
Tc-99m	Ci	N/D	N/D	N/D	N/D
Ba-140	Ci	N/D	N/D	N/D	N/D
La-140	Ci	N/D	N/D	N/D	N/D
Ce-141	Ci	N/D	N/D	N/D	N/D
Ce-144	Ci	N/D	N/D	N/D	N/D
Sb-124	Ci	N/D	N/D	1.95E-05	2.11E-05
Sb-125	Ci	N/D	N/D	6.36E-03	6.35E-03
Co-57	Ci	N/D	N/D	N/D	1.97E-05
TOTAL FOR PERIOD	Ci	1.97E-04	2.19E-04	1.34E-02	2.35E-02
Xe-133	Ci	N/D	N/D	4.67E-06	N/D
Xe-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	4.67E-06	N/A

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/15 - 12/31/15

SURRY POWER STATION
A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

1. Type of waste		12 month Period		Est. Total Error, %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	2.15E+01	Note 1	1.00E+01
	Ci	3.41E+02		3.00E+01
b. Dry compressible waste, contaminated equip., etc.	m^3	5.36E+02	Note 2	1.00E+01
	Ci	8.59E-01		3.00E+01
c. Irradiated components, control rods, etc.	m^3	0.00E+00		1.00E+01
	Ci	0.00E+00		3.00E+01
d. Other (Waste oil)	m^3	8.50E-01	Note 3	1.00E+01
	Ci	1.27E-03		3.00E+01

2. Estimate of major nuclide composition (by type of waste)

a. Co-60	%	4.95E+01	
Ni-63	%	2.71E+01	
Fe-55	%	1.04E+01	
Co-58	%	7.68E+00	
Mn-54	%	1.72E+00	
b. Co-60	%	4.00E+01	
Cs-137	%	3.97E+01	
Ni-63	%	1.14E+01	
Fe-55	%	4.64E+00	
Co-58	%	1.66E+00	
c.	%		
d. Ni-63	%	8.71E+01	
Cs-137	%	7.88E+00	
H-3	%	1.64E+00	(based on MDA concentration)
Tc-99	%	1.30E+00	(based on MDA concentration)

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/15 - 12/31/15
CONTINUED

SURRY POWER STATION

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not irradiated fuel)

3. Solid Waste Disposition

Number of Shipments	Mode of Transportation	Destination
16	Truck	Oak Ridge, TN (Energy*Solutions*)
2	Truck	Erwin, TN (Energy*Solutions*)
1	Truck	Barnwell, SC (Energy*Solutions*)

B. IRRADIATED FUEL SHIPMENT (Disposition)

Number of Shipments	Mode of Transportation	Destination
0		

NOTE 1: Some of this waste was shipped to licensed waste processors for processing and/or volume reduction. Therefore, this volume is not representative of the actual volume buried. The total volume buried for this reporting period is 9.07E+00 m^3. Burial volume by Erwin Resin Solutions is indeterminable due to mixing of Surry waste with other generators waste.

NOTE 2: Some DAW was shipped to licensed waste processors for processing and/or volume reduction. Therefore, this volume is not representative of the actual volume buried. The total volume buried for this reporting period is 2.50E+02 m^3.

NOTE 3: This waste was shipped to a licensed waste processor for processing and/or volume reduction. The actual volume buried is indeterminable. It is conservatively assumed that 1.70E-02 m^3 was buried this reporting period.

ANNUAL AND QUARTERLY DOSES

An assessment of radiation doses to the maximum exposed member of the public due to radioactive liquid and gaseous effluents released from the site for each calendar quarter for the calendar year of this report, along with an annual total of each effluent pathway is made pursuant to the ODCM, Section 6.7.2, requirement.

2015	LIQUID			GASEOUS		
	Total Body (mrem)	GI-LLI (mrem)	Liver (mrem)	Gamma (mrad)	Beta (mrad)	Bone (mrem)
1st Quarter	7.18E-05	1.44E-04	6.76E-05	3.62E-08	1.08E-07	7.90E-04
2nd Quarter	8.50E-05	2.23E-04	7.63E-05	4.49E-05	1.28E-04	6.26E-02
3rd Quarter	6.62E-05	1.61E-04	6.03E-05	1.73E-06	2.43E-06	1.43E-02
4th Quarter	1.20E-04	5.56E-04	9.16E-05	3.76E-06	4.75E-06	3.06E-02
Annual	3.43E-04	1.08E-03	2.96E-04	5.05E-05	1.33E-04	1.08E-01

REVISIONS TO OFFSITE DOSE CALCULATION MANUAL (ODCM)

As required by Technical Specification 6.8.B, revisions to the ODCM, effective for the time period covered by this report, are included with this attachment. There were two general revision to the ODCM implemented during this reporting period.

Revision 18:

* Added substep 6.6.1.b.5 addressing deviations from the Radiological Environmental Monitoring Program (REMP) sampling schedule if specimens are unattainable and requiring all deviations to be documented in the annual REMP report.
* Updated gaseous effluent dispersion and deposition factors.
* Add a garden in the SSE sector for dose assessment. This garden was idenified as a new garden location in the 2014 Land Use Census.
* Revised the description of Fish samples for the REMP to better represent the species available in the area for sampling.

Revision 19:

* Resulting from a self assessment of the REMP, the following revisions were made:
  Added, as Reference 3.1.28, the Branch Technical Position, , Revision 1, November 1979
  Added a footnote to Attachment 8 to clarify that a TLD station does not exist in the 4 - 5 mile range of the SE sector due to geographical limitations. This area is over the water of the James River.
* Resulting from corrective actions to Condition Report 1013104, documenting a liquid release without an operable flow rate measuring device, the following revisions were made:
  Added, as Reference 3.1.29, CR1013104
  On Attachment 1, revised the Action requirements for an unavailable flow rate measuring device to allow a liquid release with verification of release rate at least once per 30 minutes using design capacity pump performance curves or volume released over time.
* Revised Substep 6.4.2.b to include the release of ground water wells as a contributor to the Continuous Release pathway.

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Administrative Procedure or Guidance and Reference Document Approval

AD-AA-101 – Attachment 4 Page 1 of 1

1. Document Number:	2. Revision:	3. Document Type:	
VPAP-2103S	18	☒ Administrative Procedure	☐ GARD

4. Title:
Offsite Dose Calculation Manual (Surry)

5. Requestor(s) Print Name(s) / Locations	6. Date	7. Requestor Phone
Heather Baer	03/30/2015	8-798-2172

8. Document Request
☐ New ☒ Revision ☐ Cancel ☐ Supersede ☐ Temporary

9. Applicable Nuclear Station(s)
Millstone ☐ North Anna ☐ Surry ☒

10. Reason and Brief Description of Change:
The following changes were made in response to SAA031884.
- Added Substep 6.6.1.b.5 addressing deviations from the sampling schedule if specimens are unattainable and requiring all deviations to be documented in the annual report

For full list of changes, see Revision Summary.

11. Records Retention Requirements Affected?	12. Change Management:
☐ Yes (Complete NRRS form from RM-AA-101) ☒ No	Attach Appropriate PI-AA-4000 Attachment(s)

13. Level of Use:
☐ Continuous Use ☐ Reference Use ☒ Information Use ☐ Multiple Use

Fleet Approval

14. Fleet Approval Required by: (Check one box only. Enter Peer Group Name, if applicable)
☐ Peer Group OR ☒ Functional Area Manager (FAM)

15. Printed Approver Name	16. Signature	17. Date
Jason W. Eggart	Jason W Eggart	3/30/15

Site Approval

18. Implementation Prerequisites: (Items in addition to those listed on Document Traveler or Change Management Plan)
None

19. Implementation Prerequisites Reviewed - Procedure Supervisor Signature	20. Date
	3-31-15

21. Check Nuclear Station(s) for Which Document is being Approved for Implementation.
Millstone ☐ North Anna ☐ Surry ☒

22. Site Approval (Print Name of FAM)	23. Signature	24. Date
Jason W. Eggart	Jason W Eggart	3/31/15

25. Facility Safety Review Committee Required?	26. Facility Safety Review Committee (Site) Print Name/Signature	27. Date
☒ No ☐ Yes	N/A	N/A

28. Site Vice President Required?	29. Site Vice President) Print Name/Signature	30. Date
☐ No ☒ Yes	DOUGLAS C. LAWRENCE / for N. LANE	4/6/15

NOTE: The individual(s) posting a new or revised document to EDMS are responsible for ensuring Nuclear E-Forms is updated.

31. Nuclear E-Forms Updated for Site(s)?	32. Nuclear E-Forms Updated Print Name/Signature	33. Date
☐ MP ☐ NA ☐ SU ☒ N/A	N/A	N/A

34. Document Number:	35. Revision:	36. Effective Date	37. Expiration Date
VPAP-2103S	18	04/06/15	N/A

04/15/15 HS

Key: GARD-Guidance and Reference Document, EDMS-Electronic Document Management System

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Station Administrative Procedure

Title: Offsite Dose Calculation Manual (Surry)

Process / Program Owner: Manager Radiological Protection and Chemistry (Surry)

Procedure Number	Revision Number	Effective Date
VPAP-2103S	18	On File

Revision Summary

The following changes were made in response to SAA031884.

- Added Substep 6.6.1.b.5 addressing deviations from the sampling schedule if specimens are unattainable and requiring all deviations to be documented in the annual report

Additional Changes

- Updated X/Q and D/Q Factors on Attachment 7
- Added SSE Garden to Attachment 7
- Updated Ingestion, Fish and Invertebrates, d) and added Note 3 to Attachment 8

Approvals on File

TABLE OF CONTENTS

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1.0 PURPOSE

The Offsite Dose Calculation Manual (ODCM) establishes requirements for the Radioactive Effluent and Radiological Environmental Monitoring Programs. Methodology and parameters are provided to calculate offsite doses resulting from radioactive gaseous and liquid effluents, to calculate gaseous and liquid effluent monitoring alarm/trip setpoints, and to conduct the Environmental Monitoring Program. Requirements are established for the Annual Radiological Environmental Operating Report and the Annual Radioactive Effluent Release Report required by Station Technical Specifications. Calculation of offsite doses due to radioactive liquid and gaseous effluents are performed to assure that:

- Concentration of radioactive liquid effluents to the unrestricted area will be limited to ten times the effluent concentration values of 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases and 2E-4 μCi/mL for dissolved or entrained noble gases
- Exposure to the maximum exposed member of the public in the unrestricted area from radioactive liquid effluents will not result in doses greater than the liquid dose limits of 10 CFR 50, Appendix I
- Dose rate at and beyond the site boundary from radioactive gaseous effluents will be limited to:
  - Noble gases – less than or equal to a dose rate of 500 mrem/yr to the total body and less than or equal to a dose rate of 3000 mrem/yr to the skin
  - I^{131}, I^{133}, and H^3, and all radionuclides in particulate form with half-lives greater than 8 days – less than or equal to a dose rate of 1500 mrem/yr to any organ
- Exposure from radioactive gaseous effluents to the maximum exposed member of the public in the unrestricted area will not result in doses greater than the gaseous dose limits of 10 CFR 50, Appendix I, and
- Exposure to a real individual will not exceed 40 CFR 190 dose limits

2.0 SCOPE

This procedure applies to the Radioactive Effluent and Radiological Environmental Monitoring Programs at Surry Power Station.

3.0 REFERENCES/COMMITMENT DOCUMENTS

3.1 References

3.1.1 10 CFR 20, Standards for Protection Against Radiation

3.1.2 10 CFR 50, Domestic Licensing of Production and Utilization Facilities

3.1.3 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations

3.1.4 TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites

3.1.5 Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Rev. 1, U.S. NRC, June 1974

3.1.6 Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, Rev. 1, U.S. NRC, October 1977

3.1.7 Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Rev. 1, U.S. NRC, July 1977

3.1.8 Surry Technical Specifications (Units 1 and 2)

3.1.9 NUREG/CR-2919, XOQDOQ, Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, U.S. NRC, September 1982

3.1.10 NUREG/CR-1276, Users Manual for the LADTAP II Program, U.S. NRC, May, 1980

3.1.11 TID-4500, VCRL-50564, Rev. 1, Concentration Factors of Chemical Elements in Edible Aquatic Organisms, October, 1972

3.1.12 WASH 1258, Vol. 2, July 1973, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable" For Radioactive Material in Light Water-Cooled Nuclear Power Reactor Effluents

3.1.13 NUREG-0597, User's Guide to GASPAR Code, U.S. NRC, June, 1980

3.1.14 Radiological Assessment Branch Technical Position on Environmental Monitoring, November, 1979, Rev. 1

3.1.15 NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Stations, October, 1978

3.1.16 NUREG-0543, February 1980, Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR Part 190)

3.1.17 NUREG-0472, Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors, Draft, Rev. 3, March 1982

3.1.18 Environmental Measurements Laboratory, DOE HASL 300 Manual

3.1.19 NRC Generic Letter 89-01, Implementation of Programmatic Controls for Radiological Effluent Technical Specifications (RETS) in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program

3.1.20 Surry UFSAR

3.1.21 VPAP-2802, Notifications and Reports

3.1.22 HP-3010.021, Radioactive Liquid Waste Sampling and Analysis

3.1.23 HP-3010.031, Radioactive Gaseous Waste Sampling and Analysis

3.1.24 Design Change 01-022, Ventilation Radiation Monitoring (Kaman) System Replacement/Surry/Unit 1&2

3.1.25 NEI 07-07, Industry Ground Water Protection Initiative - Final Guidance Document

3.1.26 CR022320 (Surry), Daily Channel Checks for 1-VG-RM-131-1 Flow Rate Measuring Device Not Performed

3.1.27 RP-AA-502, Groundwater Protection Program

3.2 Commitment Documents

3.2.1 Quality Assurance Audit Report Number 92-03, Observation 04NS (Item 2)

3.2.2 Deviation Report S-97-1281, Annual Radiological Effluent Release Report

3.2.3 Deviation S-2000-0235, Continuous Vent Stack Sampling

3.2.4 S-2005-0930, Response to the Verification of Back-up Effluent Accountability Sampling

4.0 DEFINITIONS

4.1 Channel Calibration

Adjustment, as necessary, of the channel output so it responds with the necessary range and accuracy to known values of the parameter the channel monitors. It encompasses the entire channel, including the sensor and alarm and/or trip functions and the Channel Functional Test. The Channel Calibration can be performed by any series of sequential, overlapping, or total channel steps so the entire channel is calibrated.

4.2 Channel Check

A qualitative assessment, by observation, of channel behavior during operation. This assessment includes, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrumentation channels measuring the same parameter.

The Channel Check for the MGPI sampler flow rate measuring devices, as listed on Attachment 6 of this procedure, is the direct observation of the MGPI radiation monitor release rate (i.e., microcuries per second) without the presence of a sampler flow fault display.

4.3 Channel Functional Test

There are two types of Channel Functional Tests.

4.3.1 **Analog Channel**

Injection of a simulated signal into a channel, as close to the sensor as practicable, to verify Operability, including alarm and/or trip functions.

4.3.2 **Bistable Channel**

Injection of a simulated signal into a sensor to verify Operability, including alarm and/or trip functions.

4.4 Critical Organ

That organ, which has been determined to be the maximum exposed organ based on an effluent pathway analysis, thereby ensuring the dose and dose rate limitations to any organ will not be exceeded.

4.5 Dose Equivalent I-131

That concentration of I^{131} (μCi/cc) that 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. Thyroid dose conversion factors for this calculation are listed in Table III of TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites. Thyroid dose conversion factors from NRC Regulatory Guide 1.109, Revision 1, may be used.

4.6 Frequency Notations

NOTE: Frequencies are allowed a maximum extension of 25 percent.

NOTATION	FREQUENCY
D - Daily	At least once per 24 hours
W - Weekly	At least once per 7 days
M - Monthly	At least once per 31 days
Q - Quarterly	At least once per 92 days
SA - Semi-annually	At least once per 184 days
R - Refueling	At least once per 18 months
S/U - Start-up	Prior to each reactor start-up
P - Prior to release	Completed prior to each release
N/A - Not applicable	Not applicable
DR - During the release	At least once during each release

4.7 Gaseous Radwaste Treatment System

A system that reduces radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing delay or holdup to reduce total radioactivity prior to release to the environment. The system comprises the waste gas decay tanks, regenerative heat exchanger, waste gas charcoal filters, process vent blowers and waste gas surge tanks.

4.8 General Nomenclature

χ = Chi: concentration at a point at a given instant (curies per cubic meter)

D = Deposition: quantity of deposited radioactive material per unit area (curies per square meter)

Q = Source strength (instantaneous; grams, curies)

= Emission rate (continuous; grams per second, curies per second)

= Emission rate (continuous line source; grams per second per meter)

4.9 Lower Limit of Detection (LLD)

The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that can be detected with 95 percent probability with only five percent probability of falsely concluding that a blank observation represents a "real" signal.

4.10 Members of the Public

Any individual except when that individual is receiving an occupational dose. This category includes non-employees of Dominion who are permitted to use portions of the site for recreational, occupational, or other purposes not associated with Station functions. This category does not include non-employees such as vending machine servicemen or postal workers who, as part of their formal job function, occasionally enter an area that is controlled by Dominion to protect individuals from exposure to radiation and radioactive materials.

4.11 Operable - Operability

A system, subsystem, train, component, or device is operable or has operability when it is capable of performing its specified functions and all necessary, attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its functions are also capable of performing their related support functions.

4.12 Purge - Purging

Controlled discharge of air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, so that replacement air or gas is required to purify the confinement.

4.13 Rated Thermal Power

Total reactor core heat transfer rate to reactor coolant (i.e., 2587 Megawatts Thermal MWt).

4.14 Site Boundary

The line beyond which Dominion does not own, lease, or otherwise control the land.

4.15 Source Check

For Victoreen and Eberline monitors a source check is the qualitative assessment of channel response when a channel sensor is exposed to a radioactive source or a light emitting diode, LED.

For MGPI monitors a source check is the verification of proper computer response to continuous operational checks on the detector and electronics.

4.16 Special Report

A report to NRC to comply with Subsections 6.2, 6.3, or 6.5 of this procedure. Also refer to VPAP-2802, Notifications and Reports.

4.17 Thermal Power

Total reactor core heat transfer rate to the reactor coolant.

4.18 Unrestricted Area

Any area at or beyond the site boundary, access to which is neither limited nor controlled by Dominion for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the site boundary used for residential quarters or for industrial, commercial, institutional or recreational purposes.

4.19 Ventilation Exhaust Treatment System

A system that reduces gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and High Efficiency Particulate Air (HEPA) filters to remove iodines and particulates from a gaseous exhaust stream prior to release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not Ventilation Exhaust Treatment System components.

5.0 RESPONSIBILITIES

5.1 Manager Radiological Protection and Chemistry

The Manager Radiological Protection and Chemistry is responsible for:

5.1.1 Establishing and maintaining procedures for surveying, sampling, and monitoring radioactive effluents and the environment.

5.1.2 Surveying, sampling, and analyzing plant effluents and environmental monitoring, and documenting these activities.

5.1.3 Analyzing plant effluent trends and recommending actions to correct adverse trends.

5.1.4 Preparing Effluent and Environmental Monitoring Program records.

5.2 Manager Nuclear Operations

The Manager Nuclear Operations is responsible for requesting samples, analyses, and authorization to release effluents.

6.0 INSTRUCTIONS

NOTE: Meteorological, liquid, and gaseous pathway analyses are presented in Meteorological, Liquid, and Gaseous Pathway Analysis (Attachment 12).

6.1 Sampling and Monitoring Criteria

6.1.1 Surveys, sampling, and analyses shall use instruments calibrated for the type and range of radiation monitored and the type of discharge monitored.

6.1.2 Installed monitoring systems shall be calibrated for the type and range of radiation or parameter monitored.

6.1.3 A sufficient number of survey points shall be used or samples taken to adequately assess the status of the discharge monitored.

6.1.4 Samples shall be representative of the volume and type of discharge monitored.

6.1.5 Surveys, sampling, analyses, and monitoring records shall be accurately and legibly documented, and sufficiently detailed that the meaning and intent of the records are clear.

6.1.6 Surveys, analyses, and monitoring records shall be reviewed for trends, completeness, and accuracy.

6.2 Liquid Radioactive Waste Effluents

6.2.1 Liquid Effluent Concentration Limitations

a. Liquid waste concentrations discharged from the Station shall not exceed the following limits:

1. For radionuclides (other than dissolved or entrained noble gases), liquid effluent concentrations released to unrestricted areas shall not exceed ten times the effluent concentration values specified in 10 CFR 20, Appendix B, Table 2, Column 2.

2. For dissolved or entrained noble gases, concentrations shall not exceed 2E-4 μCi/mL.

b. If the concentration of liquid effluent exceeds the limits in Step 6.2.1.a., promptly reduce concentrations to within limits.

c. Concentrations of radioactive materials in liquid waste released to unrestricted areas shall meet the following:

$$\frac{\text{Volume of Waste Discharged + Volume of Dilution Water}}{\text{Volume of Waste Discharged} \times \sum_{i} \frac{\mu Ci/mL_i}{ACW_i}} \geq 1 \quad (1)$$

where:

$\mu Ci/mL_i$ = the concentration of nuclide i in the liquid effluent discharge

ACW_i = ten times the effluent concentration value in unrestricted areas of nuclide i, expressed as μCi/mL from 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases, and 2E-4 μCi/mL for dissolved or entrained noble gases

d. **Bases - Liquid Effluent Concentration Limitations**

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will not exceed 10 times the concentration values specified in Appendix B, Table 2, Column 2 of 10 CFR 20. The specification provides operational flexibility for releasing liquid effluent in concentrations to follow the Section II.A and II.C design objectives of Appendix I to 10 CFR Part 50. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) restrictions authorized by 10 CFR 20.1301(e). The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its effluent concentration 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 specification does not affect the requirements to comply with the annual limitations of 10 CFR 20.1301(e).

6.2.2 **Liquid Monitoring Instrumentation**

a. **Radioactive Liquid Effluent Monitoring Instrumentation**

Radioactive liquid effluent monitoring instrumentation channels shown on Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) shall be operable with their alarm/trip setpoints set to ensure that Step 6.2.1.a. limits are not exceeded.

1. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.2.2.d., Setpoint Calculation.

2. If a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.2.2.a., perform one of the following:
   - Promptly suspend release of radioactive liquid effluents monitored by the affected channel
   - Declare the channel inoperable
   - Change the setpoint to an acceptable, conservative value

b. **Radioactive Liquid Effluent Monitoring Instrumentation Operability**

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated operable by performing a Channel Check, Source Check, Channel Calibration, and Channel Functional Test at the frequencies shown in Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 2).

1. If the number of operable channels is less than the minimum required by the tables in Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) perform the action shown in those tables.

2. Attempt to return the instruments to operable status within 30 days. If unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. **Applicable Monitors**

Liquid effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
Service Water System Effluent Line	1-SW-RM-107 A, B, C, D
Condenser Circulating Water Line	1-SW-RM-120 2-SW-RM-220
Radwaste Facility Effluent Line	RE- RRM-131

d. **Setpoint Calculation**

NOTE: This methodology does not preclude use of more conservative setpoints.

1. Maximum setpoint values shall be calculated by:

$$S = \frac{CF_D}{F_E} \qquad (2)$$

where:

S = the setpoint, in μCi/mL, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution

C = the effluent concentration limit for the monitor used to implement 10 CFR 20 for the Station (ACW in μCi/mL) for an isotopic mixture expected in the effluent

F_E = maximum design pathway effluent flow rate

F_D = dilution water flow rate calculated as:
F_E + (200,000 gpm x number of circ. pumps in service)

2. Each of the condenser circulating water channels (e.g., SW-120, SW-220) monitors the effluent (service water, including component cooling service water, circulating water, and liquid radwaste) in the circulating water discharge tunnel beyond the last point of possible radioactive material addition. No dilution is assumed for this pathway. Therefore, Equation (2) becomes:

$$S = C \qquad (3)$$

The setpoint for Station monitors used to implement 10 CFR 20 for the site becomes the effluent concentration limit.

3. In addition, for added conservatism, setpoints shall be calculated for the service water system effluent line (i.e., SW-107 A, B, C, D), and the Radwaste Facility effluent line (i.e., RRM-131).

4. For the service water system effluent line, Equation (2) becomes:

$$S = \frac{CF_D K_{SW}}{F_E} \quad (4)$$

where:

K_{SW} = Allocation fraction of the effluent concentration limit, used to implement 10 CFR 20 for the Station, attributable to the service water effluent line pathway

5. For the Radwaste Facility effluent line, Equation (2) becomes:

$$S = \frac{CF_D K_{RW}}{F_E} \quad (5)$$

where:

K_{RW} = Allocation fraction of the effluent concentration limit, used to implement 10 CFR 20 attributable to the Radwaste Facility effluent line pathway

6. The sum $K_{SW} + K_{RW}$ shall not be greater than 1.0.

e. **Bases - Radioactive Liquid Effluent Monitoring Instrumentation**

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding 10 times the limits of 10 CFR 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 10 CFR Part 50.

6.2.3 **Liquid Effluent Dose Limit**

a. **Requirement**

At least once per 31 days, perform the dose calculations in Step 6.2.3.c. to ensure the dose or dose commitment to the maximum exposed member of the public from radioactive materials in liquid releases (from each reactor unit) to unrestricted areas is limited to:

1. During any calendar quarter:
   - Less than or equal to 1.5 mrem to the total body
   - Less than or equal to 5 mrem to the critical organ
2. During any calendar year:
   - Less than or equal to 3 mrem to the total body
   - Less than or equal to 10 mrem to the critical organ

b. **Action**

If the calculated dose from release of radioactive materials in liquid effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that identifies causes for exceeding limits and defines corrective actions taken to reduce releases of radioactive materials in liquid effluents to ensure that subsequent releases will be in compliance with the above limits.

c. **Dose Contribution Calculations**

NOTE: All critical organ doses for each age group are calculated to determine which is the limiting organ for the period being evaluated.

Dose contributions shall be calculated for all radionuclides identified in liquid effluents released to unrestricted areas based on the equation:

$$D = t\,F\,M \sum_{i} C_i A_i \qquad (6)$$

where:

Subscripts = i, refers to individual radionuclide

D = the cumulative dose commitment to the total body or critical organ from the liquid effluents for the period t, in mrem

t = the period for which C_i and F are averaged for all liquid releases, in hours

M = the mixing ratio (reciprocal of the dilution factor) at the point of exposure, dimensionless, 0.2 from Appendix 11A, Surry UFSAR

F = the near field average dilution factor for C_i during any liquid effluent release; the ratio of the average undiluted liquid waste flow during release to the average flow from the site discharge structure to unrestricted areas

C_i = the average concentration of radionuclide, i, in undiluted liquid effluent during the period t, from all liquid releases, in µCi/mL

A_i = the site-related ingestion dose commitment factor to the total body or critical organ for a particular age group for each identified principal gamma and beta emitter in mrem/hr per µCi/mL

$$A_i = 1.14\ E{+}05\ (21BF_i + 5BI_i)\ DF_i \qquad (7)$$

For example:

1.14 E+05 = 1 E+06 pCi/μCi x 1 E+03 mL/L / (8760 hr/yr), units conversion factor

21 = adult fish consumption, kg/yr, from NUREG-0133

5 = adult invertebrate consumption, kg/yr, from NUREG-0133

BI_i = the salt water bioaccumulation factor for nuclide i, in invertebrates, pCi/kg per pCi/L

BF_i = the salt water bioaccumulation factor for nuclide i, in fish, pCi/kg per pCi/L

DF_i = the critical organ dose conversion factor for nuclide i, for adults, in mrem/pCi

NOTE: The above parameters were obtained from R.G. 1.109, Rev. 1, LADTAP II and VCRL-50564, Rev. 1.

d. **Quarterly Composite Analyses**

For radionuclides not determined in each batch or weekly composite, dose contribution to current monthly or calendar quarter cumulative summation may be approximated by assuming an average monthly concentration based on previous monthly or quarterly composite analyses. However, for reporting purposes, calculated dose contribution shall be based on the actual composite analyses.

e. **Bases - Dose Due To Liquid Effluents**

This control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I to 10 CFR Part 50. The control implements the guides set forth in Section II.A. 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 releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A that conformance with the guides of Appendix I be shown by calculation procedures, such that the actual exposure of a MEMBER OF THE PUBLIC is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

6.2.4 **Liquid Radwaste Treatment**

Historical data pertaining to the volumes and radioactivity of liquid effluents released in connection with specific station functions, such as maintenance or refueling outages, shall be used in projections as appropriate.

a. **Requirement**

1. The Surry Radwaste Facility Liquid Waste System shall be used to reduce the radioactive materials in liquid waste prior to discharge when projected dose due to liquid effluent, from each reactor unit, to unrestricted areas would exceed 0.06 mrem to total body or 0.2 mrem to the critical organ in a 31-day period.
2. Doses due to liquid releases shall be projected at least once per 31 days.

b. **Action**

If radioactive liquid waste is discharged without treatment and in excess of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that includes the following:

1. An explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or sub-system, and the reason for the inoperability.
2. Actions taken to restore inoperable equipment to operable status.
3. Summary description of actions taken to prevent recurrence.

c. **Projected Total Body and Critical Organ Dose Calculation**

1. Determine D_L, the sum of all liquid open and closed release points, in mrem, by the ith organ, for the quarter.
2. Determine P, the Projection Factor, which is result of 31 divided by the number of days from start of the quarter to the end of the release.
3. Determine Da, additional anticipated dose for liquid releases by the ith organ for the particular quarter of the release.
4. Determine Dp, the 31 day projected dose by the ith organ:
   $Dp = (D_L \times P) + Da$

d. **Bases - Liquid Radwaste Treatment System**

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

6.2.5 **Liquid Sampling**

Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis requirements in Radioactive Liquid Waste Sampling and Analysis Program (Attachment 3).

6.3 Gaseous Radioactive Waste Effluents

6.3.1 Gaseous Effluent Dose Rate Limitations

a. **Requirement**

Dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to:

1. The dose rate limit for noble gases shall be $\leq$ 500 mrem/year to the total body and $\leq$ 3000 mrem/year to the skin.
2. The dose rate limit for I^{131}, I^{133}, for tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days shall be $\leq$ 1500 mrem/year to the critical organ.

b. **Action**

1. If dose rates exceed Step 6.3.1.a. limits, promptly decrease the release rate to within the above limits.
2. Dose rates due to noble gases in gaseous effluents shall be determined, continuously, to be within Step 6.3.1.a. limits.
3. Dose rates due to I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents shall be determined to be within the above limits by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified on Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4).

c. **Calculations of Gaseous Effluent Dose Rates**

1. The dose rate limit for noble gases shall be determined to be within the limit by limiting the release rate to the lesser of:

$$\sum_i [(K_i \dot{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + (K_i \dot{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \leq 500 \text{ mrem/yr to the total body} \quad (8)$$

OR

$$\sum_i [((L_i + 1.1M_i)\dot{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + ((L_i + 1.1M_i)\dot{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \leq 3000 \text{ mrem/yr to the skin} \quad (9)$$

where:

Subscripts	=	vv, refers to vent releases from the building ventilation vent, including Radwaste Facility Ventilation Vent; pv, refers to the vent releases from the process vent; i, refers to individual radionuclide
K_i	=	the total body dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrem/yr per Curie/m^3
L_i	=	the skin dose factor due to beta emissions for each identified noble gas radionuclide i, in mrem/yr per Curie/m^3
M_i	=	the air dose factor due to gamma emissions for each identified noble gas radionuclide, i, in mrad/yr per Curie/m^3
$\dot{Q}_{ivv}$, $\dot{Q}_{ipv}$	=	the release rate for ventilation vents or process vent of noble gas radionuclide i, in gaseous effluents in Curie/sec (per site)
1.1	=	the unit conversion factor that converts air dose to skin dose, in mrem/mrad
X/Q_{ivv}, X/Q_{ipv}	=	the gaseous dispersion factor, sec/m^3(See Attachment 7)

2. The dose rate limit for I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days, shall be determined to be within the limit by restricting the release rate to:

$$\sum_i [P_i \dot{Q}_{ivv} \frac{\dot{X}}{Q_{ivv}} + P_i \dot{Q}_{ipv} \frac{\dot{X}}{Q_{ipv}}] \leq 1500 \text{ mrem/yr to the critical organ} \quad (10)$$

where:

P_i = the critical organ dose factor for I^{131}, I^{133}, H^3, and all radionuclides in particulate form with half-lives greater than 8 days, for the child inhalation pathway, in mrem/yr per Curie/m^3

$\dot{Q}_{ivv}, \dot{Q}_{ipv}$ = the release rate for ventilation vents or process vent of I^{131}, I^{133}, H^3, and all radionuclides i, in particulate form with half-lives greater than 8 days, in gaseous effluents in Curie/sec (per site)

$X/Q_{ivv}, X/Q_{ipv}$ = the gaseous dispersion factor, sec/m^3(See Attachment 7)

3. All gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\dot{Q}_{ivv}$.

d. **Bases - Dose Rate**

This specification provides reasonable assurance radioactive materials discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either at or beyond the SITE BOUNDARY, in excess of the design objectives of Appendix I to 10 CFR Part 50. This specification is provided to ensure that gaseous effluents from all units on the site will be appropriately controlled. It provides operational flexibility for releasing gaseous effluents to satisfy the Section II.A and II.C design objectives of Appendix I to 10 CFR Part 50. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body, less than or equal to 3000 mrem/year to the skin and the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year. This specification does not affect the requirements to comply with the annual limitation of 10 CFR 20.1301(a). This control applies to the release of radioactive materials in gaseous effluents from all units at the site.

6.3.2 **Gaseous Monitoring Instrumentation**

a. **Requirement**

1. The radioactive gaseous effluent monitoring instrumentation channels shown in Radioactive Gaseous Effluent Monitoring Instrumentation (Attachment 5) shall be operable with alarm/trip setpoints set to ensure that Step 6.3.1.a. noble gas limits are not exceeded. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.3.2.d.

2. Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated operable by Channel Checks, Source Checks, Channel Calibrations, and Channel Functional Tests at the frequencies shown in Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 6).

b. **Action**

1. If a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.3.2.a.1, promptly:
   - Suspend the release of radioactive gaseous effluents monitored by the affected channel **and** declare the channel inoperable

     or
   - Change the setpoint so it is acceptably conservative

2. If the number of operable channels is less than the minimum required by tables in Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4), take the action shown in those tables.

3. Attempt to return instruments to operable status within 30 days. If unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. **Applicable Monitors**

Radioactive gaseous effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
Process Vent	1-GW-RM-130B
Condenser Air Ejector	1-SV-RM-111 2-SV-RM-211
Ventilation Vent No. 1	1-VG-RM-104
Ventilation Vent No. 2	1-VG-RM-131B
Radwaste Facility Vent	RRM-101

d. **Setpoint Calculations**

1. Setpoint calculations for each monitor listed in Step 6.3.2.c. shall maintain this relationship:

$$D \geq D_{pv} + D_{cae} + D_{vv} \qquad (11)$$

where:

D = Step 6.3.1.a. dose limits that implement Technical Specifications for the Station, mrem/yr

D_{pv} = the noble gas site boundary dose rate from process vent gaseous effluent releases, mrem/yr

D_{cae} = the noble gas site boundary dose rate from condenser air ejector gaseous effluent releases, mrem/yr

D_{vv} = the noble gas site boundary dose rate from summation of the Ventilation Vents 1, 2, and the Radwaste Facility vent gaseous effluent releases, mrem/yr

2. Setpoint values shall be determined by:

$$C_m = \frac{R_m \times 2.12\ E\text{-}03}{F_m} \qquad (12)$$

where:

m	=	the release pathway, process vent (pv), ventilation vent (vv) condenser air ejector (cae), or Radwaste Facility (rv)
C_m	=	the effluent concentration limit implementing Step 6.3.1.a. for the Station, µCi/mL
R_m	=	the release rate limit for pathway m determined from methodology in Step 6.3.1.c., typically using Xe^{133} as nuclide to be released, µCi/sec
2.12E-03	=	CFM per mL/sec
F_m	=	the maximum flow rate for pathway m, CFM

NOTE: According to NUREG-0133, the radioactive effluent radiation monitor alarm/trip setpoints should be based on the radioactive noble gases. It is not practicable to apply instantaneous alarm/trip setpoints to integrating monitors sensitive to radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases.

e. **Bases - Radioactive Gaseous Effluent Monitoring Instrumentation**

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the gaseous effluent dose rate limits of Section 6.3 of the ODCM. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

6.3.3 **Noble Gas Effluent Air Dose Limit**

a. **Requirement**

1. The air dose in unrestricted areas due to noble gases released in gaseous effluents from each unit at or beyond the site boundary shall be limited to:
   - During any calendar quarter: ≤ 5 mrads for gamma radiation and ≤ 10 mrad for beta radiation
   - During any calendar year: ≤ 10 mrads for gamma radiation and ≤ 20 mrad for beta radiation

2. Cumulative dose contributions for noble gases for the current calendar quarter and current calendar year shall be determined in accordance with Step 6.3.3.c. at least once per 31 days.

b. **Action**

If the calculated air dose from radioactive noble gases in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that identifies the causes for exceeding the limits and defines corrective actions that have been taken to reduce releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the limits in Step 6.3.3.a.

c. **Noble Gas Effluent Air Dose Calculation**

Gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\overline{Q}_{ivv}$.

The air dose to areas at or beyond the site boundary due to noble gases shall be determined by the following:

For gamma radiation:

$$D_g = 3.17E\text{-}08 \sum_i [(M_i \overline{Q}_{ivv} \frac{\dot{X}}{Q_{ivv}}) + (M_i \overline{Q}_{ipv} \frac{\dot{X}}{Q_{ipv}})] \qquad (13)$$

For beta radiation:

$$D_b = 3.17E\text{-}08 \sum_i [(N_i \overline{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + (N_i \overline{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \quad (14)$$

Where:

Subscripts	=	vv, refers to vent releases from the building ventilation vents, including the Radwaste Facility Ventilation Vent and air ejectors pv, refers to the vent releases from the process vent i, refers to individual radionuclide
D_g	=	the air dose for gamma radiation, in mrad
D_b	=	the air dose for beta radiation, in mrad
M_i	=	the air dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/m^3
N_i	=	the air dose factor due to beta emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/m^3
$\overline{Q}_{ivv}$, $\overline{Q}_{ipv}$	=	the release for ventilation vents or process vent of noble gas radionuclide i, in gaseous effluents for 31 days, quarter, or year as appropriate in Curies (per site)
3.17 E-08	=	the inverse of the number of seconds in a year
X/Q_{ivv}, X/Q_{ipv}	=	the gaseous dispersion factor, sec/m^3(See Attachment 7)

6.3.4 **I-131, 133, H-3 & Radionuclides in Particulate Form Effluent Dose Limit**

a. **Requirement**

1. Methods shall be implemented to ensure that the dose to any organ of a member of the public from I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released from the site to unrestricted areas from each reactor unit shall be:
   - During any calendar quarter: ≤ 7.5 mrem to the critical organ
   - During any calendar year: ≤ 15 mrem to the critical organ

2. Cumulative dose contributions to a member of the public from I^{131}, I^{133}, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released to unrestricted areas for the current calendar quarter and current calendar year shall be determined at least once per 31 days in accordance with Step 6.3.4.c.

b. **Action**

If the calculated dose from the release of I^{131}, I^{133}, tritium, and radionuclides in particulate form, with half-lives greater than 8 days, in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that contains the:

1. Causes for exceeding limits.
2. Corrective actions taken to reduce releases.
3. Proposed corrective actions to be taken to assure that subsequent releases will be in compliance with limits stated in Step 6.3.4.a.

c. **Dose Calculations**

NOTE: All critical organ doses for each age group are calculated to determine which is the limiting organ for the period being evaluated.

Gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\bar{Q}_{ivv}$. Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection to specific Station functions, such as containment purges, shall be used in the estimates, as appropriate.

1. The dose to the maximum exposed member of the public, attributable to gaseous effluents at and beyond the site boundary that contain I^{131}, I^{133}, tritium, and particulate-form radionuclides with half-lives greater than 8 days, shall be determined by:

$$D_r = 3.17E-08 \sum_i \left[RM\left(Q_{ivv} \cdot {}^{D}/_{Q_{vv}} + Q_{ipv} \cdot {}^{D}/_{Q_{pv}}\right) + RI\left(Q_{ivv} \cdot {}^{X}/_{Q_{vv}} + Q_{ipv} \cdot {}^{X}/_{Q_{pv}}\right) + RG\left(Q_{ivv} \cdot {}^{D}/_{Q_{vv}} + Q_{ipv} \cdot {}^{D}/_{Q_{pv}}\right) + RH^3\left(Q_{ivv} \cdot {}^{X}/_{Q_{vv}} + Q_{ipv} \cdot {}^{X}/_{Q_{pv}}\right)\right] \quad (15)$$

For example:

Subscripts	=	vv, refers to vent releases from the building ventilation vents, including the Radwaste Facility Ventilation Vent and air ejectors; pv, refers to the vent releases from the process vent
D_r	=	the dose to the critical organ of the maximum exposed member of the public in mrem
$\tilde{Q}_{ivv}, \tilde{Q}_{ipv}$	=	the release for ventilation vents or process vent of I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than 8 days in Curies
3.17 E-08	=	the inverse of the number of seconds in a year
X/Q_{vv}, X/Q_{pv}	=	the gaseous dispersion factor, sec/m^3(See Attachment 7)
D/Q_{vv}, D/Q_{pv}	=	the gaseous deposition factor, m^{-2} (See Attachment 7)
RM	=	the cow-milk pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in m^2·mrem/yr per Ci/sec
RI	=	the inhalation pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in mrem/yr per Ci/m^3
RG	=	the ground plane pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in m^2·mrem/yr per Ci/sec
RH^3	=	the tritium dose factor for milk in mrem/yr per Ci/m^3

6.3.5 **Gaseous Radwaste Treatment**

Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection with specific Station functions, such as containment purges, shall be used to calculate projected doses, as appropriate.

a. **Requirement**

1. Appropriate portions of the Gaseous Radwaste Treatment System shall be used to reduce radioactive materials in gaseous waste before its discharge, when the projected gaseous effluent air doses due to gaseous effluent releases, from each unit to areas at and beyond the site boundary, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation, averaged over 31 days.
2. The Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous waste before its discharge, when the projected doses due to gaseous effluent releases, from each unit to areas at and beyond the site boundary, would exceed 0.3 mrem to the critical organ, averaged over 31 days.
3. Doses due to gaseous releases from the site shall be projected at least once per 31 days, based on the calculations in Step 6.3.5.c.

b. **Action**

If gaseous waste that exceeds the limits in Step 6.3.5.a. is discharged without treatment, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that includes:

1. An explanation why gaseous radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability.
2. Actions taken to restore the inoperable equipment to operable status.
3. Summary description of actions taken to prevent recurrence.

c. **Projected Dose Calculations**

1. Determine Dg, the sum of all gaseous open and closed release points, in mrem, by the ith organ, for the quarter.
2. Determine P, the Projection Factor, which is result of 31 divided by the number of days from start of the quarter to the end of the release.

3. Determine Da, additional anticipated dose for gaseous releases by the ith organ for the particular quarter of the release.

4. Determine Dp, the 31 day projected dose by the ith organ.
   $Dp = (Dg \times P) + Da$

6.4 Radioactive Liquid and Gaseous Release Permits

RP shall maintain procedures for Liquid and Gaseous Release Permits to ensure effluent dose limits are not exceeded when making releases. As indicated on Attachment 3, Radioactive Liquid Waste Sampling and Analysis Program, prerelease assessments/permits are required for batch releases. Depending on the affected plant system, continuous releases may or may not allow for a prerelease assessment and are evaluated on a case by case basis.

6.4.1 Liquid Waste Batch Releases

a. Operations shall obtain RP authorization before initiating batch releases of radioactive liquids.

b. Release of contents from the following tanks/sumps other than transfers to the Radwaste Facility shall have a release permit before the discharge. Examples of batch releases include:
   - Turbine Building Sumps when RP determines that source activity requires placing pumps in manual mode
   - Condensate Polishing Building Sumps and Steam Generator secondary water when RP determines the presence of contamination from primary-to-secondary leakage
   - Radwaste Facility release tanks (LWMT, LDMT)

6.4.2 Continuous Liquid Releases

a. Operations shall obtain RP authorization before initiating continuous releases of radioactive liquids.

b. Examples of continuous releases include:
   - Steam generator blowdown
   - Component Cooling Water (CCW) heat exchanger to service water leakage, if applicable
   - Turbine building sumps and subsurface drains when pumps are in automatic mode or storm drains

6.4.3 **Waste Gas Decay Tank (WGDT) Release Permit**

Operations shall obtain RP authorization before initiating WGDT releases.

6.4.4 **Reactor Containment Release Permits**

Operations shall obtain authorization from RP before initiating containment purges or containment hogging. Reactor Containment Release Permits shall be valid from start of purge/hog until:

- Routine termination
- Terminated for cause by RP
- Receipt of Radiation Monitoring System (RMS) Containment Gas Monitor high alarm

6.4.5 **Miscellaneous Gaseous Release Permit**

Operations shall obtain RP authorization before initiating releases of noble gases that may not be accounted for by routine sampling, or any planned release not being routed through the Process Vent or Ventilation Vents.

6.4.6 **Radioactive Liquid and Gaseous Release Controls**

a. Operations shall notify RP of pending releases and request RP to initiate the appropriate release permit. Operations shall provide the necessary information to complete the required release permit.

b. A representative sample shall be obtained of the source to be released.

   1. Operations shall provide RP with liquid samples and sample information (e.g., time of sample) for samples obtained outside the Primary Sample Room.
   2. Chemistry shall provide RP with liquid samples and sample information for samples obtained from inside the Primary Sample Room.
   3. RP shall obtain gaseous samples.

c. RP shall perform required sample analyses.

d. RP shall calculate and record the following information on a release permit:
   - Maximum authorized release rate
   - Applicable conditions or controls pertaining to the release

e. RP shall notify the Operations Shift Supervision if it is determined that a release may not be within the effluent dose limits.

f. Upon receipt of a release permit from RP, Operations shall:

1. Verify the correct source is authorized for release.
2. Note maximum authorized release rate.
3. Note and ensure compliance with any indicated controls or conditions applicable to the release.

g. When commencing release, Operations shall provide RP with required information. As appropriate, required information shall include:

- Date and time release was started
- Starting tank/sump level
- Beginning pressure
- Release flow rate
- Dilution water flow rate

h. Upon terminating the release, Operations shall return the permit to RP and provide information necessary for completion of permit. As appropriate, required information shall include:

- Date and time release was stopped
- Tank/sump ending level
- Release flow rate just prior to termination
- Ending pressure
- Volume released

6.5 Total Dose Limit to Public From Uranium Fuel Cycle Sources

6.5.1 Requirement

The annual (calendar year) dose or dose commitment to a real individual due to releases of radioactivity and radiation from uranium fuel cycle sources shall not exceed 25 mrem to the total body or the critical organ (except the thyroid, which shall not exceed 75 mrem).

6.5.2 **Action**

a. If the calculated doses from release of radioactive materials in liquid or gaseous effluents exceed twice the limits in Steps 6.2.3.a., 6.3.3.a., or 6.3.4.a., calculate (including direct radiation contribution from the units and from outside storage tanks) whether limits in Step 6.5.1 have been exceeded.

b. If the limits in Step 6.5.1 have been exceeded, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that defines the corrective action to be taken to reduce subsequent releases and to prevent recurrence, and includes a schedule for achieving conformance with the limits. Special reports, as defined in 10 CFR 20.2203(a)(4), shall include:

1. An analysis that estimates the radiation exposure (dose) to a real individual from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the releases covered by the report.
2. A description of the levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations.
3. If the estimated dose exceeds the limits in Step 6.5.1, and if the release condition that violates 40 CFR 190 has not already been corrected, the special report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

6.6 Radiological Environmental Monitoring

6.6.1 **Monitoring Program**

a. **Requirement**

1. The Radiological Environmental Monitoring Program shall be conducted as specified in Radiological Environmental Monitoring Program (Attachment 8).
2. Samples shall be collected from specific locations specified in Environmental Sampling Locations (Attachment 9).

3. Samples shall be analyzed in accordance with:
   - Radiological Environmental Monitoring Program (Attachment 8) requirements
   - Detection capabilities required by Detection Capabilities for Environmental Sample Analysis (Attachment 10)
   - Guidance of the Radiological Assessment Branch Technical Position on Environmental Monitoring dated November, 1979, Revision No. 1

b. **Action**

1. If the Radiological Environmental Monitoring Program is not being conducted as required in Step 6.6.1.a., report the situation in accordance with VPAP-2802, Notifications and Reports, by preparing and submitting to the NRC, in the Annual Radiological Environmental Operating Report required by Technical Specification (Surry Technical Specification 6.6.B.2), a description of the reasons for not conducting the program as required, and the plan for precluding recurrence.

2. If, when averaged over any calendar quarter, radioactivity exceeds the reporting levels of Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11), prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that:
   - Identifies the causes for exceeding the limits, and
   - Defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a member of the public is less than the calendar year limits of Steps 6.2.3, 6.3.3, and 6.3.4

   When more than one of the radionuclides listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11) are detected in the sampling medium, the report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0 \qquad (15)$$

3. When radionuclides other than those listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11) are detected and are the result of plant effluents, the report shall be submitted if the potential annual dose to a member of the public is equal to or greater than the calendar year limits of Steps 6.2.3, 6.3.3, and 6.3.4. The report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, report and describe the condition in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports.

4. If milk or fresh leafy vegetable samples are unavailable from one or more of the sample locations required by Radiological Environmental Monitoring Program (Attachment 8), identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Identify the cause of the unavailability of samples and identify the new locations for obtaining replacement samples in the next Annual Radioactive Effluent Release Report in accordance with VPAP-2802, Notifications and Reports.

5. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unavailable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the annual report in accordance with VPAP-2802, Notifications and Reports.

6.6.2 **Land Use Census**

a. **Requirement**

A land use census shall be conducted and shall identify, within a distance of 8 km (5 miles), the location in each of the 16 meteorological sectors of the following:

- Nearest milk animal
- Nearest residence
- Nearest garden greater than 50 m^2 (500 ft^2) that produces broad leaf vegetation

1. The land use census shall be conducted during the growing season, at least once per 12 months, using methods that will provide the best results (e.g., door-to-door survey, aerial survey, local agriculture authorities). Land use census results shall be included in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports.
2. In lieu of the garden census, broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted ground deposition (D/Qs). Specifications for broad leaf vegetation sampling in Radiological Environmental Monitoring Program (Attachment 8) shall be followed, including analysis of control samples.

b. **Action**

1. If a land use census identifies locations that yield a calculated dose or dose commitment greater than the values currently being calculated in Step 6.3.4.a., identify the new locations in the next Annual Radioactive Effluent Release Report in accordance with VPAP-2802, Notifications and Reports.
2. If a land use census identifies locations that yield a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained, add the new locations to the Radiological Environmental Monitoring Program within 30 days. Sampling locations, excluding the control station location, that have the lowest calculated dose or dose commitments (via the same exposure pathway) may be deleted from the monitoring program. Identify new locations in the next Annual Radioactive Effluent Release Report and include in the report revised figures and tables reflecting the new locations in accordance with VPAP-2802, Notifications and Reports. **[Commitment 3.2.1]**

6.6.3 **Interlaboratory Comparison Program**

a. **Requirement**

Radioactive materials (which contain nuclides produced at the Station), supplied as part of an Interlaboratory Comparison Program, shall be analyzed.

b. **Action**

1. Analyses shall be performed at least semi-annually as follows:

Program	Cross-Check of
Milk	I^{131}, Gamma, Sr^{89} and Sr^{90}
Water	Gross Beta, Gamma, I^{131}, H^3 (Tritium), Sr^{89} and Sr^{90} (blind—any combinations of above radionuclides)
Air Filter	Gross Beta, Gamma, Sr^{90}

2. If analyses are not performed as required by Step 6.6.3.b., report in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports, the corrective actions taken to prevent recurrence.

c. **Results**

Results shall be reported in the Annual Radiological Environmental Monitoring Report in accordance with VPAP-2802, Notifications and Reports.

6.7 Reporting Requirements

6.7.1 **Annual Radiological Environmental Operating Report**

Routine Radiological Environmental Operating Reports covering the operation of the units during the previous calendar year shall be submitted prior to May 1 of each year. A single submittal may be made for the Station. Radiological Environmental Operating Reports shall include:

a. Summaries, interpretations, and analysis of trends of results of radiological environmental surveillance activities for the report period, including:

- A comparison (as appropriate) with preoperational studies, operational controls, and previous environmental surveillance reports
- An assessment of the observed impacts of the plant operation on the environment
- Results of land use census per Step 6.6.2

b. Results of analysis of radiological environmental samples and of environmental radiation measurements taken per Step 6.6.1, Monitoring Program. Results shall be summarized and tabulated in the format of the table in the Radiological Assessment Branch Technical Position on Environmental Monitoring.

   1. If some individual results are not available for inclusion with the report, the report shall be submitted, noting and explaining reasons for missing results.

   2. Missing data shall be submitted in a supplementary report as soon as possible.

c. A summary description of the radiological environmental monitoring program.

d. At least two legible maps covering sampling locations, keyed to a table giving distances and directions from the centerline of one reactor. One map shall cover stations near the site boundary; a second shall include more distant stations.

e. Results of Station participation in the Interlaboratory Comparison Program, per Step 6.6.3.

f. Discussion of deviations from the Station's environmental sampling schedule per Radiological Environmental Monitoring Program (Attachment 8).

g. Discussion of analyses in which the lower limit of detection (LLD) required by Detection Capabilities for Environmental Sample Analysis (Attachment 10) was not achievable.

h. Results of analysis of ground water wells described in the environmental monitoring program, whether required by the program or not.

NOTE: NUREG-0543 states: "There is reasonable assurance that sites with up to four operating reactors that have releases within Appendix I design objective values are also in conformance with the EPA Uranium Fuel Cycle Standard, 40 CFR Part 190."

6.7.2 **Annual Radioactive Effluent Release Report**

a. **Requirement - Station**

Radioactive Effluent Release Reports covering operation of the units during the previous 12 months of operation shall be submitted before May 1 of each year. A single submittal may be made for the Station and should combine those sections that are common to both units. Radioactive Effluent Release Reports shall include:

1. A summary of quantities of radioactive liquid and gaseous effluents and solid waste released. Data shall be summarized on a quarterly basis following the format of Regulatory Guide 1.21, Appendix B, for liquid and gaseous effluents. Data shall be summarized on an annual basis following the format of Regulatory Guide 1.21, Appendix B, for solid waste.
   [Commitment 3.2.2]
2. An assessment of radiation doses to the maximum exposed members of the public due to the radioactive liquid and gaseous effluents released from the Station during the previous calendar year. This assessment shall be in accordance with Step 6.7.2.b.
3. A list and description of unplanned releases from the site to unrestricted areas, during the reporting period, which meet the following criteria:
   - Unplanned releases that exceeded the limits in Steps 6.2.1 and 6.3.1
   - Unplanned releases which require a Condition Report and involve the discharge of contents of the wrong Waste Gas Decay Tank or the wrong liquid radwaste release tank
   - Unplanned releases from large leaks due to unexpected valve or pipe failures that result in a quantity of release such that a 10 CFR 50.72, Immediate Notification Requirements for Operating Nuclear Power Reactors or 10 CFR 50.73, Licensee Event Report System, report is required
   - Unplanned releases as determined by Radiation Protection Supervision, which may or may not require a Condition Report

4. Major changes to radioactive liquid, gaseous, and solid waste treatment systems during the reporting period.
5. Changes to VPAP-2103S, Offsite Dose Calculation Manual (Surry) (See Step 6.7.4).
6. A listing of new locations for dose calculations or environmental monitoring identified by the land use census (See Step 6.6.2).
7. A summary of radioactive leaks or spills meeting the following criteria:
   - An unintended spill or leak with the potential to reach groundwater, as defined in NEI 07-07, **and**
   - The spill or leak must be greater than 100 gallons in volume or the volume cannot be quantified but is estimated to be greater than 100 gallons; **or**
   - Any spill or leak, regardless of volume or activity deemed by the licensee to be reportable.
8. Groundwater sample results from locations not part of the Radiological Environmental Monitoring Program.

b. **Dose Assessment - Station**

1. Radiation dose to individuals due to radioactive liquid and gaseous effluents from the Station during the previous calendar year shall either be calculated in accordance with this procedure or in accordance with Regulatory Guide 1.109. Population doses shall not be included in dose assessments.
2. The dose to the maximum exposed member of the public due to radioactive liquid and gaseous effluents from the Station and from the ISFSI shall be incorporated with the dose assessment performed above. If the dose to the maximum exposed member of the public exceeds twice the limits of 6.2.3.a.1, 6.2.3.a.2, 6.3.3.a.1, or 6.3.4.a.1, the dose assessment shall include the contribution from direct radiation.
3. Meteorological conditions during the previous calendar year or historical annual average atmospheric dispersion conditions shall be used to determine gaseous pathway doses.

NOTE: The Annual Radioactive Effluent Release Reports for Surry Station and Surry ISFSI are separate and not submitted as a combined report.

c. **Requirement - ISFSI**

1. Radioactive Effluent Release Report covering operation of the ISFSI during the previous 12 months of operation shall be submitted within 60 days after January 1.

2. The ISFSI Radioactive Effluent Release Report shall specify the quantities of each of the principal radionuclides released to the environment in liquid and in gaseous effluents.

3. **Dose Assessment - ISFSI**

   Provide such information as may be required by the Commission to estimate potential radiation dose commitment to the public resulting from effluent releases from the ISFSI.

6.7.3 **Annual Meteorological Data**

a. Meteorological data collected during the previous year shall be in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.

b. Meteorological data shall be retained in a file on site and shall be made available to NRC upon request.

6.7.4 **Changes to the ODCM**

Changes to the ODCM shall be:

a. Approved by the Site Vice President before implementation.

b. Documented. Records of reviews shall be retained as Station records. Documentation shall include:

1. Sufficient information to support changes, together with appropriate analyses or evaluations justifying changes.

2. A determination that a change will not adversely impact the accuracy or reliability of effluent doses or setpoint calculations, and will maintain the level of radioactive effluent control required by:
   - 10 CFR 20, Subpart D
   - 40 CFR 190
   - 10 CFR 50.36a
   - 10 CFR 50, Appendix I
   - Technical Specifications

c. Submitted to NRC in the form of a complete, legible copy of the entire ODCM as a part of, or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change 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, and shall indicate the date (e.g., month/year) the change was implemented.

d. Submitted to NRC in accordance with VPAP-2802, Notifications and Reports.

6.7.5 **Industry Ground Water Protection Initiative**

a. **Program**

The Ground Water Protection Program is established in Administrative Procedure RP-AA-502, Groundwater Protection Program.

NOTE: RP-AA-502 Attachment 1, Voluntary Communication Protocol, contains a flow chart to assist with determining if an event should be communicated to State and Local officials and to the NRC.

b. **Communications**

1. Informal communication shall be made to the State, Local and NRC officials by the end of the next business day for any spill or leak meeting the requirements of 6.7.2.a.7.

2. Informal communication shall be made to the State, Local and NRC officials by the end of the next business day for a water sample result that meets the following criteria:
   - An off-site ground water or surface water sample result that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11).
   - An on-site surface water sample result, that is hydrologically connected to ground water, or ground water that is or could be used as a source of drinking water, that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11).

c. **30-Day Reports**

1. Submit a written 30-day report to the NRC for a water sample result for on-site or off-site ground water that is or could be used as a source of drinking water that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11). A 30-day report is only required on the initial discovery of a contaminated ground water plume.
2. Concurrently submit a copy of the written 30-day NRC report to the appropriate State and Local officials.

d. **Annual Reports**

1. Report sample results communicated per 6.7.5.b.1 in the Annual Radiological Effluent Release Report.
2. Report ground water sample results that are not included in the Radiological Environmental Monitoring Program in the Annual Radiological Effluent Release Report.
3. Report sample results communicated per 6.7.5.b.2 in the Annual Radiological Effluent Release Report or the Annual Radiological Environmental Operating Report.
4. Report ground water sample results that are included in the Radiological Environmental Monitoring Program in the Annual Radiological Environmental Operating Report.

7.0 RECORDS

7.1 The following record(s) completed as a result of this procedure are required to be transmitted to Nuclear Document Management (NDM). The records have been identified and retention requirements established for the Nuclear Records Retention Schedule (NRRS) per RM-AA-101, Record Creation, Transmittal, and Retrieval.

7.1.1 **Quality Assurance Records**

- Records of changes to the ODCM in accordance with Step 6.7.4
- Records of meteorological data in accordance with Step 6.7.3
- Records of sampling and analyses
- Records of radioactive materials and other effluents released to the environment
- Records of preventive maintenance, surveillances, and calibrations

7.1.2 **Non-Quality Assurance Records**

None

7.2 The following record(s) completed as a result of this procedure are **NOT** required to be transmitted to Nuclear Document Management (NDM), but are required to be retained as indicated below. The NRRS has been updated and Alternate Storage approved per RM-AA-101 for Quality Assurance Records.

7.2.1 **Quality Assurance Records**

None

7.2.2 **Non-Quality Assurance Records**

None

7.3 The following item(s) completed as a result of this procedure are **NOT** records and are **NOT** required to be transmitted to Nuclear Document Management (NDM).

None

ATTACHMENT 1

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Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	Minimum Operable Channels	Action
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE		
(a) Radwaste Facility Liquid Effluent Line,		
RE-RRM-131	1	1
2. GROSS BETA OR GAMMA RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE		
(a) Circulating Water Discharge Lines,		
Unit 1: 1-SW-RM-120	1	2
Unit 2: 2-SW-RM-220	1	2
(b) Component Cooling Service Water Effluent Lines,		
1-SW-RM-107A	1	2
1-SW-RM-107B	1	2
1-SW-RM-107C	1	2
1-SW-RM-107D	1	2
3. FLOW RATE MEASUREMENT DEVICES		
(a) Radwaste Facility Liquid Effluent Line,		
Instrument Loop RLW-153	1	1

ACTION 1: If the number of operable channels is less than required, effluent releases via this pathway shall be suspended.

ACTION 2: If the number of operable channels is less than required, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed for principal gamma emitters, as defined in Radioactive Liquid Waste Sampling and Analysis Program (Attachment 3). When the effluent release via this pathway continues, then initiate the "Loss of Radioactive Liquid Effluent Monitoring Instrumentation Sampling Schedule" attachment in HP-3010.021, Radioactive Liquid Waste Sampling and Analysis.

ATTACHMENT 2

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Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Channel Description	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE				
(a) Radwaste Facility Liquid Effluent Line, RE-RRM-131	D	P	R	Q
2. GROSS BETA OR GAMMA RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE				
(a) Circulating Water Discharge Lines, Unit 1: 1-SW-RM-120 Unit 2: 2-SW-RM-220	D	M	R	Q
(b) Component Cooling Service Water Effluent Lines, 1-SW-RM-107A 1-SW-RM-107B 1-SW-RM-107C 1-SW-RM-107D	D	M	R	Q
3. FLOW RATE MEASUREMENT DEVICES				
(a) Radwaste Facility Liquid Effluent Line, Instrument Loop RLW-153	DR	N/A	R	N/A

ATTACHMENT 3

(Page 1 of 3)

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), **(Note 1)**
Batch Releases **(Note 2)**	P (Each Batch)	P (Each Batch)	Principal Gamma Emitters **(Note 3)**	5×10^{-7}
			I^{131}	1×10^{-6}
	P (One Batch/M)	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P (Each Batch)	M Composite **(Note 4)**	H^3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P (Each Batch)	Q Composite **(Note 4)**	Sr^{89} and Sr^{90}	5×10^{-8}
			Fe^{55}	1×10^{-6}
Continuous Releases **(Note 5)**	Continuous **(Note 6)**	W Composite **(Note 6)**	Principal Gamma Emitters **(Note 6)**	5×10^{-7}
			I^{131}	1×10^{-6}
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	Continuous **(Note 6)**	M Composite **(Note 6)**	H^3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous **(Note 6)**	Q Composite **(Note 6)**	Sr^{89} and Sr^{90}	5×10^{-8}
			Fe^{55}	1×10^{-6}

ATTACHMENT 3

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Radioactive Liquid Waste Sampling and Analysis Program

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (8\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection (as microcuries per unit mass or volume) (See Subsection 4.9)
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm)
E	=	the counting efficiency (as counts per disintegration)
V	=	the sample size (in units of mass or volume)
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie
Y	=	the fractional radiochemical yield (when applicable)
λ	=	the radioactive decay constant for the particular radionuclide
Δt	=	the elapsed time between the midpoint of sample collection and time of counting

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

NOTE 2: A batch release is the discharge of liquid wastes of a discrete volume. Before sampling for analyses, each batch shall be isolated, and appropriate methods will be used to obtain a representative sample for analysis.

ATTACHMENT 3

(Page 3 of 3)

Radioactive Liquid Waste Sampling and Analysis Program

NOTE 3: The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Mn^{54}, Fe^{59}, Co^{58}, Co^{60}, Zn^{65}, Mo^{99}, Cs^{134}, Cs^{137}, Ce^{141}, and Ce^{144}. This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, at levels exceeding the LLD, together with the above nuclides, shall also be identified and reported.

NOTE 4: A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and for which the method of sampling employed results in a specimen that is representative of the liquids released.

NOTE 5: A continuous release is the discharge of liquid wastes of a non-discrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

NOTE 6: To be representative of the quantities and concentrations of radioactive materials in liquid effluents, composite sampling shall employ appropriate methods which will result in a specimen representative of the effluent release.

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/mL), **(Note 1)**
A. Waste Gas Storage Tank	Prior to Release (Each Tank) (Grab Sample)	Prior to Release (Each Tank)	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
B. Containment Purge	Prior to Release (Each PURGE) (Grab Sample)	Prior to Release (Each PURGE)	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}
C. Ventilation **(1)Process Vent** **(2)Vent Vent #1** **(3)Vent Vent #2** **(4)SRF Vent**	Weekly (Grab Sample) **(Note 3)**	Weekly **(Note 3)**	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}
All Release Types as listed in A, B, and C	Continuous **(Note 4)**	Weekly **(Note 5)** (Charcoal Sample)	I^{131}	1×10^{-12}
			I^{133}	1×10^{-10}
	Continuous **(Note 4)**	Weekly **(Note 5)** Particulate Sample	Principal Gamma Emitter **(Note 2)**	1×10^{-11}
	Continuous **(Note 4)**	Weekly Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous **(Note 4)**	Quarterly Composite Particulate	Sr^{89} and Sr^{90}	1×10^{-11}
	Continuous **(Note 4)**	Noble Gas Monitor	Noble Gases Gross Beta and Gamma	1×10^{-6}
Condenser Air Ejector	Weekly Grab Sample **(Note 3)**	Weekly **(Note 3)**	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/mL), **(Note 1)**
Containment Hog Depressurization	Prior to Release (Grab Sample)	Prior to Release (Each Release)	Principal Gamma Emitters	1×10^{-4}
			H^3	1×10^{-6}
	Continuous **(Note 4)**	Charcoal Sample **(Note 6)**	I^{131}	1×10^{-11}
			I^{133}	1×10^{-10}
	Continuous **(Note 4)**	Particulate Sample **(Note 6)**	Principal Gamma Emitter **(Note 2)**	1×10^{-10}
	Continuous **(Note 4)**	Composite Particulate Sample **(Note 6)**	Gross Alpha	1×10^{-10}
	Continuous **(Note 4)**	Composite Particulate Sample **(Note 6)**	Sr^{89} and Sr^{90}	1×10^{-10}

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (10\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection as defined above (as microcuries per unit mass or volume) (See Subsection 4.9).
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm).
E	=	the counting efficiency (as counts per disintegration).
V	=	the sample size (in units of mass or volume).
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie.
Y	=	the fractional radiochemical yield (when applicable).
λ	=	the radioactive decay constant for the particular radionuclide.
Δt	=	the elapsed time between the midpoint of sample collection and time of counting.

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

NOTE 2: The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr^{87}, Kr^{88}, Xe^{133}, Xe^{133m}, Xe^{135}, Xe^{135m}, and Xe^{138} for gaseous emissions and Mn^{54}, Fe^{59}, Co^{58}, Co^{60}, Zn^{65}, Mo^{99}, Cs^{134}, Cs^{137}, Ce^{141} and Ce^{144} for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other nuclides with half lives greater than 8 days, that are measurable and identifiable at levels exceeding the LLD, together with the above nuclides, shall also be identified and reported.

NOTE 3: Sampling and analysis shall also be performed following shutdown, start-up, and whenever a thermal power change exceeding 15 percent of the rated thermal power occurs within any one-hour period, when:

a. Analysis shows that the dose equivalent I^{131} concentration in the primary coolant has increased more than a factor of 3; and

b. The noble gas activity monitor shows that effluent activity has increased by more than a factor of 3.

NOTE 4: The ratio of the sample flow rate to the sampled stream flow rate shall be known for the period covered by each dose or dose rate calculation made in accordance with Steps 6.3.1, 6.3.3, and 6.3.4.

NOTE 5: Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing (or after removal from sampler). Sampling shall also be performed at least once per 24 hours for at least seven days following each shutdown, start-up, or thermal power change exceeding 15 percent of rated thermal power in one hour, and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement applies if:

a. Analysis shows that the dose equivalent I^{131} concentration in the primary coolant has increased by a factor of 3; and

b. Noble gas monitor shows that effluent activity has increased more than a factor of 3.

NOTE 6: To be representative of the quantities and concentrations of radioactive materials in gaseous effluents, composite sampling shall employ appropriate methods that will result in a specimen representative of the effluent release.

ATTACHMENT 5

(Page 1 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM OPERABLE CHANNELS	ACTION
1. PROCESS VENT SYSTEM		
(a) Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release:		
1-GW-RM-130B	1	1
(b) Iodine Sampler:		
Continuous HP Sampler, or		
1-GW-RM-130-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		
(c) Particulate Sampler:		
Continuous HP Sampler, or		
1-GW-RM-130-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		
(d) Process Vent Flow Rate Monitor:		
1-GW-FT-100	1	3
(e) Sampler Flow Rate Measuring Device:		
HP Sampler Rotometer or MGPI Flow Rate Measuring Device	1	3
2. CONDENSER AIR EJECTOR SYSTEM		
(a) Gross Activity Monitor:		
1-SV-RM-111	1	1
2-SV-RM-211	1	1
(b) Air Ejector Flow Rate Measuring Device:		
Unit 1: 1-VP-FI-1A	1	3
1-VP-FI-1B	1	3
Unit 2: 2-VP-FI-1A	1	3
2-VP-FI-1B	1	3
3. VENTILATION VENT SYSTEM		
(a) Noble Gas Activity Monitor:		
SRF: RRM-101	1	1
SPS: Vent #1, 1-VG-RM-104	1	1
Vent #2, 1-VG-RM-131B	1	1
(b) Iodine Sampler:		
SRF: RRM-101	1	2
SPS: Vent #1, 1-VG-RM-104 **(NOTE 2)**	1	2
Vent #2, Continuous HP Sampler, or		
1-VG-RM-131-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		

ATTACHMENT 5

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Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM OPERABLE CHANNELS	ACTION
(c) Particulate Sampler:		
SRF: RRM-101	1	2
SPS: Vent #1, VG-RM-104 **(NOTE 2)**	1	2
Vent #2, HP Continuous Sampler, or 1-VG-RM-131-1 **(NOTE 1)** In-Line Particulate / Iodine Sampler	1	2
(d) Ventilation Vent Flow Rate Monitor:		
SRF: 01-RHV-FT-156	1	3
SPS: Vent #1, 1-VS-FT-119	1	3
Vent #2, 1-VS-FT-116	1	3
(e) Sampler Flow Rate Measuring Device:		
SRF: RRM-101	1	3
SPS: Vent #1, 1-VG-RM-104 **(NOTE 2)**	1	3
Vent #2, HP Sampler Rotometer or MGPI Flow Rate Measuring Device	1	3

NOTE 1: The mark number listed refers to the entire radiation monitor skid which includes particulate, iodine, and noble gas components.

NOTE 2: Vent # 1, 1-VG-RM-104, HP continuous sampler pump automatically maintains isokinetic sample flow when changes in stack flow are detected. Isokinetic sample flow adjustment can take 15 - 20 minutes. **[Commitment 3.2.3]**

ACTION 1: If the number of operable channels is less than required, effluent releases via this path may continue provided that the best efforts are made to repair the channel and that grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. When the effluent release via this pathway continues, then initiate the "Loss of Radioactive Gaseous Effluent Monitoring Instrumentation Sampling Schedule" attachment in HP-3010.031, Radioactive Gaseous Waste Sampling and Analysis. **[Commitment 3.2.4]**

ACTION 2: If the number of operable channels is less than required, effluent releases via this pathway may continue provided that the best efforts are made to repair the channel and that the samples are continuously collected with auxiliary sampling equipment within 12 hours after the initiation of this ACTION statement as required in Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4). **[Commitment 3.2.4]**

ACTION 3: If the number of operable channels is less than required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ATTACHMENT 6

(Page 1 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

CHANNEL DESCRIPTION	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. PROCESS VENT SYSTEM				
(a) Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release				
1-GW-RM-130B	D	M	R	Q
(b) Iodine Sampler **(NOTE 1)**				
Process Vent Continuous HP Sampler, or 1-GW-RM-130-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(c) Particulate Sampler **(NOTE 1)**				
Process Vent Continuous HP Sampler, or 1-GW-RM-130-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(d) Process Vent Flow Rate Monitor				
1-GW-FT-100	D	N/A	R	N/A
(e) Sampler Flow Rate Measuring Device				
HP Sampler Rotometer, or	D	N/A	SA	N/A
MGPI Flow Rate Measuring Device	D	N/A	R	N/A
2. CONDENSER AIR EJECTOR SYSTEM				
(a) Gross Activity Monitor				
Unit 1: 1-SV-RM-111 Unit 2: 2-SV-RM-211	D	M	R	Q
(b) Air Ejector Flow Rate Measuring Device				
Unit 1: 1-VP-FI-1A 1-VP-FI-1B Unit 2: 2-VP-FI-1A 2-VP-FI-1B	D	N/A	R	N/A
3. VENTILATION VENT SYSTEM				
(a) Noble Gas Activity Monitor				
SRF: RRM-101 SPS: 1-VG-RM -131B 1-VG-RM-104	D	M	R	Q

ATTACHMENT 6

(Page 2 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

CHANNEL DESCRIPTION	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
(b) Iodine Sampler (**NOTE 1**) SRF: RRM-101 SPS: Vent #1, 1-VG-RM-104 Vent #2, Continuous HP Sampler or 1-VG-RM-131-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(c) Particulate Sampler (**NOTE 1**) SRF: RRM-101 SPS: Vent #1, 1-VG-RM-104 Vent #2, Continuous HP Sampler or 1-VG-RM-131-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(d) Ventilation Vent Flow Rate Monitor SRF:01-RHV-FT-156 SPS: Vent #1, 1-VS-FT-119 Vent #2, 1-VS-FT-116	D	N/A	R	N/A
(e) Sampler Flow Rate Measuring Device (**NOTE 1**)				
SRF: RRM-101	D	N/A	R	N/A
SPS: Vent #1, 1-VG-RM-104	D	N/A	R	N/A
Vent #2, HP Sampler Rotometer	D	N/A	R	N/A
or MGPI Flow Rate Measuring Device	D	N/A	SA	N/A

NOTE 1: The mark numbers listed above in 1(b), 1(c), 3(b), 3(c), and 3(e) refer to the gaseous effluent radiation monitor or monitor skid with which the iodine and particulate samplers and the flow rate measuring devices are associated. The listed mark numbers do not refer to the particulate radiation monitor.

ATTACHMENT 7

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Dispersion and Deposition Factors

Description	Sector	Distance, meters	Ventilation Vent		Process Vent	
			X/Q	D/Q	X/Q	D/Q
Site Boundary	N	500	1.4E-05	1.6E-08	4.2E-08	3.9E-10
	NNE	532	1.8E-05	3.3E-08	1.2E-07	1.2E-09
	NE	629	1.3E-05	3.0E-08	1.8E-07	1.6E-09
	ENE	806	7.1E-06	1.3E-08	1.8E-07	1.8E-09
	E	1210	2.7E-06	7.2E-09	2.6E-07	1.8E-09
	ESE	1984	9.8E-07	3.2E-09	2.4E-07	1.7E-09
	SE	1371	2.2E-06	6.8E-09	2.6E-07	2.1E-09
	SSE	919	4.3E-06	9.2E-09	2.3E-07	1.2E-09
	S	645	5.9E-06	1.1E-08	1.7E-07	1.3E-09
	SSW	565	6.3E-06	1.2E-08	1.3E-07	1.4E-09
	SW	548	9.7E-06	1.9E-08	1.3E-07	1.3E-09
	WSW	656	8.4E-06	1.6E-08	1.4E-07	1.3E-09
	W	565	1.2E-05	2.9E-08	1.2E-07	1.0E-09
	WNW	565	1.4E-05	2.6E-08	8.7E-08	5.8E-10
	NW	581	1.3E-05	1.7E-08	1.2E-07	8.9E-10
	NNW	581	9.5E-06	1.1E-08	5.1E-08	3.1E-10
Resident	N	6534	2.4E-07	2.1E-10	6.7E-08	8.8E-11
	NNE	3122	1.0E-06	1.7E-09	1.9E-07	3.7E-10
	NE	7564	2.7E-07	4.2E-10	6.7E-08	1.8E-10
	SE	4554	3.4E-07	8.6E-10	8.7E-08	2.7E-10
	SSE	4265	3.7E-07	6.6E-10	9.5E-08	2.5E-10
	S	2736	5.5E-07	9.5E-10	1.9E-07	5.7E-10
	SSW	2977	4.1E-07	7.4E-10	1.4E-07	4.5E-10
	SW	3637	4.5E-07	7.7E-10	1.2E-07	3.4E-10
	WSW	660	6.4E-06	1.3E-08	1.8E-07	1.3E-09
	W	5053	3.4E-07	7.1E-10	8.1E-08	2.1E-10
	WNW	7886	2.2E-07	2.9E-10	4.9E-08	9.4E-11
	NW	7467	2.2E-07	2.2E-10	5.8E-08	1.3E-10
	NNW	6035	2.3E-07	2.0E-10	6.2E-08	7.1E-11
Milk Cow	SSW	7693	9.9E-08	1.4E-10	5.0E-08	1.2E-10
	NNW	5938	2.4E-07	2.1E-10	6.3E-08	7.1E-11
Garden	SSE	4265	3.7E-07	6.6E-10	9.5E-08	2.5E-10
	S	3235	4.2E-07	7.1E-10	1.6E-07	4.3E-10
	SSW	3122	3.8E-07	6.8E-10	1.3E-07	4.1E-10
	SW	7596	1.5E-07	2.1E-10	5.3E-08	1.2E-10
	WSW	5713	2.0E-07	3.2E-10	7.5E-08	1.8E-10
	W	5536	3.0E-07	6.0E-10	7.5E-08	1.8E-10
	NNW	7017	1.9E-07	1.6E-10	5.3E-08	7.4E-11

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
1. DIRECT RADIATION	About 40 Routine Monitoring Stations to be placed as follows: 1) Inner Ring in general area of site boundary with station in each sector 2) Outer Ring 6 to 8 km from the site with a station in each sector 3) The balance of the 8 dosimeters should be placed in special interest areas such as population centers, nearby residents, schools, and in 2 or 3 areas to serve as controls	Quarterly	GAMMA DOSE Quarterly
2. AIRBORNE Radioiodines and Particulates	Samples from 7 locations: a) 1 sample from close to the site boundary location of the highest calculated annual average ground level D/Q b) 5 sample locations 6-8 km distance located in a concentric ring around the Station c) 1 sample from a control location 15-30 km distant, providing valid background data	Continuous Sampler operation with sample collection weekly	Radioiodine Canister I^{131} Analysis Weekly Particulate Sampler Gross beta radioactivity analysis following filter change; Gamma isotopic analysis of composite (by location) quarterly

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
a) Surface	a) 1 sample upstream b) 1 sample downstream	Monthly Sample	Gamma isotopic analysis monthly; Composite for tritium analysis quarterly
b) Ground	Sample from 1 or 2 sources	Quarterly	Gamma isotopic and tritium analysis quarterly
c) Sediment from shoreline	a) 1 sample upstream b) 1 sample downstream	Semi-Annually	Gamma isotopic analysis semi-annually
d) Silt	a) 1 sample upstream b) 1 sample downstream	Semi-Annually	Gamma isotopic analysis semi-annually
4. INGESTION			
a) Milk	a) 2 samples from milking animals in the vicinity of the Station. **(NOTE 1)** b) 1 sample from milking animals at a control location (~15-30 km distant). **(NOTE 2)**	Monthly	Gamma isotopic and I^{131} analysis monthly
b) Fish and Invertebrates	a) 6 samples of filter feeders (clams, oysters) in the vicinity of the Station	Semi-Annually	Gamma isotopic on edible portions
	c) 1 sampling of crabs from the vicinity of the Station	Annually	
	d) 1 sampling of 2 different species in vicinity of Station discharge area. **(NOTE 3)**	Semi-Annually	

NOTE 1: If milk sampling cannot be performed, use item 4.c, Food Products - d. Milk sampling cannot be performed when there are no milk sampling locations in the vicinity of the Station.

NOTE 2: If milk sampling from a control location cannot be performed, use item 4.c) e).
Milk sampling cannot be performed when there is no milk sampling location ~ 15 - 30 km distant.

NOTE 3: Commercially or recreationally important species permitted for sampling by the Virginia Marine Resources Commission include catfish, white perch, croaker, striped bass, spot, red drum, and striped mullet.

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
4. INGESTION (Continued)			
	a) 1 sample corn b) 1 sample soybeans c) 1 sample peanuts	Annually	Gamma isotopic on edible portions
c) Food Products	d) 1 sample of a broadleaf vegetation grown nearest in each of two different available offsite locations (sectors) with the highest annual average ground level D/Qs, if milk sampling is not performed. e) 1 sample of a broadleaf vegetation grown 15 - 30 km distant in the available least prevalent wind direction, if milk sampling is not performed.	Monthly, if available, or at harvest	Gamma isotopic and I^{131} analysis

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION	DISTANCE (MILES)	DIRECTION	REMARKS
Air Charcoal and Particulate	Surry Station (SS)	0.3	NNE	
	Hog Island Reserve (HIR)	2.0	NNE	
	Bacon's Castle (BC)	4.5	SSW	
	Alliance (ALL)	5.1	WSW	
	Colonial Parkway (CP)	3.8	NNW	
	BASF (BASF)	5.1	ENE	
	Fort Eustis (FE)	4.9	ESE	
	Newport News (NN)	19.3	SE	Control Location
Environmental TLDs	Control (00)			Onsite *
	West North West (02)	0.2	WNW	Site Boundary
	Surry Station Discharge (03)	0.4	NW	Site Boundary
	North North West (04)	0.2	NNW	Site Boundary
	North (05)	0.3	N	Site Boundary
	North North East (06)	0.3	NNE	Site Boundary
	North East (07)	0.3	NE	Site Boundary
	East North East (08)	0.4	ENE	Site Boundary
	East (09)	0.3	E	Site Boundary
	West (10)	0.1	W	Site Boundary
	West South West (11)	0.4	WSW	Site Boundary
	South West (12)	0.3	SW	Site Boundary
	South South West (13)	0.3	SSW	Site Boundary
	South (14)	0.4	S	Site Boundary
	South South East (15)	0.6	SSE	Site Boundary
	South East (16)	0.9	SE	Site Boundary
	Station Intake (18)	1.6	ESE	Site Boundary
	Hog Island Reserve (19)	2.0	NNE	Near Resident

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION		DISTANCE (MILES)	DIRECTION	REMARKS
Environmental TLDs	Bacon's Castle	(20)	4.5	SSW	Approx. 5 miles
	Route 633	(21)	4.9	SW	Approx. 5 miles
	Alliance	(22)	5.1	WSW	Approx. 5 miles
	Surry	(23)	7.7	WSW	Population Center
	Route 636 and 637	(24)	4.0	W	Approx. 5 miles
	Scotland Wharf	(25)	5.0	WNW	Approx. 5 miles
	Jamestown	(26)	6.3	NW	Approx. 5 miles
	Colonial Parkway	(27)	3.8	NNW	Approx. 5 miles
	Route 617 and 618	(28)	4.9	NNW	Approx. 5 miles
	Kingsmill	(29)	4.6	N	Approx. 5 miles
	Williamsburg	(30)	7.8	N	Population Center
	Kingsmill North	(31)	5.5	NNE	Approx. 5 miles
	Budweiser	(32)	5.8	NNE	Population Center
	Water Plant	(33)	5.0	NE	Approx. 5 miles
	BASF	(34)	5.1	ENE	Approx. 5 miles
	Lee Hall	(35)	7.1	ENE	Population Center
	Goose Island	(36)	5.1	E	Approx. 5 miles
	Fort Eustis	(37)	4.9	ESE	Approx. 5 miles
	Newport News	(38)	19.3	SE	Population Center
	James River Bridge	(39)	17.1	SE	Control
	Benn's Church	(40)	17.0	SSE	Control
	Smithfield	(41)	13.4	SSE	Control
	Rushmere	(42)	5.3	SSE	Approx. 5 miles
	Route 628	(43)	5.1	S	Approx. 5 miles
Milk	Epps		4.8	SSW	
	Colonial Parkway		3.7	NNW	
	Williams		27.5	S	Control Location

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION	DISTANCE (MILES)	DIRECTION	REMARKS
Well Water	Surry Station			Onsite**
	Hog Island Reserve	2.0	NNE	
	Construction Site	0.3	E	Onsite***
Crops (Corn, Peanuts, Soybeans)	Slade's Farm	3.2	S	
	Brock's Farm	3.8	S	
River Water (Monthly)	Surry Discharge	0.4	NW	
	Scotland Wharf	4.9	WNW	Control Location
Sediment (Silt)	Chickahominy River	11.2	WNW	Control Location
	Surry Station Discharge	1.3	NNW	
Clams	Chickahominy River	11.2	WNW	Control Location
	Surry Station Discharge	1.3	NNW	
	Jamestown Island	3.9	NW	
Oysters	Point of Shoals	6.4	SSE	
	Mulberry Point	4.9	ESE	
	Lawne's Creek	2.4	SE	
Crabs	Surry Station Discharge	1.3	NNW	
Fish	Surry Station Discharge	1.3	NNW	
Shoreline Sediment	Hog Island Reserve	0.6	N	
	Chickahominy River	11.2	WNW	Control Location

* Onsite Location - in Lead Shield

** Onsite sample of Well Water taken from tap-water at Surry Environmental Building

*** Onsite sample of Well Water taken from tap-water at Surry Training Center

ATTACHMENT 10

(Page 1 of 2)

Detection Capabilities for Environmental Sample Analysis

LOWER LIMIT OF DETECTION (LLD)

Analysis (NOTE 2)	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg) (wet)	Milk (pCi/L)	Food Products (pCi/kg) (wet)	Sediment (pCi/kg) (dry)
Gross beta	4	0.01				
H-3	2,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	(NOTE 3) 1	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

NOTE 1: Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

NOTE 2: This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

NOTE 3: LLD for the ground (drinking) water samples. The LLD for the surface (non-drinking) water samples is 10 pCi/L.

ATTACHMENT 10

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Detection Capabilities for Environmental Sample Analysis

LOWER LIMIT OF DETECTION (LLD)

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (24\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection as defined above (as microcuries per unit mass or volume) (See Subsection 4.9)
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm)
E	=	the counting efficiency (as counts per disintegration)
V	=	the sample size (in units of mass or volume)
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie
Y	=	the fractional radiochemical yield (when applicable)
λ	=	the radioactive decay constant for the particular radionuclide
Δt	=	the elapsed time between sample collection (or end of the sample collection period) and time of counting (for environmental samples, not plant effluent samples)

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

ATTACHMENT 11

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Reporting Levels for Radioactivity Concentrations 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*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2*	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

*Reporting level for the ground (drinking) water samples required by Radiological Environmental Monitoring Program (Attachment 8). The reporting level for the surface (non-drinking) water samples required by Attachment 8 is 30,000 pCi/L for H-3 and 20 pCi/L for I-131.

ATTACHMENT 12

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Meteorological, Liquid, and Gaseous Pathway Analysis

1.0 METEORLOGICAL ANALYSIS

1.1 Purpose

The purpose of the meteorological analysis was to determine the five (5) year average χ/Q and D/Q values at critical locations around the Station for ventilation vent (ground level) and process vent (mixed mode) releases. The five year average χ/Q and D/Q values are used in the dose pathway analysis to determine dose and dose rate at site boundary and dose to the member of the public.

1.2 Meteorological Data, Parameters, and Methodology

A five (5) year average of representative onsite meteorological data for the period January 1, 2007 through December 31, 2011, is used in the gaseous effluent dose pathway calculations. This data includes wind speed, wind direction, and differential temperature for the purpose of determining joint frequency distributions for those releases characterized as ground level (i.e., ventilation vent), and those characterized as mixed mode (i.e., process vent).

χ/Qs and D/Qs were calculated using the PC version of NRC computer code "XOQDOQ - Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", Version 2.0, provided in NUREG-0324.

The open terrain adjustment factors were applied to the χ/Q values as recommended in Regulatory Guide 1.111. The site region is characterized as flat terrain such that open terrain correction factors are considered appropriate. The ground level ventilation vent release calculations included a building wake correction based on a 1516 m^2 containment minimum cross-sectional area. The effective release height used in mixed mode release calculations was based on a process vent release height of 131 ft, and plume rise due to momentum for a vent diameter of 1.5 in. with plume exit velocity of 100 ft/sec.

Ventilation vent, and vent releases other than from the process vent, are considered ground level as specified in Regulatory Guide 1.111 for release points less than the height of adjacent solid structures. Terrain elevations were obtained from Surry Power Station Units 1 and 2 Virginia Electric and Power Company Updated Final Safety Analysis Report Table 11A-8.

χ/Q and D/Q values were calculated for the nearest site boundary, residence, milk-cow, discharge bank, and vegetable garden by sector for process vent and ventilation vent releases.

ATTACHMENT 12

(Page 2 of 7)

Meteorological, Liquid, and Gaseous Pathway Analysis

According to the definition for short term in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Stations," October, 1978, some gaseous releases may fit this category, primarily waste gas decay tank releases and containment purges. However, these releases are considered long term for dose calculations as past releases were both random in time of day and duration as evidenced by reviewing past release reports. Therefore, the use of annual average concentrations is appropriate according to NUREG-0133.

1.3 Results

The χ/Q and D/Q values used in the dose pathway analysis for ventilation vent releases and process vent releases can be found in Attachment 7.

2.0 LIQUID PATHWAY ANALYSIS

2.1 Purpose

The purpose of the liquid pathway analysis was to determine the maximum exposed member of the public in unrestricted areas as a result of radioactive liquid effluent releases. The analysis included a determination of most restrictive liquid pathway, most restrictive age group, and critical organ. This analysis is required for Subsection 6.2, Liquid Radioactive Waste Effluents.

2.2 Data, Parameters, and Methodology

Radioactive liquid effluent release data for the years 1976, 1977, 1978, 1979, 1980, and 1981 were compiled from the Surry Power Station effluent release reports. The data for each year, along with appropriate site specific parameters and default selected parameters, were entered into the NRC computer code LADTAP as described in NUREG-1276.

Liquid radioactive effluents from both units are released to the James River via the discharge canal. Possible pathways of exposure for release from the Station include ingestion of fish and invertebrates and shoreline activities. The irrigated food pathway and potable water pathway do not exist at this location. Access to the discharge canal by the general public is gained two ways: bank fishing, controlled by the Station and limited to Dominion employees or guests of employees, and by boat as far upstream as the inshore end of the discharge canal groin. It has been estimated that boat sport fishing would be performed a maximum of 800 hours per year, and that bank fishing would be performed a maximum of 160 hours per year.

ATTACHMENT 12

(Page 3 of 7)

Meteorological, Liquid, and Gaseous Pathway Analysis

For an individual fishing in the discharge canal, no river dilution was assumed for the fish pathway. For an individual located beyond the discharge canal groins, a river dilution factor of 5 (i.e., a mixing ratio of 0.2) was assumed as appropriate according to Regulatory Guide 1.109, Rev. 1, and the fish, invertebrate, and shoreline pathways were considered to exist. Dose factors, bioaccumulation factors, shore width factors and usage terms for shoreline activities and ingestion of fish and invertebrates are included in the Source Code file. Dose to an individual fishing on the discharge bank was determined by multiplying the annual dose calculated with LADTAP by the fractional year the individual spent fishing in the canal.

2.3 Results

For the years 1976, 1977, 1979, 1980, and 1981, the invertebrate pathway resulted in the largest dose. In 1978 the fish pathway resulted in the largest dose. The maximum exposed member of the public was determined to utilize the James River. The critical age group was the adult and the critical organ was either the thyroid or GI-LLI. The ingestion dose factors, which include the fish and invertebrate pathways, are calculated for total body and various critical organs. Validation of the limiting age group and critical organ is performed by the liquid effluent dose calculation program using the data, parameters, and methodology provided in the Source Code file.

3.0 GASEOUS PATHWAY ANALYSIS

3.1 Purpose

Gaseous effluent pathway analyses are performed to determine the location that would result in the maximum doses due to noble gases, for use in demonstrating compliance with Steps 6.3.1.a. and 6.3.3.a. The analyses includes a determination of the location, pathway, and critical organ, of the maximum exposed member of the public, as a result of the release of I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than eight days for use in demonstrating compliance with Step 6.3.4.a. In addition, the analyses includes a determination of the critical organ, maximum age group, and sector location of an exposed individual through the inhalation pathway from I^{131}, I^{133}, tritium, and particulates to demonstrate compliance with Step 6.3.1.a.

ATTACHMENT 12

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Meteorological, Liquid, and Gaseous Pathway Analysis

3.2 Data, Parameters, and Methodology

Five year average χ/Q values were calculated, as described in Section 1 of this attachment. The maximum doses to total body and skin, and air doses for gamma and beta radiation due to noble gases would be at these site boundary locations. The doses from both the ventilation vent and process vent release points are summed to calculate total maximum dose.

6.3.1.a.2 dose limits apply specifically to the inhalation pathway. Therefore, the locations and χ/Q values determined for maximum noble gas doses can be used to determine the maximum dose from I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days for the inhalation pathway.

The maximum exposed individual for 10 CFR 50, Appendix I, compliance could be at any of the following locations: site boundary, nearest resident, nearest milk-cow, or nearest vegetable garden, using the Land Use Census data which is assessed annually. Therefore, ventilation vent and process vent X/Q and D/Q values for these selected receptors are included in the gaseous effluent dose pathway analyses. Ground plane, inhalation, cow-milk, and vegetable garden pathways are active with the exception of the infant age group, which is not active for the vegetable garden pathway. Otherwise, all age groups are evaluated at these locations. The data, parameters, and methodology of R. G. 1.109, Rev. 1, and NUREG-0133 are used in the gaseous effluent dose pathway analyses.

The gamma and beta dose factors K_{ivv}, L_{ivv}, M_{ivv}, and N_{ivv} for ground level releases and the gamma and beta dose factors K_{ipv}, L_{ipv}, M_{ipv}, and N_{ipv} for mixed mode releases are included in the Source Code file.

Inhalation pathway dose factors P_{ivv} and P_{ipv} are calculated using the following equation:

$$P_i = K' \, (BR) \, DFA_i \qquad \text{mrem/yr per Ci/m}^3 \qquad (28\text{-}1)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

BR = the breathing rate of the particular age group, m^3/yr, from Table E-5, Regulatory Guide 1.109, Rev.1

DFA_i = the critical organ inhalation dose factor for particular age group for the ith radionuclide, in mrem/pCi

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Meteorological, Liquid, and Gaseous Pathway Analysis

Parameters used above were obtained from NUREG-0133 and R.G. 1.109, Rev. 1.

It was determined that the member of the public within site boundary would be using the discharge canal bank for fishing a maximum of 160 hours per year. Active pathways are ground plane and inhalation, and all age groups are evaluated for this pathway analysis.

The RM_{ivv} and RM_{ipv} dose factors, except for tritium, are calculated using the following equation:

$$RM_i = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m (r) (DFL_i) \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_f} \qquad (28\text{-}2)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

Q_F = cow's consumption rate, 50, in kg/day (wet weight)

U_{ap}= infant milk consumption rate, 330, in liters/yr

Y_p = agricultural productivity by unit area of pasture feed grass, 0.7 in kg/m^2

Y_s = agricultural productivity by unit area of stored feed, 2.0, in kg/m^2

F_m = stable element transfer coefficients, in days/liter

r = fraction of deposited activity retained on cow's feed grass, 1.0 for radioiodine, and 0.2 for particulates

DFL_i=critical organ ingestion dose factor for the ith radionuclide for the particular age group, in mrem/pCi

λ_i = decay constant for the ith radionuclide, in sec^{-1}

λ_w = decay constant for removal of activity of leaf and plant surfaces by weathering, 5.73E-07 sec^{-1} (corresponding to a 14 day half-life)

t_f = transport time from pasture to cow, to milk, to receptor, 1.73+05, in seconds

t_h = transport time from pasture, to harvest, to cow, to milk, to receptor, 7.78E+06, in seconds

f_p = fraction of year that cow is on pasture, 1.0 (dimensionless)

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Meteorological, Liquid, and Gaseous Pathway Analysis

f_s = fraction of cow feed that is pasture grass while cow is on pasture, 0.8 (dimensionless)

Parameters used above were obtained from NUREG-0133 and Regulatory Guide 1.109, Rev.1.

Since the concentration of tritium in milk is based on the airborne concentration rather than the deposition, the following equation is used:

$$R_{H^3} = K'K'''F_m Q_F U_{ap}(DFL_{H^3})\left[0.75(0.5/H)\right] \qquad (28\text{-}3)$$

where:

K''' = a constant of unit conversion 1E+03 gm/kg

H = absolute humidity of the atmosphere, 8.0, in 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

Other parameters have been previously defined.

The inhalation pathway dose factors RI_{ivv} and RI_{ipv} were calculated using the following equation:

$$RI_i = K' (BR)\, DFA_i \qquad \text{mrem/yr per Ci/m}^3 \qquad (28\text{-}4)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

BR = breathing rate of the particular age group, m^3/yr

DFA_i=critical organ inhalation dose factor for particular age group for the ith radionuclide, in mrem/pCi

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Meteorological, Liquid, and Gaseous Pathway Analysis

Parameters used above were obtained from NUREG-0133 and R. G. 1.109, Rev. 1.

Breathing Rate		
Infant	=	1400 m^3/yr
Child	=	3700 m^3/yr
Teen	=	8000 m^3/yr
Adult	=	8000 m^3/yr

The RG dose factors are calculated using the following equation:

$$RG = K'K''(SF)DFG_i \left[\frac{1 - e^{-\lambda_i t_b}}{\lambda_i}\right]\left(\frac{m^2 \bullet mrem/yr}{Ci/\sec}\right) \qquad (28 - 5)$$

where:

K' = A constant of unit conversion, 1E+12 pCi/Ci

K" = A constant of unit conversion, 8760 hr/year.

λ_i = The decay constant for nuclide i, sec^{-1}.

t_b = The exposure time, 4.73×10^8 sec (15 years), from Table E-15 of Reg Guide 1.109.

DFG_i = The ground plane dose conversion factor for nuclide i, from Table E-6 of Reg. Guide 1.109 (mrem/hr per pCi/m^2).

SF = The shielding factor 0.7 (dimensionless), from Table E-15 of Reg Guide 1.109.

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Administrative Procedure or Guidance and Reference Document Approval

1. Document Number:	2. Revision:	3. Document Type:	
VPAP-2103S	19	☒ Administrative Procedure	☐ GARD

4. Title:
Offsite Dose Calculation Manual (Surry)

5. Requestor(s) Print Name(s) / Locations	6. Date	7. Requestor Phone
Pete Blount / SPS	10/13/2015	8-798-2467

8. Document Request
☐ New ☒ Revision ☐ Cancel ☐ Supersede ☐ Temporary

9. Applicable Nuclear Station(s)
Millstone ☐ North Anna ☐ Surry ☒

10. Reason and Brief Description of Change:
Revision initiated to incorporate changes from SAR002630, Radiological Environmental Monitoring Program and CR1013104, VPAP-2103S compensatory actions review not completed for 1-RLW-FIT-153 failure.

For full list of changes, see Revision Summary.

11. Records Retention Requirements Affected?	12. Change Management:
☐ Yes (Complete NRRS form from RM-AA-101) ☒ No	Attach Appropriate PI-AA-4000 Attachment(s)

13. Level of Use:
☐ Continuous Use ☐ Reference Use ☒ Information Use ☐ Multiple Use

Fleet Approval

14. Fleet Approval Required by: (Check one box only. Enter Peer Group Name, if applicable)
☐ Peer Group OR ☒ Functional Area Manager (FAM)

15. Printed Approver Name	16. Signature	17. Date
Jason Eggart	Jason Eggart	10/13/15

Site Approval

18. Implementation Prerequisites: (Items in addition to those listed on Document Traveler or Change Management Plan)
None

19. Implementation Prerequisites Reviewed - Procedure Supervisor Signature	20. Date
	10-13-15

21. Check Nuclear Station(s) for Which Document is being Approved for Implementation.
Millstone ☐ North Anna ☑ Surry ☒

22. Site Approval (Print Name of FAM)	23. Signature	24. Date
Jason Eggart Lee Raglard for		10/14/15

25. Facility Safety Review Committee Required?	26. Facility Safety Review Committee (Site) Print Name/Signature	27. Date
☒ No ☐ Yes	N/A	N/A

28. Site Vice President Required?	29. Site Vice President) Print Name/Signature	30. Date
☐ No ☒ Yes	Larry Lane	10/14/15

NOTE: The individual(s) posting a new or revised document to EDMS are responsible for ensuring Nuclear E-Forms is updated.

31. Nuclear E-Forms Updated for Site(s)?	32. Nuclear E-Forms Updated Print Name/Signature	33. Date
☐ MP ☐ NA ☐ SU ☒ N/A	N/A	N/A

34. Document Number:	35. Revision:	36. Effective Date	37. Expiration Date
VPAP-2103S	19	10/14/15	N/A

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Station Administrative Procedure

Title: Offsite Dose Calculation Manual (Surry)

Process / Program Owner: Manager Radiological Protection and Chemistry (Surry)

Procedure Number	Revision Number	Effective Date
VPAP-2103S	19	On File

Revision Summary

The following changes were made in response to SAR002630, Radiological Environmental Monitoring Program.

- Added Reference 3.1.28 for Branch Technical Position
- Added footnote to Attachment 8 to clarify the omission of the TLD station in the SE sector

The following changes were made in response to CR1013104, VPAP-2103S compensatory actions review not completed for 1-RLW-FIT-153 failure.

- Added Reference 3.1.29 for CR1013104
- Updated required action for instrument 3(a) on Attachment 1
- Added Action 3 on Attachment 1

Other Changes:

- Reworded 3rd bullet of Substep 6.4.2.b

Approvals on File

TABLE OF CONTENTS

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1.0 PURPOSE

The Offsite Dose Calculation Manual (ODCM) establishes requirements for the Radioactive Effluent and Radiological Environmental Monitoring Programs. Methodology and parameters are provided to calculate offsite doses resulting from radioactive gaseous and liquid effluents, to calculate gaseous and liquid effluent monitoring alarm/trip setpoints, and to conduct the Environmental Monitoring Program. Requirements are established for the Annual Radiological Environmental Operating Report and the Annual Radioactive Effluent Release Report required by Station Technical Specifications. Calculation of offsite doses due to radioactive liquid and gaseous effluents are performed to assure that:

- Concentration of radioactive liquid effluents to the unrestricted area will be limited to ten times the effluent concentration values of 10 CFR 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained noble gases and 2E-4 μCi/mL for dissolved or entrained noble gases
- Exposure to the maximum exposed member of the public in the unrestricted area from radioactive liquid effluents will not result in doses greater than the liquid dose limits of 10 CFR 50, Appendix I
- Dose rate at and beyond the site boundary from radioactive gaseous effluents will be limited to:
  - Noble gases – less than or equal to a dose rate of 500 mrem/yr to the total body and less than or equal to a dose rate of 3000 mrem/yr to the skin
  - I^{131}, I^{133}, and H^3, and all radionuclides in particulate form with half-lives greater than 8 days – less than or equal to a dose rate of 1500 mrem/yr to any organ
- Exposure from radioactive gaseous effluents to the maximum exposed member of the public in the unrestricted area will not result in doses greater than the gaseous dose limits of 10 CFR 50, Appendix I, and
- Exposure to a real individual will not exceed 40 CFR 190 dose limits

2.0 SCOPE

This procedure applies to the Radioactive Effluent and Radiological Environmental Monitoring Programs at Surry Power Station.

3.0 REFERENCES/COMMITMENT DOCUMENTS

3.1 References

3.1.1 10 CFR 20, Standards for Protection Against Radiation

3.1.2 10 CFR 50, Domestic Licensing of Production and Utilization Facilities

3.1.3 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations

3.1.4 TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites

3.1.5 Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Rev. 1, U.S. NRC, June 1974

3.1.6 Regulatory Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I, Rev. 1, U.S. NRC, October 1977

3.1.7 Regulatory Guide 1.111, Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors, Rev. 1, U.S. NRC, July 1977

3.1.8 Surry Technical Specifications (Units 1 and 2)

3.1.9 NUREG/CR-2919, XOQDOQ, Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations, U.S. NRC, September 1982

3.1.10 NUREG/CR-1276, Users Manual for the LADTAP II Program, U.S. NRC, May, 1980

3.1.11 TID-4500, VCRL-50564, Rev. 1, Concentration Factors of Chemical Elements in Edible Aquatic Organisms, October, 1972

3.1.12 WASH 1258, Vol. 2, July 1973, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion "As Low As Practicable" For Radioactive Material in Light Water-Cooled Nuclear Power Reactor Effluents

3.1.13 NUREG-0597, User's Guide to GASPAR Code, U.S. NRC, June, 1980

3.1.14 Radiological Assessment Branch Technical Position on Environmental Monitoring, November, 1979, Rev. 1

3.1.15 NUREG-0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Stations, October, 1978

3.1.16 NUREG-0543, February 1980, Methods for Demonstrating LWR Compliance With the EPA Uranium Fuel Cycle Standard (40 CFR Part 190)

3.1.17 NUREG-0472, Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors, Draft, Rev. 3, March 1982

3.1.18 Environmental Measurements Laboratory, DOE HASL 300 Manual

3.1.19 NRC Generic Letter 89-01, Implementation of Programmatic Controls for Radiological Effluent Technical Specifications (RETS) in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program

3.1.20 Surry UFSAR

3.1.21 VPAP-2802, Notifications and Reports

3.1.22 HP-3010.021, Radioactive Liquid Waste Sampling and Analysis

3.1.23 HP-3010.031, Radioactive Gaseous Waste Sampling and Analysis

3.1.24 Design Change 01-022, Ventilation Radiation Monitoring (Kaman) System Replacement/Surry/Unit 1&2

3.1.25 NEI 07-07, Industry Ground Water Protection Initiative - Final Guidance Document

3.1.26 CR022320 (Surry), Daily Channel Checks for 1-VG-RM-131-1 Flow Rate Measuring Device Not Performed

3.1.27 RP-AA-502, Groundwater Protection Program

3.1.28 Branch Technical Position, Revision 1, November 1979

3.1.29 CR1013104, VPAP-2103S compensatory actions review not completed for 1-RLW-FIT-153 failure

3.2 Commitment Documents

3.2.1 Quality Assurance Audit Report Number 92-03, Observation 04NS (Item 2)

3.2.2 Deviation Report S-97-1281, Annual Radiological Effluent Release Report

3.2.3 Deviation S-2000-0235, Continuous Vent Stack Sampling

3.2.4 S-2005-0930, Response to the Verification of Back-up Effluent Accountability Sampling

4.0 DEFINITIONS

4.1 Channel Calibration

Adjustment, as necessary, of the channel output so it responds with the necessary range and accuracy to known values of the parameter the channel monitors. It encompasses the entire channel, including the sensor and alarm and/or trip functions and the Channel Functional Test. The Channel Calibration can be performed by any series of sequential, overlapping, or total channel steps so the entire channel is calibrated.

4.2 Channel Check

A qualitative assessment, by observation, of channel behavior during operation. This assessment includes, where possible, comparison of the channel indication and/or status with other indications and/or status derived from independent instrumentation channels measuring the same parameter.

The Channel Check for the MGPI sampler flow rate measuring devices, as listed on Attachment 6 of this procedure, is the direct observation of the MGPI radiation monitor release rate (i.e., microcuries per second) without the presence of a sampler flow fault display.

4.3 Channel Functional Test

There are two types of Channel Functional Tests.

4.3.1 Analog Channel

Injection of a simulated signal into a channel, as close to the sensor as practicable, to verify Operability, including alarm and/or trip functions.

4.3.2 Bistable Channel

Injection of a simulated signal into a sensor to verify Operability, including alarm and/or trip functions.

4.4 Critical Organ

That organ, which has been determined to be the maximum exposed organ based on an effluent pathway analysis, thereby ensuring the dose and dose rate limitations to any organ will not be exceeded.

4.5 Dose Equivalent I-131

That concentration of I^{131} (μCi/cc) that 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. Thyroid dose conversion factors for this calculation are listed in Table III of TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites. Thyroid dose conversion factors from NRC Regulatory Guide 1.109, Revision 1, may be used.

4.6 Frequency Notations

NOTE: Frequencies are allowed a maximum extension of 25 percent.

NOTATION	FREQUENCY
D - Daily	At least once per 24 hours
W - Weekly	At least once per 7 days
M - Monthly	At least once per 31 days
Q - Quarterly	At least once per 92 days
SA - Semi-annually	At least once per 184 days
R - Refueling	At least once per 18 months
S/U - Start-up	Prior to each reactor start-up
P - Prior to release	Completed prior to each release
N/A - Not applicable	Not applicable
DR - During the release	At least once during each release

4.7 Gaseous Radwaste Treatment System

A system that reduces radioactive gaseous effluents by collecting primary coolant system offgases from the primary system and providing delay or holdup to reduce total radioactivity prior to release to the environment. The system comprises the waste gas decay tanks, regenerative heat exchanger, waste gas charcoal filters, process vent blowers and waste gas surge tanks.

4.8 General Nomenclature

χ = Chi: concentration at a point at a given instant (curies per cubic meter)

D = Deposition: quantity of deposited radioactive material per unit area (curies per square meter)

Q = Source strength (instantaneous; grams, curies)

= Emission rate (continuous; grams per second, curies per second)

= Emission rate (continuous line source; grams per second per meter)

4.9 Lower Limit of Detection (LLD)

The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that can be detected with 95 percent probability with only five percent probability of falsely concluding that a blank observation represents a "real" signal.

4.10 Members of the Public

Any individual except when that individual is receiving an occupational dose. This category includes non-employees of Dominion who are permitted to use portions of the site for recreational, occupational, or other purposes not associated with Station functions. This category does not include non-employees such as vending machine servicemen or postal workers who, as part of their formal job function, occasionally enter an area that is controlled by Dominion to protect individuals from exposure to radiation and radioactive materials.

4.11 Operable - Operability

A system, subsystem, train, component, or device is operable or has operability when it is capable of performing its specified functions and all necessary, attendant instrumentation, controls, normal and emergency electrical power sources, cooling or seal water, lubrication or other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its functions are also capable of performing their related support functions.

4.12 Purge - Purging

Controlled discharge of air or gas from a confinement to maintain temperature, pressure, humidity, concentration, or other operating condition, so that replacement air or gas is required to purify the confinement.

4.13 Rated Thermal Power

Total reactor core heat transfer rate to reactor coolant (i.e., 2587 Megawatts Thermal MWt).

4.14 Site Boundary

The line beyond which Dominion does not own, lease, or otherwise control the land.

4.15 Source Check

For Victoreen and Eberline monitors a source check is the qualitative assessment of channel response when a channel sensor is exposed to a radioactive source or a light emitting diode, LED.

For MGPI monitors a source check is the verification of proper computer response to continuous operational checks on the detector and electronics.

4.16 Special Report

A report to NRC to comply with Subsections 6.2, 6.3, or 6.5 of this procedure. Also refer to VPAP-2802, Notifications and Reports.

4.17 Thermal Power

Total reactor core heat transfer rate to the reactor coolant.

4.18 Unrestricted Area

Any area at or beyond the site boundary, access to which is neither limited nor controlled by Dominion for purposes of protection of individuals from exposure to radiation and radioactive materials, or any area within the site boundary used for residential quarters or for industrial, commercial, institutional or recreational purposes.

4.19 Ventilation Exhaust Treatment System

A system that reduces gaseous radioiodine or radioactive material in particulate form in effluents by passing ventilation or vent exhaust gases through charcoal adsorbers and High Efficiency Particulate Air (HEPA) filters to remove iodines and particulates from a gaseous exhaust stream prior to release to the environment (such a system is not considered to have any effect on noble gas effluents). Engineered Safety Feature (ESF) atmospheric cleanup systems are not Ventilation Exhaust Treatment System components.

5.0 RESPONSIBILITIES

5.1 Manager Radiological Protection and Chemistry

The Manager Radiological Protection and Chemistry is responsible for:

5.1.1 Establishing and maintaining procedures for surveying, sampling, and monitoring radioactive effluents and the environment.

5.1.2 Surveying, sampling, and analyzing plant effluents and environmental monitoring, and documenting these activities.

5.1.3 Analyzing plant effluent trends and recommending actions to correct adverse trends.

5.1.4 Preparing Effluent and Environmental Monitoring Program records.

5.2 Manager Nuclear Operations

The Manager Nuclear Operations is responsible for requesting samples, analyses, and authorization to release effluents.

6.0 INSTRUCTIONS

NOTE: Meteorological, liquid, and gaseous pathway analyses are presented in Meteorological, Liquid, and Gaseous Pathway Analysis (Attachment 12).

6.1 Sampling and Monitoring Criteria

6.1.1 Surveys, sampling, and analyses shall use instruments calibrated for the type and range of radiation monitored and the type of discharge monitored.

6.1.2 Installed monitoring systems shall be calibrated for the type and range of radiation or parameter monitored.

6.1.3 A sufficient number of survey points shall be used or samples taken to adequately assess the status of the discharge monitored.

6.1.4 Samples shall be representative of the volume and type of discharge monitored.

6.1.5 Surveys, sampling, analyses, and monitoring records shall be accurately and legibly documented, and sufficiently detailed that the meaning and intent of the records are clear.

6.1.6 Surveys, analyses, and monitoring records shall be reviewed for trends, completeness, and accuracy.

6.2 Liquid Radioactive Waste Effluents

6.2.1 Liquid Effluent Concentration Limitations

a. Liquid waste concentrations discharged from the Station shall not exceed the following limits:

1. For radionuclides (other than dissolved or entrained noble gases), liquid effluent concentrations released to unrestricted areas shall not exceed ten times the effluent concentration values specified in 10 CFR 20, Appendix B, Table 2, Column 2.

2. For dissolved or entrained noble gases, concentrations shall not exceed 2E-4 µCi/mL.

b. If the concentration of liquid effluent exceeds the limits in Step 6.2.1.a., promptly reduce concentrations to within limits.

c. Concentrations of radioactive materials in liquid waste released to unrestricted areas shall meet the following:

$$\frac{\text{Volume of Waste Discharged + Volume of Dilution Water}}{\text{Volume of Waste Discharged} \times \sum_{i} \frac{\mu Ci/mL_i}{ACW_i}} \geq 1 \quad (1)$$

where:

$\mu Ci/mL_i$ = the concentration of nuclide i in the liquid effluent discharge

ACW_i = ten times the effluent concentration value in unrestricted areas of nuclide i, expressed as µCi/mL from 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases, and 2E-4 µCi/mL for dissolved or entrained noble gases

d. **Bases - Liquid Effluent Concentration Limitations**

This control is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will not exceed 10 times the concentration values specified in Appendix B, Table 2, Column 2 of 10 CFR 20. The specification provides operational flexibility for releasing liquid effluent in concentrations to follow the Section II.A and II.C design objectives of Appendix I to 10 CFR Part 50. This limitation provides additional assurance that the levels of radioactive materials in bodies of water in UNRESTRICTED AREAS will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) restrictions authorized by 10 CFR 20.1301(e). The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its effluent concentration 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 specification does not affect the requirements to comply with the annual limitations of 10 CFR 20.1301(e).

6.2.2 **Liquid Monitoring Instrumentation**

a. **Radioactive Liquid Effluent Monitoring Instrumentation**

Radioactive liquid effluent monitoring instrumentation channels shown on Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) shall be operable with their alarm/trip setpoints set to ensure that Step 6.2.1.a. limits are not exceeded.

1. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.2.2.d., Setpoint Calculation.

2. If a radioactive liquid effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.2.2.a., perform one of the following:
   - Promptly suspend release of radioactive liquid effluents monitored by the affected channel
   - Declare the channel inoperable
   - Change the setpoint to an acceptable, conservative value

b. **Radioactive Liquid Effluent Monitoring Instrumentation Operability**

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated operable by performing a Channel Check, Source Check, Channel Calibration, and Channel Functional Test at the frequencies shown in Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 2).

1. If the number of operable channels is less than the minimum required by the tables in Radioactive Liquid Effluent Monitoring Instrumentation (Attachment 1) perform the action shown in those tables.

2. Attempt to return the instruments to operable status within 30 days. If unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. **Applicable Monitors**

Liquid effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
Service Water System Effluent Line	1-SW-RM-107 A, B, C, D
Condenser Circulating Water Line	1-SW-RM-120 2-SW-RM-220
Radwaste Facility Effluent Line	RE- RRM-131

d. **Setpoint Calculation**

NOTE: This methodology does not preclude use of more conservative setpoints.

1. Maximum setpoint values shall be calculated by:

$$S = \frac{CF_D}{F_E} \qquad (2)$$

where:

S = the setpoint, in μCi/mL, of the radioactivity monitor measuring the radioactivity concentration in the effluent line prior to dilution

C = the effluent concentration limit for the monitor used to implement 10 CFR 20 for the Station (ACW in μCi/mL) for an isotopic mixture expected in the effluent

F_E = maximum design pathway effluent flow rate

F_D = dilution water flow rate calculated as:
F_E + (200,000 gpm x number of circ. pumps in service)

2. Each of the condenser circulating water channels (e.g., SW-120, SW-220) monitors the effluent (service water, including component cooling service water, circulating water, and liquid radwaste) in the circulating water discharge tunnel beyond the last point of possible radioactive material addition. No dilution is assumed for this pathway. Therefore, Equation (2) becomes:

$$S = C \qquad (3)$$

The setpoint for Station monitors used to implement 10 CFR 20 for the site becomes the effluent concentration limit.

3. In addition, for added conservatism, setpoints shall be calculated for the service water system effluent line (i.e., SW-107 A, B, C, D), and the Radwaste Facility effluent line (i.e., RRM-131).

4. For the service water system effluent line, Equation (2) becomes:

$$S = \frac{CF_D K_{SW}}{F_E} \quad (4)$$

where:

K_{SW} = Allocation fraction of the effluent concentration limit, used to implement 10 CFR 20 for the Station, attributable to the service water effluent line pathway

5. For the Radwaste Facility effluent line, Equation (2) becomes:

$$S = \frac{CF_D K_{RW}}{F_E} \quad (5)$$

where:

K_{RW} = Allocation fraction of the effluent concentration limit, used to implement 10 CFR 20 attributable to the Radwaste Facility effluent line pathway

6. The sum $K_{SW} + K_{RW}$ shall not be greater than 1.0.

e. **Bases - Radioactive Liquid Effluent Monitoring Instrumentation**

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding 10 times the limits of 10 CFR 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 10 CFR Part 50.

6.2.3 **Liquid Effluent Dose Limit**

a. **Requirement**

At least once per 31 days, perform the dose calculations in Step 6.2.3.c. to ensure the dose or dose commitment to the maximum exposed member of the public from radioactive materials in liquid releases (from each reactor unit) to unrestricted areas is limited to:

1. During any calendar quarter:
   - Less than or equal to 1.5 mrem to the total body
   - Less than or equal to 5 mrem to the critical organ
2. During any calendar year:
   - Less than or equal to 3 mrem to the total body
   - Less than or equal to 10 mrem to the critical organ

b. **Action**

If the calculated dose from release of radioactive materials in liquid effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that identifies causes for exceeding limits and defines corrective actions taken to reduce releases of radioactive materials in liquid effluents to ensure that subsequent releases will be in compliance with the above limits.

c. **Dose Contribution Calculations**

NOTE: All critical organ doses for each age group are calculated to determine which is the limiting organ for the period being evaluated.

Dose contributions shall be calculated for all radionuclides identified in liquid effluents released to unrestricted areas based on the equation:

$$D = t\,F\,M \sum_i C_i A_i \qquad (6)$$

where:

Subscripts = i, refers to individual radionuclide

D = the cumulative dose commitment to the total body or critical organ from the liquid effluents for the period t, in mrem

t = the period for which C_i and F are averaged for all liquid releases, in hours

M = the mixing ratio (reciprocal of the dilution factor) at the point of exposure, dimensionless, 0.2 from Appendix 11A, Surry UFSAR

F = the near field average dilution factor for C_i during any liquid effluent release; the ratio of the average undiluted liquid waste flow during release to the average flow from the site discharge structure to unrestricted areas

C_i = the average concentration of radionuclide, i, in undiluted liquid effluent during the period t, from all liquid releases, in µCi/mL

A_i = the site-related ingestion dose commitment factor to the total body or critical organ for a particular age group for each identified principal gamma and beta emitter in mrem/hr per µCi/mL

$$A_i = 1.14\ E{+}05\ (21BF_i + 5BI_i)\ DF_i \qquad (7)$$

For example:

1.14 E+05 = 1 E+06 pCi/μCi x 1 E+03 mL/L / (8760 hr/yr), units conversion factor

21 = adult fish consumption, kg/yr, from NUREG-0133

5 = adult invertebrate consumption, kg/yr, from NUREG-0133

BI_i = the salt water bioaccumulation factor for nuclide i, in invertebrates, pCi/kg per pCi/L

BF_i = the salt water bioaccumulation factor for nuclide i, in fish, pCi/kg per pCi/L

DF_i = the critical organ dose conversion factor for nuclide i, for adults, in mrem/pCi

NOTE: The above parameters were obtained from R.G. 1.109, Rev. 1, LADTAP II and VCRL-50564, Rev. 1.

d. **Quarterly Composite Analyses**

For radionuclides not determined in each batch or weekly composite, dose contribution to current monthly or calendar quarter cumulative summation may be approximated by assuming an average monthly concentration based on previous monthly or quarterly composite analyses. However, for reporting purposes, calculated dose contribution shall be based on the actual composite analyses.

e. **Bases - Dose Due To Liquid Effluents**

This control is provided to implement the requirements of Sections II.A, III.A, and IV.A of Appendix I to 10 CFR Part 50. The control implements the guides set forth in Section II.A. 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 releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A that conformance with the guides of Appendix I be shown by calculation procedures, such that the actual exposure of a MEMBER OF THE PUBLIC is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977.

6.2.4 **Liquid Radwaste Treatment**

Historical data pertaining to the volumes and radioactivity of liquid effluents released in connection with specific station functions, such as maintenance or refueling outages, shall be used in projections as appropriate.

a. **Requirement**

1. The Surry Radwaste Facility Liquid Waste System shall be used to reduce the radioactive materials in liquid waste prior to discharge when projected dose due to liquid effluent, from each reactor unit, to unrestricted areas would exceed 0.06 mrem to total body or 0.2 mrem to the critical organ in a 31-day period.
2. Doses due to liquid releases shall be projected at least once per 31 days.

b. **Action**

If radioactive liquid waste is discharged without treatment and in excess of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that includes the following:

1. An explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or sub-system, and the reason for the inoperability.
2. Actions taken to restore inoperable equipment to operable status.
3. Summary description of actions taken to prevent recurrence.

c. **Projected Total Body and Critical Organ Dose Calculation**

1. Determine D_L, the sum of all liquid open and closed release points, in mrem, by the ith organ, for the quarter.
2. Determine P, the Projection Factor, which is result of 31 divided by the number of days from start of the quarter to the end of the release.
3. Determine Da, additional anticipated dose for liquid releases by the ith organ for the particular quarter of the release.
4. Determine Dp, the 31 day projected dose by the ith organ:
   $Dp = (D_L \times P) + Da$

d. **Bases - Liquid Radwaste Treatment System**

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

6.2.5 **Liquid Sampling**

Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis requirements in Radioactive Liquid Waste Sampling and Analysis Program (Attachment 3).

6.3 Gaseous Radioactive Waste Effluents

6.3.1 Gaseous Effluent Dose Rate Limitations

a. **Requirement**

Dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to:

1. The dose rate limit for noble gases shall be $\leq$ 500 mrem/year to the total body and $\leq$ 3000 mrem/year to the skin.
2. The dose rate limit for I^{131}, I^{133}, for tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days shall be $\leq$ 1500 mrem/year to the critical organ.

b. **Action**

1. If dose rates exceed Step 6.3.1.a. limits, promptly decrease the release rate to within the above limits.
2. Dose rates due to noble gases in gaseous effluents shall be determined, continuously, to be within Step 6.3.1.a. limits.
3. Dose rates due to I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents shall be determined to be within the above limits by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified on Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4).

c. **Calculations of Gaseous Effluent Dose Rates**

1. The dose rate limit for noble gases shall be determined to be within the limit by limiting the release rate to the lesser of:

$$\sum_i [(K_i \dot{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + (K_i \dot{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \leq 500 \text{ mrem/yr to the total body} \quad (8)$$

OR

$$\sum_i [((L_i + 1.1M_i)\dot{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + ((L_i + 1.1M_i)\dot{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \leq 3000 \text{ mrem/yr to the skin} \quad (9)$$

where:

Subscripts	=	vv, refers to vent releases from the building ventilation vent, including Radwaste Facility Ventilation Vent; pv, refers to the vent releases from the process vent; i, refers to individual radionuclide
K_i	=	the total body dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrem/yr per Curie/m^3
L_i	=	the skin dose factor due to beta emissions for each identified noble gas radionuclide i, in mrem/yr per Curie/m^3
M_i	=	the air dose factor due to gamma emissions for each identified noble gas radionuclide, i, in mrad/yr per Curie/m^3
$\dot{Q}_{ivv}$, $\dot{Q}_{ipv}$	=	the release rate for ventilation vents or process vent of noble gas radionuclide i, in gaseous effluents in Curie/sec (per site)
1.1	=	the unit conversion factor that converts air dose to skin dose, in mrem/mrad
X/Q_{ivv}, X/Q_{ipv}	=	the gaseous dispersion factor, sec/m^3(See Attachment 7)

2. The dose rate limit for I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days, shall be determined to be within the limit by restricting the release rate to:

$$\sum_i [P_i \dot{Q}_{ivv} \frac{\dot{X}}{\dot{Q}_{ivv}} + P_i \dot{Q}_{ipv} \frac{\dot{X}}{\dot{Q}_{ipv}}] \leq 1500 \text{ mrem/yr to the critical organ} \quad (10)$$

where:

P_i = the critical organ dose factor for I^{131}, I^{133}, H^3, and all radionuclides in particulate form with half-lives greater than 8 days, for the child inhalation pathway, in mrem/yr per Curie/m^3

$\dot{Q}_{ivv}, \dot{Q}_{ipv}$ = the release rate for ventilation vents or process vent of I^{131}, I^{133}, H^3, and all radionuclides i, in particulate form with half-lives greater than 8 days, in gaseous effluents in Curie/sec (per site)

$X/Q_{ivv}, X/Q_{ipv}$ = the gaseous dispersion factor, sec/m^3(See Attachment 7)

3. All gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\dot{Q}_{ivv}$.

d. **Bases - Dose Rate**

This specification provides reasonable assurance radioactive materials discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either at or beyond the SITE BOUNDARY, in excess of the design objectives of Appendix I to 10 CFR Part 50. This specification is provided to ensure that gaseous effluents from all units on the site will be appropriately controlled. It provides operational flexibility for releasing gaseous effluents to satisfy the Section II.A and II.C design objectives of Appendix I to 10 CFR Part 50. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body, less than or equal to 3000 mrem/year to the skin and the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrem/year. This specification does not affect the requirements to comply with the annual limitation of 10 CFR 20.1301(a). This control applies to the release of radioactive materials in gaseous effluents from all units at the site.

6.3.2 **Gaseous Monitoring Instrumentation**

a. **Requirement**

1. The radioactive gaseous effluent monitoring instrumentation channels shown in Radioactive Gaseous Effluent Monitoring Instrumentation (Attachment 5) shall be operable with alarm/trip setpoints set to ensure that Step 6.3.1.a. noble gas limits are not exceeded. Alarm/trip setpoints of these channels shall be determined and adjusted in accordance with Step 6.3.2.d.

2. Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated operable by Channel Checks, Source Checks, Channel Calibrations, and Channel Functional Tests at the frequencies shown in Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements (Attachment 6).

b. **Action**

1. If a radioactive gaseous effluent monitoring instrumentation channel alarm/trip setpoint is less conservative than required by Step 6.3.2.a.1, promptly:
   - Suspend the release of radioactive gaseous effluents monitored by the affected channel **and** declare the channel inoperable

     or
   - Change the setpoint so it is acceptably conservative

2. If the number of operable channels is less than the minimum required by tables in Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4), take the action shown in those tables.

3. Attempt to return instruments to operable status within 30 days. If unsuccessful, explain in the next Annual Radioactive Effluent Release Report why the inoperability was not corrected in a timely manner.

c. **Applicable Monitors**

Radioactive gaseous effluent monitors for which alarm/trip setpoints shall be determined are:

Release Point	Instrument Number
Process Vent	1-GW-RM-130B
Condenser Air Ejector	1-SV-RM-111 2-SV-RM-211
Ventilation Vent No. 1	1-VG-RM-104
Ventilation Vent No. 2	1-VG-RM-131B
Radwaste Facility Vent	RRM-101

d. **Setpoint Calculations**

1. Setpoint calculations for each monitor listed in Step 6.3.2.c. shall maintain this relationship:

$$D \geq D_{pv} + D_{cae} + D_{vv} \qquad (11)$$

where:

D = Step 6.3.1.a. dose limits that implement Technical Specifications for the Station, mrem/yr

D_{pv} = the noble gas site boundary dose rate from process vent gaseous effluent releases, mrem/yr

D_{cae} = the noble gas site boundary dose rate from condenser air ejector gaseous effluent releases, mrem/yr

D_{vv} = the noble gas site boundary dose rate from summation of the Ventilation Vents 1, 2, and the Radwaste Facility vent gaseous effluent releases, mrem/yr

2. Setpoint values shall be determined by:

$$C_m = \frac{R_m \times 2.12\ E\text{-}03}{F_m} \qquad (12)$$

where:

m	=	the release pathway, process vent (pv), ventilation vent (vv) condenser air ejector (cae), or Radwaste Facility (rv)
C_m	=	the effluent concentration limit implementing Step 6.3.1.a. for the Station, µCi/mL
R_m	=	the release rate limit for pathway m determined from methodology in Step 6.3.1.c., typically using Xe^{133} as nuclide to be released, µCi/sec
2.12E-03	=	CFM per mL/sec
F_m	=	the maximum flow rate for pathway m, CFM

NOTE: According to NUREG-0133, the radioactive effluent radiation monitor alarm/trip setpoints should be based on the radioactive noble gases. It is not practicable to apply instantaneous alarm/trip setpoints to integrating monitors sensitive to radioiodines, radioactive materials in particulate form, and radionuclides other than noble gases.

e. **Bases - Radioactive Gaseous Effluent Monitoring Instrumentation**

The radioactive gaseous effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the gaseous effluent dose rate limits of Section 6.3 of the ODCM. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

6.3.3 **Noble Gas Effluent Air Dose Limit**

a. **Requirement**

1. The air dose in unrestricted areas due to noble gases released in gaseous effluents from each unit at or beyond the site boundary shall be limited to:
   - During any calendar quarter: ≤ 5 mrads for gamma radiation and ≤ 10 mrad for beta radiation
   - During any calendar year: ≤ 10 mrads for gamma radiation and ≤ 20 mrad for beta radiation

2. Cumulative dose contributions for noble gases for the current calendar quarter and current calendar year shall be determined in accordance with Step 6.3.3.c. at least once per 31 days.

b. **Action**

If the calculated air dose from radioactive noble gases in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that identifies the causes for exceeding the limits and defines corrective actions that have been taken to reduce releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the limits in Step 6.3.3.a.

c. **Noble Gas Effluent Air Dose Calculation**

Gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\overline{Q}_{ivv}$.

The air dose to areas at or beyond the site boundary due to noble gases shall be determined by the following:

For gamma radiation:

$$D_g = 3.17E\text{-}08 \sum_i [(M_i \overline{Q}_{ivv} \frac{\dot{X}}{Q_{ivv}}) + (M_i \overline{Q}_{ipv} \frac{\dot{X}}{Q_{ipv}})] \qquad (13)$$

For beta radiation:

$$D_b = 3.17E\text{-}08 \sum_i [(N_i \overline{Q}_{ivv} \frac{\dot{X}}{Q}_{ivv}) + (N_i \overline{Q}_{ipv} \frac{\dot{X}}{Q}_{ipv})] \quad (14)$$

Where:

Subscripts	=	vv, refers to vent releases from the building ventilation vents, including the Radwaste Facility Ventilation Vent and air ejectors pv, refers to the vent releases from the process vent i, refers to individual radionuclide
D_g	=	the air dose for gamma radiation, in mrad
D_b	=	the air dose for beta radiation, in mrad
M_i	=	the air dose factor due to gamma emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/m^3
N_i	=	the air dose factor due to beta emissions for each identified noble gas radionuclide i, in mrad/yr per Curie/m^3
$\overline{Q}_{ivv}$, $\overline{Q}_{ipv}$	=	the release for ventilation vents or process vent of noble gas radionuclide i, in gaseous effluents for 31 days, quarter, or year as appropriate in Curies (per site)
3.17 E-08	=	the inverse of the number of seconds in a year
X/Q_{ivv}, X/Q_{ipv}	=	the gaseous dispersion factor, sec/m^3(See Attachment 7)

6.3.4 **I-131, 133, H-3 & Radionuclides in Particulate Form Effluent Dose Limit**

a. **Requirement**

1. Methods shall be implemented to ensure that the dose to any organ of a member of the public from I^{131}, I^{133}, tritium, and all radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released from the site to unrestricted areas from each reactor unit shall be:
   - During any calendar quarter: ≤ 7.5 mrem to the critical organ
   - During any calendar year: ≤ 15 mrem to the critical organ

2. Cumulative dose contributions to a member of the public from I^{131}, I^{133}, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents released to unrestricted areas for the current calendar quarter and current calendar year shall be determined at least once per 31 days in accordance with Step 6.3.4.c.

b. **Action**

If the calculated dose from the release of I^{131}, I^{133}, tritium, and radionuclides in particulate form, with half-lives greater than 8 days, in gaseous effluents exceeds any of the above limits, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that contains the:

1. Causes for exceeding limits.
2. Corrective actions taken to reduce releases.
3. Proposed corrective actions to be taken to assure that subsequent releases will be in compliance with limits stated in Step 6.3.4.a.

c. **Dose Calculations**

NOTE: All critical organ doses for each age group are calculated to determine which is the limiting organ for the period being evaluated.

Gaseous releases, not through the process vent, are considered ground level and shall be included in the determination of $\tilde{Q}_{ivv}$. Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection to specific Station functions, such as containment purges, shall be used in the estimates, as appropriate.

1. The dose to the maximum exposed member of the public, attributable to gaseous effluents at and beyond the site boundary that contain I^{131}, I^{133}, tritium, and particulate-form radionuclides with half-lives greater than 8 days, shall be determined by:

$$D_r = 3.17E-08 \sum_i \left[RM\left(Q_{ivv} \cdot {}^{D}/_{Q_{vv}} + Q_{ipv} \cdot {}^{D}/_{Q_{pv}}\right) + RI\left(Q_{ivv} \cdot {}^{X}/_{Q_{vv}} + Q_{ipv} \cdot {}^{X}/_{Q_{pv}}\right) + RG\left(Q_{ivv} \cdot {}^{D}/_{Q_{vv}} + Q_{ipv} \cdot {}^{D}/_{Q_{pv}}\right) + RH^3\left(Q_{ivv} \cdot {}^{X}/_{Q_{vv}} + Q_{ipv} \cdot {}^{X}/_{Q_{pv}}\right)\right] \quad (15)$$

For example:

Subscripts = vv, refers to vent releases from the building ventilation vents, including the Radwaste Facility Ventilation Vent and air ejectors;
pv, refers to the vent releases from the process vent

D_r = the dose to the critical organ of the maximum exposed member of the public in mrem

$\tilde{Q}_{ivv}, \tilde{Q}_{ipv}$ = the release for ventilation vents or process vent of I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than 8 days in Curies

3.17 E-08 = the inverse of the number of seconds in a year

X/Q_{vv}, X/Q_{pv} = the gaseous dispersion factor, sec/m^3 (See Attachment 7)

D/Q_{vv}, D/Q_{pv} = the gaseous deposition factor, m^{-2} (See Attachment 7)

RM = the cow-milk pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in m^2·mrem/yr per Ci/sec

RI = the inhalation pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in mrem/yr per Ci/m^3

RG = the ground plane pathway dose factor due to I^{131}, I^{133}, tritium, and from all particulate-form radionuclides with half-lives greater than eight days, in m^2·mrem/yr per Ci/sec

RH^3 = the tritium dose factor for milk in mrem/yr per Ci/m^3

6.3.5 **Gaseous Radwaste Treatment**

Historical data pertaining to the volumes and radioactive concentrations of gaseous effluents released in connection with specific Station functions, such as containment purges, shall be used to calculate projected doses, as appropriate.

a. **Requirement**

1. Appropriate portions of the Gaseous Radwaste Treatment System shall be used to reduce radioactive materials in gaseous waste before its discharge, when the projected gaseous effluent air doses due to gaseous effluent releases, from each unit to areas at and beyond the site boundary, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation, averaged over 31 days.
2. The Ventilation Exhaust Treatment System shall be used to reduce radioactive materials in gaseous waste before its discharge, when the projected doses due to gaseous effluent releases, from each unit to areas at and beyond the site boundary, would exceed 0.3 mrem to the critical organ, averaged over 31 days.
3. Doses due to gaseous releases from the site shall be projected at least once per 31 days, based on the calculations in Step 6.3.5.c.

b. **Action**

If gaseous waste that exceeds the limits in Step 6.3.5.a. is discharged without treatment, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that includes:

1. An explanation why gaseous radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability.
2. Actions taken to restore the inoperable equipment to operable status.
3. Summary description of actions taken to prevent recurrence.

c. **Projected Dose Calculations**

1. Determine Dg, the sum of all gaseous open and closed release points, in mrem, by the ith organ, for the quarter.
2. Determine P, the Projection Factor, which is result of 31 divided by the number of days from start of the quarter to the end of the release.

3. Determine Da, additional anticipated dose for gaseous releases by the ith organ for the particular quarter of the release.

4. Determine Dp, the 31 day projected dose by the ith organ.
   Dp = (Dg x P) + Da

6.4 Radioactive Liquid and Gaseous Release Permits

RP shall maintain procedures for Liquid and Gaseous Release Permits to ensure effluent dose limits are not exceeded when making releases. As indicated on Attachment 3, Radioactive Liquid Waste Sampling and Analysis Program, prerelease assessments/permits are required for batch releases. Depending on the affected plant system, continuous releases may or may not allow for a prerelease assessment and are evaluated on a case by case basis.

6.4.1 Liquid Waste Batch Releases

a. Operations shall obtain RP authorization before initiating batch releases of radioactive liquids.

b. Release of contents from the following tanks/sumps other than transfers to the Radwaste Facility shall have a release permit before the discharge. Examples of batch releases include:
   - Turbine Building Sumps when RP determines that source activity requires placing pumps in manual mode
   - Condensate Polishing Building Sumps and Steam Generator secondary water when RP determines the presence of contamination from primary-to-secondary leakage
   - Radwaste Facility release tanks (LWMT, LDMT)

6.4.2 Continuous Liquid Releases

a. Operations shall obtain RP authorization before initiating continuous releases of radioactive liquids.

b. Examples of continuous releases include:
   - Steam generator blowdown
   - Component Cooling Water (CCW) heat exchanger to service water leakage, if applicable
   - Storm drains, equipped with composite sampling systems, that receive run-off from rain and turbine building sumps, subsurface drains and ground water wells when pumps are in automatic mode.

6.4.3 **Waste Gas Decay Tank (WGDT) Release Permit**

Operations shall obtain RP authorization before initiating WGDT releases.

6.4.4 **Reactor Containment Release Permits**

Operations shall obtain authorization from RP before initiating containment purges or containment hogging. Reactor Containment Release Permits shall be valid from start of purge/hog until:

- Routine termination
- Terminated for cause by RP
- Receipt of Radiation Monitoring System (RMS) Containment Gas Monitor high alarm

6.4.5 **Miscellaneous Gaseous Release Permit**

Operations shall obtain RP authorization before initiating releases of noble gases that may not be accounted for by routine sampling, or any planned release not being routed through the Process Vent or Ventilation Vents.

6.4.6 **Radioactive Liquid and Gaseous Release Controls**

a. Operations shall notify RP of pending releases and request RP to initiate the appropriate release permit. Operations shall provide the necessary information to complete the required release permit.

b. A representative sample shall be obtained of the source to be released.

   1. Operations shall provide RP with liquid samples and sample information (e.g., time of sample) for samples obtained outside the Primary Sample Room.
   2. Chemistry shall provide RP with liquid samples and sample information for samples obtained from inside the Primary Sample Room.
   3. RP shall obtain gaseous samples.

c. RP shall perform required sample analyses.

d. RP shall calculate and record the following information on a release permit:
   - Maximum authorized release rate
   - Applicable conditions or controls pertaining to the release

e. RP shall notify the Operations Shift Supervision if it is determined that a release may not be within the effluent dose limits.

f. Upon receipt of a release permit from RP, Operations shall:

1. Verify the correct source is authorized for release.
2. Note maximum authorized release rate.
3. Note and ensure compliance with any indicated controls or conditions applicable to the release.

g. When commencing release, Operations shall provide RP with required information. As appropriate, required information shall include:

- Date and time release was started
- Starting tank/sump level
- Beginning pressure
- Release flow rate
- Dilution water flow rate

h. Upon terminating the release, Operations shall return the permit to RP and provide information necessary for completion of permit. As appropriate, required information shall include:

- Date and time release was stopped
- Tank/sump ending level
- Release flow rate just prior to termination
- Ending pressure
- Volume released

6.5 Total Dose Limit to Public From Uranium Fuel Cycle Sources

6.5.1 Requirement

The annual (calendar year) dose or dose commitment to a real individual due to releases of radioactivity and radiation from uranium fuel cycle sources shall not exceed 25 mrem to the total body or the critical organ (except the thyroid, which shall not exceed 75 mrem).

6.5.2 **Action**

a. If the calculated doses from release of radioactive materials in liquid or gaseous effluents exceed twice the limits in Steps 6.2.3.a., 6.3.3.a., or 6.3.4.a., calculate (including direct radiation contribution from the units and from outside storage tanks) whether limits in Step 6.5.1 have been exceeded.

b. If the limits in Step 6.5.1 have been exceeded, prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that defines the corrective action to be taken to reduce subsequent releases and to prevent recurrence, and includes a schedule for achieving conformance with the limits. Special reports, as defined in 10 CFR 20.2203(a)(4), shall include:

1. An analysis that estimates the radiation exposure (dose) to a real individual from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the releases covered by the report.
2. A description of the levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations.
3. If the estimated dose exceeds the limits in Step 6.5.1, and if the release condition that violates 40 CFR 190 has not already been corrected, the special report shall include a request for a variance in accordance with the provisions of 40 CFR 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

6.6 Radiological Environmental Monitoring

6.6.1 **Monitoring Program**

a. **Requirement**

1. The Radiological Environmental Monitoring Program shall be conducted as specified in Radiological Environmental Monitoring Program (Attachment 8).
2. Samples shall be collected from specific locations specified in Environmental Sampling Locations (Attachment 9).

3. Samples shall be analyzed in accordance with:
   - Radiological Environmental Monitoring Program (Attachment 8) requirements
   - Detection capabilities required by Detection Capabilities for Environmental Sample Analysis (Attachment 10)
   - Guidance of the Radiological Assessment Branch Technical Position on Environmental Monitoring dated November, 1979, Revision No. 1

b. **Action**

1. If the Radiological Environmental Monitoring Program is not being conducted as required in Step 6.6.1.a., report the situation in accordance with VPAP-2802, Notifications and Reports, by preparing and submitting to the NRC, in the Annual Radiological Environmental Operating Report required by Technical Specification (Surry Technical Specification 6.6.B.2), a description of the reasons for not conducting the program as required, and the plan for precluding recurrence.

2. If, when averaged over any calendar quarter, radioactivity exceeds the reporting levels of Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11), prepare and submit to the NRC, within 30 days, a special report in accordance with VPAP-2802, Notifications and Reports, that:
   - Identifies the causes for exceeding the limits, and
   - Defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose to a member of the public is less than the calendar year limits of Steps 6.2.3, 6.3.3, and 6.3.4

   When more than one of the radionuclides listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11) are detected in the sampling medium, the report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting level (2)}} + \ldots \geq 1.0 \qquad (15)$$

3. When radionuclides other than those listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11) are detected and are the result of plant effluents, the report shall be submitted if the potential annual dose to a member of the public is equal to or greater than the calendar year limits of Steps 6.2.3, 6.3.3, and 6.3.4. The report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, report and describe the condition in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports.

4. If milk or fresh leafy vegetable samples are unavailable from one or more of the sample locations required by Radiological Environmental Monitoring Program (Attachment 8), identify locations for obtaining replacement samples and add them to the radiological environmental monitoring program within 30 days. The specific locations from which samples were unavailable may then be deleted from the monitoring program. Identify the cause of the unavailability of samples and identify the new locations for obtaining replacement samples in the next Annual Radioactive Effluent Release Report in accordance with VPAP-2802, Notifications and Reports.

5. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment and other legitimate reasons. If specimens are unavailable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the annual report in accordance with VPAP-2802, Notifications and Reports.

6.6.2 **Land Use Census**

a. **Requirement**

A land use census shall be conducted and shall identify, within a distance of 8 km (5 miles), the location in each of the 16 meteorological sectors of the following:

- Nearest milk animal
- Nearest residence
- Nearest garden greater than 50 m^2 (500 ft^2) that produces broad leaf vegetation

1. The land use census shall be conducted during the growing season, at least once per 12 months, using methods that will provide the best results (e.g., door-to-door survey, aerial survey, local agriculture authorities). Land use census results shall be included in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports.

2. In lieu of the garden census, broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted ground deposition (D/Qs). Specifications for broad leaf vegetation sampling in Radiological Environmental Monitoring Program (Attachment 8) shall be followed, including analysis of control samples.

b. **Action**

1. If a land use census identifies locations that yield a calculated dose or dose commitment greater than the values currently being calculated in Step 6.3.4.a., identify the new locations in the next Annual Radioactive Effluent Release Report in accordance with VPAP-2802, Notifications and Reports.

2. If a land use census identifies locations that yield a calculated dose or dose commitment (via the same exposure pathway) 20 percent greater than at a location from which samples are currently being obtained, add the new locations to the Radiological Environmental Monitoring Program within 30 days. Sampling locations, excluding the control station location, that have the lowest calculated dose or dose commitments (via the same exposure pathway) may be deleted from the monitoring program. Identify new locations in the next Annual Radioactive Effluent Release Report and include in the report revised figures and tables reflecting the new locations in accordance with VPAP-2802, Notifications and Reports. **[Commitment 3.2.1]**

6.6.3 **Interlaboratory Comparison Program**

a. **Requirement**

Radioactive materials (which contain nuclides produced at the Station), supplied as part of an Interlaboratory Comparison Program, shall be analyzed.

b. **Action**

1. Analyses shall be performed at least semi-annually as follows:

Program	Cross-Check of
Milk	I^{131}, Gamma, Sr^{89} and Sr^{90}
Water	Gross Beta, Gamma, I^{131}, H^3 (Tritium), Sr^{89} and Sr^{90} (blind—any combinations of above radionuclides)
Air Filter	Gross Beta, Gamma, Sr^{90}

2. If analyses are not performed as required by Step 6.6.3.b., report in the Annual Radiological Environmental Operating Report in accordance with VPAP-2802, Notifications and Reports, the corrective actions taken to prevent recurrence.

c. **Results**

Results shall be reported in the Annual Radiological Environmental Monitoring Report in accordance with VPAP-2802, Notifications and Reports.

6.7 Reporting Requirements

6.7.1 **Annual Radiological Environmental Operating Report**

Routine Radiological Environmental Operating Reports covering the operation of the units during the previous calendar year shall be submitted prior to May 1 of each year. A single submittal may be made for the Station. Radiological Environmental Operating Reports shall include:

a. Summaries, interpretations, and analysis of trends of results of radiological environmental surveillance activities for the report period, including:

- A comparison (as appropriate) with preoperational studies, operational controls, and previous environmental surveillance reports
- An assessment of the observed impacts of the plant operation on the environment
- Results of land use census per Step 6.6.2

b. Results of analysis of radiological environmental samples and of environmental radiation measurements taken per Step 6.6.1, Monitoring Program. Results shall be summarized and tabulated in the format of the table in the Radiological Assessment Branch Technical Position on Environmental Monitoring.

   1. If some individual results are not available for inclusion with the report, the report shall be submitted, noting and explaining reasons for missing results.
   2. Missing data shall be submitted in a supplementary report as soon as possible.

c. A summary description of the radiological environmental monitoring program.

d. At least two legible maps covering sampling locations, keyed to a table giving distances and directions from the centerline of one reactor. One map shall cover stations near the site boundary; a second shall include more distant stations.

e. Results of Station participation in the Interlaboratory Comparison Program, per Step 6.6.3.

f. Discussion of deviations from the Station's environmental sampling schedule per Radiological Environmental Monitoring Program (Attachment 8).

g. Discussion of analyses in which the lower limit of detection (LLD) required by Detection Capabilities for Environmental Sample Analysis (Attachment 10) was not achievable.

h. Results of analysis of ground water wells described in the environmental monitoring program, whether required by the program or not.

NOTE: NUREG-0543 states: "There is reasonable assurance that sites with up to four operating reactors that have releases within Appendix I design objective values are also in conformance with the EPA Uranium Fuel Cycle Standard, 40 CFR Part 190."

6.7.2 **Annual Radioactive Effluent Release Report**

a. **Requirement - Station**

Radioactive Effluent Release Reports covering operation of the units during the previous 12 months of operation shall be submitted before May 1 of each year. A single submittal may be made for the Station and should combine those sections that are common to both units. Radioactive Effluent Release Reports shall include:

1. A summary of quantities of radioactive liquid and gaseous effluents and solid waste released. Data shall be summarized on a quarterly basis following the format of Regulatory Guide 1.21, Appendix B, for liquid and gaseous effluents. Data shall be summarized on an annual basis following the format of Regulatory Guide 1.21, Appendix B, for solid waste.
   [Commitment 3.2.2]
2. An assessment of radiation doses to the maximum exposed members of the public due to the radioactive liquid and gaseous effluents released from the Station during the previous calendar year. This assessment shall be in accordance with Step 6.7.2.b.
3. A list and description of unplanned releases from the site to unrestricted areas, during the reporting period, which meet the following criteria:
   - Unplanned releases that exceeded the limits in Steps 6.2.1 and 6.3.1
   - Unplanned releases which require a Condition Report and involve the discharge of contents of the wrong Waste Gas Decay Tank or the wrong liquid radwaste release tank
   - Unplanned releases from large leaks due to unexpected valve or pipe failures that result in a quantity of release such that a 10 CFR 50.72, Immediate Notification Requirements for Operating Nuclear Power Reactors or 10 CFR 50.73, Licensee Event Report System, report is required
   - Unplanned releases as determined by Radiation Protection Supervision, which may or may not require a Condition Report

4. Major changes to radioactive liquid, gaseous, and solid waste treatment systems during the reporting period.
5. Changes to VPAP-2103S, Offsite Dose Calculation Manual (Surry) (See Step 6.7.4).
6. A listing of new locations for dose calculations or environmental monitoring identified by the land use census (See Step 6.6.2).
7. A summary of radioactive leaks or spills meeting the following criteria:
   - An unintended spill or leak with the potential to reach groundwater, as defined in NEI 07-07, **and**
   - The spill or leak must be greater than 100 gallons in volume or the volume cannot be quantified but is estimated to be greater than 100 gallons; **or**
   - Any spill or leak, regardless of volume or activity deemed by the licensee to be reportable.
8. Groundwater sample results from locations not part of the Radiological Environmental Monitoring Program.

b. **Dose Assessment - Station**

1. Radiation dose to individuals due to radioactive liquid and gaseous effluents from the Station during the previous calendar year shall either be calculated in accordance with this procedure or in accordance with Regulatory Guide 1.109. Population doses shall not be included in dose assessments.
2. The dose to the maximum exposed member of the public due to radioactive liquid and gaseous effluents from the Station and from the ISFSI shall be incorporated with the dose assessment performed above. If the dose to the maximum exposed member of the public exceeds twice the limits of 6.2.3.a.1, 6.2.3.a.2, 6.3.3.a.1, or 6.3.4.a.1, the dose assessment shall include the contribution from direct radiation.
3. Meteorological conditions during the previous calendar year or historical annual average atmospheric dispersion conditions shall be used to determine gaseous pathway doses.

NOTE: The Annual Radioactive Effluent Release Reports for Surry Station and Surry ISFSI are separate and not submitted as a combined report.

c. **Requirement - ISFSI**

1. Radioactive Effluent Release Report covering operation of the ISFSI during the previous 12 months of operation shall be submitted within 60 days after January 1.

2. The ISFSI Radioactive Effluent Release Report shall specify the quantities of each of the principal radionuclides released to the environment in liquid and in gaseous effluents.

3. **Dose Assessment - ISFSI**

   Provide such information as may be required by the Commission to estimate potential radiation dose commitment to the public resulting from effluent releases from the ISFSI.

6.7.3 **Annual Meteorological Data**

a. Meteorological data collected during the previous year shall be in the form of joint frequency distributions of wind speed, wind direction, and atmospheric stability.

b. Meteorological data shall be retained in a file on site and shall be made available to NRC upon request.

6.7.4 **Changes to the ODCM**

Changes to the ODCM shall be:

a. Approved by the Site Vice President before implementation.

b. Documented. Records of reviews shall be retained as Station records. Documentation shall include:

1. Sufficient information to support changes, together with appropriate analyses or evaluations justifying changes.

2. A determination that a change will not adversely impact the accuracy or reliability of effluent doses or setpoint calculations, and will maintain the level of radioactive effluent control required by:
   - 10 CFR 20, Subpart D
   - 40 CFR 190
   - 10 CFR 50.36a
   - 10 CFR 50, Appendix I
   - Technical Specifications

c. Submitted to NRC in the form of a complete, legible copy of the entire ODCM as a part of, or concurrent with the Annual Radioactive Effluent Release Report for the period of the report in which any change 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, and shall indicate the date (e.g., month/year) the change was implemented.

d. Submitted to NRC in accordance with VPAP-2802, Notifications and Reports.

6.7.5 **Industry Ground Water Protection Initiative**

a. **Program**

The Ground Water Protection Program is established in Administrative Procedure RP-AA-502, Groundwater Protection Program.

NOTE: RP-AA-502 Attachment 1, Voluntary Communication Protocol, contains a flow chart to assist with determining if an event should be communicated to State and Local officials and to the NRC.

b. **Communications**

1. Informal communication shall be made to the State, Local and NRC officials by the end of the next business day for any spill or leak meeting the requirements of 6.7.2.a.7.

2. Informal communication shall be made to the State, Local and NRC officials by the end of the next business day for a water sample result that meets the following criteria:
   - An off-site ground water or surface water sample result that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11).
   - An on-site surface water sample result, that is hydrologically connected to ground water, or ground water that is or could be used as a source of drinking water, that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11).

c. **30-Day Reports**

1. Submit a written 30-day report to the NRC for a water sample result for on-site or off-site ground water that is or could be used as a source of drinking water that exceeds the reporting criteria listed in Reporting Levels for Radioactivity Concentrations in Environmental Samples (Attachment 11). A 30-day report is only required on the initial discovery of a contaminated ground water plume.
2. Concurrently submit a copy of the written 30-day NRC report to the appropriate State and Local officials.

d. **Annual Reports**

1. Report sample results communicated per 6.7.5.b.1 in the Annual Radiological Effluent Release Report.
2. Report ground water sample results that are not included in the Radiological Environmental Monitoring Program in the Annual Radiological Effluent Release Report.
3. Report sample results communicated per 6.7.5.b.2 in the Annual Radiological Effluent Release Report or the Annual Radiological Environmental Operating Report.
4. Report ground water sample results that are included in the Radiological Environmental Monitoring Program in the Annual Radiological Environmental Operating Report.

7.0 RECORDS

7.1 The following record(s) completed as a result of this procedure are required to be transmitted to Nuclear Document Management (NDM). The records have been identified and retention requirements established for the Nuclear Records Retention Schedule (NRRS) per RM-AA-101, Record Creation, Transmittal, and Retrieval.

7.1.1 **Quality Assurance Records**

- Records of changes to the ODCM in accordance with Step 6.7.4
- Records of meteorological data in accordance with Step 6.7.3
- Records of sampling and analyses
- Records of radioactive materials and other effluents released to the environment
- Records of preventive maintenance, surveillances, and calibrations

7.1.2 **Non-Quality Assurance Records**

None

7.2 The following record(s) completed as a result of this procedure are **NOT** required to be transmitted to Nuclear Document Management (NDM), but are required to be retained as indicated below. The NRRS has been updated and Alternate Storage approved per RM-AA-101 for Quality Assurance Records.

7.2.1 **Quality Assurance Records**

None

7.2.2 **Non-Quality Assurance Records**

None

7.3 The following item(s) completed as a result of this procedure are **NOT** records and are **NOT** required to be transmitted to Nuclear Document Management (NDM).

None

ATTACHMENT 1

(Page 1 of 1)

Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	Minimum Operable Channels	Action
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE		
(a) Radwaste Facility Liquid Effluent Line,		
RE-RRM-131	1	1
2. GROSS BETA OR GAMMA RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE		
(a) Circulating Water Discharge Lines,		
Unit 1: 1-SW-RM-120	1	2
Unit 2: 2-SW-RM-220	1	2
(b) Component Cooling Service Water Effluent Lines,		
1-SW-RM-107A	1	2
1-SW-RM-107B	1	2
1-SW-RM-107C	1	2
1-SW-RM-107D	1	2
3. FLOW RATE MEASUREMENT DEVICES		
(a) Radwaste Facility Liquid Effluent Line,		
Instrument Loop RLW-153	1	3

ACTION 1: If the number of operable channels is less than required, effluent releases via this pathway shall be suspended.

ACTION 2: If the number of operable channels is less than required, effluent releases via this pathway may continue provided that, at least once per 12 hours, grab samples are collected and analyzed for principal gamma emitters, as defined in Radioactive Liquid Waste Sampling and Analysis Program (Attachment 3). When the effluent release via this pathway continues, then initiate the "Loss of Radioactive Liquid Effluent Monitoring Instrumentation Sampling Schedule" attachment in HP-3010.021, Radioactive Liquid Waste Sampling and Analysis.

ACTION 3: If the number of operable channels is less than required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 30 minutes during the actual releases. Design capacity pump performance curves generated in place or volume released over time may be used to estimate flow.

ATTACHMENT 2

(Page 1 of 1)

Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Channel Description	Channel Check	Source Check	Channel Calibration	Channel Functional Test
1. GROSS RADIOACTIVITY MONITORS PROVIDING ALARM AND AUTOMATIC TERMINATION OF RELEASE				
(a) Radwaste Facility Liquid Effluent Line, RE-RRM-131	D	P	R	Q
2. GROSS BETA OR GAMMA RADIOACTIVITY MONITORS PROVIDING ALARM BUT NOT PROVIDING AUTOMATIC TERMINATION OF RELEASE				
(a) Circulating Water Discharge Lines, Unit 1: 1-SW-RM-120 Unit 2: 2-SW-RM-220	D	M	R	Q
(b) Component Cooling Service Water Effluent Lines, 1-SW-RM-107A 1-SW-RM-107B 1-SW-RM-107C 1-SW-RM-107D	D	M	R	Q
3. FLOW RATE MEASUREMENT DEVICES				
(a) Radwaste Facility Liquid Effluent Line, Instrument Loop RLW-153	DR	N/A	R	N/A

ATTACHMENT 3

(Page 1 of 3)

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), **(Note 1)**
Batch Releases **(Note 2)**	P (Each Batch)	P (Each Batch)	Principal Gamma Emitters **(Note 3)**	5×10^{-7}
			I^{131}	1×10^{-6}
	P (One Batch/M)	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	P (Each Batch)	M Composite **(Note 4)**	H^3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	P (Each Batch)	Q Composite **(Note 4)**	Sr^{89} and Sr^{90}	5×10^{-8}
			Fe^{55}	1×10^{-6}
Continuous Releases **(Note 5)**	Continuous **(Note 6)**	W Composite **(Note 6)**	Principal Gamma Emitters **(Note 6)**	5×10^{-7}
			I^{131}	1×10^{-6}
	M Grab Sample	M	Dissolved and Entrained Gases (Gamma Emitters)	1×10^{-5}
	Continuous **(Note 6)**	M Composite **(Note 6)**	H^3	1×10^{-5}
			Gross Alpha	1×10^{-7}
	Continuous **(Note 6)**	Q Composite **(Note 6)**	Sr^{89} and Sr^{90}	5×10^{-8}
			Fe^{55}	1×10^{-6}

ATTACHMENT 3

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Radioactive Liquid Waste Sampling and Analysis Program

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (8\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection (as microcuries per unit mass or volume) (See Subsection 4.9)
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm)
E	=	the counting efficiency (as counts per disintegration)
V	=	the sample size (in units of mass or volume)
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie
Y	=	the fractional radiochemical yield (when applicable)
λ	=	the radioactive decay constant for the particular radionuclide
Δt	=	the elapsed time between the midpoint of sample collection and time of counting

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

NOTE 2: A batch release is the discharge of liquid wastes of a discrete volume. Before sampling for analyses, each batch shall be isolated, and appropriate methods will be used to obtain a representative sample for analysis.

ATTACHMENT 3

(Page 3 of 3)

Radioactive Liquid Waste Sampling and Analysis Program

NOTE 3: The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Mn^{54}, Fe^{59}, Co^{58}, Co^{60}, Zn^{65}, Mo^{99}, Cs^{134}, Cs^{137}, Ce^{141}, and Ce^{144}. This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, at levels exceeding the LLD, together with the above nuclides, shall also be identified and reported.

NOTE 4: A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and for which the method of sampling employed results in a specimen that is representative of the liquids released.

NOTE 5: A continuous release is the discharge of liquid wastes of a non-discrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

NOTE 6: To be representative of the quantities and concentrations of radioactive materials in liquid effluents, composite sampling shall employ appropriate methods which will result in a specimen representative of the effluent release.

ATTACHMENT 4

(Page 1 of 4)

Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/mL), **(Note 1)**
A. Waste Gas Storage Tank	Prior to Release (Each Tank) (Grab Sample)	Prior to Release (Each Tank)	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
B. Containment Purge	Prior to Release (Each PURGE) (Grab Sample)	Prior to Release (Each PURGE)	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}
C. Ventilation **(1)Process Vent** **(2)Vent Vent #1** **(3)Vent Vent #2** **(4)SRF Vent**	Weekly (Grab Sample) **(Note 3)**	Weekly **(Note 3)**	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}
All Release Types as listed in A, B, and C	Continuous **(Note 4)**	Weekly **(Note 5)** (Charcoal Sample)	I^{131}	1×10^{-12}
			I^{133}	1×10^{-10}
	Continuous **(Note 4)**	Weekly **(Note 5)** Particulate Sample	Principal Gamma Emitter **(Note 2)**	1×10^{-11}
	Continuous **(Note 4)**	Weekly Composite Particulate Sample	Gross Alpha	1×10^{-11}
	Continuous **(Note 4)**	Quarterly Composite Particulate	Sr^{89} and Sr^{90}	1×10^{-11}
	Continuous **(Note 4)**	Noble Gas Monitor	Noble Gases Gross Beta and Gamma	1×10^{-6}
Condenser Air Ejector	Weekly Grab Sample **(Note 3)**	Weekly **(Note 3)**	Principal Gamma Emitters **(Note 2)**	1×10^{-4}
			H^3	1×10^{-6}

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (μCi/mL), **(Note 1)**
Containment Hog Depressurization	Prior to Release (Grab Sample)	Prior to Release (Each Release)	Principal Gamma Emitters	1×10^{-4}
			H^3	1×10^{-6}
	Continuous **(Note 4)**	Charcoal Sample **(Note 6)**	I^{131}	1×10^{-11}
			I^{133}	1×10^{-10}
	Continuous **(Note 4)**	Particulate Sample **(Note 6)**	Principal Gamma Emitter **(Note 2)**	1×10^{-10}
	Continuous **(Note 4)**	Composite Particulate Sample **(Note 6)**	Gross Alpha	1×10^{-10}
	Continuous **(Note 4)**	Composite Particulate Sample **(Note 6)**	Sr^{89} and Sr^{90}	1×10^{-10}

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (10\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection as defined above (as microcuries per unit mass or volume) (See Subsection 4.9).
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm).
E	=	the counting efficiency (as counts per disintegration).
V	=	the sample size (in units of mass or volume).
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie.
Y	=	the fractional radiochemical yield (when applicable).
λ	=	the radioactive decay constant for the particular radionuclide.
Δt	=	the elapsed time between the midpoint of sample collection and time of counting.

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

ATTACHMENT 4

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Radioactive Gaseous Waste Sampling and Analysis Program

NOTE 2: The principal gamma emitters for which the LLD specification applies exclusively are the following radionuclides: Kr^{87}, Kr^{88}, Xe^{133}, Xe^{133m}, Xe^{135}, Xe^{135m}, and Xe^{138} for gaseous emissions and Mn^{54}, Fe^{59}, Co^{58}, Co^{60}, Zn^{65}, Mo^{99}, Cs^{134}, Cs^{137}, Ce^{141} and Ce^{144} for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other nuclides with half lives greater than 8 days, that are measurable and identifiable at levels exceeding the LLD, together with the above nuclides, shall also be identified and reported.

NOTE 3: Sampling and analysis shall also be performed following shutdown, start-up, and whenever a thermal power change exceeding 15 percent of the rated thermal power occurs within any one-hour period, when:

a. Analysis shows that the dose equivalent I^{131} concentration in the primary coolant has increased more than a factor of 3; and

b. The noble gas activity monitor shows that effluent activity has increased by more than a factor of 3.

NOTE 4: The ratio of the sample flow rate to the sampled stream flow rate shall be known for the period covered by each dose or dose rate calculation made in accordance with Steps 6.3.1, 6.3.3, and 6.3.4.

NOTE 5: Samples shall be changed at least once per seven days and analyses shall be completed within 48 hours after changing (or after removal from sampler). Sampling shall also be performed at least once per 24 hours for at least seven days following each shutdown, start-up, or thermal power change exceeding 15 percent of rated thermal power in one hour, and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLDs may be increased by a factor of 10. This requirement applies if:

a. Analysis shows that the dose equivalent I^{131} concentration in the primary coolant has increased by a factor of 3; and

b. Noble gas monitor shows that effluent activity has increased more than a factor of 3.

NOTE 6: To be representative of the quantities and concentrations of radioactive materials in gaseous effluents, composite sampling shall employ appropriate methods that will result in a specimen representative of the effluent release.

ATTACHMENT 5

(Page 1 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM OPERABLE CHANNELS	ACTION
1. PROCESS VENT SYSTEM		
(a) Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release:		
1-GW-RM-130B	1	1
(b) Iodine Sampler:		
Continuous HP Sampler, or		
1-GW-RM-130-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		
(c) Particulate Sampler:		
Continuous HP Sampler, or		
1-GW-RM-130-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		
(d) Process Vent Flow Rate Monitor:		
1-GW-FT-100	1	3
(e) Sampler Flow Rate Measuring Device:		
HP Sampler Rotometer or MGPI Flow Rate Measuring Device	1	3
2. CONDENSER AIR EJECTOR SYSTEM		
(a) Gross Activity Monitor:		
1-SV-RM-111	1	1
2-SV-RM-211	1	1
(b) Air Ejector Flow Rate Measuring Device:		
Unit 1: 1-VP-FI-1A	1	3
1-VP-FI-1B	1	3
Unit 2: 2-VP-FI-1A	1	3
2-VP-FI-1B	1	3
3. VENTILATION VENT SYSTEM		
(a) Noble Gas Activity Monitor:		
SRF: RRM-101	1	1
SPS: Vent #1, 1-VG-RM-104	1	1
Vent #2, 1-VG-RM-131B	1	1
(b) Iodine Sampler:		
SRF: RRM-101	1	2
SPS: Vent #1, 1-VG-RM-104 **(NOTE 2)**	1	2
Vent #2, Continuous HP Sampler, or		
1-VG-RM-131-1 **(NOTE 1)**	1	2
In-Line Particulate / Iodine Sampler		

ATTACHMENT 5

(Page 2 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation

INSTRUMENT	MINIMUM OPERABLE CHANNELS	ACTION
(c) Particulate Sampler:		
SRF: RRM-101	1	2
SPS: Vent #1, VG-RM-104 **(NOTE 2)**	1	2
Vent #2, HP Continuous Sampler, or 1-VG-RM-131-1 **(NOTE 1)** In-Line Particulate / Iodine Sampler	1	2
(d) Ventilation Vent Flow Rate Monitor:		
SRF: 01-RHV-FT-156	1	3
SPS: Vent #1, 1-VS-FT-119	1	3
Vent #2, 1-VS-FT-116	1	3
(e) Sampler Flow Rate Measuring Device:		
SRF: RRM-101	1	3
SPS: Vent #1, 1-VG-RM-104 **(NOTE 2)**	1	3
Vent #2, HP Sampler Rotometer or MGPI Flow Rate Measuring Device	1	3

NOTE 1: The mark number listed refers to the entire radiation monitor skid which includes particulate, iodine, and noble gas components.

NOTE 2: Vent # 1, 1-VG-RM-104, HP continuous sampler pump automatically maintains isokinetic sample flow when changes in stack flow are detected. Isokinetic sample flow adjustment can take 15 - 20 minutes. **[Commitment 3.2.3]**

ACTION 1: If the number of operable channels is less than required, effluent releases via this path may continue provided that the best efforts are made to repair the channel and that grab samples are taken at least once per 12 hours and these samples are analyzed for gross activity within 24 hours. When the effluent release via this pathway continues, then initiate the "Loss of Radioactive Gaseous Effluent Monitoring Instrumentation Sampling Schedule" attachment in HP-3010.031, Radioactive Gaseous Waste Sampling and Analysis. **[Commitment 3.2.4]**

ACTION 2: If the number of operable channels is less than required, effluent releases via this pathway may continue provided that the best efforts are made to repair the channel and that the samples are continuously collected with auxiliary sampling equipment within 12 hours after the initiation of this ACTION statement as required in Radioactive Gaseous Waste Sampling and Analysis Program (Attachment 4). **[Commitment 3.2.4]**

ACTION 3: If the number of operable channels is less than required, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours.

ATTACHMENT 6

(Page 1 of 2)

Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

CHANNEL DESCRIPTION	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
1. PROCESS VENT SYSTEM				
(a) Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release				
1-GW-RM-130B	D	M	R	Q
(b) Iodine Sampler **(NOTE 1)**				
Process Vent Continuous HP Sampler, or 1-GW-RM-130-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(c) Particulate Sampler **(NOTE 1)**				
Process Vent Continuous HP Sampler, or 1-GW-RM-130-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(d) Process Vent Flow Rate Monitor				
1-GW-FT-100	D	N/A	R	N/A
(e) Sampler Flow Rate Measuring Device				
HP Sampler Rotometer, or	D	N/A	SA	N/A
MGPI Flow Rate Measuring Device	D	N/A	R	N/A
2. CONDENSER AIR EJECTOR SYSTEM				
(a) Gross Activity Monitor				
Unit 1: 1-SV-RM-111 Unit 2: 2-SV-RM-211	D	M	R	Q
(b) Air Ejector Flow Rate Measuring Device				
Unit 1: 1-VP-FI-1A 1-VP-FI-1B Unit 2: 2-VP-FI-1A 2-VP-FI-1B	D	N/A	R	N/A
3. VENTILATION VENT SYSTEM				
(a) Noble Gas Activity Monitor				
SRF: RRM-101 SPS: 1-VG-RM -131B 1-VG-RM-104	D	M	R	Q

ATTACHMENT 6

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Radioactive Gaseous Effluent Monitoring Instrumentation Surveillance Requirements

CHANNEL DESCRIPTION	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL FUNCTIONAL TEST
(b) Iodine Sampler (**NOTE 1**) SRF: RRM-101 SPS: Vent #1, 1-VG-RM-104 Vent #2, Continuous HP Sampler or 1-VG-RM-131-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(c) Particulate Sampler (**NOTE 1**) SRF: RRM-101 SPS: Vent #1, 1-VG-RM-104 Vent #2, Continuous HP Sampler or 1-VG-RM-131-1 In-Line Particulate / Iodine Sampler	W	N/A	N/A	N/A
(d) Ventilation Vent Flow Rate Monitor SRF:01-RHV-FT-156 SPS: Vent #1, 1-VS-FT-119 Vent #2, 1-VS-FT-116	D	N/A	R	N/A
(e) Sampler Flow Rate Measuring Device (**NOTE 1**)				
SRF: RRM-101	D	N/A	R	N/A
SPS: Vent #1, 1-VG-RM-104	D	N/A	R	N/A
Vent #2, HP Sampler Rotometer	D	N/A	R	N/A
or MGPI Flow Rate Measuring Device	D	N/A	SA	N/A

NOTE 1: The mark numbers listed above in 1(b), 1(c), 3(b), 3(c), and 3(e) refer to the gaseous effluent radiation monitor or monitor skid with which the iodine and particulate samplers and the flow rate measuring devices are associated. The listed mark numbers do not refer to the particulate radiation monitor.

ATTACHMENT 7

(Page 1 of 1)

Dispersion and Deposition Factors

Description	Sector	Distance, meters	Ventilation Vent		Process Vent	
			X/Q	D/Q	X/Q	D/Q
Site Boundary	N	500	1.4E-05	1.6E-08	4.2E-08	3.9E-10
	NNE	532	1.8E-05	3.3E-08	1.2E-07	1.2E-09
	NE	629	1.3E-05	3.0E-08	1.8E-07	1.6E-09
	ENE	806	7.1E-06	1.3E-08	1.8E-07	1.8E-09
	E	1210	2.7E-06	7.2E-09	2.6E-07	1.8E-09
	ESE	1984	9.8E-07	3.2E-09	2.4E-07	1.7E-09
	SE	1371	2.2E-06	6.8E-09	2.6E-07	2.1E-09
	SSE	919	4.3E-06	9.2E-09	2.3E-07	1.2E-09
	S	645	5.9E-06	1.1E-08	1.7E-07	1.3E-09
	SSW	565	6.3E-06	1.2E-08	1.3E-07	1.4E-09
	SW	548	9.7E-06	1.9E-08	1.3E-07	1.3E-09
	WSW	656	8.4E-06	1.6E-08	1.4E-07	1.3E-09
	W	565	1.2E-05	2.9E-08	1.2E-07	1.0E-09
	WNW	565	1.4E-05	2.6E-08	8.7E-08	5.8E-10
	NW	581	1.3E-05	1.7E-08	1.2E-07	8.9E-10
	NNW	581	9.5E-06	1.1E-08	5.1E-08	3.1E-10
Resident	N	6534	2.4E-07	2.1E-10	6.7E-08	8.8E-11
	NNE	3122	1.0E-06	1.7E-09	1.9E-07	3.7E-10
	NE	7564	2.7E-07	4.2E-10	6.7E-08	1.8E-10
	SE	4554	3.4E-07	8.6E-10	8.7E-08	2.7E-10
	SSE	4265	3.7E-07	6.6E-10	9.5E-08	2.5E-10
	S	2736	5.5E-07	9.5E-10	1.9E-07	5.7E-10
	SSW	2977	4.1E-07	7.4E-10	1.4E-07	4.5E-10
	SW	3637	4.5E-07	7.7E-10	1.2E-07	3.4E-10
	WSW	660	6.4E-06	1.3E-08	1.8E-07	1.3E-09
	W	5053	3.4E-07	7.1E-10	8.1E-08	2.1E-10
	WNW	7886	2.2E-07	2.9E-10	4.9E-08	9.4E-11
	NW	7467	2.2E-07	2.2E-10	5.8E-08	1.3E-10
	NNW	6035	2.3E-07	2.0E-10	6.2E-08	7.1E-11
Milk Cow	SSW	7693	9.9E-08	1.4E-10	5.0E-08	1.2E-10
	NNW	5938	2.4E-07	2.1E-10	6.3E-08	7.1E-11
Garden	SSE	4265	3.7E-07	6.6E-10	9.5E-08	2.5E-10
	S	3235	4.2E-07	7.1E-10	1.6E-07	4.3E-10
	SSW	3122	3.8E-07	6.8E-10	1.3E-07	4.1E-10
	SW	7596	1.5E-07	2.1E-10	5.3E-08	1.2E-10
	WSW	5713	2.0E-07	3.2E-10	7.5E-08	1.8E-10
	W	5536	3.0E-07	6.0E-10	7.5E-08	1.8E-10
	NNW	7017	1.9E-07	1.6E-10	5.3E-08	7.4E-11

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
1. DIRECT RADIATION	About 40 Routine Monitoring Stations to be placed as follows: 1) Inner Ring in general area of site boundary with station in each sector 2) Outer Ring 6 to 8 km from the site with a station in each sector **(NOTE 1)** 3) The balance of the 8 dosimeters should be placed in special interest areas such as population centers, nearby residents, schools, and in 2 or 3 areas to serve as controls	Quarterly	GAMMA DOSE Quarterly
2. AIRBORNE Radioiodines and Particulates	Samples from 7 locations: a) 1 sample from close to the site boundary location of the highest calculated annual average ground level D/Q b) 5 sample locations 6-8 km distance located in a concentric ring around the Station c) 1 sample from a control location 15-30 km distant, providing valid background data	Continuous Sampler operation with sample collection weekly	Radioiodine Canister I^{131} Analysis Weekly Particulate Sampler Gross beta radioactivity analysis following filter change; Gamma isotopic analysis of composite (by location) quarterly

NOTE 1: As described in the Branch Technical Position, Revision 1, November 1979, no TLD station is required in the SE sector at the 4-5 mile range due to geographical limitations.

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
3. WATERBORNE			
a) Surface	a) 1 sample upstream b) 1 sample downstream	Monthly Sample	Gamma isotopic analysis monthly; Composite for tritium analysis quarterly
b) Ground	Sample from 1 or 2 sources	Quarterly	Gamma isotopic and tritium analysis quarterly
c) Sediment from shoreline	a) 1 sample upstream b) 1 sample downstream	Semi-Annually	Gamma isotopic analysis semi-annually
d) Silt	a) 1 sample upstream b) 1 sample downstream	Semi-Annually	Gamma isotopic analysis semi-annually
4. INGESTION			
a) Milk	a) 2 samples from milking animals in the vicinity of the Station. **(NOTE 1)** b) 1 sample from milking animals at a control location (~15-30 km distant). **(NOTE 2)**	Monthly	Gamma isotopic and I^{131} analysis monthly
b) Fish and Invertebrates	a) 6 samples of filter feeders (clams, oysters) in the vicinity of the Station	Semi-Annually	Gamma isotopic on edible portions
	c) 1 sampling of crabs from the vicinity of the Station	Annually	
	d) 1 sampling of 2 different species in vicinity of Station discharge area. **(NOTE 3)**	Semi-Annually	

NOTE 1: If milk sampling cannot be performed, use item 4.c, Food Products - d. Milk sampling cannot be performed when there are no milk sampling locations in the vicinity of the Station.

NOTE 2: If milk sampling from a control location cannot be performed, use item 4.c) e).
Milk sampling cannot be performed when there is no milk sampling location ~ 15 - 30 km distant.

NOTE 3: Commercially or recreationally important species permitted for sampling by the Virginia Marine Resources Commission include catfish, white perch, croaker, striped bass, spot, red drum, and striped mullet.

ATTACHMENT 8

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Radiological Environmental Monitoring Program

Exposure Pathway and/or Sample	Number of Sample and Sample Location	Collection Frequency	Type and Frequency of Analysis
4. INGESTION (Continued)			
	a) 1 sample corn b) 1 sample soybeans c) 1 sample peanuts	Annually	Gamma isotopic on edible portions
c) Food Products	d) 1 sample of a broadleaf vegetation grown nearest in each of two different available offsite locations (sectors) with the highest annual average ground level D/Qs, if milk sampling is not performed. e) 1 sample of a broadleaf vegetation grown 15 - 30 km distant in the available least prevalent wind direction, if milk sampling is not performed.	Monthly, if available, or at harvest	Gamma isotopic and I^{131} analysis

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION	DISTANCE (MILES)	DIRECTION	REMARKS
Air Charcoal and Particulate	Surry Station (SS)	0.3	NNE	
	Hog Island Reserve (HIR)	2.0	NNE	
	Bacon's Castle (BC)	4.5	SSW	
	Alliance (ALL)	5.1	WSW	
	Colonial Parkway (CP)	3.8	NNW	
	BASF (BASF)	5.1	ENE	
	Fort Eustis (FE)	4.9	ESE	
	Newport News (NN)	19.3	SE	Control Location
Environmental TLDs	Control (00)			Onsite *
	West North West (02)	0.2	WNW	Site Boundary
	Surry Station Discharge (03)	0.4	NW	Site Boundary
	North North West (04)	0.2	NNW	Site Boundary
	North (05)	0.3	N	Site Boundary
	North North East (06)	0.3	NNE	Site Boundary
	North East (07)	0.3	NE	Site Boundary
	East North East (08)	0.4	ENE	Site Boundary
	East (09)	0.3	E	Site Boundary
	West (10)	0.1	W	Site Boundary
	West South West (11)	0.4	WSW	Site Boundary
	South West (12)	0.3	SW	Site Boundary
	South South West (13)	0.3	SSW	Site Boundary
	South (14)	0.4	S	Site Boundary
	South South East (15)	0.6	SSE	Site Boundary
	South East (16)	0.9	SE	Site Boundary
	Station Intake (18)	1.6	ESE	Site Boundary
	Hog Island Reserve (19)	2.0	NNE	Near Resident

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION		DISTANCE (MILES)	DIRECTION	REMARKS
Environmental TLDs	Bacon's Castle	(20)	4.5	SSW	Approx. 5 miles
	Route 633	(21)	4.9	SW	Approx. 5 miles
	Alliance	(22)	5.1	WSW	Approx. 5 miles
	Surry	(23)	7.7	WSW	Population Center
	Route 636 and 637	(24)	4.0	W	Approx. 5 miles
	Scotland Wharf	(25)	5.0	WNW	Approx. 5 miles
	Jamestown	(26)	6.3	NW	Approx. 5 miles
	Colonial Parkway	(27)	3.8	NNW	Approx. 5 miles
	Route 617 and 618	(28)	4.9	NNW	Approx. 5 miles
	Kingsmill	(29)	4.6	N	Approx. 5 miles
	Williamsburg	(30)	7.8	N	Population Center
	Kingsmill North	(31)	5.5	NNE	Approx. 5 miles
	Budweiser	(32)	5.8	NNE	Population Center
	Water Plant	(33)	5.0	NE	Approx. 5 miles
	BASF	(34)	5.1	ENE	Approx. 5 miles
	Lee Hall	(35)	7.1	ENE	Population Center
	Goose Island	(36)	5.1	E	Approx. 5 miles
	Fort Eustis	(37)	4.9	ESE	Approx. 5 miles
	Newport News	(38)	19.3	SE	Population Center
	James River Bridge	(39)	17.1	SE	Control
	Benn's Church	(40)	17.0	SSE	Control
	Smithfield	(41)	13.4	SSE	Control
	Rushmere	(42)	5.3	SSE	Approx. 5 miles
	Route 628	(43)	5.1	S	Approx. 5 miles
Milk	Epps		4.8	SSW	
	Colonial Parkway		3.7	NNW	
	Williams		27.5	S	Control Location

ATTACHMENT 9

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Environmental Sampling Locations

SAMPLE MEDIA	LOCATION	DISTANCE (MILES)	DIRECTION	REMARKS
Well Water	Surry Station			Onsite**
	Hog Island Reserve	2.0	NNE	
	Construction Site	0.3	E	Onsite***
Crops (Corn, Peanuts, Soybeans)	Slade's Farm	3.2	S	
	Brock's Farm	3.8	S	
River Water (Monthly)	Surry Discharge	0.4	NW	
	Scotland Wharf	4.9	WNW	Control Location
Sediment (Silt)	Chickahominy River	11.2	WNW	Control Location
	Surry Station Discharge	1.3	NNW	
Clams	Chickahominy River	11.2	WNW	Control Location
	Surry Station Discharge	1.3	NNW	
	Jamestown Island	3.9	NW	
Oysters	Point of Shoals	6.4	SSE	
	Mulberry Point	4.9	ESE	
	Lawne's Creek	2.4	SE	
Crabs	Surry Station Discharge	1.3	NNW	
Fish	Surry Station Discharge	1.3	NNW	
Shoreline Sediment	Hog Island Reserve	0.6	N	
	Chickahominy River	11.2	WNW	Control Location

* Onsite Location - in Lead Shield

** Onsite sample of Well Water taken from tap-water at Surry Environmental Building

*** Onsite sample of Well Water taken from tap-water at Surry Training Center

ATTACHMENT 10

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Detection Capabilities for Environmental Sample Analysis

LOWER LIMIT OF DETECTION (LLD)

Analysis (NOTE 2)	Water (pCi/L)	Airborne Particulate or Gases (pCi/m^3)	Fish (pCi/kg) (wet)	Milk (pCi/L)	Food Products (pCi/kg) (wet)	Sediment (pCi/kg) (dry)
Gross beta	4	0.01				
H-3	2,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	(**NOTE 3**) 1	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

NOTE 1: Required detection capabilities for thermoluminescent dosimeters used for environmental measurements are given in Regulatory Guide 4.13.

NOTE 2: This list does not mean that only these nuclides are to be detected and reported. Other peaks that are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

NOTE 3: LLD for the ground (drinking) water samples. The LLD for the surface (non-drinking) water samples is 10 pCi/L.

ATTACHMENT 10

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Detection Capabilities for Environmental Sample Analysis

LOWER LIMIT OF DETECTION (LLD)

NOTE 1: For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66\ s_b}{E \bullet V \bullet 2.22E{+}06 \bullet Y \bullet e^{-(\lambda \Delta t)}} \qquad (24\text{-}1)$$

Where:

LLD	=	the "a priori" (before the fact) Lower Limit of Detection as defined above (as microcuries per unit mass or volume) (See Subsection 4.9)
s_b	=	the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute, cpm)
E	=	the counting efficiency (as counts per disintegration)
V	=	the sample size (in units of mass or volume)
2.22E+06	=	the number of disintegrations per minute (dpm) per microcurie
Y	=	the fractional radiochemical yield (when applicable)
λ	=	the radioactive decay constant for the particular radionuclide
Δt	=	the elapsed time between sample collection (or end of the sample collection period) and time of counting (for environmental samples, not plant effluent samples)

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

The LLD is an "a priori" (before the fact) limit representing the capability of a measurement system and not a "posteriori" (after the fact) limit for a particular measurement.

ATTACHMENT 11

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Reporting Levels for Radioactivity Concentrations 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*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95	400				
I-131	2*	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140	200			300	

*Reporting level for the ground (drinking) water samples required by Radiological Environmental Monitoring Program (Attachment 8). The reporting level for the surface (non-drinking) water samples required by Attachment 8 is 30,000 pCi/L for H-3 and 20 pCi/L for I-131.

ATTACHMENT 12

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Meteorological, Liquid, and Gaseous Pathway Analysis

1.0 METEORLOGICAL ANALYSIS

1.1 Purpose

The purpose of the meteorological analysis was to determine the five (5) year average χ/Q and D/Q values at critical locations around the Station for ventilation vent (ground level) and process vent (mixed mode) releases. The five year average χ/Q and D/Q values are used in the dose pathway analysis to determine dose and dose rate at site boundary and dose to the member of the public.

1.2 Meteorological Data, Parameters, and Methodology

A five (5) year average of representative onsite meteorological data for the period January 1, 2007 through December 31, 2011, is used in the gaseous effluent dose pathway calculations. This data includes wind speed, wind direction, and differential temperature for the purpose of determining joint frequency distributions for those releases characterized as ground level (i.e., ventilation vent), and those characterized as mixed mode (i.e., process vent).

χ/Qs and D/Qs were calculated using the PC version of NRC computer code "XOQDOQ - Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations", Version 2.0, provided in NUREG-0324.

The open terrain adjustment factors were applied to the χ/Q values as recommended in Regulatory Guide 1.111. The site region is characterized as flat terrain such that open terrain correction factors are considered appropriate. The ground level ventilation vent release calculations included a building wake correction based on a 1516 m^2 containment minimum cross-sectional area. The effective release height used in mixed mode release calculations was based on a process vent release height of 131 ft, and plume rise due to momentum for a vent diameter of 1.5 in. with plume exit velocity of 100 ft/sec.

Ventilation vent, and vent releases other than from the process vent, are considered ground level as specified in Regulatory Guide 1.111 for release points less than the height of adjacent solid structures. Terrain elevations were obtained from Surry Power Station Units 1 and 2 Virginia Electric and Power Company Updated Final Safety Analysis Report Table 11A-8.

χ/Q and D/Q values were calculated for the nearest site boundary, residence, milk-cow, discharge bank, and vegetable garden by sector for process vent and ventilation vent releases.

ATTACHMENT 12

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Meteorological, Liquid, and Gaseous Pathway Analysis

According to the definition for short term in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Stations," October, 1978, some gaseous releases may fit this category, primarily waste gas decay tank releases and containment purges. However, these releases are considered long term for dose calculations as past releases were both random in time of day and duration as evidenced by reviewing past release reports. Therefore, the use of annual average concentrations is appropriate according to NUREG-0133.

1.3 Results

The χ/Q and D/Q values used in the dose pathway analysis for ventilation vent releases and process vent releases can be found in Attachment 7.

2.0 LIQUID PATHWAY ANALYSIS

2.1 Purpose

The purpose of the liquid pathway analysis was to determine the maximum exposed member of the public in unrestricted areas as a result of radioactive liquid effluent releases. The analysis included a determination of most restrictive liquid pathway, most restrictive age group, and critical organ. This analysis is required for Subsection 6.2, Liquid Radioactive Waste Effluents.

2.2 Data, Parameters, and Methodology

Radioactive liquid effluent release data for the years 1976, 1977, 1978, 1979, 1980, and 1981 were compiled from the Surry Power Station effluent release reports. The data for each year, along with appropriate site specific parameters and default selected parameters, were entered into the NRC computer code LADTAP as described in NUREG-1276.

Liquid radioactive effluents from both units are released to the James River via the discharge canal. Possible pathways of exposure for release from the Station include ingestion of fish and invertebrates and shoreline activities. The irrigated food pathway and potable water pathway do not exist at this location. Access to the discharge canal by the general public is gained two ways: bank fishing, controlled by the Station and limited to Dominion employees or guests of employees, and by boat as far upstream as the inshore end of the discharge canal groin. It has been estimated that boat sport fishing would be performed a maximum of 800 hours per year, and that bank fishing would be performed a maximum of 160 hours per year.

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Meteorological, Liquid, and Gaseous Pathway Analysis

For an individual fishing in the discharge canal, no river dilution was assumed for the fish pathway. For an individual located beyond the discharge canal groins, a river dilution factor of 5 (i.e., a mixing ratio of 0.2) was assumed as appropriate according to Regulatory Guide 1.109, Rev. 1, and the fish, invertebrate, and shoreline pathways were considered to exist. Dose factors, bioaccumulation factors, shore width factors and usage terms for shoreline activities and ingestion of fish and invertebrates are included in the Source Code file. Dose to an individual fishing on the discharge bank was determined by multiplying the annual dose calculated with LADTAP by the fractional year the individual spent fishing in the canal.

2.3 Results

For the years 1976, 1977, 1979, 1980, and 1981, the invertebrate pathway resulted in the largest dose. In 1978 the fish pathway resulted in the largest dose. The maximum exposed member of the public was determined to utilize the James River. The critical age group was the adult and the critical organ was either the thyroid or GI-LLI. The ingestion dose factors, which include the fish and invertebrate pathways, are calculated for total body and various critical organs. Validation of the limiting age group and critical organ is performed by the liquid effluent dose calculation program using the data, parameters, and methodology provided in the Source Code file.

3.0 GASEOUS PATHWAY ANALYSIS

3.1 Purpose

Gaseous effluent pathway analyses are performed to determine the location that would result in the maximum doses due to noble gases, for use in demonstrating compliance with Steps 6.3.1.a. and 6.3.3.a. The analyses includes a determination of the location, pathway, and critical organ, of the maximum exposed member of the public, as a result of the release of I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than eight days for use in demonstrating compliance with Step 6.3.4.a. In addition, the analyses includes a determination of the critical organ, maximum age group, and sector location of an exposed individual through the inhalation pathway from I^{131}, I^{133}, tritium, and particulates to demonstrate compliance with Step 6.3.1.a.

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Meteorological, Liquid, and Gaseous Pathway Analysis

3.2 Data, Parameters, and Methodology

Five year average χ/Q values were calculated, as described in Section 1 of this attachment. The maximum doses to total body and skin, and air doses for gamma and beta radiation due to noble gases would be at these site boundary locations. The doses from both the ventilation vent and process vent release points are summed to calculate total maximum dose.

6.3.1.a.2 dose limits apply specifically to the inhalation pathway. Therefore, the locations and χ/Q values determined for maximum noble gas doses can be used to determine the maximum dose from I^{131}, I^{133}, tritium, and for all radionuclides in particulate form with half-lives greater than 8 days for the inhalation pathway.

The maximum exposed individual for 10 CFR 50, Appendix I, compliance could be at any of the following locations: site boundary, nearest resident, nearest milk-cow, or nearest vegetable garden, using the Land Use Census data which is assessed annually. Therefore, ventilation vent and process vent X/Q and D/Q values for these selected receptors are included in the gaseous effluent dose pathway analyses. Ground plane, inhalation, cow-milk, and vegetable garden pathways are active with the exception of the infant age group, which is not active for the vegetable garden pathway. Otherwise, all age groups are evaluated at these locations. The data, parameters, and methodology of R. G. 1.109, Rev. 1, and NUREG-0133 are used in the gaseous effluent dose pathway analyses.

The gamma and beta dose factors K_{ivv}, L_{ivv}, M_{ivv}, and N_{ivv} for ground level releases and the gamma and beta dose factors K_{ipv}, L_{ipv}, M_{ipv}, and N_{ipv} for mixed mode releases are included in the Source Code file.

Inhalation pathway dose factors P_{ivv} and P_{ipv} are calculated using the following equation:

$$P_i = K' \, (BR) \, DFA_i \qquad \text{mrem/yr per Ci/m}^3 \qquad (28\text{-}1)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

BR = the breathing rate of the particular age group, m^3/yr, from Table E-5, Regulatory Guide 1.109, Rev.1

DFA_i = the critical organ inhalation dose factor for particular age group for the ith radionuclide, in mrem/pCi

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Meteorological, Liquid, and Gaseous Pathway Analysis

Parameters used above were obtained from NUREG-0133 and R.G. 1.109, Rev. 1.

It was determined that the member of the public within site boundary would be using the discharge canal bank for fishing a maximum of 160 hours per year. Active pathways are ground plane and inhalation, and all age groups are evaluated for this pathway analysis.

The RM_{ivv} and RM_{ipv} dose factors, except for tritium, are calculated using the following equation:

$$RM_i = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m (r) (DFL_i) \left[\frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_f} \qquad (28\text{-}2)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

Q_F = cow's consumption rate, 50, in kg/day (wet weight)

U_{ap}= infant milk consumption rate, 330, in liters/yr

Y_p = agricultural productivity by unit area of pasture feed grass, 0.7 in kg/m^2

Y_s = agricultural productivity by unit area of stored feed, 2.0, in kg/m^2

F_m = stable element transfer coefficients, in days/liter

r = fraction of deposited activity retained on cow's feed grass, 1.0 for radioiodine, and 0.2 for particulates

DFL_i=critical organ ingestion dose factor for the ith radionuclide for the particular age group, in mrem/pCi

λ_i = decay constant for the ith radionuclide, in sec^{-1}

λ_w = decay constant for removal of activity of leaf and plant surfaces by weathering, 5.73E-07 sec^{-1} (corresponding to a 14 day half-life)

t_f = transport time from pasture to cow, to milk, to receptor, 1.73+05, in seconds

t_h = transport time from pasture, to harvest, to cow, to milk, to receptor, 7.78E+06, in seconds

f_p = fraction of year that cow is on pasture, 1.0 (dimensionless)

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Meteorological, Liquid, and Gaseous Pathway Analysis

f_s = fraction of cow feed that is pasture grass while cow is on pasture, 0.8 (dimensionless)

Parameters used above were obtained from NUREG-0133 and Regulatory Guide 1.109, Rev.1.

Since the concentration of tritium in milk is based on the airborne concentration rather than the deposition, the following equation is used:

$$R_{H^3} = K'K'''F_m Q_F U_{ap}(DFL_{H^3})\left[0.75(0.5/H)\right] \qquad (28\text{-}3)$$

where:

K''' = a constant of unit conversion 1E+03 gm/kg

H = absolute humidity of the atmosphere, 8.0, in 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

Other parameters have been previously defined.

The inhalation pathway dose factors RI_{ivv} and RI_{ipv} were calculated using the following equation:

$$RI_i = K' (BR)\, DFA_i \qquad \text{mrem/yr per Ci/m}^3 \qquad (28\text{-}4)$$

where:

K' = a constant of unit conversion, 1E+12 pCi/Ci

BR = breathing rate of the particular age group, m^3/yr

DFA_i=critical organ inhalation dose factor for particular age group for the ith radionuclide, in mrem/pCi

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Meteorological, Liquid, and Gaseous Pathway Analysis

Parameters used above were obtained from NUREG-0133 and R. G. 1.109, Rev. 1.

Breathing Rate		
Infant	=	1400 m^3/yr
Child	=	3700 m^3/yr
Teen	=	8000 m^3/yr
Adult	=	8000 m^3/yr

The RG dose factors are calculated using the following equation:

$$RG = K'K''(SF)DFG_i \left[\frac{1 - e^{-\lambda_i t_b}}{\lambda_i}\right]\left(\frac{m^2 \bullet mrem/yr}{Ci/\sec}\right) \qquad (28 - 5)$$

where:

K' = A constant of unit conversion, 1E+12 pCi/Ci

K" = A constant of unit conversion, 8760 hr/year.

λ_i = The decay constant for nuclide i, sec^{-1}.

t_b = The exposure time, 4.73×10^8 sec (15 years), from Table E-15 of Reg Guide 1.109.

DFG_i = The ground plane dose conversion factor for nuclide i, from Table E-6 of Reg. Guide 1.109 (mrem/hr per pCi/m^2).

SF = The shielding factor 0.7 (dimensionless), from Table E-15 of Reg Guide 1.109.

MAJOR CHANGES TO RADIOACTIVE LIQUID, GASEOUS AND SOLID WASTE TREATMENT SYSTEMS

There were no major changes to the radioactive liquid, gaseous or solid waste treatment systems for this reporting period.

INOPERABILITY OF RADIOACTIVE LIQUID AND GASEOUS EFFLUENT MONITORING INSTRUMENTATION

The Annual Radioactive Effluent Release Report shall explain why monitoring instrumentation required by the ODCM Attachments 1 and 5, which were determined to be inoperable, were not returned to operable status within 30 days. Two of the above referenced instrumentation were inoperable greater than 30 days during this reporting period.

On 05/06/2015, the Surry Radwaste Facility (SRF) Ventilation Stack Noble Gas Monitor selector switch was determined inoperable. The selector switch provides the capability to toggle through various monitor parameters and perform selected functions. Two instruments required to monitor the SRF stack release pathway, in accordance with Attachment 5 of the ODCM, were rendered inoperable with the loss of the selector switch. The instruments lost were the noble gas activity radiation monitor and the flow rate measuring device for the stack continuous particulate and iodine sampler. Additionally, although not required by Attachment 5, the capability to source check the noble gas activity radiation monitor was rendered inoperable.

Compensatory measures for the loss of the instruments were initiated in accordance with the ODCM. For the loss of the noble gas activity radiation maonitor, grab samples of the SRF stack exhaust are taken and analyzed at least once every 12 hours. No activity has been detected in any of these samples. For the loss of the sampler flow rate measuring device, an estimate of the sampler flow rate is made at least once per 4 hours and documented in the Station logs.

At this time, these instruments remain inoperable with compensatory measures in place. A similar radiation monitor skid was obtained to replace the current skid, but it could not be made functional. Design Change 15-01054 has been initiated to obtain and install a new radiation monitoring system for the SRF ventillation in 2016.

UNPLANNED RELEASES

There were no unplanned liquid or unplanned gaseous releases during this reporting period.

LOWER LIMIT OF DETECTION (LLD) FOR EFFLUENT SAMPLE ANALYSIS

	Isotope	Required LLD	Typical LLD
GASEOUS:	Kr-87	1.00E-04	2.21E-06 - 4.78E-05
	Kr-88	1.00E-04	1.56E-06 - 1.94E-05
	Xe-133	1.00E-04	1.28E-06 - 1.48E-05
	Xe-133m	1.00E-04	3.68E-06 - 4.06E-05
	Xe-135	1.00E-04	3.66E-07 - 1.23E-05
	Xe-135m	1.00E-04	1.35E-05 - 8.36E-05
	Xe-138	1.00E-04	2.32E-05 - 9.90E-05
	I-131	1.00E-12	4.06E-13 - 4.06E-13
	I-133	1.00E-10	4.06E-11 - 4.06E-11
	Sr-89	1.00E-11	1.23E-14 - 3.68E-12
	Sr-90	1.00E-11	1.76E-15 - 5.87E-13
	Cs-134	1.00E-11	1.53E-13 - 2.50E-13
	Cs-137	1.00E-11	1.54E-13 - 3.38E-13
	Mn-54	1.00E-11	2.50E-14 - 2.77E-13
	Fe-59	1.00E-11	3.50E-13 - 8.38E-13
	Co-58	1.00E-11	1.72E-14 - 3.12E-13
	Co-60	1.00E-11	2.58E-14 - 4.97E-13
	Zn-65	1.00E-11	4.98E-14 - 6.99E-13
	Mo-99	1.00E-11	4.06E-12 - 4.06E-12
	Ce-141	1.00E-11	2.06E-13 - 2.98E-13
	Ce-144	1.00E-11	7.89E-13 - 1.34E-12
	Alpha	1.00E-11	1.68E-14 - 2.21E-14
	Tritium	1.00E-06	5.09E-08 - 6.61E-08
LIQUID:	Sr-89	5.00E-08	2.61E-08 - 4.30E-08
	Sr-90	5.00E-08	6.15E-09 - 1.69E-08
	Cs-134	5.00E-07	1.94E-08 - 5.01E-08
	Cs-137	5.00E-07	1.58E-08 - 7.85E-08
	I-131	1.00E-06	2.81E-08 - 5.52E-08
	Co-58	5.00E-07	2.18E-09 - 5.99E-08
	Co-60	5.00E-07	2.77E-09 - 8.82E-08
	Fe-59	5.00E-07	3.25E-08 - 1.48E-07
	Zn-65	5.00E-07	5.09E-09 - 1.37E-07
	Mn-54	5.00E-07	3.19E-09 - 6.09E-08
	Mo-99	5.00E-07	2.92E-07 - 4.95E-07
	Ce-141	5.00E-07	2.93E-08 - 9.27E-08
	Ce-144	5.00E-07	1.17E-07 - 3.47E-07
	Fe-55	1.00E-06	3.02E-07 - 9.94E-07
	Alpha	1.00E-07	2.73E-08 - 2.76E-08
	Tritium	1.00E-05	1.26E-06 - 1.63E-06
	Xe-133	1.00E-05	8.67E-08 - 2.95E-07
	Xe-135	1.00E-05	2.07E-08 - 1.18E-07
	Xe-133m	1.00E-05	2.10E-07 - 5.66E-07
	Xe-135m	1.00E-05	1.53E-06 - 2.81E-06
	Xe-138	1.00E-05	2.38E-06 - 8.78E-06
	Kr-87	1.00E-05	1.15E-07 - 2.53E-07
	Kr-88	1.00E-05	1.59E-08 - 7.85E-07

INDUSTRY GROUND WATER PROTECTION INITIATIVE

The following is a summary of 2015 sample analyses of ground water monitoring wells that are not a part of the Radiological Environmental Monitoring Program (REMP). Analyses are performed by an independent laboratory.

Well Designation	Sample Date	Tritium pCi/Liter	Gamma pCi/Liter	Fe-55 pCi/Liter	Ni-63 pCi/Liter	Sr-90 pCi/Liter	TRU pCi/Liter
1-PL-Piez-04	3/11/15	<1,240	ND	NA	NA	NA	NA
1-PL-Piez-05	3/11/15	6,690	ND	<95.4	<3.04	<1.00	NA
1-PL-Piez-06	3/11/15	2,030	ND	<175	<4.95	<0.884	NA
1-PL-Piez-07	3/11/15	<1,250	ND	NA	NA	NA	NA
1-PL-Piez-27	3/11/15	<1,260	ND	NA	NA	NA	NA
1-PL-Piez-33	3/11/15	<1,270	ND	NA	NA	NA	NA
1-PL-Piez-34	3/11/15	<1,250	ND	NA	NA	NA	NA
1-PL-Piez-41	3/11/15	<1,260	ND	NA	NA	NA	NA
1-PL-Piez-42	3/11/15	<1,250	ND	NA	NA	NA	NA
1-PL-Piez-29	3/12/15	7,670	ND	<141	<3.06	<0.713	NA
1-PL-Piez-05	6/8/15	7,150	ND	NA	NA	NA	NA
1-PL-Piez-06	6/8/15	1,960	ND	NA	NA	NA	NA
1-PL-Piez-09	6/8/15	<1,090	ND	NA	NA	NA	NA
1-PL-Piez-20	6/8/15	<1,090	ND	NA	NA	NA	NA
1-PL-Piez-22	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-24	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-25	6/8/15	<1,110	ND	NA	NA	NA	NA
1-PL-Piez-28	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-33	6/8/15	<1,090	ND	NA	NA	NA	NA
1-PL-Piez-34	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-37	6/8/15	<1,090	ND	NA	NA	NA	NA
1-PL-Piez-39	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-40	6/8/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-03	6/9/15	<1,090	ND	NA	NA	NA	NA
1-PL-Piez-04	6/9/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-07	6/9/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-08	6/9/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-23	6/9/15	<1,100	ND	NA	NA	NA	NA
1-PL-Piez-27	6/9/15	<1,120	ND	NA	NA	NA	NA
1-PL-Piez-29	6/9/15	9,480	ND	NA	NA	NA	NA
1-PL-Piez-35	6/9/15	<1090	ND	NA	NA	NA	NA
1-PL-Piez-36	6/9/15	<1100	ND	NA	NA	NA	NA
1-PL-Piez-38	6/9/15	<1090	ND	NA	NA	NA	NA
1-PL-Piez-41	6/9/15	<1090	ND	NA	NA	NA	NA
1-PL-Piez-42	6/9/15	<1100	ND	NA	NA	NA	NA

INDUSTRY GROUND WATER PROTECTION INITIATIVE

Well Designation	Sample Date	Tritium pCi/Liter	Gamma pCi/Liter	Fe-55 pCi/Liter	Ni-63 pCi/Liter	Sr-90 pCi/Liter	TRU pCi/Liter
1-PL-Piez-04	8/25/15	<976	NA	NA	NA	NA	NA
1-PL-Piez-05	8/25/15	6,260	ND	NA	NA	NA	NA
1-PL-Piez-06	8/25/15	2,340	ND	NA	NA	NA	NA
1-PL-Piez-07	8/25/15	<974	ND	NA	NA	NA	NA
1-PL-Piez-27	8/25/15	<976	ND	NA	NA	NA	NA
1-PL-Piez-29	8/25/15	7,640	ND	NA	NA	NA	NA
1-PL-Piez-33	8/25/15	<975	ND	NA	NA	NA	NA
1-PL-Piez-34	8/25/15	<975	ND	NA	NA	NA	NA
1-PL-Piez-41	8/25/15	<975	ND	NA	NA	NA	NA
1-PL-Piez-42	8/25/15	<976	NA	NA	NA	NA	NA
1-PL-Piez-04	12/9/15	<1,290	NA	NA	NA	NA	NA
1-PL-Piez-05	12/9/15	7,220	ND	NA	NA	NA	NA
1-PL-Piez-06	12/9/15	2,900	ND	NA	NA	NA	NA
1-PL-Piez-07	12/9/15	<1,290	ND	NA	NA	NA	NA
1-PL-Piez-08	12/9/15	<1,290	ND	NA	NA	NA	NA
1-PL-Piez-24	12/9/15	<1,300	ND	NA	NA	NA	NA
1-PL-Piez-25	12/9/15	<1,300	NA	NA	NA	NA	NA
1-PL-Piez-27	12/9/15	<1,280	NA	NA	NA	NA	NA
1-PL-Piez-29	12/9/15	7,470	NA	NA	NA	NA	NA
1-PL-Piez-33	12/9/15	<1,250	ND	NA	NA	NA	NA
1-PL-Piez-34	12/9/15	<1,280	ND	NA	NA	NA	NA
1-PL-Piez-40	12/9/15	<1,290	NA	NA	NA	NA	NA
1-PL-Piez-41	12/9/15	<1,310	NA	NA	NA	NA	NA
1-PL-Piez-42	12/9/15	<1,300	NA	NA	NA	NA	NA

NA = Analysis not required.
ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.
TRU = Transuranics (Am-241, Cm-242, Cm-243/244, Pu-238 ,Pu-239/240 and Pu-241)