

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

April 27, 2017

United States Nuclear Regulatory Commission
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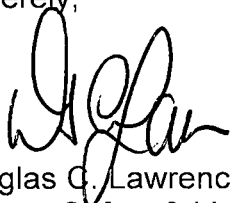
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Docket Nos. 50-280
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License Nos. DPR-32
DPR-37

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, 2016 through December 31, 2016. 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 2016 calendar year, as outlined in Regulatory Guide 1.21, Revision 1, June 1974.

If you have any further questions, please contact Lee Ragland 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
NRK

ATTACHMENT

Annual Radioactive Effluent Release Report

Surry Power Station

January 1, 2016 through December 31, 2016

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

Surry Power Station



2016 Annual Radioactive Effluent Release Report




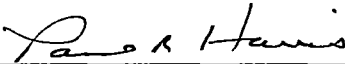
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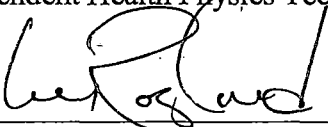
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

SURRY POWER STATION

January 1, 2016 through December 31, 2016

Prepared By: 
P. F. Blount
Health Physicist

Reviewed By: 
P. R. Harris
Superintendent Health Physics Technical Services

Approved By: 
T. L. Ragland
Manager Radiological Protection and Chemistry

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR THE

SURRY POWER STATION

January 1, 2016 through December 31, 2016

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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 2016 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 2016 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 $1.34\text{E-}04$ mrem, which is $2.23\text{E-}03\%$ of the 6 mrem dose limit. The critical organ dose due to liquid effluents was $1.72\text{E-}04$ mrem to the GI-LLI, which is $8.70\text{E-}04\%$ of the 20 mrem dose limit.
2. The air dose due to noble gases in gaseous effluents was $2.22\text{E-}05$ mrad gamma, which is $1.11\text{E-}04\%$ of the 20 mrad gamma dose limit, and $4.68\text{E-}05$ mrad beta, which is $1.17\text{E-}04\%$ 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 $9.00\text{E-}02$ mrem, which is $3.00\text{E-}01\%$ 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 no changes made to VPAP-2103S, Offsite Dose Calculation Manual, during this reporting period.

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 2016.

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 2016, no on-site radioactive spills or leaks were communicated in accordance with the Industry Ground Water Protection Initiative.

Attachment 9 provides a redetermination of the gaseous effluent doses reported for 2015. In November of 2016, it was discovered that atmospheric dispersion and deposition factors were determined using meteorological data that was processed as delta-degrees Celsius vice delta-degrees Fahrenheit. Dispersion and deposition factors were updated based on delta-degrees Fahrenheit and the revised doses are provided. The revised doses represent a 4% to 5% increase in the noble gas air doses originally reported. No gaseous effluent dose limits were challenged due to the misprocessed meteorological data.

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 modeled as a teenage individual 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 modeled as 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 modeled as 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.

Attachment 5 provides a discussion on the gaseous effluent monitoring instrumentation that was inoperable for greater than 30 days. As presented in the discussion, the instrumentation remained inoperable at the end of 2016. It should be noted, however, that the instrumentation was returned to operable status in February of 2017.

There were no unplanned gaseous or liquid releases in 2016 to describe in Attachment 6 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. In April 2016, the control milk sample was not obtained because the dairy closed its operation. A new control milk sample location was added to the Radiological Environmental Monitoring Program and sampling commenced in May 2016.

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.

EFFLUENT RELEASE DATA

January 1, 2016 through December 31, 2016

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: 1/1/16 TO 12/31/16
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	1.28E-03	2.64E-03	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	1.63E-04	3.36E-04	
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	N/D	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	N/A	N/A	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	5.69E+00	5.61E+00	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	7.24E-01	7.14E-01	
E. CARBON-14				
1. TOTAL RELEASE	Ci	8.94E-03	1.84E-02	
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	1.14E-03	2.34E-03	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	1.10E-03	1.10E-03	
TOTAL BODY DOSE RATE	%	2.31E-09	1.72E-06	
SKIN DOSE RATE	%	9.06E-10	4.76E-07	

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
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	N/D	2.80E+00	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	N/A	3.56E-01	
B. IODINE				
1. TOTAL I-131	Ci	N/D	1.17E-04	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	N/A	1.49E-05	
C. PARTICULATE				
1. HALF-LIFE >8 DAYS	Ci	3.41E-06	1.19E-05	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	4.34E-07	1.51E-06	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	2.96E+00	1.47E+01	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	3.76E-01	1.87E+00	
E. CARBON-14				
1. TOTAL RELEASE	Ci	N/D	1.96E+01	
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	N/A	2.49E+00	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	5.66E-04	3.29E-03	
TOTAL BODY DOSE RATE	%	0.00E+00	1.42E-05	
SKIN DOSE RATE	%	0.00E+00	5.70E-06	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
GASEOUS EFFLUENTS-MIXED MODE RELEASES

SURRY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		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	1.28E-03	N/D
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	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	1.28E-03	N/A
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	8.94E-03	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	8.94E-03	N/A

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
GASEOUS EFFLUENTS-MIXED MODE 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	5.77E-01
Kr-85m	Ci	N/D	N/D	N/D	8.79E-03
Kr-87	Ci	N/D	N/D	N/D	N/D
Kr-88	Ci	N/D	N/D	N/D	4.14E-03
Xe-133	Ci	N/D	5.41E-01	N/D	1.16E+00
Xe-135	Ci	N/D	8.55E-03	N/D	4.06E-01
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	1.28E-02
Xe-133m	Ci	N/D	N/D	N/D	2.31E-02
Ar-41	Ci	N/D	N/D	N/D	3.97E-02
TOTAL FOR PERIOD	Ci	N/A	5.50E-01	N/A	2.23E+00
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	3.84E+00	N/D	1.56E+01
TOTAL FOR PERIOD	Ci	N/A	3.84E+00	N/A	1.56E+01

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES

SURREY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		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	2.48E-05	N/D	N/D
Kr-87	Ci	N/D	5.27E-06	N/D	N/D
Kr-88	Ci	N/D	2.75E-05	N/D	N/D
Xe-133	Ci	N/D	2.17E-03	N/D	N/D
Xe-135	Ci	N/D	8.87E-05	N/D	N/D
Xe-135m	Ci	N/D	2.30E-06	N/D	N/D
Xe-138	Ci	N/D	N/D	N/D	N/D
Xe-131m	Ci	N/D	1.43E-05	N/D	N/D
Xe-133m	Ci	N/D	3.16E-05	N/D	N/D
Ar-41	Ci	N/D	2.80E-04	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	2.64E-03	N/A	N/A
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	1.84E-02	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	1.84E-02	NA	NA

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
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	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	2.22E-03	N/D	1.84E-02
Xe-135	Ci	N/D	N/D	N/D	8.94E-06
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	3.18E-04
Ar-41	Ci	N/D	2.90E-04	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	2.51E-03	N/A	1.87E-02
2. IODINES					
I-131	Ci	N/D	9.27E-05	N/D	N/D
I-133	Ci	N/D	2.43E-05	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	1.17E-04	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	3.41E-06	1.19E-05	N/D	3.65E-08
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	1.75E-02	N/D	1.31E-01
TOTAL FOR PERIOD	Ci	3.41E-06	1.75E-02	NA	1.31E-01

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
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	2.00E-03	6.99E-03	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	3.05E-12	1.02E-11	
3. PERCENT OF APPLICABLE LIMIT	%	5.37E-06	1.12E-05	
B. TRITIUM				
1. TOTAL RELEASE	Ci	3.74E+01	2.43E+01	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	5.71E-08	3.56E-08	
3. PERCENT OF APPLICABLE LIMIT	%	5.71E-04	3.56E-04	
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	5.49E+07	5.28E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD				
	LITERS	6.54E+11	6.82E+11	3.00E+00

TABLE 2A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
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	1.55E-03	9.22E-04	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	1.95E-12	1.37E-12	
3. PERCENT OF APPLICABLE LIMIT	%	7.05E-06	5.29E-06	
B. TRITIUM				
1. TOTAL RELEASE	Ci	1.71E+02	4.47E+02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	2.16E-07	6.62E-07	
3. PERCENT OF APPLICABLE LIMIT	%	2.16E-03	6.62E-03	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	Ci	N/D	6.66E-03	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	N/A	9.86E-12	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	4.93E-06	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)				
	LITERS	5.35E+07	5.40E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD				
	LITERS	7.93E+11	6.75E+11	3.00E+00

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/16 TO 12/31/16
LIQUID EFFLUENTS

SURREY 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	2.24E-04	2.17E-04	2.14E-05	4.30E-05
I-131	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	N/D	2.03E-04	8.93E-04
Co-60	Ci	N/D	N/D	1.44E-04	8.78E-04
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	N/D
Cr-51	Ci	N/D	N/D	N/D	4.92E-05
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	9.20E-06	N/D
Sb-125	Ci	N/D	N/D	1.39E-03	4.91E-03
Co-57	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	2.24E-04	2.17E-04	1.77E-03	6.77E-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: 1/1/16 TO 12/31/16
LIQUID EFFLUENTS

SURREY 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	1.34E-05
Cs-137	Ci	4.23E-04	2.74E-04	2.65E-05	1.03E-05
I-131	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	2.00E-07	3.08E-05	9.27E-05
Co-60	Ci	N/D	1.76E-06	2.40E-04	1.17E-04
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	N/D
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	4.27E-06	N/D
Sb-125	Ci	N/D	7.14E-07	8.26E-04	4.12E-04
Co-57	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	4.23E-04	2.77E-04	1.13E-03	6.45E-04
Xe-133	Ci	N/D	N/D	N/D	6.66E-03
Xe-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	6.66E-03

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/16 - 12/31/16

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	2.26E+00	Note 1	1.00E+01
	Ci	8.20E+01		3.00E+01
b. Dry compressible waste, contaminated equip., etc.	m ³	5.14E+02	Note 2	1.00E+01
	Ci	1.74E+00		3.00E+01
c. Irradiated components, control rods, etc.	m ³	0.00E+00		
	Ci	0.00E+00		
d. Other (Waste oil)	m ³	3.13E+00	Note 3	1.00E+01
	Ci	5.40E-08		3.00E+01

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

a.	Co-60	%	5.57E+01
	Ni-63	%	2.92E+01
	Fe-55	%	7.50E+00
	Co-58	%	2.78E+00
	Mn-54	%	1.37E+00
b.	Co-60	%	6.67E+01
	Ni-63	%	1.50E+01
	Cs-137	%	9.35E+00
	Fe-55	%	4.72E+00
c.		%	
d.	C-14	%	3.92E+01
	H-3	%	3.13E+01
	I-129	%	1.56E+01
	Tc-99	%	1.32E+01

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/16 - 12/31/16
CONTINUED

SURRY POWER STATION

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

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
19	Truck	Oak Ridge, TN (EnergySolutions)
1	Truck	Erwin, TN (EnergySolutions)

B. IRRADIATED FUEL SHIPMENT (Disposition)

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
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 1.16E+00 m³. 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 1.81E+02 m³.

NOTE 3: This waste was shipped to a licensed waste processor 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 0.00E+00 m³.

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.

2016	LIQUID			GASEOUS		
	Total Body (mrem)	GI-LLI (mrem)	Liver (mrem)	Gamma (mrad)	Beta (mrad)	Bone (mrem)
1st Quarter	8.84E-06	1.36E-05	9.19E-06	3.43E-09	1.02E-08	4.04E-05
2nd Quarter	8.71E-06	3.64E-05	7.66E-06	2.30E-06	2.09E-06	2.56E-04
3rd Quarter	2.96E-05	3.26E-05	3.03E-05	0.00E+00	0.00E+00	2.91E-08
4th Quarter	8.70E-05	8.89E-05	8.76E-05	1.99E-05	4.47E-05	8.97E-02
Annual	1.34E-04	1.72E-04	1.35E-04	2.22E-05	4.68E-05	9.00E-02

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 no revisions to the ODCM implemented during this reporting period.

**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 monitor, 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 was initiated to obtain a new radiation monitoring system for the SRF ventilation. In 2016, the new radiation monitoring skid was manufactured and delivered to the station. Installation of and return to operational status with the new noble gas radiation monitor will occur in 2017.

UNPLANNED RELEASES

There were no unplanned liquid or unplanned gaseous releases during this reporting period.

LOWER LIMIT OF DETECTION (LLD) FOR EFFLUENT SAMPLE ANALYSIS

<u>GASEOUS:</u>	<u>Isotope</u>	<u>Required LLD</u>	<u>Typical LLD</u>
	Kr-87	1.00E-04	1.97E-06 - 4.78E-05
	Kr-88	1.00E-04	1.71E-06 - 2.13E-05
	Xe-133	1.00E-04	1.05E-06 - 1.68E-05
	Xe-133m	1.00E-04	3.61E-06 - 4.06E-05
	Xe-135	1.00E-04	4.59E-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	1.38E-14 - 9.34E-13
	Sr-90	1.00E-11	1.77E-15 - 1.14E-13
	Cs-134	1.00E-11	1.29E-13 - 2.50E-13
	Cs-137	1.00E-11	1.81E-13 - 3.64E-13
	Mn-54	1.00E-11	2.50E-14 - 2.70E-13
	Fe-59	1.00E-11	3.41E-13 - 8.38E-13
	Co-58	1.00E-11	1.72E-14 - 2.86E-13
	Co-60	1.00E-11	2.58E-14 - 4.79E-13
	Zn-65	1.00E-11	3.13E-13 - 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	7.84E-13 - 1.34E-12
	Alpha	1.00E-11	1.69E-14 - 2.21E-14
	Tritium	1.00E-06	4.94E-08 - 6.82E-08

<u>LIQUID:</u>			
	Sr-89	5.00E-08	2.78E-08 - 4.54E-08
	Sr-90	5.00E-08	6.46E-09 - 9.49E-09
	Cs-134	5.00E-07	1.77E-08 - 5.46E-08
	Cs-137	5.00E-07	2.45E-08 - 8.33E-08
	I-131	1.00E-06	2.61E-08 - 6.48E-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	3.64E-08 - 1.37E-07
	Mn-54	5.00E-07	3.19E-09 - 5.70E-08
	Mo-99	5.00E-07	2.20E-07 - 4.95E-07
	Ce-141	5.00E-07	3.13E-08 - 9.27E-08
	Ce-144	5.00E-07	1.32E-07 - 3.47E-07
	Fe-55	1.00E-06	4.27E-07 - 9.70E-07
	Alpha	1.00E-07	2.70E-08 - 2.73E-08
	Tritium	1.00E-05	1.22E-06 - 1.69E-06
	Xe-133	1.00E-05	8.90E-08 - 1.73E-07
	Xe-135	1.00E-05	2.78E-08 - 1.18E-07
	Xe-133m	1.00E-05	2.27E-07 - 3.71E-07
	Xe-135m	1.00E-05	1.59E-06 - 2.81E-06
	Xe-138	1.00E-05	2.38E-06 - 8.93E-06
	Kr-87	1.00E-05	1.30E-07 - 2.22E-07
	Kr-88	1.00E-05	1.59E-08 - 7.85E-07

INDUSTRY GROUND WATER PROTECTION INITIATIVE

The following is a summary of 2016 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	3/9/16	<1,400	ND	NA	NA	NA	NA
1-PL-Piez-05	3/9/16	6,160	ND	<119	<4.43	<0.461	ND
1-PL-Piez-06	3/9/16	2,580	ND	<87.1	<4.44	<0.355	ND
1-PL-Piez-07	3/9/16	<1,410	ND	NA	NA	NA	NA
1-PL-Piez-27	3/9/16	<1,410	ND	NA	NA	NA	NA
1-PL-Piez-33	3/9/16	<1,420	ND	NA	NA	NA	NA
1-PL-Piez-34	3/9/16	<1,420	ND	NA	NA	NA	NA
1-PL-Piez-41	3/9/16	<1,430	ND	NA	NA	NA	NA
1-PL-Piez-42	3/9/16	<1,420	ND	NA	NA	NA	NA
1-PL-Piez-29	3/9/16	8,340	ND	<83.4	<4.62	<0.433	ND
1-PL-Piez-04	5/11/16	<947	ND	NA	NA	NA	NA
1-PL-Piez-05	5/11/16	5,380	ND	NA	NA	NA	NA
1-PL-Piez-06	5/11/16	2,750	ND	NA	NA	NA	NA
1-PL-Piez-07	5/11/16	<971	ND	NA	NA	NA	NA
1-PL-Piez-08	5/11/16	<958	ND	NA	NA	NA	NA
1-PL-Piez-09	5/11/16	<956	NA	NA	NA	NA	NA
1-PL-Piez-20	5/11/16	<946	ND	NA	NA	NA	NA
1-PL-Piez-22	5/11/16	<968	ND	NA	NA	NA	NA
1-PL-Piez-24	5/11/16	<950	ND	NA	NA	NA	NA
1-PL-Piez-25	5/11/16	<942	ND	NA	NA	NA	NA
1-PL-Piez-27	5/11/16	<970	ND	NA	NA	NA	NA
1-PL-Piez-28	5/11/16	<952	ND	NA	NA	NA	NA
1-PL-Piez-29	5/11/16	7,780	ND	NA	NA	NA	NA
1-PL-Piez-33	5/11/16	<953	ND	NA	NA	NA	NA
1-PL-Piez-03	5/12/16	<964	NA	NA	NA	NA	NA
1-PL-Piez-23	5/12/16	<951	ND	NA	NA	NA	NA
1-PL-Piez-34	5/12/16	<954	ND	NA	NA	NA	NA
1-PL-Piez-35	5/12/16	<973	NA	NA	NA	NA	NA
1-PL-Piez-36	5/12/16	<965	NA	NA	NA	NA	NA
1-PL-Piez-37	5/12/16	<958	NA	NA	NA	NA	NA
1-PL-Piez-38	5/12/16	<967	NA	NA	NA	NA	NA
1-PL-Piez-39	5/12/16	<963	NA	NA	NA	NA	NA
1-PL-Piez-40	5/12/16	<963	ND	NA	NA	NA	NA
1-PL-Piez-41	5/12/16	<960	ND	NA	NA	NA	NA
1-PL-Piez-42	5/12/16	<951	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-05	8/2/16	4,950	ND	NA	NA	NA	NA
1-PL-Piez-06	8/2/16	1,880	ND	NA	NA	NA	NA
1-PL-Piez-07	8/2/16	<931	ND	NA	NA	NA	NA
1-PL-Piez-27	8/2/16	<945	ND	NA	NA	NA	NA
1-PL-Piez-04	8/3/16	<937	ND	NA	NA	NA	NA
1-PL-Piez-29	8/3/16	7,640	ND	NA	NA	NA	NA
1-PL-Piez-33	8/3/16	<928	ND	NA	NA	NA	NA
1-PL-Piez-34	8/3/16	<942	ND	NA	NA	NA	NA
1-PL-Piez-41	8/3/16	<934	ND	NA	NA	NA	NA
1-PL-Piez-42	8/3/16	<921	ND	NA	NA	NA	NA
1-PL-Piez-04	12/5/16	<951	ND	NA	NA	NA	NA
1-PL-Piez-05	12/5/16	4,840	ND	NA	NA	NA	NA
1-PL-Piez-06	12/5/16	1,330	ND	NA	NA	NA	NA
1-PL-Piez-07	12/5/16	<951	ND	NA	NA	NA	NA
1-PL-Piez-08	12/5/16	<970	ND	NA	NA	NA	NA
1-PL-Piez-24	12/5/16	<965	ND	NA	NA	NA	NA
1-PL-Piez-25	12/5/16	<953	ND	NA	NA	NA	NA
1-PL-Piez-27	12/5/16	<950	ND	NA	NA	NA	NA
1-PL-Piez-33	12/5/16	<952	ND	NA	NA	NA	NA
1-PL-Piez-34	12/5/16	<942	ND	NA	NA	NA	NA
1-PL-Piez-40	12/5/16	<953	ND	NA	NA	NA	NA
1-PL-Piez-41	12/5/16	<953	ND	NA	NA	NA	NA
1-PL-Piez-42	12/5/16	<944	ND	NA	NA	NA	NA

Well Designation	Sample Date	Tritium pCi/Liter	Co-58 pCi/Liter	Fe-55 pCi/Liter	Ni-63 pCi/Liter	Sr-90 pCi/Liter	TRU pCi/Liter
1-PL-Piez-29	12/5/16	6,700	16.3	NA	NA	NA	NA
	12/15/16	6,210	11.6	<67.2	<3.73	<0.637	ND

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),

ND = not detected

ERRATA/CORRECTIONS TO PREVIOUS REPORTS

This section contains revised gaseous effluent doses and associated release data for 2015. In November 2016, it was determined that delta-temperature data transmitted in delta-degrees Celsius from the Surry Power Station meteorological tower was erroneously processed and used as delta-degrees Fahrenheit data. This had the potential to impact the gaseous effluent doses reported for 2015 because the dispersion and deposition factors used in the calculations were based on a joint frequency distribution determined with delta-degrees Celsius vice Fahrenheit. The delta-degrees data was converted to Fahrenheit, processed as a new joint frequency distribution, and doses for 2015 were determined using dispersion and deposition factors based on the new joint frequency distribution. The revised doses indicate minimal change to the originally reported doses. The gamma and beta air doses increased by 4% to 5% while the critical organ dose decreased by ~14%.

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

Revised 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	3.35E-08	9.95E-08	6.42E-04
2nd Quarter	8.50E-05	2.23E-04	7.63E-05	4.60E-05	1.30E-04	5.56E-02
3rd Quarter	6.62E-05	1.61E-04	6.03E-05	2.28E-06	2.61E-06	1.16E-02
4th Quarter	1.20E-04	5.56E-04	9.16E-05	4.71E-06	5.55E-06	2.48E-02
Annual	3.43E-04	1.08E-03	2.96E-04	5.30E-05	1.38E-04	9.26E-02

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	μ Ci/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	μ Ci/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	μ Ci/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	μ Ci/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	μ Ci/sec	1.83E-02	9.40E-01	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	1.62E-03	1.33E-02	
TOTAL BODY DOSE RATE	%	2.27E-08	3.10E-05	
SKIN DOSE RATE	%	8.92E-09	1.19E-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	%	8.51E-04	1.67E-03	
TOTAL BODY DOSE RATE	%	1.67E-06	3.43E-06	
SKIN DOSE RATE	%	5.05E-07	1.01E-06	

TABLE 1B

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

SURRY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		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	1.03E-02	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	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	1.17E-01	N/D	2.46E-02	5.02E+00
TOTAL FOR PERIOD	Ci	1.17E-01	N/A	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

SURREY 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	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

SURREY POWER STATION UNITS 1&2	UNIT	CONTINUOUS MODE		BATCH MODE	
		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

SURREY 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