

WOLF CREEK

NUCLEAR OPERATING CORPORATION

April 25, 2018

Cynthia R. Hafenstine
Manager Nuclear and Regulatory Affairs

RA 18-0046

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

Reference:

Subject: Docket No. 50-482: Wolf Creek Generating Station 2017 Annual Radioactive Effluent Release Report – Report 41

To Whom It May Concern:

The purpose of this letter is to transmit the enclosed Wolf Creek Generating Station (WCGS) Annual Radioactive Effluent Release Report. The report covers the period from January 1, 2017 through December 31, 2017. It is being submitted pursuant to Section 5.6.3 of the WCGS Technical Specifications. The report provides procedures AP 07B-003, Revision 8, "Offsite Dose Calculation Manual," AP 07B-004, Revision 21, "Offsite Dose Calculation Manual (Radiological Environmental Monitoring Program)," and AP 31A-100, Revision 8, "Solid Radwaste Process Control Program" that are included as part of the report in accordance with Section 5.5.1 of the WCGS Technical Specifications. These procedures have the changes made during the reporting period marked as required.

This letter contains no commitments. If you have any questions concerning this matter, please contact me at (620) 364-4204.

Sincerely,



Cynthia R. Hafenstine

CRH/rlt

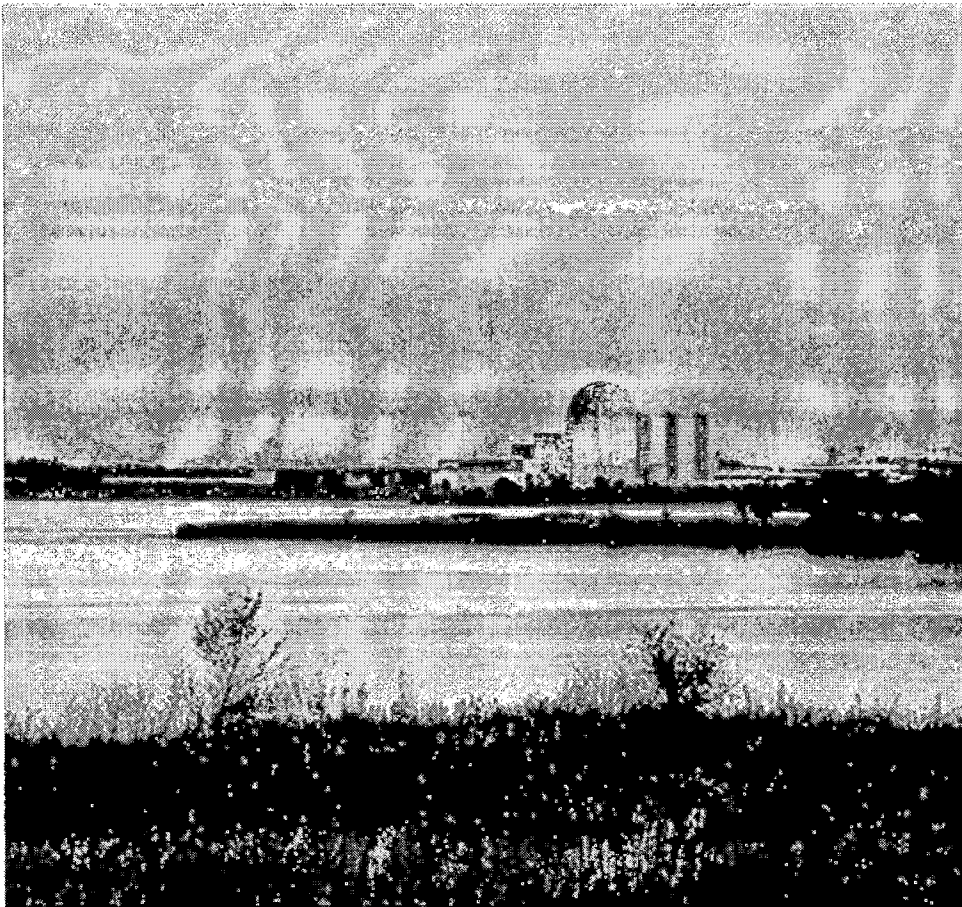
Enclosure: 2017 Annual Radioactive Effluent Release Report – Report 41

cc: K. M. Kennedy (NRC), w/e
B. K. Singal (NRC), w/e
N.H. Taylor (NRC), w/e
Senior Resident Inspector (NRC), w/e

IE48
NRR

Wolf Creek Generating Station

2017 Annual Radioactive Effluent Release Report – Report 41
(297 pages including this page)



WOLF CREEK NUCLEAR OPERATING CORPORATION

2017 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Wolf Creek Generating Station

Docket Number 50-482

Renewed Facility Operating License NPF-42

Report Number 41

WOLF CREEK NUCLEAR OPERATING CORPORATION

2017 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Introduction

This Annual Radioactive Effluent Release Report (ARERR) covers the operation of Wolf Creek Generating Station (WCGS) from January 1, 2017 through December 31, 2017. The ARERR includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit in accordance with Technical Specification 5.6.3. The content of this ARERR is presented in the general format of Revision 1 of Regulatory Guide 1.21.

I. SUPPLEMENTAL INFORMATION

A. Regulatory Limits

The Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used in the calculation of offsite doses due to radioactive liquid and gaseous effluents. The following are limits required by the ODCM:

1. GASEOUS EFFLUENTS

The 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 the following:

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

For Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrem/yr to any organ.

The air dose due to noble gases released in gaseous effluents to areas at and beyond the site boundary shall be limited to the following:

During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation, and

During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

The dose to a member of the public from Iodine-131, Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and

During any calendar year: Less than or equal to 15 mrems to any organ.

2. LIQUID EFFLUENTS

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to 10 times the limit specified in 10 CFR 20, 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 $2.00E-04$ $\mu\text{Ci/ml}$ total activity.

The dose or dose commitment to a member of the public from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

B. Effluent Concentration Limit (ECL)

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to 10 times the limit specified in 10 CFR 20, 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 $\mu\text{Ci/ml}$ total activity. The percent of ECL values are found in Appendix A, Table 4A.

C. Average Energy

Average energy of fission and activation gaseous effluents is not applicable. See ODCM section 3.1 for the methodology used in determining the release rate limits from noble gas releases.

D. Measurements and Approximations of Total Radioactivity

Measurements of total radioactivity were performed in accordance with the sampling and analysis requirements of Tables 2-1 and 3-1 of the ODCM (Enclosure I).

Gamma spectroscopy is used as the primary method in determining radionuclide composition and concentration of liquid and gaseous effluents. Liquid composites are sent off site for analysis of Sr-89, Sr-90, Fe-55 and Ni-63. Gaseous composites are also sent off site for Sr-89 and Sr-90 analysis. Liquid scintillation and scintillation alpha counters are used to measure tritium and gross alpha.

E. Batch Releases

1. LIQUID

Number of batch releases-40

Total time period for batch release-4,594 minutes

Maximum time period for a batch release-190 minutes

Average time period for batch releases-114.9 minutes

Minimum time period for a batch release-39 minutes

Average stream flow during periods of release of effluent into a flowing stream-
Not applicable

2. GASEOUS

Number of batch releases-49

Total time period for batch release-3,409 minutes

Maximum time period for a batch release-491 minutes

Average time period for batch releases-69.6 minutes

Minimum time period for a batch release-28 minutes

F. Continuous Releases

1. GASES

Continuous gaseous release pathways include the Unit Vent and Radwaste Vent.

2. LIQUID

Continuous liquid release pathways include Steam Generator Blowdown, Lime Sludge Pond, Turbine Building Sump and Waste Water Treatment.

G. Abnormal Releases

There was no unplanned or uncontrolled release of radioactive material from the site boundary in 2017.

Update on CR 84942: On June 14, 2013, approximately 100 gallons of contaminated water leaked from the Spent Fuel Pool into the Component Cooling Water A train (CCW). The primary gamma emitting isotope (Cs-137) was removed from CCW by ion exchange to below detection limits. By the end of 2014, the CCW tritium concentration equalized in both trains to 1.00E-03 uCi/ml and no gamma emitting isotopes were detected. A portion of the CCW system was drained through the normal discharge path during the 2015 and 2016 refueling outages. After partially draining and refilling the system, tritium values in the CCW are now approximately 3.00E-04 µCi/ml. The CCW system is scheduled to be drained and monitored via the normal discharge path during the 2018 refueling outage for system maintenance. The following CRs document the event and evaluation: 70420, 70451, 70546 and 72212.

II. GASEOUS EFFLUENTS

An elevated release pathway does not exist at WCGS. All airborne releases are considered to be ground level releases. Appendix A, Table 1A contains the summation of all gaseous effluent discharges, while Table 1B shows the quarterly sums of curies discharged and is divided according to batch or continuous mode.

III. LIQUID EFFLUENTS

Summary information can be found in Appendix A, Tables 2A and 2B. Table 2A contains the summation of all liquid effluent discharges, while Table 2B reports the quarterly sums of total curies released and is divided according to batch or continuous mode.

IV. SOLID WASTE

Appendix A, Table 3 contains information on shipments of solid waste and irradiated fuel transported from the site during the period.

V. RADIOLOGICAL IMPACT ON MAN

No ODCM dose limits were exceeded in 2017.

Dose calculations are performed for the limiting age group i.e., adult age group for the liquid pathway and the child age group for gaseous effluent organ doses. All calculations were performed in accordance with the methodology and parameters in the ODCM. A conservative error of thirty percent has been estimated in the effluent data for liquid and gaseous dose.

A. Dose Due to Liquid Effluents

The dose due to liquid effluents was calculated in accordance with the methodology and parameters in the ODCM and can be found in Appendix A, Tables 4B and 4C. Table 4C is included to show the correlation between curies released and the associated calculated maximum organ dose.

Wolf Creek ODCM methodology is used to calculate the maximum organ dose which assumes that an individual drinks the water and eats the fish from the discharge point. ODCM section 2.2 organ dose limits are used.

B. Dose Due to Gaseous Effluents

The dose due to gaseous effluents can be found in Appendix A, Tables 4D and 4E and is calculated in accordance with the methodology and parameters in the ODCM. Table 4E is included to show the correlation between curies released and the associated calculated maximum organ dose. The gaseous pathway dose determination is met by the ODCM methodology of assigning all gaseous pathways to a hypothetical individual residing at the highest annual X/Q and D/Q location, which assumes that an individual actually resides at the site boundary. This results in a conservative estimate of dose to a member of the public, rather than determining each pathway dose for each release condition. ODCM section 3.2.2 organ dose limits are used.

C. Dose to a Member of the Public from Activities Inside the Site Boundary

Four activities by members of the public were considered in this evaluation. The dose calculated for the maximum exposed individual is as follows:

	Total Dose
1. Personnel making deliveries to the plant	3.20E-01 mrem/yr
2. Workers at the William Allen White Building located outside the protected area boundary	6.88E-03 mrem/yr
3. Use of the access road south of the Radwaste Building	3.28E-03 mrem/yr
4. Public use of the cooling lake during times when fishing was allowed	4.09E-02 mrem/yr

The plant delivery calculations were based on deliveries being made 3 hours per week for 50 weeks per year. The William Allen White Building occupancy was based on normal working hours of 2,000 per year. The usage factor for the access road south of the Radwaste Building was 25 hours per year. The dose to anglers on the lake was based upon 3,768 hours (12 hours a day for 314 days, based on the number of days that the lake was open to anglers). The Submersion, Inhalation and Ground Plane pathway doses were added to derive the total dose. All calculations were performed in accordance with the methodology and parameters in the ODCM.

VI. METEOROLOGICAL DATA

Appendix B documents WCGS meteorological data for wind speed, wind direction and atmospheric stability. The meteorological data supplied in the tables covers the period from January 1, 2017 through December 31, 2017, and indicates the number of hours at each wind speed and direction for each stability class. All gaseous releases at the WCGS are ground level releases.

WCGS met Regulatory Guide 1.23 requirement for data recovery for all instruments.

VII. ADDITIONAL INFORMATION

A. Unplanned Releases

There were no unplanned releases in 2017.

B. ODCM

There were no changes made to the ODCM in 2017. The ODCM is in the form of two separate procedures. They are AP 07B-003 (Offsite Dose Calculation Manual) and AP 07B-004 (Offsite Dose Calculation Manual-Radiological Environmental Monitoring Program). Both procedures are attached as enclosures.

C. Radwaste Treatment System Changes

There were no major changes made to the Liquid, Solid or Gaseous Radwaste Systems in 2017 that alter the capacity or handling of radioactive wastes or differ in the method of treatment.

The sluice line that routes BL (Reactor Makeup) water through the selected vessel was replaced in 2017. This will improve the residual dose that remains from the resin left in the lines.

D. Annual Land Use Census Changes

Per the Annual Land Use Census, three changes were identified for the nearest occupied residence in each sector. Five changes were noted for the nearest garden producing broadleaf vegetation. There were no changes regarding milk sample locations. No locations were identified that milked animals for human consumption.

E. Liquid Holdup or Gas Storage Tanks

No limits were exceeded in 2017 for Technical Requirement 3.10.1 (Liquid Holdup Tanks) or Technical Surveillance Requirement 3.10.3.1 (Gas Storage Tanks).

F. Functionality of Effluent Monitoring Instrumentation

Effluent monitoring instrumentation returned to functional status within specified time.

G. Missed samples

CR 00110361

On January 9, 2017, SYS GT-300 was performed to commence a planned Unit Vent outage. When non-isokinetic conditions were reached, GTRE21B was incorrectly placed out of service by Control Room staff. However, GTRE21B should have remained functional upon the loss of isokinetic flow. With the belief that GTRE21B was out of service, a channel check on the monitor was not performed as required by the ODCM. The Control Room staff also failed to communicate the status of GTRE21B to Chemistry, which resulted in a grab sample not being obtained for a period of 24 hours. System trends were reviewed and showed no indications of an abnormal release. The procedures were updated to define monitor status during performance of the surveillance and to clarify impact of isokinetic flow.

CR 00112928

On May 10, 2017, power was unexpectedly removed from the two gaseous effluent radiation monitors GHRE10A/B (Radwaste Building Vent) and GTRE21A/B (Unit Vent). The loss of power was due to a scheduled performance of a first time work activity to replace the Radiation Monitoring System inverter. Impact of the work activity did not include input from Chemistry. Once notification was made, alternate sample carts were set up and placed in service to meet the continuous filter flow requirements of ODCM Table 3-2. Continuous filtration was not in place for approximately 83 minutes on the Unit Vent monitor and 143 minutes on the Radwaste Vent monitor as required by AP 07B-003, Table 3-2 (1.b., 1.c., 3.b. & 3.c.). The same work performed in 2018 was a success.

H. NEI Groundwater Protection Industry Initiative

See Appendix C.

I. Other

CR 00112547

During the final review of radioactive liquid release permit packet U1LB2017-016, it was found that a technician incorrectly identified an energy line, which resulted in omitting an isotope (Mn-54) from the release permit calculations as required by AP 07B-003, Offsite Dose Calculation Manual. The error was not caught by the technician performing the 2nd review. The tank was discharged using setpoints more conservative than if Mn-54 had been included. The low setpoint used for the release was 5.28E-04 $\mu\text{Ci/ml}$. The setpoint including Mn-54 would have been 7.56E-04 $\mu\text{Ci/ml}$. The permit post release calculations were later corrected to include the Mn-54 activity of 3.24E-08 $\mu\text{Ci/ml}$.

CARBON-14 (CR 36059)

Regulation 10CFR50.36a requires nuclear power plants to report quantities of principal radionuclides in the annual radioactive effluent release report. In the early 1980s, the NRC decided that C-14 radionuclide would not be required to be reported because it would not make a significant contribution to dose. Since this time, technology has advanced both for effluent isotopic reduction and isotope detection and estimation. It is more likely the C-14 meets the definition of a principal radionuclide in accordance with the newly published Regulatory Guide 1.21 Revision 2 (June 2009).

The NRC allows the reporting of this isotope based on estimation methods. EPRI TR 1021106 developed an estimation method based on peer-reviewed research that incorporates parameters of Wolf Creek's reactor design to estimate the gross amount of C-14 produced annually. This value is fed into additional calculations, based on 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, to provide an estimation of annual dose. Based on the 2010 theoretical calculations and assuming the maximum percentage of inorganic C-14 compounds (30%), Wolf Creek has estimated the annual release of C-14 to be 10.7 curies and to contribute maximum dose values of 1.30 mrem/yr child bone dose and 0.259 mrem/yr child total body. This is well below the 10CFR50, Appendix I, ALARA design objective of 15 mrem/yr. Additionally, this value is on par with the dose expected from naturally occurring radiocarbon.

Appendix A
(Effluent Tables)

**TABLE 1A:
GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES**

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error, %
Fission & Activation Gases						
<i>Total Release</i>	Ci	7.02E-02	8.72E-02	5.14E-01	2.76E+00	3.00E+01
<i>Average Release Rate for period</i>	μCi/sec	9.03E-03	1.11E-02	6.47E-02	3.47E-01	
<i>Percent of ODCM limit</i>	%	8.74E-04	8.32E-04	9.26E-04	2.30E-03	
Iodines						
<i>Total Iodine-131</i>	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+01
<i>Average Release Rate for period</i>	μCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<i>Percent of ODCM limit</i>	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Particulates						
<i>Particulates with half-lives >8 days</i>	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+01
<i>Average Release Rate for period</i>	μCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<i>Percent of ODCM limit</i>	%	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<i>Gross alpha radioactivity</i>	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+01
Tritium						
<i>Total release</i>	Ci	4.93E+00	1.11E+01	1.75E+01	8.54E+00	3.00E+01
<i>Average Release Rate for period</i>	μCi/sec	6.34E-01	1.41E+00	2.20E+00	1.07E+00	
<i>Percent of ODCM limit</i>	%	4.65E-02	1.04E-01	1.65E-01	8.06E-02	

**TABLE 1B:
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES-BATCH MODE**

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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Fission gases

Argon-41	Ci	6.73E-02	6.32E-02	5.39E-02	7.30E-02
Xenon-133	Ci	2.88E-03	2.39E-02	1.16E-01	1.88E-01
Krypton-85	Ci	0.00E+00	0.00E+00	0.00E+00	2.58E-01
Krypton-85m	Ci	<1.31E-03	<1.16E-03	<9.56E-04	<1.20E-03
Krypton-87	Ci	<2.34E-03	<2.06E-03	<1.70E-03	<2.14E-03
Krypton-88	Ci	<5.32E-03	<4.68E-03	<3.87E-03	<4.86E-03
Xenon-133m	Ci	<5.64E-03	<4.96E-03	<4.10E-03	1.00E-04
Xenon-135	Ci	<1.05E-03	<9.22E-04	<7.62E-04	<9.59E-04
Xenon-135m	Ci	<2.74E-02	<2.41E-02	<1.99E-02	<2.51E-02
Xenon-138	Ci	<4.84E-02	<4.26E-02	<3.52E-02	<4.43E-02
Xenon-131m	Ci	0.00E+00	0.00E+00	0.00E+00	3.10E-03
Total for period*	Ci	7.02E-02	8.72E-02	1.70E-01	5.22E-01

Iodines

Iodine-131	Ci	<7.98E-08	<7.02E-08	<5.80E-08	<7.30E-08
Iodine-133	Ci	<7.98E-06	<7.02E-06	<5.80E-06	<7.30E-06
Total for period*	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Particulates

Strontium-89	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Strontium-90	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cesium-134	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cesium-137	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Manganese-54	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Iron-59	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cobalt-58	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cobalt-60	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Zinc-65	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Molybdenum-99	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cerium-141	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Cerium-144	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07
Total for period*	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium	Ci	1.01E-01	2.79E-01	4.02E-01	1.48E-01
Gross Alpha	Ci	<7.98E-07	<7.02E-07	<5.80E-07	<7.30E-07

*Less than values are not included in the summation for the total release values.

**TABLE 1B:
GASEOUS EFFLUENTS-GROUND LEVEL RELEASES -CONTINUOUS MODE**

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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Fission gases

Argon-41	Ci	<8.21E+00	<8.67E+00	<8.71E+00	<8.32E+00
Xenon-133	Ci	<1.19E+01	<1.26E+01	3.44E-01	2.24E+00
Krypton-85m	Ci	<3.85E+00	<4.07E+00	<4.09E+00	<3.91E+00
Krypton-87	Ci	<6.87E+00	<7.25E+00	<7.28E+00	<6.96E+00
Krypton-88	Ci	<1.56E+01	<1.65E+01	<1.65E+01	<1.58E+01
Xenon-133m	Ci	<1.66E+01	<1.75E+01	<1.76E+01	<1.68E+01
Xenon-135	Ci	<3.07E+00	<3.24E+00	<3.26E+00	<3.11E+00
Xenon-135m	Ci	<8.03E+01	<8.48E+01	<8.52E+01	<8.14E+01
Xenon-138	Ci	<1.42E+02	<1.50E+02	<1.51E+02	<1.44E+02
Total for period	Ci	0.00E+00	0.00E+00	3.44E-01	2.24E+00

Iodines

Iodine-131	Ci	<2.34E-04	<2.47E-04	<2.48E-04	<2.37E-04
Iodine-133	Ci	<2.34E-02	<2.47E-02	<2.48E-02	<2.37E-02
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Particulates

Strontium-89	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Strontium-90	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cesium-134	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cesium-137	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Manganese-54	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Iron-59	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cobalt-58	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cobalt-60	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Zinc-65	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Molybdenum-99	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cerium-141	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Cerium-144	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
Total for period	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Tritium	Ci	4.83E+00	1.08E+01	1.71E+01	8.40E+00
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Gross Alpha	Ci	<2.34E-03	<2.47E-03	<2.48E-03	<2.37E-03
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*Less than values are not included in the summation for the total release values.

**TABLE 2A:
LIQUID EFFLUENTS – SUMMATION OF ALL RELEASES**

Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error, %
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FISSION AND ACTIVATION PRODUCTS

Total Release (not including tritium, gases, alpha)	Ci	2.22E-03	2.46E-03	9.65E-04	4.41E-04	3.00E+01
Average Diluted Concentration during period	µCi/ml	8.65E-12	9.08E-12	3.47E-12	1.62E-12	
Percent of Applicable Limit	%	4.45E-02	4.92E-02	1.93E-02	8.82E-03	

TRITIUM

Total release	Ci	1.42E+01	4.45E+01	3.98E+02	5.16E+02	3.00E+01
Average Diluted Concentration during period	µCi/ml	5.53E-08	1.64E-07	1.43E-06	1.89E-06	
Percent of Applicable Limit	%	5.53E-03	1.64E-02	1.43E-01	1.89E-01	

DISSOLVED AND ENTRAINED GASES

Total release	Ci	0.00E+00	0.00E+00	3.12E-02	1.04E-01	3.00E+01
Average Diluted Concentration during period	µCi/ml	0.00E+00	0.00E+00	1.12E-10	3.81E-10	
Percent of Applicable Limit	%	0.00E+00	0.00E+00	5.61E-05	1.91E-04	

GROSS ALPHA RADIOACTIVITY

Total Release	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+01
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Volume of waste released (prior to dilution)	L	9.34E+07	1.70E+08	9.70E+07	9.34E+07	3.00E+01
Volume of dilution water used during period	L	2.57E+11	2.71E+11	2.78E+11	2.73E+11	3.00E+01

TABLE 2B: LIQUID EFFLUENTS – BATCH MODE

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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Fission & Activation Products

Strontium-89	Ci	<1.26E-05	<1.45E-05	<2.30E-05	<2.68E-05
Strontium-90	Ci	<1.26E-05	<1.45E-05	<2.30E-05	<2.68E-05
Cesium-134	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Cesium-137	Ci	1.64E-05	5.45E-06	<2.30E-04	<2.68E-04
Cobalt-57	Ci	1.38E-05	1.01E-05	3.12E-06	0.00E+00
Cobalt-58	Ci	2.14E-03	9.15E-04	3.06E-04	1.01E-04
Cobalt-60	Ci	4.65E-05	4.94E-05	3.62E-05	2.43E-05
Iron-55	Ci	<2.52E-04	<2.89E-04	<4.59E-04	<5.35E-04
Iron-59	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Zinc-65	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Manganese-54	Ci	<1.26E-04	1.37E-06	<2.30E-04	<2.68E-04
Nickel-63	Ci	<2.52E-04	1.13E-03	4.59E-04	3.16E-04
Antimony-125	Ci	1.12E-05	0.00E+00	1.60E-04	0.00E+00
Telerium-125m	Ci	0.00E+00	3.50E-04	0.00E+00	0.00E+00
Molybdenum-99	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Cerium-141	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Cerium-144	Ci	<1.26E-04	<1.45E-04	<2.30E-04	<2.68E-04
Iodine-131	Ci	<2.52E-04	<2.89E-04	<4.59E-04	<5.35E-04
Total for period*	Ci	2.22E-03	2.46E-03	9.65E-04	4.41E-04

Dissolved & Entrained Gases

Xe-133	Ci	<2.52E-03	<2.89E-03	2.68E-02	9.28E-02
Xe-133m	Ci	<2.52E-03	<2.89E-03	4.72E-05	5.04E-04
Xe-135	Ci	<2.52E-03	<2.89E-03	<4.59E-03	9.22E-06
Xenon-131m	Ci	<2.52E-03	<2.89E-03	1.50E-03	2.62E-03
Krypton-85	Ci	<2.52E-03	<2.89E-03	2.82E-03	7.98E-03
Total for period*	Ci	0.00E+00	0.00E+00	3.12E-02	1.04E-01

Tritium	Ci	1.26E+01	4.25E+01	3.97E+02	5.14E+02
Gross Alpha	Ci	<2.52E-05	<2.89E-05	<4.59E-05	<5.35E-05

*Less than values are not included in the summation for the total release values.

TABLE 2B: LIQUID EFFLUENTS – CONTINUOUS MODE

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4
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Fission & Activation Products

Strontium-89	Ci	<4.66E-03	<8.45E-03	<4.83E-03	<4.64E-03
Strontium-90	Ci	<4.66E-03	<8.45E-03	<4.83E-03	<4.64E-03
Cesium-134	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Cesium-137	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Cobalt-58	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Cobalt-60	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Iron-55	Ci	<9.31E-02	<1.69E-01	<9.65E-02	<9.28E-02
Iron-59	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Zinc-65	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Manganese-54	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Nickel-63	Ci	<9.31E-02	<1.69E-01	<9.65E-02	<9.28E-02
Molybdenum-99	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Cerium-141	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Cerium-144	Ci	<4.66E-02	<8.45E-02	<4.83E-02	<4.64E-02
Iodine-131	Ci	<9.31E-02	<1.69E-01	<9.65E-02	<9.28E-02
Total for period*	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Dissolved & Entrained Gases

None discharged	Ci	<9.31E-01	<1.69E+00	<9.65E-01	<9.28E-01
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Tritium	Ci	1.62E+00	1.96E+00	1.28E+00	1.77E+00
Gross Alpha	Ci	<9.31E-03	<1.69E-02	<9.65E-03	<9.28E-03

*Less than values are not included in the summation for the total release values.

**TABLE 3:
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS**

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

1. Type of Waste	Units	1-Year Period	Est. Total Error (%)
a. Spent resins, filter sludges, evaporator bottoms, etc.	m ^{3*}	1.73E+01	
	Ci	5.93E+00	2.50E+01
b. Dry compressible waste, contaminated equip., etc.	m ^{3*}	2.92E+02	
	Ci	3.68E-01	2.50E+01
c. Irradiated components, control rods, etc.	m ^{3*}	0.00E+00	
	Ci	0.00E+00	
d. Other	m ^{3*}	0.00E+00	
	Ci	0.00E+00	

*This is the volume sent offsite for volume reduction prior to disposal (waste volume).

2. Estimate of Major Nuclide Composition (by Type of Waste) [Nuclides listed with % abundance greater than 10%]

- a. Spent resins, filter sludges, evaporator bottoms, etc.

<u>Nuclide</u>	<u>% Abundance</u>	<u>Curies</u>
H-3	30.58	1.81E+00
Fe-55	11.02	6.53E-01
Co-60	13.11	7.77E-01
Ni-63	37.82	2.24E+00

- b. Dry compressible waste, contaminated equipment, etc.

<u>Nuclide</u>	<u>% Abundance</u>	<u>Curies</u>
CO-60	37.21	1.37E-01
CS-137	57.89	2.13E-01

- c. Irradiated components, control rods, etc. – None
d. Other - None

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
7	Truck (Hittman Transport Services)	Energy Solutions Oak Ridge, TN (Bear Creek)
7	Truck (Hittman Transport Services)	Energy Solutions Kingston, TN (Gallaher Road Facility)

4. Class of Solid Waste

- a. Class A –Corresponding to 2a
- b. Class A –Corresponding to 2b
- c. Not applicable
- d. Not applicable

5. Type of Container

- a. LSA (General Design), Type A-corresponding to 2a
- b. LSA (General Design)-corresponding 2b
- c. Not applicable
- d. Not applicable

6. Solidification Agent

- a. Not applicable
- b. Not applicable
- c. Not applicable
- d. Not applicable

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

No irradiated fuel shipments occurred during the 2017 period.

TABLE 4A: 2017 EFFLUENT CONCENTRATION LIMITS

<i>Nuclides</i>	<i>Curies</i>	<i>Average Diluted Concentration ($\mu\text{Ci/ml}$)</i>	<i>10 CFR 20 ECL ($\mu\text{Ci/ml}$)</i>	<i>% ECL</i>
<i>Tritium</i>	9.72E+02	9.00E-07	1.00E-03	9.00E-02
<i>Manganese-54</i>	1.37E-06	1.27E-15	3.00E-05	4.23E-09
<i>Cobalt-57</i>	2.70E-05	2.50E-14	6.00E-05	4.17E-08
<i>Cobalt-58</i>	3.46E-03	3.21E-12	2.00E-05	1.60E-05
<i>Cobalt-60</i>	1.56E-04	1.45E-13	3.00E-06	4.83E-06
<i>Nickel-63</i>	1.90E-03	1.76E-12	1.00E-04	1.76E-06
<i>Antimony-125</i>	1.71E-04	1.59E-13	3.00E-05	5.29E-07
<i>Tellurium-125m</i>	3.50E-04	3.24E-13	2.00E-05	1.62E-06
<i>Cesium-137</i>	2.18E-05	2.02E-14	1.00E-06	2.02E-06
<i>Xenon-133m</i>	5.51E-04	5.11E-13	2.00E-04	2.55E-07
<i>Xenon-133</i>	1.20E-01	1.11E-10	2.00E-04	5.54E-05
<i>Xenon-135</i>	9.22E-06	8.54E-15	2.00E-04	4.27E-09
<i>Krypton-85</i>	1.08E-02	1.00E-11	2.00E-04	5.00E-06
<i>Xenon-131m</i>	4.12E-03	3.82E-12	2.00E-04	1.91E-06

TABLE 4B: 2017 LIQUID CUMULATIVE DOSE SUMMARY

QUARTER 1 OF 2017 (MREM)	ODCM Calculated Dose	ODCM Limit (mrem)	% of Limit
Total Dose for Bone	5.23E-05	5.00E+00	1.05E-03
Total Dose for Liver	1.27E-03	5.00E+00	2.54E-02
Total Dose for Total Body	1.25E-03	1.50E+00	8.33E-02
Total Dose for Thyroid	1.20E-03	5.00E+00	2.40E-02
Total Dose for Kidney	1.22E-03	5.00E+00	2.44E-02
Total Dose for Lung	1.20E-03	5.00E+00	2.40E-02
Total Dose for GI-LLI	1.26E-03	5.00E+00	2.52E-02
QUARTER 2 OF 2017 (MREM)			
Total Dose for Bone	4.14E-04	5.00E+00	8.28E-03
Total Dose for Liver	4.22E-02	5.00E+00	8.44E-01
Total Dose for Total Body	4.22E-02	1.50E+00	2.81E+00
Total Dose for Thyroid	4.21E-02	5.00E+00	8.42E-01
Total Dose for Kidney	4.22E-02	5.00E+00	8.44E-01
Total Dose for Lung	4.21E-02	5.00E+00	8.42E-01
Total Dose for GI-LLI	4.22E-02	5.00E+00	8.44E-01
QUARTER 3 OF 2017 (MREM)			
Total Dose for Bone	1.58E-04	5.00E+00	3.16E-03
Total Dose for Liver	3.54E-02	5.00E+00	7.08E-01
Total Dose for Total Body	3.54E-02	1.50E+00	2.36E+00
Total Dose for Thyroid	3.54E-02	5.00E+00	7.08E-01
Total Dose for Kidney	3.54E-02	5.00E+00	7.08E-01
Total Dose for Lung	3.54E-02	5.00E+00	7.08E-01
Total Dose for GI-LLI	3.54E-02	5.00E+00	7.08E-01
QUARTER 4 OF 2017 (MREM)			
Total Dose for Bone	1.11E-04	5.00E+00	2.22E-03
Total Dose for Liver	4.82E-02	5.00E+00	9.64E-01
Total Dose for Total Body	4.82E-02	1.50E+00	3.21E+00
Total Dose for Thyroid	4.82E-02	5.00E+00	9.64E-01
Total Dose for Kidney	4.82E-02	5.00E+00	9.64E-01
Total Dose for Lung	4.82E-02	5.00E+00	9.64E-01
Total Dose for GI-LLI	4.82E-02	5.00E+00	9.64E-01
TOTALS FOR 2017 (MREM)			
Total Dose for Bone	7.35E-04	1.00E+01	7.35E-03
Total Dose for Liver	1.27E-01	1.00E+01	1.27E+00
Total Dose for Total Body	1.27E-01	3.00E+00	4.23E+00
Total Dose for Thyroid	1.27E-01	1.00E+01	1.27E+00
Total Dose for Kidney	1.27E-01	1.00E+01	1.27E+00
Total Dose for Lung	1.27E-01	1.00E+01	1.27E+00
Total Dose for GI-LLI	1.27E-01	1.00E+01	1.27E+00

**TABLE 4C:
LIQUID CUMULATIVE DOSE SUMMARY**

Quarter 1 Quarter 2 Quarter 3 Quarter 4 Total

Fission & Activation Products*

Total Release (Ci)	2.22E-03	2.46E-03	9.65E-04	4.41E-04	6.09E-03
Maximum Organ Dose (mrem)	7.48E-05	4.14E-04	1.58E-04	1.11E-04	7.35E-04
Organ Dose Limit (mrem)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
Percent of Limit	1.50E-03	8.27E-03	3.16E-03	2.22E-03	7.35E-03

Tritium

Total Release (Ci)	1.42E+01	4.45E+01	3.98E+02	5.16E+02	9.72E+02
Maximum Organ Dose (mrem)	1.20E-03	4.21E-02	3.54E-02	4.82E-02	1.27E-01
Organ Dose Limit (mrem)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
Percent of Limit	2.39E-02	8.43E-01	7.08E-01	9.65E-01	1.27E+00

Dissolved & Entrained Gases

Total Release (Ci)	0.00E+00	0.00E+00	3.12E-02	1.04E-01	1.35E-01
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Gross Alpha Radioactivity

Total Release (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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*Does not include H-3, gases or alpha

TABLE 4D: 2017 GASEOUS CUMULATIVE DOSE SUMMARY

QUARTER 1 OF 2017 (MREM)	ODCM Calculated Dose	ODCM Limit (mrem)	% of Limit
Total Dose for Bone	0.00E+00	7.50E+00	0.00E+00
Total Dose for Liver	3.49E-03	7.50E+00	4.65E-02
Total Dose for Total Body	3.49E-03	7.50E+00	4.65E-02
Total Dose for Thyroid	3.49E-03	7.50E+00	4.65E-02
Total Dose for Kidney	3.49E-03	7.50E+00	4.65E-02
Total Dose for Lung	3.49E-03	7.50E+00	4.65E-02
Total Dose for GI-LLI	3.49E-03	7.50E+00	4.65E-02

QUARTER 2 OF 2017 (MREM)

Total Dose for Bone	0.00E+00	7.50E+00	0.00E+00
Total Dose for Liver	7.84E-03	7.50E+00	1.05E-01
Total Dose for Total Body	7.84E-03	7.50E+00	1.05E-01
Total Dose for Thyroid	7.84E-03	7.50E+00	1.05E-01
Total Dose for Kidney	7.84E-03	7.50E+00	1.05E-01
Total Dose for Lung	7.84E-03	7.50E+00	1.05E-01
Total Dose for GI-LLI	7.84E-03	7.50E+00	1.05E-01

QUARTER 3 OF 2017 (MREM)

Total Dose for Bone	0.00E+00	7.50E+00	0.00E+00
Total Dose for Liver	1.24E-02	7.50E+00	1.65E-01
Total Dose for Total Body	1.24E-02	7.50E+00	1.65E-01
Total Dose for Thyroid	1.24E-02	7.50E+00	1.65E-01
Total Dose for Kidney	1.24E-02	7.50E+00	1.65E-01
Total Dose for Lung	1.24E-02	7.50E+00	1.65E-01
Total Dose for GI-LLI	1.24E-02	7.50E+00	1.65E-01

QUARTER 4 OF 2017 (MREM)

Total Dose for Bone	0.00E+00	7.50E+00	0.00E+00
Total Dose for Liver	6.04E-03	7.50E+00	8.05E-02
Total Dose for Total Body	6.04E-03	7.50E+00	8.05E-02
Total Dose for Thyroid	6.04E-03	7.50E+00	8.05E-02
Total Dose for Kidney	6.04E-03	7.50E+00	8.05E-02
Total Dose for Lung	6.04E-03	7.50E+00	8.05E-02
Total Dose for GI-LLI	6.04E-03	7.50E+00	8.05E-02

TOTALS FOR 2017 (MREM)

Total Dose for Bone	0.00E+00	1.50E+01	0.00E+00
Total Dose for Liver	2.97E-02	1.50E+01	1.98E-01
Total Dose for Total Body	2.97E-02	1.50E+01	1.98E-01
Total Dose for Thyroid	2.97E-02	1.50E+01	1.98E-01
Total Dose for Kidney	2.97E-02	1.50E+01	1.98E-01
Total Dose for Lung	2.97E-02	1.50E+01	1.98E-01
Total Dose for GI-LLI	2.97E-02	1.50E+01	1.98E-01

TABLE 4E: 2017 GASEOUS CUMULATIVE DOSE SUMMARY

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<i>Fission & Activation Gases</i>					
Total Release (Ci)	7.02E-02	8.72E-02	5.14E-01	2.76E+00	3.43E+00
Total Gamma Air Dose (mrad)	4.37E-05	4.16E-05	4.63E-05	1.07E-04	2.39E-04
Gamma Air Dose Limit (mrad)	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
Percent of Gamma Air Dose Limit	8.74E-04	8.32E-04	9.26E-04	2.15E-03	2.39E-03
Total Beta Air Dose (mrad)	1.56E-05	1.62E-05	4.60E-05	2.30E-04	3.08E-04
Beta Air Dose Limit (mrad)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
Percent of Beta Air Dose Limit	1.56E-04	1.62E-04	4.60E-04	2.30E-03	1.54E-03
<i>Particulates</i>					
Total Particulates (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Maximum Organ Dose (mrem)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Organ Dose Limit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
Percent of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<i>Tritium</i>					
Total Release (Ci)	4.93E+00	1.11E+01	1.75E+01	8.54E+00	4.20E+01
Maximum Organ Dose (mrem)	3.49E-03	7.84E-03	1.24E-02	6.04E-03	2.97E-02
Organ Dose Limit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
Percent of Limit	4.65E-02	1.04E-01	1.65E-01	8.06E-02	1.98E-01
<i>Iodine</i>					
Total Release (Ci)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Maximum Organ Dose (mrem)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Organ Dose Limit (mrem)	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
Percent of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CALCULATIONS:

Gases:

1. The percent of ODCM limit for fission and activation gases is calculated using the following methodology: (The larger value calculated between Gamma and Beta air dose is listed as the % of ODCM Limit)

$$\% \text{ of ODCM Limit} = \frac{(\text{Quarterly Total Beta Airdose})(100)}{10 \text{ mrad}}$$

OR

$$\% \text{ of ODCM Limit} = \frac{(\text{Quarterly Total Gamma Airdose})(100)}{5 \text{ mrad}}$$

2. The percent of ODCM limit for iodine is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Total Curies of Iodine} - 131)(100)}{1 \text{ Curie}}$$

3. The percent of ODCM limit for particulates is calculated using the following methodology:

$$\% \text{ of ODCM Limit} = \frac{(\text{Highest Organ Dose due to Particulates})(100)}{7.5 \text{ mrem}}$$

4. The percent of ODCM limit for tritium is calculated using the following methodology (this type of methodology is used since the Wolf Creek ODCM ties release limits to doses rather than curie release rates:

$$\% \text{ of ODCM Limit} = \frac{(\text{Highest Organ Dose due to H} - 3)(100)}{7.5 \text{ mrem}}$$

5. Less than values for Noble Gases are calculated using the Lower Limit of Detection (LLD) values obtained at WCGS multiplied by the volume of air discharged during the respective quarter. For the Halogens and Particulates, the ODCM LLD values are used.

Liquids:

1. The Applicable Limit for fission and activation products at WCGS is 5 curies per year (reference 10CFR50, Appendix I, paragraph A.2). The percent of Applicable Limit is derived by the following:

$$\% \text{ of Applicable Limit} = \frac{(\text{Total Release Ci})(100)}{5 \text{ Ci}}$$

2. The percent of Applicable Limit for tritium is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})(100)}{(\text{ECL}^*)}$$

*The ECL can be found in 10CFR20, Appendix B, Table 2

3. The percent of Applicable Limit for dissolved and entrained gases is derived by the following formula:

$$\% \text{ of Applicable Limit} = \frac{(\text{Average Diluted Concentration})(100)}{(2.00E - 04^*)}$$

*From ODCM, section 2.1

4. Less than values are calculated using the Lower Limit of Detection (LLD) values listed in Table 2-1 of the ODCM multiplied by the volume of waste discharged during the respective quarter. The less than values are not included in the summation for the total release values.

Appendix B
Meteorological Data

HOURS AT EACH WIND SPEED AND DIRECTION

This section documents WCGS meteorological data for wind speed, wind direction, and atmospheric stability.

The meteorological data supplied in the following tables covers the period from January 1, 2017, through December 31, 2017, and indicates the number of hours at each wind speed and direction for each stability class. All gaseous releases at the WCGS are ground level releases.

Wolf Creek Generating Station met Regulatory Guide 1.23 requirement for data recovery, for all instruments. The instruments, both at 10 and 60 meters, met or exceeded a 90% meteorological data recovery for 2017.

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: A

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0.00	0.75	5.75	12.75	2.75	0.00	22.00
NNE	0.50	3.25	18.50	7.75	1.25	0.00	31.25
NE	1.75	12.50	19.00	3.25	0.00	0.00	36.50
ENE	0.25	6.00	19.50	4.25	0.50	0.00	30.50
E	0.25	5.50	11.75	0.75	0.00	0.00	18.25
ESE	0.25	4.50	10.50	0.00	0.00	0.00	15.25
SE	0.25	5.75	22.50	7.75	0.00	0.00	36.25
SSE	0.25	3.50	56.25	45.50	15.25	1.00	121.75
S	1.25	1.00	41.25	102.00	57.25	17.25	220.00
SSW	1.00	0.75	22.75	31.75	10.75	1.50	68.50
SW	0.25	1.75	15.00	3.50	0.75	0.25	21.50
WSW	0.50	2.25	7.75	5.50	0.50	0.00	16.50
W	0.25	7.00	12.75	20.50	2.25	0.50	43.25
WNW	0.00	6.00	10.75	12.50	12.50	1.00	42.75
NW	0.00	4.50	11.50	12.75	7.25	0.50	36.50
NNW	0.25	2.50	13.50	15.25	3.75	0.00	35.25
Total	7.00	67.50	299.00	285.75	114.75	22.00	796.00

Hours of Calm (<1.0 mph): 14.75

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: B

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0.00	3.00	9.25	6.50	4.00	0.25	23.00
NNE	0.50	8.75	18.00	8.00	0.25	0.00	35.50
NE	1.00	15.25	9.25	1.75	0.00	0.00	27.25
ENE	0.50	13.25	11.25	2.50	0.25	0.00	27.75
E	0.50	12.25	6.25	0.75	0.00	0.00	19.75
ESE	0.75	11.50	6.50	0.50	0.25	0.00	19.50
SE	0.25	10.00	12.50	2.25	0.00	0.00	25.00
SSE	1.75	17.25	28.50	8.50	2.50	0.00	58.50
S	0.50	6.75	24.50	20.00	7.25	2.25	61.25
SSW	1.00	3.75	19.00	15.00	5.00	1.25	45.00
SW	0.25	7.75	8.50	1.50	1.00	0.25	19.25
WSW	1.75	9.25	3.25	1.25	0.25	0.00	15.75
W	0.75	6.00	6.00	1.75	0.25	0.00	14.75
WNW	2.00	5.75	6.75	5.75	4.50	0.00	24.75
NW	0.75	7.00	18.75	13.25	4.50	0.00	44.25
NNW	0.00	2.50	15.75	13.50	7.50	0.25	39.50
Total	12.25	140.00	204.00	102.75	37.50	4.25	500.75
Hours of Calm (<1.0 mph): 3.25							

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: C

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0.00	1.75	10.25	9.75	2.00	0.00	23.75
NNE	2.75	15.50	27.25	6.00	0.25	0.00	51.75
NE	3.00	22.00	4.50	3.50	0.00	0.00	33.00
ENE	2.75	17.50	9.75	0.50	0.00	0.00	30.50
E	2.00	17.75	4.50	2.00	0.00	0.00	26.25
ESE	2.00	15.50	5.25	0.25	0.00	0.00	23.00
SE	1.50	14.00	11.50	1.50	0.00	0.00	28.50
SSE	1.25	36.25	21.75	9.75	4.75	0.00	73.75
S	2.50	14.00	29.00	18.00	10.75	3.75	78.00
SSW	2.75	8.00	21.50	16.00	10.50	4.00	62.75
SW	3.00	10.50	8.00	1.25	0.25	0.00	23.00
WSW	2.75	11.00	5.50	0.25	0.25	0.00	19.75
W	1.00	7.75	4.75	3.00	1.25	0.00	17.75
WNW	1.75	5.00	7.00	5.25	5.00	0.75	24.75
NW	1.50	8.25	15.75	14.50	7.50	0.50	48.00
NNW	0.25	5.25	20.50	10.50	6.25	1.75	44.50
Total	30.75	210.00	206.75	102.00	48.75	10.75	609.00

Hours of Calm (<1.0 mph): 4.25

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: D

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2.00	29.25	72.75	61.75	12.75	0.50	179.25
NNE	18.75	124.25	145.25	36.25	1.25	0.00	325.75
NE	19.75	110.50	66.50	10.25	0.25	0.00	207.25
ENE	12.00	69.25	71.75	14.00	0.75	0.00	167.75
E	11.75	47.75	28.25	4.00	0.00	0.00	91.75
ESE	17.25	52.75	31.50	4.75	0.50	0.00	106.75
SE	11.00	72.00	64.75	9.00	0.00	0.00	156.75
SSE	12.75	92.50	138.75	87.75	19.50	0.75	352.00
S	8.75	74.75	154.25	141.25	69.75	35.25	484.00
SSW	6.75	55.75	94.25	81.00	26.00	72.00	335.75
SW	10.50	50.00	21.25	5.25	2.00	0.25	89.25
WSW	5.75	19.00	14.25	7.50	2.75	0.00	49.25
W	5.75	21.00	27.50	16.50	2.75	0.50	74.00
WNW	3.00	15.50	48.75	40.50	7.25	1.25	116.25
NW	4.00	29.25	125.50	72.75	17.50	5.25	254.25
NNW	3.50	37.75	104.00	92.75	35.75	8.25	282.00
Total	153.25	901.25	1209.25	685.25	198.75	124.00	3272.00
Hours of Calm (<1.0 mph): 32.75							

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: E

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	7.00	36.00	45.75	13.00	0.00	0.00	101.75
NNE	22.00	56.00	33.75	8.25	0.00	0.00	120.00
NE	27.50	47.00	22.50	1.75	0.00	0.00	98.75
ENE	16.00	38.00	25.25	2.00	0.00	0.00	81.25
E	26.25	36.50	14.50	1.75	0.00	0.00	79.00
ESE	23.00	77.25	18.75	2.00	0.00	0.00	121.00
SE	13.00	116.75	56.25	7.50	0.25	0.00	193.75
SSE	7.50	124.25	187.75	73.25	12.25	0.25	405.25
S	6.50	62.75	143.25	82.00	46.00	18.00	358.50
SSW	11.75	45.00	85.00	43.75	6.00	1.00	192.50
SW	15.00	44.25	12.25	3.00	0.25	0.00	74.75
WSW	4.75	20.50	17.25	2.25	0.25	0.00	45.00
W	1.50	25.50	20.75	1.00	0.50	0.25	49.50
WNW	3.25	11.25	17.00	1.00	0.50	0.25	33.25
NW	4.50	28.25	34.25	4.00	0.50	0.75	72.25
NNW	10.00	61.25	55.75	14.25	2.50	0.25	144.00
Total	199.50	830.50	790.00	260.75	69.00	20.75	2170.50

Hours of Calm (<1.0 mph): 42.75

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: F

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	7.75	22.00	4.75	0.00	0.00	0.00	34.50
NNE	25.50	48.75	2.25	0.25	0.00	0.00	76.75
NE	30.50	20.25	1.00	0.00	0.00	0.00	51.75
ENE	15.25	44.00	1.75	0.25	0.00	0.00	61.25
E	24.75	45.00	4.00	0.00	0.00	0.00	73.75
ESE	20.50	72.25	1.75	0.00	0.00	0.00	94.50
SE	16.25	69.00	4.00	0.00	0.00	0.00	89.25
SSE	10.50	54.00	19.00	2.25	0.00	0.00	85.75
S	5.50	27.00	16.00	4.75	0.50	0.00	53.75
SSW	7.50	14.75	7.00	0.25	0.50	0.00	30.00
SW	7.00	16.00	2.50	0.50	0.00	0.00	26.00
WSW	5.75	9.50	1.50	0.50	0.00	0.00	17.25
W	1.50	5.50	1.00	0.25	0.25	0.00	8.50
WNW	2.00	1.25	0.75	0.50	0.00	0.00	4.50
NW	6.25	11.25	1.25	0.25	0.00	0.00	19.00
NNW	9.00	44.00	8.25	0.50	0.00	0.00	61.75
Total	195.50	504.50	76.75	10.25	1.25	0.00	788.25
Hours of Calm (<1.0 mph): 2.50							

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: G

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	7.00	19.25	0.50	0.00	0.00	0.00	26.75
NNE	67.00	53.50	1.25	0.00	0.00	0.00	121.75
NE	25.50	22.00	0.25	0.50	0.00	0.00	48.25
ENE	12.50	27.50	2.00	0.50	0.00	0.00	42.50
E	23.25	27.50	0.25	0.00	0.00	0.00	51.00
ESE	19.50	55.75	1.00	0.00	0.00	0.00	76.25
SE	8.25	30.00	0.25	0.00	0.00	0.00	38.50
SSE	3.25	15.75	0.25	0.00	0.00	0.00	19.25
S	2.50	5.75	3.00	0.25	0.00	0.00	11.50
SSW	2.00	2.25	0.75	0.00	0.00	0.00	5.00
SW	3.25	4.75	0.25	0.00	0.00	0.00	8.25
WSW	4.25	2.25	0.25	0.00	0.00	0.00	6.75
W	2.00	1.50	0.00	0.00	0.00	0.00	3.50
WNW	2.00	0.75	0.00	0.00	0.00	0.00	2.75
NW	4.00	5.25	0.00	0.00	0.00	0.00	9.25
NNW	15.25	27.25	2.25	0.00	0.00	0.00	44.75
Total	201.50	301.00	12.25	1.25	0.00	0.00	516.00

Hours of Calm (<1.0 mph): 2.25

Hours At Each Wind Speed and Direction

Period of Record: 01-JAN-2017 00:00:00 to 31-DEC-2017 23:45:00

Stability Class: ALL

Elevation: 10 Meters

Wind Direction

Cardinals

	Wind Speed (mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	23.75	112.00	149.00	103.75	21.50	0.75	410.75
NNE	137.00	310.00	246.25	66.50	3.00	0.00	762.75
NE	109.00	249.50	123.00	21.00	0.25	0.00	502.75
ENE	59.25	215.50	141.25	24.00	1.50	0.00	441.50
E	88.75	192.25	69.50	9.25	0.00	0.00	359.75
ESE	83.25	289.50	75.25	7.50	0.75	0.00	456.25
SE	50.50	317.50	171.75	28.00	0.25	0.00	568.00
SSE	37.25	343.50	452.25	227.00	54.25	2.00	1116.25
S	27.50	192.00	411.25	368.25	191.50	76.50	1267.00
SSW	32.75	130.25	250.25	187.75	58.75	79.75	739.50
SW	39.25	135.00	67.75	15.00	4.25	0.75	262.00
WSW	25.50	73.75	49.75	17.25	4.00	0.00	170.25
W	12.75	74.25	72.75	43.00	7.25	1.25	211.25
WNW	14.00	45.50	91.00	65.50	29.75	3.25	249.00
NW	21.00	93.75	207.00	117.50	37.25	7.00	483.50
NNW	38.25	180.50	220.00	146.75	55.75	10.50	651.75
Total	799.75	2954.75	2798.00	1448.00	470.00	181.75	8652.25
Hours of Calm (<1.0 mph):		102.50		Maximum Hours of invalid Data: 718.50			

Appendix C
ONSITE GROUNDWATER PROTECTION PROGRAM MONITORING

Objective

The objective of onsite groundwater protection program monitoring is to ensure timely detection of inadvertent radiological releases to ground water. At the Wolf Creek Generating Station, some background tritium influences from lake water reuse are normal and expected.

Basis

The onsite groundwater protection program monitoring sample results are being reported in the Radioactive Effluent Release Report per guidance received in association with the Nuclear Energy Institute (NEI) Groundwater Protection Industry Initiative. The following information is also being reported in association with the NEI Groundwater Protection Industry Initiative:

1. Describe any onsite licensed radioactive materials releases or spills that were voluntarily communicated to State/Local officials during the calendar year. - None
2. Describe any onsite groundwater sample results that exceeded the reporting thresholds that were voluntarily communicated to State/Local officials during the calendar year. – None

There were no radioactive materials releases, spills, or reporting level exceedances reported to State/Local officials during 2017.

Onsite Groundwater Protection Program Monitoring Description

In March of 2006, Wolf Creek Generating Station (WCGS) established an onsite groundwater protection monitoring program. During 2008, thirteen monitoring wells were added to the onsite groundwater protection monitoring program. The onsite groundwater protection program monitoring is implemented via procedure AI 07-007, *Onsite Groundwater Protection Program Monitoring*. The onsite groundwater samples were collected by the WCGS Environmental Management group and were analyzed by Environmental, Inc., Midwest Laboratory. Onsite groundwater samples were collected quarterly when available and were analyzed by gamma isotopic analysis, radiochemical analysis for I-131 and tritium analysis. The vendor lab (Environmental, Inc., Midwest Laboratory) participated in an interlaboratory comparison program. The following tables describe the sample locations, the lower limits of detection and the reporting levels for radioactivity detected.

Sample Location	Sample Location Description
AUX	Dewatering Well located near the Auxiliary Building, on East Side
EAST ESW-W	Essential Service Water Dewatering Well, East Group, West well, located southeast of the reactor
MW-01A	Monitoring Well, shallow depth, located northeast of the reactor (control sample location)
MW-01B	Monitoring Well, mid-range depth, located northeast of the reactor (control sample location)
MW-01C	Monitoring Well, deep depth, located northeast of the reactor (control sample location)
MW-02A	Monitoring Well, shallow depth, located northwest of the reactor
MW-02B	Monitoring Well, mid-range depth, located northwest of the reactor
MW-03A	Monitoring Well, shallow depth, located southwest of the reactor
MW-03B	Monitoring Well, mid-range depth, located southwest of the reactor
MW-03C	Monitoring Well, deep depth, located southwest of the reactor
MW-05C	Monitoring Well, deep depth, located south of the reactor
MW-11A	Monitoring Well, shallow depth, located southwest of the reactor
MW-11B	Monitoring Well, mid-range depth, located southwest of the reactor
MW-12A	Monitoring Well, shallow depth, located south of the reactor
MW-12B	Monitoring Well, mid-range depth, located south of the reactor
WEST ESW-W	Essential Service Water Dewatering Well, West Group, West well, located south of the reactor

Onsite Groundwater Lower Limits of Detection

Analysis	(pCi/L)	Analysis	(pCi/L)
H-3	2,000	Zr-Nb-95	15
Mn-54	15	I-131	1
Co-58	15	Cs-134	15
Fe-59	30	Cs-137	18
Co-60	15	Ba-La-140	15
Zn-65	30		

Reporting Levels for Radioactivity Detected in Onsite Groundwater

Analysis	(pCi/L)	Analysis	(pCi/L)
H-3	20,000	Zr-Nb-95	400
Mn-54	1,000	I-131	2
Co-58	1,000	Cs-134	30
Fe-59	400	Cs-137	50
Co-60	300	Ba-La-140	200
Zn-65	300		

Discussion of Results

Low levels of tritium were detected in an Essential Service Water dewatering well (WEST ESW-W) and in the dewatering well located near the Auxiliary Building (AUX), all within areas of backfill during plant construction. This has been attributed to the Plant's reuse of tritiated lake water and is consistent with gaseous tritium deposition during normal operation. Lake water is used for plant cooling, which includes essential service water, and in the Fire Protection System.

The sample with the highest level of tritium detected (1,316 +/- 130 pCi/L) was collected on 02-13-17 from the WEST ESW-W location. The measured tritium levels are significantly lower than the tritium levels routinely detected in surface water collected from Coffey County Lake (2017 range was 7,382 to 11,221 pCi/L).

The tritium activity was the only activity detected in the onsite groundwater samples. Lower limits of detection were met and sample analysis results were below the applicable reporting levels.

Subsurface Water

Due to Industry Operating Experience, the Wolf Creek Generating Station started collecting and analyzing subsurface water during 2010. Subsurface water monitoring is a portion of the Groundwater Protection Program and is implemented via procedure AI 07-007, *Onsite Groundwater Protection Program Monitoring*. The definitions for subsurface water include:

1. Water that is encountered below grade while excavating, trenching, or drilling outside of the Radiologically Controlled Area and within the area displayed in Figure 1 (of AI 07-007). This excludes recent rainfall build-up in open excavation trenches.
2. Water that is encountered below grade or water that needs to be removed that is outside of a building, outside of the Radiologically Controlled Area and within the area displayed in Figure 1 (of AI 07-007). Examples include electrical vaults, piping vaults, valve pits, manholes, concrete pits, etc. Excludes removing water from powerblock sumps, sanitary sewers, spill containment berms or from within buildings.

The subsurface water samples were analyzed by the WCGS Chemistry Laboratory and the results were reviewed by Environmental Management. The subsurface water samples were analyzed for tritium. The following table identifies the sample dates, sample locations, and the analysis results.

Date	Location Description	Tritium (pCi/L)
01/19/17	Anode A-3 (Northwest side of Turbine Building)	<2,034
01/30/17	CW-1 (1CW0006C) Manhole North of the Turbine Building	13,140
02/23/17	EMH138 Electrical Manhole West of Water Hammer Tower	<2,262
03/01/17	EMH152 Electrical Manhole East of the Turbine Building	4,270
03/16/17	EMH119 Electrical Manhole NW of Turbine Building	<2,099
03/16/17	EMH120 Electrical Manhole NE of Turbine Building	<2,202
03/16/17	EMH125 Electrical Manhole East of Turbine Building	<2,307
03/16/17	EMH104 Electrical Manhole West of Shop Building	<2,217
04/03/17	Dewatering Well #5 - West of Hot Machine Shop (1DWV005)	1,660
04/03/17	EMH152 Electrical Manhole East of the Turbine Building	<1,706
04/10/17	EMH138 Electrical Manhole West of Water Hammer Tower	2,728
04/12/17	EMH125 Electrical Manhole East of Turbine Building	<1,728
04/12/17	EMH152 Electrical Manhole East of the Turbine Building	<2,137
04/18/17	Dewatering Well #1 - East of the Turbine Building	1,875
04/20/17	EMH125 Electrical Manhole East of the Turbine Building	<1,971
04/20/17	EMH152 Electrical Manhole East of the Turbine Building	2,964
04/24/17	EMH125 Electrical Manhole East of the Turbine Building	2,144
04/24/17	EMH152 Electrical Manhole East of the Turbine Building	3,509
04/24/17	Dewatering Well #2 - East of the Turbine Building	<1,974
04/24/17	Dewatering Well #3 - West of the Turbine Building	<2,081
04/24/17	Dewatering Well #7 - Southwest of the Communication Corridor	<2,473
05/02/17	EMH138 Electrical Manhole West of Water Hammer Tower	4,767
05/02/17	CW-1 (1CW0006C) Manhole North of the Turbine Building	2,919
05/02/17	CW-3 (1CW0008C) Manhole near the Radwaste Building	2,286
05/04/17	EMH138 Electrical Manhole West of Water Hammer Tower	6,476
05/08/17	Anode A-3 (Northwest side of Turbine Building)	<2,310
05/10/17	EMH138 Electrical Manhole West of Water Hammer Tower	<1,720
06/12/17	XNB01 & XNB02 Transformer Discharge Vault, Sump 095	2,708
06/12/17	XMA01D Transformer Discharge Vault, Sump 0725	<1,727
06/12/17	XMR01 Transformer Discharge Vault, Sump 096	<1,905
06/12/17	XPB03 & XPB04 Transformer Discharge Vault, Sump 094	<1,677
06/12/17	XMA01A, XMA01B, XMA01C & XMA02 Transformer Discharge Vault, Sump 097 (Main)	2,925
07/26/17	Dewatering Well #1 - East of the Turbine Building	4,520
08/01/17	CW-2 (1CW0007C) Manhole East of Condensate Storage Tank	2,595
08/01/17	CW-3 (1CW0008C) Manhole near the Radwaste Building	<2,115
08/02/17	Dewatering Well #3 - West of the Turbine Building	<1,612
08/21/17	CW-1 (1CW0006C) Manhole North of the Turbine Building	<1,733

Date	Location Description	Tritium (pCi/L)
08/21/17	CW-3 (1CW0008C) Manhole near the Radwaste Building	<1,725
08/22/17	CW-1 (1CW0006C) Manhole North of the Turbine Building	1,984
08/23/17	EMH-B1-1 West of Main Security Building	3,559
09/20/17	EMH123 Electrical Manhole NW of Maintenance Shop	1,045
09/20/17	EMH102 Electrical Manhole NW of Maintenance Shop	1,680
09/20/17	EMH101 Electrical Manhole North of the Turbine Building	1,874
09/25/17	EMH105 Electrical Manhole West of Olive Ann Beech Building	<1,898
09/25/17	EMH104 Electrical Manhole West of Maintenance Shop	<1,845
09/25/17	EMH119 Electrical Manhole North of Turbine Building	<2,038
09/25/17	EMH120 Electrical Manhole NE of Turbine Building	<2,045
10/03/17	EMH104 Electrical Manhole West of Maintenance Shop	<1,622
10/04/17	EMH118 Electrical Manhole East of Condensate Storage Tank	5,811
10/13/17	EMH104 Electrical Manhole West of Maintenance Shop	<2,456
10/13/17	EMH118 Electrical Manhole East of Condensate Storage Tank	7,138
10/16/17	EMH104 Electrical Manhole West of Maintenance Shop	<2,175
10/17/17	EMH104 Electrical Manhole West of Maintenance Shop	2,719
10/17/17	AUX Spill Remediation Well SE of Turbine Building	4,215
10/30/17	CW-1 (1CW0006C) Manhole North of the Turbine Building	<2,513

As expected, tritium activity was detected in some of the subsurface water samples. The highest detected tritium measured was 13,140 pCi/L in a sample collected 01-30-17 from manhole CW-1 (1CW0006C) located north of the Turbine Building. Gamma activity was not detected in the 01-30-17 subsurface water sample. Again, the detected tritium activity is likely due to the Plant's reuse of tritiated lake water. Lake water is used for plant cooling, which includes essential service water, and in the Fire Protection System. The measured tritium levels from subsurface water monitoring were lower than the onsite groundwater tritium reporting level of 20,000 pCi/L.

Conclusion

Based upon the results of the water samples that were analyzed in association with the Onsite Groundwater Protection Program, no inadvertent radiological releases to ground water were identified.

**Onsite Groundwater Results
Concentration (pCi/L)**

	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
AUX	08-May-17	MN-54		<	2.8	
AUX	08-May-17	CO-58		<	3.3	
AUX	08-May-17	FE-59		<	6.1	
AUX	08-May-17	CO-60		<	2.5	
AUX	08-May-17	ZN-65		<	3.5	
AUX	08-May-17	ZR-NB-95		<	2.6	
AUX	08-May-17	I-131		<	0.440	
AUX	08-May-17	CS-134		<	2.9	
AUX	08-May-17	CS-137		<	3.4	
AUX	08-May-17	BA-LA-140		<	2.3	
AUX	08-May-17	H-3	489	+/-	95	
EAST ESW-W	13-Feb-17	MN-54		<	2.8	
EAST ESW-W	13-Feb-17	MN-54		<	2.6	Duplicate
EAST ESW-W	13-Feb-17	CO-58		<	1.9	Duplicate
EAST ESW-W	13-Feb-17	CO-58		<	2.4	
EAST ESW-W	13-Feb-17	FE-59		<	3.0	
EAST ESW-W	13-Feb-17	FE-59		<	5.0	Duplicate
EAST ESW-W	13-Feb-17	CO-60		<	2.6	Duplicate
EAST ESW-W	13-Feb-17	CO-60		<	2.3	
EAST ESW-W	13-Feb-17	ZN-65		<	4.6	
EAST ESW-W	13-Feb-17	ZN-65		<	3.8	Duplicate
EAST ESW-W	13-Feb-17	ZR-NB-95		<	2.6	Duplicate
EAST ESW-W	13-Feb-17	ZR-NB-95		<	2.2	
EAST ESW-W	13-Feb-17	I-131		<	0.458	
EAST ESW-W	13-Feb-17	I-131		<	0.430	Duplicate
EAST ESW-W	13-Feb-17	CS-134		<	2.5	Duplicate
EAST ESW-W	13-Feb-17	CS-134		<	3.3	
EAST ESW-W	13-Feb-17	CS-137		<	2.0	
EAST ESW-W	13-Feb-17	CS-137		<	2.7	Duplicate
EAST ESW-W	13-Feb-17	BA-LA-140		<	2.0	Duplicate
EAST ESW-W	13-Feb-17	BA-LA-140		<	4.2	
EAST ESW-W	13-Feb-17	H-3		<	187	
EAST ESW-W	13-Feb-17	H-3		<	187	Duplicate
EAST ESW-W	08-May-17	MN-54		<	2.6	
EAST ESW-W	08-May-17	CO-58		<	2.6	
EAST ESW-W	08-May-17	FE-59		<	2.1	
EAST ESW-W	08-May-17	CO-60		<	2.3	
EAST ESW-W	08-May-17	ZN-65		<	2.1	
EAST ESW-W	08-May-17	ZR-NB-95		<	2.0	
EAST ESW-W	08-May-17	I-131		<	0.337	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
EAST ESW-W	08-May-17	CS-134		<	2.4	
EAST ESW-W	08-May-17	CS-137		<	2.9	
EAST ESW-W	08-May-17	BA-LA-140		<	2.2	
EAST ESW-W	08-May-17	H-3		<	151	
EAST ESW-W	24-Aug-17	MN-54		<	3.6	
EAST ESW-W	24-Aug-17	CO-58		<	3.3	
EAST ESW-W	24-Aug-17	FE-59		<	6.0	
EAST ESW-W	24-Aug-17	CO-60		<	1.7	
EAST ESW-W	24-Aug-17	ZN-65		<	4.8	
EAST ESW-W	24-Aug-17	ZR-NB-95		<	3.1	
EAST ESW-W	24-Aug-17	I-131		<	0.210	
EAST ESW-W	24-Aug-17	CS-134		<	3.2	
EAST ESW-W	24-Aug-17	CS-137		<	3.4	
EAST ESW-W	24-Aug-17	BA-LA-140		<	2.2	
EAST ESW-W	24-Aug-17	H-3		<	149	
EAST ESW-W	06-Nov-17	MN-54		<	4.0	
EAST ESW-W	06-Nov-17	CO-58		<	6.2	
EAST ESW-W	06-Nov-17	FE-59		<	6.8	
EAST ESW-W	06-Nov-17	CO-60		<	4.6	
EAST ESW-W	06-Nov-17	ZN-65		<	5.3	
EAST ESW-W	06-Nov-17	ZR-NB-95		<	4.5	
EAST ESW-W	06-Nov-17	I-131		<	0.426	
EAST ESW-W	06-Nov-17	CS-134		<	6.4	
EAST ESW-W	06-Nov-17	CS-137		<	5.5	
EAST ESW-W	06-Nov-17	BA-LA-140		<	5.3	
EAST ESW-W	06-Nov-17	H-3		<	183	
MW-01A	13-Feb-17	MN-54		<	1.9	
MW-01A	13-Feb-17	CO-58		<	3.0	
MW-01A	13-Feb-17	FE-59		<	4.5	
MW-01A	13-Feb-17	CO-60		<	3.3	
MW-01A	13-Feb-17	ZN-65		<	6.5	
MW-01A	13-Feb-17	ZR-NB-95		<	3.4	
MW-01A	13-Feb-17	I-131		<	0.235	
MW-01A	13-Feb-17	CS-134		<	4.4	
MW-01A	13-Feb-17	CS-137		<	2.7	
MW-01A	13-Feb-17	BA-LA-140		<	3.3	
MW-01A	13-Feb-17	H-3		<	187	
MW-01A	08-May-17	MN-54		<	3.5	
MW-01A	08-May-17	CO-58		<	2.5	
MW-01A	08-May-17	FE-59		<	9.5	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-01A	08-May-17	CO-60		<	3.7	
MW-01A	08-May-17	ZN-65		<	8.7	
MW-01A	08-May-17	ZR-NB-95		<	4.0	
MW-01A	08-May-17	I-131		<	0.330	
MW-01A	08-May-17	CS-134		<	4.2	
MW-01A	08-May-17	CS-137		<	4.2	
MW-01A	08-May-17	BA-LA-140		<	3.8	
MW-01A	08-May-17	H-3		<	147	
MW-01A	24-Aug-17	MN-54		<	3.2	
MW-01A	24-Aug-17	CO-58		<	2.9	
MW-01A	24-Aug-17	FE-59		<	7.7	
MW-01A	24-Aug-17	CO-60		<	2.5	
MW-01A	24-Aug-17	ZN-65		<	6.0	
MW-01A	24-Aug-17	ZR-NB-95		<	3.9	
MW-01A	24-Aug-17	I-131		<	0.276	
MW-01A	24-Aug-17	CS-134		<	4.0	
MW-01A	24-Aug-17	CS-137		<	2.7	
MW-01A	24-Aug-17	BA-LA-140		<	4.7	
MW-01A	24-Aug-17	H-3		<	152	
MW-01A	06-Nov-17	MN-54		<	2.9	
MW-01A	06-Nov-17	CO-58		<	2.0	
MW-01A	06-Nov-17	FE-59		<	6.1	
MW-01A	06-Nov-17	CO-60		<	2.5	
MW-01A	06-Nov-17	ZN-65		<	5.8	
MW-01A	06-Nov-17	ZR-NB-95		<	3.4	
MW-01A	06-Nov-17	I-131		<	0.283	
MW-01A	06-Nov-17	CS-134		<	3.5	
MW-01A	06-Nov-17	CS-137		<	3.9	
MW-01A	06-Nov-17	BA-LA-140		<	4.1	
MW-01A	06-Nov-17	H-3		<	183	
MW-01B	13-Feb-17	MN-54		<	2.1	
MW-01B	13-Feb-17	CO-58		<	2.4	
MW-01B	13-Feb-17	FE-59		<	4.8	
MW-01B	13-Feb-17	CO-60		<	1.7	
MW-01B	13-Feb-17	ZN-65		<	5.5	
MW-01B	13-Feb-17	ZR-NB-95		<	2.2	
MW-01B	13-Feb-17	I-131		<	0.237	
MW-01B	13-Feb-17	CS-134		<	3.1	
MW-01B	13-Feb-17	CS-137		<	3.3	
MW-01B	13-Feb-17	BA-LA-140		<	2.4	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-01B	13-Feb-17	H-3		<	154	
MW-01B	08-May-17	MN-54		<	3.2	
MW-01B	08-May-17	CO-58		<	1.9	
MW-01B	08-May-17	FE-59		<	5.7	
MW-01B	08-May-17	CO-60		<	2.0	
MW-01B	08-May-17	ZN-65		<	3.5	
MW-01B	08-May-17	ZR-NB-95		<	2.1	
MW-01B	08-May-17	I-131		<	0.435	
MW-01B	08-May-17	CS-134		<	3.2	
MW-01B	08-May-17	CS-137		<	3.2	
MW-01B	08-May-17	BA-LA-140		<	1.4	
MW-01B	08-May-17	H-3		<	147	
MW-01B	24-Aug-17	MN-54		<	2.5	
MW-01B	24-Aug-17	CO-58		<	2.8	
MW-01B	24-Aug-17	FE-59		<	2.9	
MW-01B	24-Aug-17	CO-60		<	1.9	
MW-01B	24-Aug-17	ZN-65		<	5.1	
MW-01B	24-Aug-17	ZR-NB-95		<	3.8	
MW-01B	24-Aug-17	I-131		<	0.498	
MW-01B	24-Aug-17	CS-134		<	3.5	
MW-01B	24-Aug-17	CS-137		<	2.9	
MW-01B	24-Aug-17	BA-LA-140		<	2.3	
MW-01B	24-Aug-17	H-3		<	149	
MW-01B	06-Nov-17	MN-54		<	4.3	
MW-01B	06-Nov-17	CO-58		<	2.9	
MW-01B	06-Nov-17	FE-59		<	6.2	
MW-01B	06-Nov-17	CO-60		<	2.7	
MW-01B	06-Nov-17	ZN-65		<	9.6	
MW-01B	06-Nov-17	ZR-NB-95		<	6.2	
MW-01B	06-Nov-17	I-131		<	0.244	
MW-01B	06-Nov-17	CS-134		<	4.7	
MW-01B	06-Nov-17	CS-137		<	3.2	
MW-01B	06-Nov-17	BA-LA-140		<	5.3	
MW-01B	06-Nov-17	H-3		<	183	
MW-01C	13-Feb-17	MN-54		<	3.1	
MW-01C	13-Feb-17	CO-58		<	2.3	
MW-01C	13-Feb-17	FE-59		<	6.7	
MW-01C	13-Feb-17	CO-60		<	2.8	
MW-01C	13-Feb-17	ZN-65		<	2.9	
MW-01C	13-Feb-17	ZR-NB-95		<	3.1	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-01C	13-Feb-17	I-131		<	0.213	
MW-01C	13-Feb-17	CS-134		<	3.7	
MW-01C	13-Feb-17	CS-137		<	4.0	
MW-01C	13-Feb-17	BA-LA-140		<	2.7	
MW-01C	13-Feb-17	H-3		<	154	
MW-01C	08-May-17	MN-54		<	2.2	
MW-01C	08-May-17	CO-58		<	3.0	
MW-01C	08-May-17	FE-59		<	5.6	
MW-01C	08-May-17	CO-60		<	2.5	
MW-01C	08-May-17	ZN-65		<	2.7	
MW-01C	08-May-17	ZR-NB-95		<	2.3	
MW-01C	08-May-17	I-131		<	0.262	
MW-01C	08-May-17	CS-134		<	3.2	
MW-01C	08-May-17	CS-137		<	2.2	
MW-01C	08-May-17	BA-LA-140		<	2.7	
MW-01C	08-May-17	H-3		<	147	
MW-01C	24-Aug-17	MN-54		<	2.9	
MW-01C	24-Aug-17	CO-58		<	3.9	
MW-01C	24-Aug-17	FE-59		<	9.8	
MW-01C	24-Aug-17	CO-60		<	2.6	
MW-01C	24-Aug-17	ZN-65		<	6.2	
MW-01C	24-Aug-17	ZR-NB-95		<	5.1	
MW-01C	24-Aug-17	I-131		<	0.433	
MW-01C	24-Aug-17	CS-134		<	4.2	
MW-01C	24-Aug-17	CS-137		<	2.8	
MW-01C	24-Aug-17	BA-LA-140		<	3.2	
MW-01C	24-Aug-17	H-3		<	149	
MW-01C	06-Nov-17	MN-54		<	2.4	
MW-01C	06-Nov-17	MN-54		<	2.5	Duplicate
MW-01C	06-Nov-17	CO-58		<	2.5	
MW-01C	06-Nov-17	CO-58		<	3.0	Duplicate
MW-01C	06-Nov-17	FE-59		<	5.4	Duplicate
MW-01C	06-Nov-17	FE-59		<	5.3	
MW-01C	06-Nov-17	CO-60		<	1.9	Duplicate
MW-01C	06-Nov-17	CO-60		<	2.3	
MW-01C	06-Nov-17	ZN-65		<	3.2	Duplicate
MW-01C	06-Nov-17	ZN-65		<	2.9	
MW-01C	06-Nov-17	ZR-NB-95		<	3.5	
MW-01C	06-Nov-17	ZR-NB-95		<	3.5	Duplicate
MW-01C	06-Nov-17	I-131		<	0.462	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-01C	06-Nov-17	I-131		<	0.452	Duplicate
MW-01C	06-Nov-17	CS-134		<	3.0	
MW-01C	06-Nov-17	CS-134		<	3.6	Duplicate
MW-01C	06-Nov-17	CS-137		<	3.1	
MW-01C	06-Nov-17	CS-137		<	1.9	Duplicate
MW-01C	06-Nov-17	BA-LA-140		<	3.1	
MW-01C	06-Nov-17	BA-LA-140		<	3.0	Duplicate
MW-01C	06-Nov-17	H-3		<	183	Duplicate
MW-01C	06-Nov-17	H-3		<	183	
MW-02A	13-Feb-17	MN-54		<	1.7	
MW-02A	13-Feb-17	CO-58		<	1.3	
MW-02A	13-Feb-17	FE-59		<	3.4	
MW-02A	13-Feb-17	CO-60		<	2.5	
MW-02A	13-Feb-17	ZN-65		<	3.4	
MW-02A	13-Feb-17	ZR-NB-95		<	2.4	
MW-02A	13-Feb-17	I-131		<	0.201	
MW-02A	13-Feb-17	CS-134		<	3.0	
MW-02A	13-Feb-17	CS-137		<	3.0	
MW-02A	13-Feb-17	BA-LA-140		<	2.5	
MW-02A	13-Feb-17	H-3		<	154	
MW-02A	08-May-17	MN-54		<	2.5	
MW-02A	08-May-17	CO-58		<	2.4	
MW-02A	08-May-17	FE-59		<	5.2	
MW-02A	08-May-17	CO-60		<	2.9	
MW-02A	08-May-17	ZN-65		<	6.4	
MW-02A	08-May-17	ZR-NB-95		<	2.9	
MW-02A	08-May-17	I-131		<	0.387	
MW-02A	08-May-17	CS-134		<	4.1	
MW-02A	08-May-17	CS-137		<	2.7	
MW-02A	08-May-17	BA-LA-140		<	4.1	
MW-02A	08-May-17	H-3		<	147	
MW-02A	24-Aug-17	MN-54		<	5.5	
MW-02A	24-Aug-17	CO-58		<	5.4	
MW-02A	24-Aug-17	FE-59		<	7.2	
MW-02A	24-Aug-17	CO-60		<	5.0	
MW-02A	24-Aug-17	ZN-65		<	6.6	
MW-02A	24-Aug-17	ZR-NB-95		<	5.0	
MW-02A	24-Aug-17	I-131		<	0.482	
MW-02A	24-Aug-17	CS-134		<	6.2	
MW-02A	24-Aug-17	CS-137		<	4.1	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-02A	24-Aug-17	BA-LA-140		<	8.6	
MW-02A	24-Aug-17	H-3		<	149	
MW-02A	06-Nov-17	MN-54		<	2.0	
MW-02A	06-Nov-17	CO-58		<	2.9	
MW-02A	06-Nov-17	FE-59		<	4.0	
MW-02A	06-Nov-17	CO-60		<	1.6	
MW-02A	06-Nov-17	ZN-65		<	2.6	
MW-02A	06-Nov-17	ZR-NB-95		<	2.3	
MW-02A	06-Nov-17	I-131		<	0.233	
MW-02A	06-Nov-17	CS-134		<	3.3	
MW-02A	06-Nov-17	CS-137		<	4.0	
MW-02A	06-Nov-17	BA-LA-140		<	2.8	
MW-02A	06-Nov-17	H-3		<	183	
MW-02B	13-Feb-17	MN-54		<	1.9	
MW-02B	13-Feb-17	CO-58		<	2.1	
MW-02B	13-Feb-17	FE-59		<	6.9	
MW-02B	13-Feb-17	CO-60		<	1.9	
MW-02B	13-Feb-17	ZN-65		<	4.9	
MW-02B	13-Feb-17	ZR-NB-95		<	1.8	
MW-02B	13-Feb-17	I-131		<	0.433	
MW-02B	13-Feb-17	CS-134		<	2.6	
MW-02B	13-Feb-17	CS-137		<	2.1	
MW-02B	13-Feb-17	BA-LA-140		<	3.0	
MW-02B	13-Feb-17	H-3		<	154	
MW-02B	08-May-17	MN-54		<	3.4	
MW-02B	08-May-17	CO-58		<	2.5	
MW-02B	08-May-17	FE-59		<	2.6	
MW-02B	08-May-17	CO-60		<	2.1	
MW-02B	08-May-17	ZN-65		<	2.0	
MW-02B	08-May-17	ZR-NB-95		<	3.5	
MW-02B	08-May-17	I-131		<	0.252	
MW-02B	08-May-17	CS-134		<	3.3	
MW-02B	08-May-17	CS-137		<	2.5	
MW-02B	08-May-17	BA-LA-140		<	4.1	
MW-02B	08-May-17	H-3		<	147	
MW-02B	24-Aug-17	MN-54		<	1.9	
MW-02B	24-Aug-17	CO-58		<	2.8	
MW-02B	24-Aug-17	FE-59		<	5.8	
MW-02B	24-Aug-17	CO-60		<	1.5	
MW-02B	24-Aug-17	ZN-65		<	4.5	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-02B	24-Aug-17	ZR-NB-95		<	2.9	
MW-02B	24-Aug-17	I-131		<	0.418	
MW-02B	24-Aug-17	CS-134		<	3.0	
MW-02B	24-Aug-17	CS-137		<	2.0	
MW-02B	24-Aug-17	BA-LA-140		<	2.5	
MW-02B	24-Aug-17	H-3		<	149	
MW-02B	06-Nov-17	MN-54		<	2.1	
MW-02B	06-Nov-17	CO-58		<	2.9	
MW-02B	06-Nov-17	FE-59		<	6.0	
MW-02B	06-Nov-17	CO-60		<	2.1	
MW-02B	06-Nov-17	ZN-65		<	4.0	
MW-02B	06-Nov-17	ZR-NB-95		<	3.9	
MW-02B	06-Nov-17	I-131		<	0.454	
MW-02B	06-Nov-17	CS-134		<	3.5	
MW-02B	06-Nov-17	CS-137		<	3.1	
MW-02B	06-Nov-17	BA-LA-140		<	2.8	
MW-02B	06-Nov-17	H-3		<	183	
MW-03A	13-Feb-17	MN-54		<	2.3	
MW-03A	13-Feb-17	CO-58		<	2.1	
MW-03A	13-Feb-17	FE-59		<	4.1	
MW-03A	13-Feb-17	CO-60		<	2.5	
MW-03A	13-Feb-17	ZN-65		<	3.4	
MW-03A	13-Feb-17	ZR-NB-95		<	2.2	
MW-03A	13-Feb-17	I-131		<	0.478	
MW-03A	13-Feb-17	CS-134		<	3.1	
MW-03A	13-Feb-17	CS-137		<	2.4	
MW-03A	13-Feb-17	BA-LA-140		<	2.3	
MW-03A	13-Feb-17	H-3		<	154	
MW-03A	08-May-17	MN-54		<	6.0	
MW-03A	08-May-17	CO-58		<	6.6	
MW-03A	08-May-17	FE-59		<	5.2	
MW-03A	08-May-17	CO-60		<	5.3	
MW-03A	08-May-17	ZN-65		<	11.0	
MW-03A	08-May-17	ZR-NB-95		<	6.0	
MW-03A	08-May-17	I-131		<	0.302	
MW-03A	08-May-17	CS-134		<	6.7	
MW-03A	08-May-17	CS-137		<	4.3	
MW-03A	08-May-17	BA-LA-140		<	4.9	
MW-03A	08-May-17	H-3		<	147	
MW-03A	24-Aug-17	MN-54		<	2.8	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-03A	24-Aug-17	CO-58		<	3.0	
MW-03A	24-Aug-17	FE-59		<	7.3	
MW-03A	24-Aug-17	CO-60		<	1.6	
MW-03A	24-Aug-17	ZN-65		<	4.4	
MW-03A	24-Aug-17	ZR-NB-95		<	3.1	
MW-03A	24-Aug-17	I-131		<	0.341	
MW-03A	24-Aug-17	CS-134		<	2.7	
MW-03A	24-Aug-17	CS-137		<	4.1	
MW-03A	24-Aug-17	BA-LA-140		<	1.3	
MW-03A	24-Aug-17	H-3		<	149	
MW-03A	06-Nov-17	MN-54		<	2.8	
MW-03A	06-Nov-17	CO-58		<	2.9	
MW-03A	06-Nov-17	FE-59		<	6.3	
MW-03A	06-Nov-17	CO-60		<	3.0	
MW-03A	06-Nov-17	ZN-65		<	4.8	
MW-03A	06-Nov-17	ZR-NB-95		<	3.7	
MW-03A	06-Nov-17	I-131		<	0.408	
MW-03A	06-Nov-17	CS-134		<	3.4	
MW-03A	06-Nov-17	CS-137		<	2.8	
MW-03A	06-Nov-17	BA-LA-140		<	3.3	
MW-03A	06-Nov-17	H-3		<	183	
MW-03B	13-Feb-17	MN-54		<	1.9	
MW-03B	13-Feb-17	CO-58		<	1.5	
MW-03B	13-Feb-17	FE-59		<	4.1	
MW-03B	13-Feb-17	CO-60		<	1.9	
MW-03B	13-Feb-17	ZN-65		<	3.3	
MW-03B	13-Feb-17	ZR-NB-95		<	2.7	
MW-03B	13-Feb-17	I-131		<	0.471	
MW-03B	13-Feb-17	CS-134		<	2.8	
MW-03B	13-Feb-17	CS-137		<	3.1	
MW-03B	13-Feb-17	BA-LA-140		<	2.0	
MW-03B	13-Feb-17	H-3		<	154	
MW-03B	08-May-17	MN-54		<	2.0	
MW-03B	08-May-17	CO-58		<	3.2	
MW-03B	08-May-17	FE-59		<	6.8	
MW-03B	08-May-17	CO-60		<	2.2	
MW-03B	08-May-17	ZN-65		<	4.7	
MW-03B	08-May-17	ZR-NB-95		<	2.2	
MW-03B	08-May-17	I-131		<	0.306	
MW-03B	08-May-17	CS-134		<	3.3	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-03B	08-May-17	CS-137		<	3.5	
MW-03B	08-May-17	BA-LA-140		<	1.8	
MW-03B	08-May-17	H-3		<	147	
MW-03B	24-Aug-17	MN-54		<	3.0	
MW-03B	24-Aug-17	CO-58		<	1.7	
MW-03B	24-Aug-17	FE-59		<	5.4	
MW-03B	24-Aug-17	CO-60		<	2.2	
MW-03B	24-Aug-17	ZN-65		<	3.6	
MW-03B	24-Aug-17	ZR-NB-95		<	3.7	
MW-03B	24-Aug-17	I-131		<	0.275	
MW-03B	24-Aug-17	CS-134		<	3.8	
MW-03B	24-Aug-17	CS-137		<	3.6	
MW-03B	24-Aug-17	BA-LA-140		<	2.9	
MW-03B	24-Aug-17	H-3		<	149	
MW-03B	06-Nov-17	MN-54		<	2.1	
MW-03B	06-Nov-17	CO-58		<	2.5	
MW-03B	06-Nov-17	FE-59		<	4.6	
MW-03B	06-Nov-17	CO-60		<	3.2	
MW-03B	06-Nov-17	ZN-65		<	5.8	
MW-03B	06-Nov-17	ZR-NB-95		<	2.2	
MW-03B	06-Nov-17	I-131		<	0.420	
MW-03B	06-Nov-17	CS-134		<	3.0	
MW-03B	06-Nov-17	CS-137		<	2.4	
MW-03B	06-Nov-17	BA-LA-140		<	2.4	
MW-03B	06-Nov-17	H-3		<	183	
MW-03C	13-Feb-17	MN-54		<	2.5	
MW-03C	13-Feb-17	CO-58		<	2.0	
MW-03C	13-Feb-17	FE-59		<	3.8	
MW-03C	13-Feb-17	CO-60		<	2.9	
MW-03C	13-Feb-17	ZN-65		<	4.1	
MW-03C	13-Feb-17	ZR-NB-95		<	1.8	
MW-03C	13-Feb-17	I-131		<	0.347	
MW-03C	13-Feb-17	CS-134		<	3.0	
MW-03C	13-Feb-17	CS-137		<	3.1	
MW-03C	13-Feb-17	BA-LA-140		<	2.7	
MW-03C	13-Feb-17	H-3		<	154	
MW-03C	08-May-17	MN-54		<	2.3	
MW-03C	08-May-17	CO-58		<	1.7	
MW-03C	08-May-17	FE-59		<	2.5	
MW-03C	08-May-17	CO-60		<	2.2	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-03C	08-May-17	ZN-65		<	2.9	
MW-03C	08-May-17	ZR-NB-95		<	2.3	
MW-03C	08-May-17	I-131		<	0.362	
MW-03C	08-May-17	CS-134		<	3.5	
MW-03C	08-May-17	CS-137		<	3.0	
MW-03C	08-May-17	BA-LA-140		<	3.2	
MW-03C	08-May-17	H-3		<	147	
MW-03C	24-Aug-17	MN-54		<	3.8	
MW-03C	24-Aug-17	CO-58		<	2.3	
MW-03C	24-Aug-17	FE-59		<	5.1	
MW-03C	24-Aug-17	CO-60		<	2.4	
MW-03C	24-Aug-17	ZN-65		<	7.8	
MW-03C	24-Aug-17	ZR-NB-95		<	3.6	
MW-03C	24-Aug-17	I-131		<	0.321	
MW-03C	24-Aug-17	CS-134		<	4.3	
MW-03C	24-Aug-17	CS-137		<	3.3	
MW-03C	24-Aug-17	BA-LA-140		<	4.4	
MW-03C	24-Aug-17	H-3		<	149	
MW-03C	06-Nov-17	MN-54		<	1.5	
MW-03C	06-Nov-17	CO-58		<	1.7	
MW-03C	06-Nov-17	FE-59		<	4.4	
MW-03C	06-Nov-17	CO-60		<	1.3	
MW-03C	06-Nov-17	ZN-65		<	3.6	
MW-03C	06-Nov-17	ZR-NB-95		<	2.9	
MW-03C	06-Nov-17	I-131		<	0.307	
MW-03C	06-Nov-17	CS-134		<	3.2	
MW-03C	06-Nov-17	CS-137		<	1.8	
MW-03C	06-Nov-17	BA-LA-140		<	2.6	
MW-03C	06-Nov-17	H-3		<	183	
MW-05C	13-Feb-17	MN-54		<	2.0	
MW-05C	13-Feb-17	CO-58		<	3.0	
MW-05C	13-Feb-17	FE-59		<	5.3	
MW-05C	13-Feb-17	CO-60		<	2.1	
MW-05C	13-Feb-17	ZN-65		<	5.0	
MW-05C	13-Feb-17	ZR-NB-95		<	2.5	
MW-05C	13-Feb-17	I-131		<	0.358	
MW-05C	13-Feb-17	CS-134		<	3.6	
MW-05C	13-Feb-17	CS-137		<	2.0	
MW-05C	13-Feb-17	BA-LA-140		<	2.5	
MW-05C	13-Feb-17	H-3		<	154	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-05C	08-May-17	MN-54		<	2.9	
MW-05C	08-May-17	CO-58		<	2.1	
MW-05C	08-May-17	FE-59		<	5.3	
MW-05C	08-May-17	CO-60		<	1.7	
MW-05C	08-May-17	ZN-65		<	4.0	
MW-05C	08-May-17	ZR-NB-95		<	3.1	
MW-05C	08-May-17	I-131		<	0.450	
MW-05C	08-May-17	CS-134		<	3.0	
MW-05C	08-May-17	CS-137		<	2.5	
MW-05C	08-May-17	BA-LA-140		<	1.4	
MW-05C	08-May-17	H-3		<	147	
MW-05C	24-Aug-17	MN-54		<	3.2	
MW-05C	24-Aug-17	CO-58		<	2.5	
MW-05C	24-Aug-17	FE-59		<	5.0	
MW-05C	24-Aug-17	CO-60		<	2.5	
MW-05C	24-Aug-17	ZN-65		<	4.2	
MW-05C	24-Aug-17	ZR-NB-95		<	3.7	
MW-05C	24-Aug-17	I-131		<	0.237	
MW-05C	24-Aug-17	CS-134		<	3.4	
MW-05C	24-Aug-17	CS-137		<	2.6	
MW-05C	24-Aug-17	BA-LA-140		<	2.6	
MW-05C	24-Aug-17	H-3		<	149	
MW-05C	06-Nov-17	MN-54		<	3.0	
MW-05C	06-Nov-17	CO-58		<	3.7	
MW-05C	06-Nov-17	FE-59		<	7.1	
MW-05C	06-Nov-17	CO-60		<	3.8	
MW-05C	06-Nov-17	ZN-65		<	3.7	
MW-05C	06-Nov-17	ZR-NB-95		<	5.1	
MW-05C	06-Nov-17	I-131		<	0.291	
MW-05C	06-Nov-17	CS-134		<	4.7	
MW-05C	06-Nov-17	CS-137		<	4.9	
MW-05C	06-Nov-17	BA-LA-140		<	1.7	
MW-05C	06-Nov-17	H-3		<	183	
MW-11A	13-Feb-17	MN-54		<	3.0	
MW-11A	13-Feb-17	CO-58		<	3.3	
MW-11A	13-Feb-17	FE-59		<	5.9	
MW-11A	13-Feb-17	CO-60		<	2.9	
MW-11A	13-Feb-17	ZN-65		<	3.1	
MW-11A	13-Feb-17	ZR-NB-95		<	2.2	
MW-11A	13-Feb-17	I-131		<	0.283	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-11A	13-Feb-17	CS-134		<	3.4	
MW-11A	13-Feb-17	CS-137		<	3.3	
MW-11A	13-Feb-17	BA-LA-140		<	4.1	
MW-11A	13-Feb-17	H-3		<	154	
MW-11A	08-May-17	MN-54		<	2.1	
MW-11A	08-May-17	CO-58		<	2.7	
MW-11A	08-May-17	FE-59		<	3.1	
MW-11A	08-May-17	CO-60		<	2.9	
MW-11A	08-May-17	ZN-65		<	7.2	
MW-11A	08-May-17	ZR-NB-95		<	3.3	
MW-11A	08-May-17	I-131		<	0.298	
MW-11A	08-May-17	CS-134		<	3.5	
MW-11A	08-May-17	CS-137		<	3.3	
MW-11A	08-May-17	BA-LA-140		<	3.0	
MW-11A	08-May-17	H-3		<	151	
MW-11A	24-Aug-17	MN-54		<	3.6	
MW-11A	24-Aug-17	CO-58		<	1.5	
MW-11A	24-Aug-17	FE-59		<	4.3	
MW-11A	24-Aug-17	CO-60		<	2.7	
MW-11A	24-Aug-17	ZN-65		<	3.7	
MW-11A	24-Aug-17	ZR-NB-95		<	3.1	
MW-11A	24-Aug-17	I-131		<	0.247	
MW-11A	24-Aug-17	CS-134		<	2.9	
MW-11A	24-Aug-17	CS-137		<	2.0	
MW-11A	24-Aug-17	BA-LA-140		<	2.3	
MW-11A	24-Aug-17	H-3		<	149	
MW-11A	06-Nov-17	MN-54		<	1.6	
MW-11A	06-Nov-17	CO-58		<	2.3	
MW-11A	06-Nov-17	FE-59		<	2.6	
MW-11A	06-Nov-17	CO-60		<	1.3	
MW-11A	06-Nov-17	ZN-65		<	4.0	
MW-11A	06-Nov-17	ZR-NB-95		<	3.0	
MW-11A	06-Nov-17	I-131		<	0.286	
MW-11A	06-Nov-17	CS-134		<	2.8	
MW-11A	06-Nov-17	CS-137		<	3.1	
MW-11A	06-Nov-17	BA-LA-140		<	2.9	
MW-11A	06-Nov-17	H-3		<	183	
MW-11B	13-Feb-17	MN-54		<	5.6	
MW-11B	13-Feb-17	CO-58		<	2.4	
MW-11B	13-Feb-17	FE-59		<	6.9	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-11B	13-Feb-17	CO-60		<	5.0	
MW-11B	13-Feb-17	ZN-65		<	2.9	
MW-11B	13-Feb-17	ZR-NB-95		<	3.9	
MW-11B	13-Feb-17	I-131		<	0.443	
MW-11B	13-Feb-17	CS-134		<	5.4	
MW-11B	13-Feb-17	CS-137		<	5.2	
MW-11B	13-Feb-17	BA-LA-140		<	5.7	
MW-11B	13-Feb-17	H-3		<	154	
MW-11B	08-May-17	MN-54		<	3.8	
MW-11B	08-May-17	CO-58		<	2.3	
MW-11B	08-May-17	FE-59		<	6.7	
MW-11B	08-May-17	CO-60		<	2.7	
MW-11B	08-May-17	ZN-65		<	7.1	
MW-11B	08-May-17	ZR-NB-95		<	3.5	
MW-11B	08-May-17	I-131		<	0.369	
MW-11B	08-May-17	CS-134		<	4.0	
MW-11B	08-May-17	CS-137		<	3.3	
MW-11B	08-May-17	BA-LA-140		<	3.1	
MW-11B	08-May-17	H-3		<	151	
MW-11B	24-Aug-17	MN-54		<	2.2	
MW-11B	24-Aug-17	MN-54		<	3.6	Duplicate
MW-11B	24-Aug-17	CO-58		<	4.5	Duplicate
MW-11B	24-Aug-17	CO-58		<	3.0	
MW-11B	24-Aug-17	FE-59		<	7.0	Duplicate
MW-11B	24-Aug-17	FE-59		<	5.1	
MW-11B	24-Aug-17	CO-60		<	1.8	
MW-11B	24-Aug-17	CO-60		<	3.5	Duplicate
MW-11B	24-Aug-17	ZN-65		<	2.3	
MW-11B	24-Aug-17	ZN-65		<	7.3	Duplicate
MW-11B	24-Aug-17	ZR-NB-95		<	4.0	Duplicate
MW-11B	24-Aug-17	ZR-NB-95		<	3.0	
MW-11B	24-Aug-17	I-131		<	0.312	Duplicate
MW-11B	24-Aug-17	I-131		<	0.245	
MW-11B	24-Aug-17	CS-134		<	4.3	Duplicate
MW-11B	24-Aug-17	CS-134		<	3.3	
MW-11B	24-Aug-17	CS-137		<	5.1	Duplicate
MW-11B	24-Aug-17	CS-137		<	4.0	
MW-11B	24-Aug-17	BA-LA-140		<	1.7	
MW-11B	24-Aug-17	BA-LA-140		<	2.0	Duplicate
MW-11B	24-Aug-17	H-3		<	149	Duplicate

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-11B	24-Aug-17	H-3		<	149	
MW-11B	06-Nov-17	MN-54		<	2.0	
MW-11B	06-Nov-17	CO-58		<	2.0	
MW-11B	06-Nov-17	FE-59		<	3.6	
MW-11B	06-Nov-17	CO-60		<	2.4	
MW-11B	06-Nov-17	ZN-65		<	3.5	
MW-11B	06-Nov-17	ZR-NB-95		<	2.0	
MW-11B	06-Nov-17	I-131		<	0.271	
MW-11B	06-Nov-17	CS-134		<	2.4	
MW-11B	06-Nov-17	CS-137		<	3.3	
MW-11B	06-Nov-17	BA-LA-140		<	2.6	
MW-11B	06-Nov-17	H-3		<	183	
MW-12A	13-Feb-17	MN-54		<	3.5	
MW-12A	13-Feb-17	CO-58		<	3.5	
MW-12A	13-Feb-17	FE-59		<	7.1	
MW-12A	13-Feb-17	CO-60		<	1.8	
MW-12A	13-Feb-17	ZN-65		<	4.3	
MW-12A	13-Feb-17	ZR-NB-95		<	5.2	
MW-12A	13-Feb-17	I-131		<	0.339	
MW-12A	13-Feb-17	CS-134		<	3.8	
MW-12A	13-Feb-17	CS-137		<	2.4	
MW-12A	13-Feb-17	BA-LA-140		<	5.3	
MW-12A	13-Feb-17	H-3		<	154	
MW-12A	08-May-17	MN-54		<	3.1	
MW-12A	08-May-17	CO-58		<	2.2	
MW-12A	08-May-17	FE-59		<	2.8	
MW-12A	08-May-17	CO-60		<	1.8	
MW-12A	08-May-17	ZN-65		<	2.5	
MW-12A	08-May-17	ZR-NB-95		<	2.9	
MW-12A	08-May-17	I-131		<	0.482	
MW-12A	08-May-17	CS-134		<	3.4	
MW-12A	08-May-17	CS-137		<	2.9	
MW-12A	08-May-17	BA-LA-140		<	2.0	
MW-12A	08-May-17	H-3		<	151	
MW-12A	24-Aug-17	MN-54		<	3.2	
MW-12A	24-Aug-17	CO-58		<	2.6	
MW-12A	24-Aug-17	FE-59		<	4.5	
MW-12A	24-Aug-17	CO-60		<	1.1	
MW-12A	24-Aug-17	ZN-65		<	5.4	
MW-12A	24-Aug-17	ZR-NB-95		<	3.2	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-12A	24-Aug-17	I-131		<	0.218	
MW-12A	24-Aug-17	CS-134		<	3.3	
MW-12A	24-Aug-17	CS-137		<	4.2	
MW-12A	24-Aug-17	BA-LA-140		<	2.4	
MW-12A	24-Aug-17	H-3		<	149	
MW-12A	06-Nov-17	MN-54		<	2.6	
MW-12A	06-Nov-17	CO-58		<	2.7	
MW-12A	06-Nov-17	FE-59		<	2.7	
MW-12A	06-Nov-17	CO-60		<	1.7	
MW-12A	06-Nov-17	ZN-65		<	4.4	
MW-12A	06-Nov-17	ZR-NB-95		<	2.7	
MW-12A	06-Nov-17	I-131		<	0.257	
MW-12A	06-Nov-17	CS-134		<	3.6	
MW-12A	06-Nov-17	CS-137		<	2.3	
MW-12A	06-Nov-17	BA-LA-140		<	3.0	
MW-12A	06-Nov-17	H-3		<	183	
MW-12B	13-Feb-17	MN-54		<	3.6	
MW-12B	13-Feb-17	CO-58		<	2.4	
MW-12B	13-Feb-17	FE-59		<	4.2	
MW-12B	13-Feb-17	CO-60		<	2.0	
MW-12B	13-Feb-17	ZN-65		<	2.4	
MW-12B	13-Feb-17	ZR-NB-95		<	4.1	
MW-12B	13-Feb-17	I-131		<	0.386	
MW-12B	13-Feb-17	CS-134		<	3.9	
MW-12B	13-Feb-17	CS-137		<	2.5	
MW-12B	13-Feb-17	BA-LA-140		<	2.5	
MW-12B	13-Feb-17	H-3		<	154	
MW-12B	08-May-17	MN-54		<	2.2	
MW-12B	08-May-17	CO-58		<	1.5	
MW-12B	08-May-17	FE-59		<	5.5	
MW-12B	08-May-17	CO-60		<	1.6	
MW-12B	08-May-17	ZN-65		<	2.7	
MW-12B	08-May-17	ZR-NB-95		<	1.4	
MW-12B	08-May-17	I-131		<	0.320	
MW-12B	08-May-17	CS-134		<	2.4	
MW-12B	08-May-17	CS-137		<	2.3	
MW-12B	08-May-17	BA-LA-140		<	1.5	
MW-12B	08-May-17	H-3		<	151	
MW-12B	24-Aug-17	MN-54		<	5.0	
MW-12B	24-Aug-17	CO-58		<	3.2	

**Onsite Groundwater Results
Concentration (pCi/L)**

LOCATION	DATE	NUCLIDE	ACTIVITY	SIGN	ERROR	NOTE
MW-12B	24-Aug-17	FE-59		<	5.9	
MW-12B	24-Aug-17	CO-60		<	3.1	
MW-12B	24-Aug-17	ZN-65		<	7.6	
MW-12B	24-Aug-17	ZR-NB-95		<	4.1	
MW-12B	24-Aug-17	I-131		<	0.217	
MW-12B	24-Aug-17	CS-134		<	4.4	
MW-12B	24-Aug-17	CS-137		<	5.6	
MW-12B	24-Aug-17	BA-LA-140		<	2.0	
MW-12B	24-Aug-17	H-3		<	149	
MW-12B	06-Nov-17	MN-54		<	2.6	
MW-12B	06-Nov-17	CO-58		<	2.5	
MW-12B	06-Nov-17	FE-59		<	3.3	
MW-12B	06-Nov-17	CO-60		<	1.7	
MW-12B	06-Nov-17	ZN-65		<	3.7	
MW-12B	06-Nov-17	ZR-NB-95		<	2.3	
MW-12B	06-Nov-17	I-131		<	0.370	
MW-12B	06-Nov-17	CS-134		<	3.2	
MW-12B	06-Nov-17	CS-137		<	2.7	
MW-12B	06-Nov-17	BA-LA-140		<	4.5	
MW-12B	06-Nov-17	H-3		<	183	
WEST ESW-W	13-Feb-17	MN-54		<	7.1	
WEST ESW-W	13-Feb-17	CO-58		<	4.9	
WEST ESW-W	13-Feb-17	FE-59		<	11.7	
WEST ESW-W	13-Feb-17	CO-60		<	4.7	
WEST ESW-W	13-Feb-17	ZN-65		<	7.7	
WEST ESW-W	13-Feb-17	ZR-NB-95		<	5.2	
WEST ESW-W	13-Feb-17	I-131		<	0.259	
WEST ESW-W	13-Feb-17	CS-134		<	8.0	
WEST ESW-W	13-Feb-17	CS-137		<	6.3	
WEST ESW-W	13-Feb-17	BA-LA-140		<	6.0	
WEST ESW-W	13-Feb-17	H-3	1,316	+/-	130	

ENCLOSURES TO WCGS
ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Enclosure I contains the *Offsite Dose Calculation Manual*, AP 07B-003, Revision 8

Enclosure II contains the *Offsite Dose Calculation Manual (Radiological Environmental Monitoring Program)*, AP 07B-004, Revision 21

Enclosure III contains the *Solid Radwaste Process Control Program*, AP 31A-100, Revision 8