

VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

APR 22 2019

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No. 19-185
S&L/TSC R0
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, 2018, through December 31, 2018. 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 2018 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,



Robert M. Garver II
Director Nuclear Safety & Licensing
Surry Power Station

Attachment

Commitments made in this letter: None

cc: U. S. Nuclear Regulatory Commission
Region II
Marquis One Tower
ATTN: Division of Reactor Safety – Radiation Safety Branch
245 Peachtree Center Ave., NE Suite 1200
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector
Surry Power Station

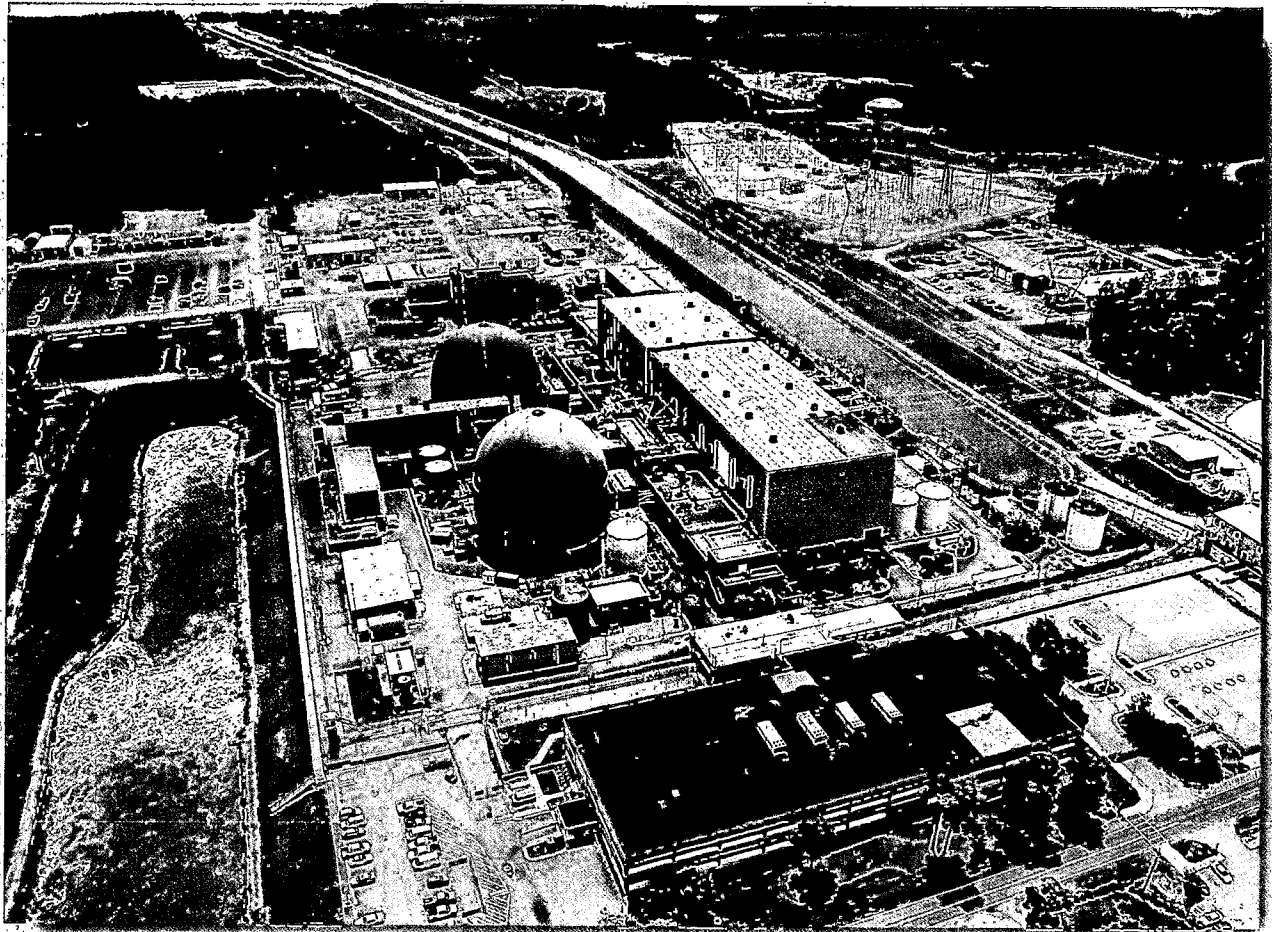
IE48
A009
NRR

ATTACHMENT

2018 Annual Radioactive Effluent Release Report

Surry Power Station

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



2018 Annual Radioactive Effluent Release Report

Surry Power Station



ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

SURRY POWER STATION

January 1, 2018 through December 31, 2018

Prepared By: P. F. Blount
P. F. Blount
Health Physicist

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

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

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

FOR THE

SURRY POWER STATION

January 1, 2018 through December 31, 2018

Index

<u>Section No.</u>	<u>Subject</u>	<u>Page</u>
1	Executive Summary	1
2	Purpose and Scope	2
3	Discussion	3
4	Supplemental Information	4
	Attachment 1 Effluent Release Data	
	Attachment 2 Annual and Quarterly Doses	
	Attachment 3 Revisions to Offsite Dose Calculation Manual (ODCM)	
	Attachment 4 Major Changes to Radioactive Liquid, Gaseous and Solid Waste Treatment Systems	
	Attachment 5 Inoperability of Radioactive Liquid and Gaseous Effluent Monitoring Instrumentation	
	Attachment 6 Unplanned Releases	
	Attachment 7 Lower Limit of Detection (LLD) for Effluent Sample Analysis	
	Attachment 8 Industry Ground Water Protection Initiative	

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 2018 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 2018 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 $5.61\text{E-}04$ mrem, which is $9.35\text{E-}03\%$ of the 6 mrem dose limit. The critical organ dose due to liquid effluents was $8.72\text{E-}04$ mrem to the GI-LLI, which is $4.36\text{E-}03\%$ of the 20 mrem dose limit.
2. The air dose due to noble gases in gaseous effluents was $6.12\text{E-}04$ mrad gamma, which is $3.06\text{E-}03\%$ of the 20 mrad gamma dose limit, and $1.81\text{E-}03$ mrad beta, which is $4.53\text{E-}03\%$ 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 $1.42\text{E-}01$ mrem, which is $4.73\text{E-}01\%$ 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 revisions 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 2018.

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 is provided in Attachment 8 of on-site radioactive leaks or spills and ground water sample analyses that were communicated in accordance with the Industry Ground Water Protection Initiative reporting protocol. Sample analyses from ground water wells that are not part of the Radiological Environmental Monitoring Program are also provided in Attachment 8. In 2018, no communications were made 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 modeled as a teenage individual for the 1st, 2nd and 3rd quarters and the child for the 4th quarter, 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 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.

There was no liquid or gaseous effluent monitoring instrumentation inoperable for greater than 30 days in 2018 to describe in Attachment 5 as required by the ODCM, Section 6.2.2 and 6.3.2.

There were no unplanned gaseous or liquid releases in 2018 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.

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, 2018 through December 31, 2018

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: 1/1/18 TO 12/31/18
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	3.98E-04	7.19E-01	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	5.12E-05	9.15E-01	
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	5.54E-06	3.16E-05	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	7.13E-07	4.01E-06	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	1.44E+01	1.22E+01	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	1.86E+00	1.55E+00	
E. CARBON-14				
1. TOTAL RELEASE	Ci	6.63E-04	1.20E+00	
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	8.53E-05	1.52E-01	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	2.84E-03	2.38E-03	
TOTAL BODY DOSE RATE	%	1.53E-06	1.92E-06	
SKIN DOSE RATE	%	3.77E-07	7.54E-07	

TABLE 1A

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	1.74E+00	8.99E+00	1.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	2.19E-01	1.13E+00	
B. IODINE				
1. TOTAL I-131	Ci	9.48E-07	1.38E-04	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	1.19E-07	1.74E-05	
C. PARTICULATE				
1. HALF-LIFE >8 DAYS	Ci	3.00E-07	8.08E-06	2.80E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	3.77E-08	1.02E-06	
3. GROSS ALPHA RADIOACTIVITY	Ci	N/D	N/D	
D. TRITIUM				
1. TOTAL RELEASE	Ci	7.28E+00	1.02E+01	3.10E+01
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	9.16E-01	1.29E+00	
E. CARBON-14				
1. TOTAL RELEASE	Ci	2.90E+00	1.50E+01	
2. AVE RELEASE RATE FOR PERIOD	μCi/sec	3.64E-01	1.89E+00	
PERCENTAGE OF T.S. LIMITS				
CRITICAL ORGAN DOSE RATE	%	1.34E-03	2.64E-02	
TOTAL BODY DOSE RATE	%	7.81E-06	3.95E-04	
SKIN DOSE RATE	%	2.80E-06	1.55E-04	

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
GASEOUS EFFLUENTS-MIXED MODE 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	6.94E-01
Xe-135	Ci	N/D	N/D	N/D	1.59E-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	5.44E-03
Ar-41	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	7.16E-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	1.67E-08	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	N/D	1.19E+00
TOTAL FOR PERIOD	Ci	N/A	1.67E-08	N/A	1.19E+00

TABLE 1B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	3.05E-01
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	2.25E-02	2.35E-02	1.66E+00	5.64E+00
Xe-135	Ci	N/D	N/D	1.07E-03	2.61E-03
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	4.49E-02	1.12E-01
Xe-133m	Ci	N/D	N/D	6.70E-03	3.31E-02
Ar-41	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	2.25E-02	2.35E-02	1.71E+00	6.09E+00
2. IODINES					
I-131	Ci	N/D	3.76E-07	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	3.76E-07	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	3.86E-09	9.88E-09	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	3.75E-02	3.91E-02	2.85E+00	1.01E+01
TOTAL FOR PERIOD	Ci	3.75E-02	3.91E-02	2.85E+00	1.01E+01

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	3.52E-03
Xe-135	Ci	2.95E-05	2.04E-05	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	3.69E-04	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	3.98E-04	2.04E-05	N/A	3.52E-03
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	4.47E-07	2.57E-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	5.10E-06	5.80E-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	6.63E-04	3.40E-05	N/D	5.86E-03
TOTAL FOR PERIOD	Ci	6.69E-04	6.55E-05	NA	5.86E-03

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	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	1.75E-03	1.51E+00	4.02E-03	1.37E+00
Xe-135	Ci	8.17E-04	2.04E-04	2.18E-03	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	3.90E-04	6.43E-05	N/D	N/D
TOTAL FOR PERIOD	Ci	2.95E-03	1.51E+00	6.21E-03	1.37E+00
2. IODINES					
I-131	Ci	9.48E-07	1.37E-04	N/D	N/D
I-133	Ci	N/D	4.43E-05	N/D	N/D
I-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	9.48E-07	1.82E-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	2.96E-07	8.07E-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	4.91E-03	2.51E+00	1.03E-02	2.28E+00
TOTAL FOR PERIOD	Ci	4.91E-03	2.51E+00	1.03E-02	2.28E+00

TABLE 2A

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	4.38E-03	8.64E-03	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	7.33E-12	1.49E-11	
3. PERCENT OF APPLICABLE LIMIT	%	2.85E-05	7.07E-05	
B. TRITIUM				
1. TOTAL RELEASE	Ci	3.03E+02	5.83E+02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	5.08E-07	1.00E-06	
3. PERCENT OF APPLICABLE LIMIT	%	5.08E-03	1.00E-02	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	Ci	N/D	1.17E-04	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	N/A	2.02E-13	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	1.01E-07	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)				
	LITERS	5.23E+07	5.38E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD				
	LITERS	5.97E+11	5.81E+11	3.00E+00

TABLE 2A

**EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	8.55E-03	1.74E-02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	1.09E-11	3.18E-11	
3. PERCENT OF APPLICABLE LIMIT	%	5.23E-05	1.79E-04	
B. TRITIUM				
1. TOTAL RELEASE	Ci	1.71E+02	7.59E+02	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	2.18E-07	1.39E-06	
3. PERCENT OF APPLICABLE LIMIT	%	2.18E-03	1.39E-02	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	Ci	N/D	8.29E-04	2.00E+01
2. AVE DIL. CONC. DURING PERIOD	μCi/mL	N/A	1.51E-12	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	7.56E-07	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	Ci	N/D	N/D	2.00E+01
E. VOLUME OF WASTE RELEASED (PRIOR TO DILUTION)				
	LITERS	5.39E+07	5.52E+07	3.00E+00
F. VOLUME OF DILUTION WATER USED DURING PERIOD				
	LITERS	7.48E+11	5.48E+11	3.00E+00

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	3.69E-04	2.25E-04	4.98E-04	2.18E-03
I-131	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	N/D	N/D	1.45E-04	3.01E-04
Co-60	Ci	N/D	N/D	2.39E-03	4.96E-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	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	N/D	N/D
Sb-125	Ci	N/D	N/D	9.77E-04	9.49E-04
Mn-56	Ci	N/D	N/D	N/D	2.30E-05
TOTAL FOR PERIOD	Ci	3.69E-04	2.25E-04	4.01E-03	8.41E-03
Xe-133	Ci	N/D	N/D	N/D	1.17E-04
Xe-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	1.17E-04

TABLE 2B

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
PERIOD: 1/1/18 TO 12/31/18
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	N/D
Cs-137	Ci	3.51E-04	2.07E-04	2.63E-03	7.62E-03
I-131	Ci	N/D	N/D	N/D	N/D
Co-58	Ci	6.76E-05	N/D	2.09E-04	7.93E-04
Co-60	Ci	N/D	N/D	3.10E-03	5.56E-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	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	4.06E-05	5.95E-06
Sb-125	Ci	N/D	N/D	2.16E-03	3.24E-03
Co-57	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	4.19E-04	2.07E-04	8.13E-03	1.72E-02
Xe-133	Ci	N/D	N/D	N/D	8.29E-04
Xe-135	Ci	N/D	N/D	N/D	N/D
TOTAL FOR PERIOD	Ci	N/A	N/A	N/A	8.29E-04

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/18 - 12/31/18

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 Ci	3.27E+01 5.97E+02	Note 1	1.00E+01 3.00E+01
b. Dry compressible waste, contaminated equip., etc.	m ³ Ci	4.23E+02 7.93E-01	Note 2	1.00E+01 3.00E+01
c. Irradiated components, control rods, etc.	m ³ Ci	0.00E+00 0.00E+00		
d. Other (Waste oil)	m ³ Ci	3.57E+00 2.06E-07	Note 3	1.00E+01 3.00E+01

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

a. Ni-63	%	2.94E+01
Co-60	%	1.76E+01
Cs-134	%	1.45E+01
Co-58	%	1.30E+01
Cs-137	%	1.11E+01
Sb-125	%	6.37E+00
Fe-55	%	3.82E+00
b. Co-60	%	6.30E+01
Ni-63	%	2.17E+01
Fe-55	%	5.73E+00
Cs-137	%	4.13E+00
Mn-54	%	2.09E+00
Sb-125	%	1.13E+00
Pu-241	%	1.09E+00
c.	%	
d. Cs-137	%	9.20E+01
Co-60	%	7.98E+00

TABLE 3

EFFLUENT AND WASTE DISPOSAL ANNUAL REPORT
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS
PERIOD: 1/1/18 - 12/31/18
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>
10	Truck	Oak Ridge, TN (EnergySolutions)
2	Truck	Kingston, TN (EnergySolutions)
2	Truck	Erwin, TN (EnergySolutions)
1	Barge	Memphis, 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 7.58E+00 m³.

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 1.04E+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.

2018	LIQUID		
	Maximum Receptor - Adult		
	Total Body (mrem)	GI-LLI (mrem)	Liver (mrem)
1st Quarter	7.30E-05	1.20E-04	7.19E-05
2nd Quarter	1.78E-04	2.94E-04	1.77E-04
3rd Quarter	4.80E-05	9.00E-05	5.11E-05
4th Quarter	2.62E-04	3.68E-04	2.80E-04
Annual	5.61E-04	8.72E-04	5.80E-04

2018	GASEOUS - Air Dose	
	Gamma (mrad)	Beta (mrad)
1st Quarter	1.99E-06	7.31E-07
2nd Quarter	2.84E-06	8.04E-06
3rd Quarter	1.11E-05	2.23E-05
4th Quarter	5.96E-04	1.78E-03
Annual	6.12E-04	1.81E-03

2018	GASEOUS - Organ Dose		
	Annual Maximum	Maximum by Quarter	
	Child/Bone (mrem)	(mrem)	Receptor / Organ
1st Quarter	1.01E-05	1.05E-02	Teen/Lung
2nd Quarter	6.69E-03	9.18E-03	Teen/Liver
3rd Quarter	1.61E-02	1.61E-02	Child/Bone
4th Quarter	1.19E-01	1.19E-01	Child/Bone
Annual	1.42E-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 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. None of the above referenced instrumentation were inoperable greater than 30 days during this reporting period.

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	2.02E-06 - 3.41E-05
	Kr-88	1.00E-04	2.00E-06 - 2.00E-05
	Xe-133	1.00E-04	1.23E-06 - 1.94E-05
	Xe-133m	1.00E-04	4.26E-06 - 4.06E-05
	Xe-135	1.00E-04	5.65E-07 - 6.11E-05
	Xe-135m	1.00E-04	1.35E-05 - 9.21E-05
	Xe-138	1.00E-04	2.26E-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	1.35E-14 - 1.93E-12
	Sr-90	1.00E-11	2.27E-15 - 3.30E-13
	Cs-134	1.00E-11	1.10E-13 - 2.77E-13
	Cs-137	1.00E-11	1.79E-13 - 3.14E-13
	Mn-54	1.00E-11	1.59E-13 - 3.31E-13
	Fe-59	1.00E-11	5.07E-14 - 7.09E-13
	Co-58	1.00E-11	1.97E-14 - 3.48E-13
	Co-60	1.00E-11	2.25E-13 - 5.85E-13
	Zn-65	1.00E-11	2.43E-13 - 6.63E-13
	Mo-99	1.00E-11	4.06E-12 - 4.06E-12
	Ce-141	1.00E-11	2.03E-13 - 3.20E-13
	Ce-144	1.00E-11	7.28E-13 - 1.20E-12
	Alpha	1.00E-11	1.68E-14 - 1.70E-14
	Tritium	1.00E-06	5.45E-08 - 8.46E-08
<u>LIQUID:</u>	Sr-89	5.00E-08	2.58E-08 - 2.61E-07
	Sr-90	5.00E-08	6.49E-09 - 1.33E-08
	Cs-134	5.00E-07	1.14E-08 - 6.23E-08
	Cs-137	5.00E-07	1.84E-09 - 7.17E-08
	I-131	1.00E-06	2.02E-08 - 6.22E-08
	Co-58	5.00E-07	2.35E-09 - 7.26E-08
	Co-60	5.00E-07	4.53E-09 - 1.13E-07
	Fe-59	5.00E-07	5.52E-09 - 1.32E-07
	Zn-65	5.00E-07	2.55E-08 - 1.33E-07
	Mn-54	5.00E-07	1.63E-08 - 7.05E-08
	Mo-99	5.00E-07	3.36E-07 - 4.95E-07
	Ce-141	5.00E-07	2.05E-08 - 7.94E-08
	Ce-144	5.00E-07	1.11E-07 - 3.47E-07
	Fe-55	1.00E-06	1.03E-07 - 9.68E-07
	Alpha	1.00E-07	2.65E-08 - 2.68E-08
	Tritium	1.00E-05	1.35E-06 - 2.09E-06
	Xe-133	1.00E-05	1.00E-07 - 3.76E-07
	Xe-135	1.00E-05	2.09E-08 - 6.98E-08
	Xe-133m	1.00E-05	1.99E-07 - 3.38E-07
	Xe-135m	1.00E-05	1.35E-06 - 3.60E-06
	Xe-138	1.00E-05	1.98E-06 - 7.64E-06
	Kr-87	1.00E-05	1.02E-07 - 2.39E-07
	Kr-88	1.00E-05	1.09E-07 - 2.32E-07

INDUSTRY GROUND WATER PROTECTION INITIATIVE

The following is a summary of 2018 sample analyses of ground water monitoring wells that are not a part of the Radiological Environmental Monitoring Program (REMP).

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-44	2/19/18	69,400	NA	NA	NA	NA	NA
1-PL-Piez-45	2/19/18	2,760	NA	NA	NA	NA	NA
1-PL-Piez-04	2/20/18	<1,030	ND	NA	NA	NA	NA
1-PL-Piez-05	2/20/18	6,840	ND	<194	<4.44	<0.753	ND
1-PL-Piez-06	2/20/18	3,330	ND	<195	<4.52	<0.646	ND
1-PL-Piez-07	2/20/18	<1,040	ND	NA	NA	NA	NA
1-PL-Piez-27	2/20/18	<1,050	ND	NA	NA	NA	NA
1-PL-Piez-33	2/21/18	<1,000	ND	NA	NA	NA	NA
1-PL-Piez-34	2/21/18	<1,010	ND	NA	NA	NA	NA
1-PL-Piez-41	2/21/18	<1,020	ND	NA	NA	NA	NA
1-PL-Piez-42	2/21/18	<1,010	ND	NA	NA	NA	NA
1-PL-Piez-51	2/22/18	7,410	ND	<197	<4.55	<0.876	ND
1-PL-Piez-52	2/22/18	<819	ND	NA	NA	NA	NA
1-PL-Piez-43	2/26/18	<785	ND	NA	NA	NA	NA
1-PL-Piez-44	2/26/18	61,700	ND	NA	NA	NA	NA
1-PL-Piez-45	2/26/18	812	ND	NA	NA	NA	NA
1-PL-Piez-47	2/26/18	1,900	ND	NA	NA	NA	NA
1-PL-Piez-50	2/26/18	<781	ND	NA	NA	NA	NA
1-PL-Piez-29	2/27/18	6,110	ND	<194	<4.71	<0.877	ND
1-PL-Piez-46	2/27/18	<783	ND	NA	NA	NA	NA
1-PL-Piez-48	2/27/18	<786	ND	NA	NA	NA	NA
1-PL-Piez-49	2/27/18	22,900	ND	NA	NA	NA	NA
1-PL-Piez-44	3/5/18	71,800	NA	NA	NA	NA	NA
1-PL-Piez-49	3/5/18	26,900	NA	NA	NA	NA	NA
1-PL-Piez-44	3/12/18	70,900	NA	NA	NA	NA	NA
1-PL-Piez-49	3/12/18	25,800	NA	NA	NA	NA	NA
1-PL-Piez-44	3/19/18	77,000	NA	NA	NA	NA	NA
1-PL-Piez-49	3/19/18	26,100	NA	NA	NA	NA	NA
1-PL-Piez-44	3/26/18	70,100	NA	NA	NA	NA	NA
1-PL-Piez-49	3/26/18	23,800	NA	NA	NA	NA	NA
1-PL-Piez-48	4/2/18	<1,010	ND	NA	NA	NA	NA
1-PL-Piez-51	4/2/18	9,060	ND	NA	NA	NA	NA
1-PL-Piez-52	4/2/18	<992	ND	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMF LLDs.

TRU = Transuranics (Am-241, Cm-242, Cm-243/244, Pu-238, Pu-239/240 and Pu-241)

ND = not detected

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-33	4/2/18	<999	ND	NA	NA	NA	NA
1-PL-Piez-34	4/2/18	<1,010	ND	NA	NA	NA	NA
1-PL-Piez-41	4/2/18	<1,000	ND	NA	NA	NA	NA
1-PL-Piez-42	4/2/18	<982	ND	NA	NA	NA	NA
1-PL-Piez-04	4/3/18	<1,063	ND	NA	NA	NA	NA
1-PL-Piez-05	4/3/18	4,640	ND	NA	NA	NA	NA
1-PL-Piez-06	4/3/18	1,530	ND	NA	NA	NA	NA
1-PL-Piez-29	4/3/18	7,300	ND	NA	NA	NA	NA
1-PL-Piez-43	4/3/18	<1,050	ND	NA	NA	NA	NA
1-PL-Piez-44	4/3/18	78,200	ND	NA	NA	NA	NA
1-PL-Piez-45	4/3/18	2,010	ND	NA	NA	NA	NA
1-PL-Piez-46	4/3/18	<1,060	ND	NA	NA	NA	NA
1-PL-Piez-49	4/3/18	25,000	ND	NA	NA	NA	NA
1-PL-Piez-47	4/5/18	1,850	ND	NA	NA	NA	NA
1-PL-Piez-50	4/5/18	<1,080	ND	NA	NA	NA	NA
1-PL-Piez-07	4/6/18	<1,070	ND	NA	NA	NA	NA
1-PL-Piez-27	4/6/18	<1,080	ND	NA	NA	NA	NA
1-PL-Piez-44	4/6/18	57,800	NA	NA	NA	NA	NA
1-PL-Piez-44	4/9/18	28,800	NA	NA	NA	NA	NA
1-PL-Piez-44	4/9/18	26,300	NA	NA	NA	NA	NA
1-PL-Piez-49	4/9/18	23,400	NA	NA	NA	NA	NA
1-PL-Piez-49	4/9/18	19,300	NA	NA	NA	NA	NA
1-PL-Piez-44	4/10/18	33,200	NA	NA	NA	NA	NA
1-PL-Piez-44	4/11/18	34,000	NA	NA	NA	NA	NA
1-PL-Piez-44	4/12/18	25,000	NA	NA	NA	NA	NA
1-PL-Piez-44	4/13/18	18,000	NA	NA	NA	NA	NA
1-PL-Piez-44	4/16/18	25,700	NA	NA	NA	NA	NA
1-PL-Piez-44	4/17/18	15,600	NA	NA	NA	NA	NA
1-PL-Piez-44	4/17/18	15,700	NA	NA	NA	NA	NA
1-PL-Piez-49	4/17/18	22,500	NA	NA	NA	NA	NA
1-PL-Piez-49	4/17/18	20,900	NA	NA	NA	NA	NA
1-PL-Piez-44	4/18/18	19,000	NA	NA	NA	NA	NA
1-PL-Piez-44	4/19/18	16,100	NA	NA	NA	NA	NA
1-PL-Piez-44	4/20/18	17,300	NA	NA	NA	NA	NA
1-PL-Piez-44	4/21/18	14,200	NA	NA	NA	NA	NA
1-PL-Piez-44	4/22/18	15,200	NA	NA	NA	NA	NA
1-PL-Piez-44	4/23/18	14,300	NA	NA	NA	NA	NA
1-PL-Piez-44	4/24/18	13,200	NA	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.

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-44	4/25/18	19,200	NA	NA	NA	NA	NA
1-PL-Piez-44	4/26/18	22,700	NA	NA	NA	NA	NA
1-PL-Piez-44	4/27/18	11,900	NA	NA	NA	NA	NA
1-PL-Piez-44	4/28/18	11,000	NA	NA	NA	NA	NA
1-PL-Piez-44	4/29/18	14,400	NA	NA	NA	NA	NA
1-PL-Piez-44	4/30/18	11,300	NA	NA	NA	NA	NA
1-PL-Piez-44	5/1/18	12,200	NA	NA	NA	NA	NA
1-PL-Piez-06	5/2/18	3,010	NA	NA	NA	NA	NA
1-PL-Piez-43	5/2/18	<571	NA	NA	NA	NA	NA
1-PL-Piez-44	5/2/18	9,030	NA	NA	NA	NA	NA
1-PL-Piez-47	5/2/18	1,520	NA	NA	NA	NA	NA
1-PL-Piez-05	5/3/18	5,820	NA	NA	NA	NA	NA
1-PL-Piez-29	5/3/18	7,720	NA	NA	NA	NA	NA
1-PL-Piez-44	5/3/18	10,600	NA	NA	NA	NA	NA
1-PL-Piez-49	5/3/18	18,800	NA	NA	NA	NA	NA
1-PL-Piez-51	5/3/18	9,550	NA	NA	NA	NA	NA
1-PL-Piez-07	5/4/18	<284	NA	NA	NA	NA	NA
1-PL-Piez-44	5/4/18	11,300	NA	NA	NA	NA	NA
1-PL-Piez-45	5/4/18	1,160	NA	NA	NA	NA	NA
1-PL-Piez-44	5/5/18	11,200	NA	NA	NA	NA	NA
1-PL-Piez-44	5/6/18	10,300	NA	NA	NA	NA	NA
1-PL-Piez-42	5/7/18	<325	NA	NA	NA	NA	NA
1-PL-Piez-44	5/7/18	9,820	NA	NA	NA	NA	NA
1-PL-Piez-46	5/7/18	<221	NA	NA	NA	NA	NA
1-PL-Piez-44	5/8/18	9,300	NA	NA	NA	NA	NA
1-PL-Piez-44	5/9/18	9,810	NA	NA	NA	NA	NA
1-PL-Piez-44	5/10/18	8,380	NA	NA	NA	NA	NA
1-PL-Piez-49	5/10/18	25,700	NA	NA	NA	NA	NA
1-PL-Piez-44	5/11/18	9,640	NA	NA	NA	NA	NA
1-PL-Piez-44	5/12/18	10,500	NA	NA	NA	NA	NA
1-PL-Piez-44	5/13/18	10,700	NA	NA	NA	NA	NA
1-PL-Piez-44	5/14/18	9,720	NA	NA	NA	NA	NA
1-PL-Piez-44	5/15/18	12,254	NA	NA	NA	NA	NA
1-PL-Piez-44	5/16/18	11,104	NA	NA	NA	NA	NA
1-PL-Piez-44	5/17/18	9,734	NA	NA	NA	NA	NA
1-PL-Piez-44	5/18/18	11,226	NA	NA	NA	NA	NA
1-PL-Piez-44	5/19/18	11,026	NA	NA	NA	NA	NA
1-PL-Piez-44	5/20/18	10,440	NA	NA	NA	NA	NA
1-PL-Piez-44	5/21/18	11,562	NA	NA	NA	NA	NA

NA = Analysis not required.

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-44	5/22/18	9,626	NA	NA	NA	NA	NA
1-PL-Piez-44	5/23/18	11,955	NA	NA	NA	NA	NA
1-PL-Piez-29	5/24/18	7,410	NA	NA	NA	NA	NA
1-PL-Piez-44	5/24/18	12,500	NA	NA	NA	NA	NA
1-PL-Piez-44	5/24/18	14,400	NA	NA	NA	NA	NA
1-PL-Piez-49	5/24/18	25,900	NA	NA	NA	NA	NA
1-PL-Piez-51	5/24/18	10,800	NA	NA	NA	NA	NA
1-PL-Piez-29	5/25/18	6,610	NA	NA	NA	NA	NA
1-PL-Piez-44	5/25/18	24,400	NA	NA	NA	NA	NA
1-PL-Piez-44	5/25/18	19,900	NA	NA	NA	NA	NA
1-PL-Piez-49	5/25/18	14,100	NA	NA	NA	NA	NA
1-PL-Piez-51	5/25/18	8,280	NA	NA	NA	NA	NA
1-PL-Piez-51	5/25/18	8,010	NA	NA	NA	NA	NA
1-PL-Piez-44	5/26/18	31,800	NA	NA	NA	NA	NA
1-PL-Piez-51	5/26/18	5,960	NA	NA	NA	NA	NA
1-PL-Piez-29	5/27/18	6,680	NA	NA	NA	NA	NA
1-PL-Piez-44	5/27/18	31,600	NA	NA	NA	NA	NA
1-PL-Piez-44	5/27/18	24,800	NA	NA	NA	NA	NA
1-PL-Piez-44	5/27/18	26,900	NA	NA	NA	NA	NA
1-PL-Piez-49	5/27/18	10,600	NA	NA	NA	NA	NA
1-PL-Piez-51	5/27/18	5,490	NA	NA	NA	NA	NA
1-PL-Piez-29	5/28/18	6,630	NA	NA	NA	NA	NA
1-PL-Piez-44	5/28/18	27,300	NA	NA	NA	NA	NA
1-PL-Piez-44	5/28/18	18,200	NA	NA	NA	NA	NA
1-PL-Piez-49	5/28/18	6,770	NA	NA	NA	NA	NA
1-PL-Piez-51	5/28/18	4,850	NA	NA	NA	NA	NA
1-PL-Piez-29	5/29/18	7,120	NA	NA	NA	NA	NA
1-PL-Piez-44	5/29/18	24,700	NA	NA	NA	NA	NA
1-PL-Piez-49	5/29/18	10,600	NA	NA	NA	NA	NA
1-PL-Piez-51	5/29/18	6,230	NA	NA	NA	NA	NA
1-PL-Piez-29	5/30/18	6,360	NA	NA	NA	NA	NA
1-PL-Piez-44	5/30/18	27,900	NA	NA	NA	NA	NA
1-PL-Piez-49	5/30/18	7,600	NA	NA	NA	NA	NA
1-PL-Piez-51	5/30/18	5,900	NA	NA	NA	NA	NA
1-PL-Piez-51	5/31/18	5,120	NA	NA	NA	NA	NA
1-PL-Piez-29	6/4/18	4,710	ND	NA	NA	NA	NA
1-PL-Piez-44	6/4/18	30,300	ND	NA	NA	NA	NA
1-PL-Piez-48	6/4/18	<1,233	ND	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.

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-49	6/4/18	9,420	ND	NA	NA	NA	NA
1-PL-Piez-51	6/4/18	5,690	ND	NA	NA	NA	NA
1-PL-Piez-46	6/6/18	<822	ND	NA	NA	NA	NA
1-PL-Piez-52	6/6/18	<822	ND	NA	NA	NA	NA
1-PL-Piez-29	6/12/18	4,360	NA	NA	NA	NA	NA
1-PL-Piez-44	6/12/18	27,600	NA	<169	<4.28	<0.726	ND
1-PL-Piez-49	6/12/18	12,100	NA	<188	<4.41	<0.717	ND
1-PL-Piez-51	6/12/18	5,220	NA	NA	NA	NA	NA
1-PL-Piez-06	6/13/18	1,970	ND	NA	NA	NA	NA
1-PL-Piez-07	6/13/18	<652	ND	NA	NA	NA	NA
1-PL-Piez-43	6/13/18	717	ND	NA	NA	NA	NA
1-PL-Piez-45	6/13/18	1,900	ND	<194	<3.85	<0.708	ND
1-PL-Piez-47	6/13/18	1,030	ND	<147	<4.10	<0.830	ND
1-PL-Piez-27	6/14/18	<640	ND	NA	NA	NA	NA
1-PL-Piez-44	6/15/18	21,900	NA	NA	NA	NA	NA
1-PL-Piez-04	6/18/18	<647	ND	NA	NA	NA	NA
1-PL-Piez-24	6/18/18	<659	ND	NA	NA	NA	NA
1-PL-Piez-25	6/18/18	<654	ND	NA	NA	NA	NA
1-PL-Piez-44	6/18/18	15,400	NA	NA	NA	NA	NA
1-PL-Piez-50	6/18/18	<655	ND	NA	NA	NA	NA
1-PL-Piez-20	6/18/18	<813	ND	NA	NA	NA	NA
1-PL-Piez-44	6/19/18	13,300	NA	NA	NA	NA	NA
1-PL-Piez-51	6/19/18	4,540	NA	NA	NA	NA	NA
1-PL-Piez-44	6/20/18	14,300	NA	NA	NA	NA	NA
1-PL-Piez-29	6/21/18	4,070	NA	NA	NA	NA	NA
1-PL-Piez-44	6/21/18	13,700	NA	NA	NA	NA	NA
1-PL-Piez-49	6/21/18	8,620	NA	NA	NA	NA	NA
1-PL-Piez-44	6/22/18	22,700	NA	NA	NA	NA	NA
1-PL-Piez-05	6/25/18	5,660	ND	NA	NA	NA	NA
1-PL-Piez-22	6/25/18	<617	ND	NA	NA	NA	NA
1-PL-Piez-44	6/25/18	16,600	NA	NA	NA	NA	NA
1-PL-Piez-09	6/26/18	<620	NA	NA	NA	NA	NA
1-PL-Piez-28	6/26/18	<622	ND	NA	NA	NA	NA
1-PL-Piez-29	6/26/18	3,510	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)

ND = not detected

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-44	6/26/18	16,200	NA	NA	NA	NA	NA
1-PL-Piez-49	6/26/18	7,640	NA	NA	NA	NA	NA
1-PL-Piez-51	6/26/18	4,830	NA	NA	NA	NA	NA
1-PL-Piez-08	6/27/18	<629	ND	NA	NA	NA	NA
1-PL-Piez-44	6/27/18	16,700	NA	NA	NA	NA	NA
1-PL-Piez-23	6/28/18	<651	ND	NA	NA	NA	NA
1-PL-Piez-36	6/28/18	<651	NA	NA	NA	NA	NA
1-PL-Piez-39	6/28/18	<657	NA	NA	NA	NA	NA
1-PL-Piez-44	6/28/18	16,500	NA	NA	NA	NA	NA
1-PL-Piez-34	7/2/18	<643	ND	NA	NA	NA	NA
1-PL-Piez-33	7/3/18	<654	ND	NA	NA	NA	NA
1-PL-Piez-41	7/3/18	<649	ND	NA	NA	NA	NA
1-PL-Piez-44	7/3/18	23,000	NA	NA	NA	NA	NA
1-PL-Piez-44	7/4/18	16,200	NA	NA	NA	NA	NA
1-PL-Piez-44	7/5/18	13,400	NA	NA	NA	NA	NA
1-PL-Piez-51	7/5/18	4,810	NA	NA	NA	NA	NA
1-PL-Piez-42	7/9/18	<622	ND	NA	NA	NA	NA
1-PL-Piez-03	7/10/18	<630	NA	NA	NA	NA	NA
1-PL-Piez-38	7/10/18	<621	NA	NA	NA	NA	NA
1-PL-Piez-40	7/10/18	<634	ND	NA	NA	NA	NA
1-PL-Piez-37	7/11/18	<624	NA	NA	NA	NA	NA
1-PL-Piez-29	7/17/18	2,740	NA	NA	NA	NA	NA
1-PL-Piez-44	7/17/18	74,700	NA	NA	NA	NA	NA
1-PL-Piez-49	7/17/18	20,000	NA	NA	NA	NA	NA
1-PL-Piez-51	7/17/18	5,390	NA	NA	NA	NA	NA
1-PL-Piez-44	7/26/18	24,300	NA	NA	NA	NA	NA
1-PL-Piez-51	7/26/18	4,980	NA	NA	NA	NA	NA
1-PL-Piez-29	7/31/18	2,360	NA	NA	NA	NA	NA
1-PL-Piez-44	7/31/18	27,800	NA	NA	NA	NA	NA
1-PL-Piez-49	7/31/18	11,200	NA	NA	NA	NA	NA
1-PL-Piez-51	7/31/18	6,340	NA	NA	NA	NA	NA
1-PL-Piez-07	8/6/18	<650	ND	NA	NA	NA	NA
1-PL-Piez-33	8/6/18	<651	ND	NA	NA	NA	NA
1-PL-Piez-41	8/6/18	<651	ND	NA	NA	NA	NA
1-PL-Piez-47	8/6/18	1,110	ND	NA	NA	NA	NA
1-PL-Piez-06	8/7/18	2,040	ND	NA	NA	NA	NA
1-PL-Piez-27	8/7/18	<668	ND	NA	NA	NA	NA
1-PL-Piez-34	8/7/18	<660	ND	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.

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-43	8/7/18	<661	ND	NA	NA	NA	NA
1-PL-Piez-45	8/7/18	1,570	ND	NA	NA	NA	NA
1-PL-Piez-04	8/8/18	<659	ND	NA	NA	NA	NA
1-PL-Piez-05	8/8/18	6,510	ND	NA	NA	NA	NA
1-PL-Piez-42	8/8/18	<659	ND	NA	NA	NA	NA
1-PL-Piez-50	8/8/18	<654	ND	NA	NA	NA	NA
1-PL-Piez-46	8/13/18	<644	ND	NA	NA	NA	NA
1-PL-Piez-48	8/13/18	<663	ND	NA	NA	NA	NA
1-PL-Piez-52	8/13/18	<657	ND	NA	NA	NA	NA
1-PL-Piez-29	8/14/18	2,680	ND	NA	NA	NA	NA
1-PL-Piez-44	8/14/18	38,700	ND	NA	NA	NA	NA
1-PL-Piez-49	8/14/18	11,000	ND	NA	NA	NA	NA
1-PL-Piez-51	8/14/18	6,130	ND	NA	NA	NA	NA
1-PL-Piez-44	8/22/18	12,300	NA	NA	NA	NA	NA
1-PL-Piez-29	8/28/18	1,550	NA	NA	NA	NA	NA
1-PL-Piez-44	8/28/18	8,760	NA	NA	NA	NA	NA
1-PL-Piez-49	8/28/18	12,100	NA	NA	NA	NA	NA
1-PL-Piez-51	8/28/18	3,790	NA	NA	NA	NA	NA
1-PL-Piez-44	9/6/18	8,810	NA	NA	NA	NA	NA
1-PL-Piez-49	9/12/18	10,600	NA	NA	NA	NA	NA
1-PL-Piez-51	9/12/18	6,280	NA	NA	NA	NA	NA
1-PL-Piez-44	9/13/18	11,000	NA	NA	NA	NA	NA
1-PL-Piez-05	9/18/18	5,270	NA	NA	NA	NA	NA
1-PL-Piez-06	9/18/18	1,360	NA	NA	NA	NA	NA
1-PL-Piez-43	9/18/18	<751	NA	NA	NA	NA	NA
1-PL-Piez-45	9/18/18	825	NA	NA	NA	NA	NA
1-PL-Piez-29	9/19/18	2,650	NA	NA	NA	NA	NA
1-PL-Piez-47	9/19/18	<743	NA	NA	NA	NA	NA
1-PL-Piez-49	9/19/18	13,200	NA	NA	NA	NA	NA
1-PL-Piez-51	9/25/18	6,180	NA	NA	NA	NA	NA
1-PL-Piez-44	9/26/18	14,000	NA	NA	NA	NA	NA
1-PL-Piez-29	9/27/18	2,610	NA	NA	NA	NA	NA
1-PL-Piez-46	9/27/18	<741	NA	NA	NA	NA	NA
1-PL-Piez-44	10/2/18	8,860	NA	NA	NA	NA	NA
1-PL-Piez-51	10/8/18	5,670	NA	NA	NA	NA	NA
1-PL-Piez-51	10/16/18	5,740	NA	NA	NA	NA	NA
1-PL-Piez-29	10/17/18	2,400	NA	NA	NA	NA	NA
1-PL-Piez-44	10/17/18	11,000	NA	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.

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-46	10/17/18	<811	NA	NA	NA	NA	NA
1-PL-Piez-49	10/17/18	19,500	NA	NA	NA	NA	NA
1-PL-Piez-43	10/18/18	<809	NA	NA	NA	NA	NA
1-PL-Piez-45	10/18/18	<807	NA	NA	NA	NA	NA
1-PL-Piez-47	10/18/18	<806	NA	NA	NA	NA	NA
1-PL-Piez-05	10/22/18	5,900	NA	NA	NA	NA	NA
1-PL-Piez-06	10/22/18	1,680	NA	NA	NA	NA	NA
1-PL-Piez-51	10/22/18	7,930	NA	NA	NA	NA	NA
1-PL-Piez-42	10/23/18	<694	NA	NA	NA	NA	NA
1-PL-Piez-44	10/23/18	12,600	NA	NA	NA	NA	NA
1-PL-Piez-29	11/1/18	3,110	ND	NA	NA	NA	NA
1-PL-Piez-49	11/1/18	13,000	ND	NA	NA	NA	NA
1-PL-Piez-51	11/1/18	5,920	ND	NA	NA	NA	NA
1-PL-Piez-44	11/7/18	12,700	ND	NA	NA	NA	NA
1-PL-Piez-46	11/7/18	<637	ND	NA	NA	NA	NA
1-PL-Piez-05	11/8/18	5,280	ND	NA	NA	NA	NA
1-PL-Piez-06	11/8/18	2,170	ND	NA	NA	NA	NA
1-PL-Piez-43	11/8/18	<633	ND	NA	NA	NA	NA
1-PL-Piez-45	11/8/18	<691	ND	NA	NA	NA	NA
1-PL-Piez-44	11/9/18	6,370	NA	NA	NA	NA	NA
1-PL-Piez-25	11/11/18	<566	ND	NA	NA	NA	NA
1-PL-Piez-47	11/11/18	1,340	ND	NA	NA	NA	NA
1-PL-Piez-29	11/16/18	2,530	NA	NA	NA	NA	NA
1-PL-Piez-44	11/16/18	13,100	NA	NA	NA	NA	NA
1-PL-Piez-49	11/16/18	11,200	NA	NA	NA	NA	NA
1-PL-Piez-51	11/16/18	5,000	NA	NA	NA	NA	NA
1-PL-Piez-44	12/5/18	9,230	NA	NA	NA	NA	NA
1-PL-Piez-51	12/5/18	5,110	NA	NA	NA	NA	NA
1-PL-Piez-06	12/6/18	3,000	NA	NA	NA	NA	NA
1-PL-Piez-43	12/6/18	<612	NA	NA	NA	NA	NA
1-PL-Piez-45	12/7/18	981	NA	NA	NA	NA	NA
1-PL-Piez-46	12/7/18	<610	NA	NA	NA	NA	NA
1-PL-Piez-47	12/7/18	949	NA	NA	NA	NA	NA
1-PL-Piez-29	12/10/18	2,910	NA	NA	NA	NA	NA
1-PL-Piez-49	12/10/18	6,670	NA	NA	NA	NA	NA
1-PL-Piez-52	12/10/18	<610	ND	NA	NA	NA	NA
1-PL-Piez-05	12/11/18	6,270	NA	NA	NA	NA	NA
1-PL-Piez-50	12/11/18	<547	ND	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.

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-48	12/12/18	<610	ND	NA	NA	NA	NA
1-PL-Piez-51	12/12/18	5,640	NA	NA	NA	NA	NA
1-PL-Piez-44	12/17/18	8,960	NA	NA	NA	NA	NA
1-PL-Piez-51	12/17/18	5,800	NA	NA	NA	NA	NA

NA = Analysis not required.

ND = No non-natural gamma emitting nuclides detected when analyzed to REMP LLDs.