



Callaway Plant

April 26, 2016

ULNRC-06300

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555-0001

40 CFR 190  
10 CFR 72.44(d)

Ladies and Gentlemen:

**DOCKET NUMBERS 50-483 and 72-1045  
CALLAWAY PLANT UNIT 1  
UNION ELECTRIC CO.  
FACILITY OPERATING LICENSE NPF-30  
2015 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**

Please find enclosed the 2015 Annual Radioactive Effluent Release Report for Callaway Plant. This report is submitted in accordance with Section 5.6.3 of the Callaway Plant Technical Specifications and Section 5.1 of the HI-STORM UMAX Certificate of Compliance.

This letter does not contain new commitments.

If there are any questions, please contact Johann S. Geyer at (314) 225-1589

Sincerely,

Johann S. Geyer  
Director, Radiation Protection

TAW

Enclosure

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# Callaway Energy Center 2015 Annual Radioactive Effluent Release Report

Facility Operating License NPF-30

Docket Numbers 50-483 and 72-1045



# Callaway Energy Center 2015 Annual Radioactive Effluent Release Report

Facility Operating License NPF-30  
Docket Numbers 50-483 and 72-1045

## 1. Introduction

This Annual Radioactive Effluent Release Report (ARERR) is submitted by Union Electric Co., dba Ameren Missouri, in accordance with the requirements of 10 CFR 50.36a and 10 CFR 72.44(d)(3), Callaway Energy Center Technical Specification 5.6.3, and HI-STORM UMAX Certificate of Compliance Section 5.1.c. This report is for the period January 1, 2015 to December 31, 2015.

The doses to the Member of the Public from all liquid and gaseous effluents discharged during the reporting period were small fractions of the NRC and EPA regulatory limits and the Radioactive Effluent Control limits in the Offsite Dose Calculation Manual.

To maximize consistency, aid in the review by Members of the Public, and to allow easier industry- wide comparison of the data, this report is presented in the format recommended by Regulatory Guide 1.21, revision 2, *insofar as is practicable*. Callaway is committed to revision

## Abstract

The Annual Radioactive Effluent Release Report covers the operation of the Callaway Energy Center during the year 2015. The report includes a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The report also includes an annual summary of hourly meteorological data collected during the year and an assessment of radiation dose to the Member of the Public from liquid and gaseous effluents.

( 1 )

1 of Regulatory Guide 1.21, and some of the information is not readily available in the format recommended by revision 2.

## 2. Gaseous Effluents

The quantity of radioactive material released in gaseous effluents during the reporting period is summarized in Table A-1. The quarterly and annual sums of all radionuclides discharged in gaseous effluents are reported in Tables A-1A and A-1B. All gaseous effluent releases are considered to be ground level.

The quantity of  $^{14}\text{C}$  released in gaseous effluents was calculated as described in EPRI Technical Report 1021106<sup>1</sup>.

There were no radioactive effluents from the Independent Spent Fuel Storage Installation (ISFSI). The HI-STORM UMAX Canister Storage System does not create any radioactive materials or have any radioactive waste treatment systems. Specification 3.1.1, "Multi-Purpose Canister (MPC)", provides assurance that there are no radioactive effluents from the ISFSI.<sup>2</sup>

## 3. Liquid Effluents

The quantity of radioactive material released in liquid effluents during the reporting period is summarized in Table A-2. The quarterly and annual sums of all radionuclides discharged in liquid effluents are reported in Table A-2A. All liquid effluents were discharged in batch mode; there were no continuous liquid discharges for the reporting period. Dilution by the Missouri River, in the form of the near-field dilution factor, is utilized in the ODCM dose calculation methodology.

## 4. Solid Waste Storage and Shipments

The volume and activity of solid waste shipped for disposal is provided in Table A-3. Table A-3 is presented in the format of rev. 1 to Regulatory Guide 1.21 because the data is not readily available in the format recommended by rev. 2 to Regulatory Guide 1.21.

## 5. Dose Assessments

The annual evaluation of dose to the Member of the Public is calculated in accordance with the methodology and parameters in the ODCM and is reported in Tables A-4 and A-5.

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<sup>1</sup> *Estimation of Carbon- 14 in Nuclear Power Plant Gaseous Effluents*, Technical Report 1011106, Electric Power Research Institute, December, 2010.

<sup>2</sup> Certificate of Compliance No. 1040, Appendix A, Technical Specifications for the HI-STORM UMAX Canister Storage System, Specification 5.1.

### 5.1 Table A-4, Dose Assessments, 10 CFR 50, Appendix I

The dose assessments reported in Table A-4 were calculated using the methodology and parameters in the ODCM and demonstrate compliance with 10 CFR 50, Appendix I. The gamma air dose and beta air dose were calculated at the nearest Site Boundary location with the highest value of X/Q, as described in the ODCM. The maximum organ dose from gaseous effluents was calculated for the ingestion, inhalation, and ground plane pathways at the location of the nearest resident with the highest value of D/Q, as described in the ODCM. The organ dose does not include the dose from  $^{14}\text{C}$ , which is listed separately.

### 5.2 Table A-5, EPA 40 CFR 190 Individual in the Unrestricted Area

The dose assessments reported in Table A-5 are the doses to the Member of the Public from activities within the Site Boundary plus the doses at the location of the Nearest Residence. A large portion of the residual land of the Callaway Site is managed by the State of Missouri Conservation Department as the Reform Wildlife Management Area. Pursuant to the guidance provided in Regulatory Guide 1.21, rev.2, the dose reported in Table A-5 is the sum of the dose from gaseous effluents (at the Nearest Resident location and within the Site Boundary), plus the dose contribution due to activities within the Site Boundary and the organ dose from inhalation of  $^{14}\text{C}$  (at the Nearest Resident location and within the Site Boundary). The dose assessments in Table A-5 demonstrate compliance with 10 CFR 20.1301(e), 10 CFR 72.104, and 40 CFR 190.

## 6. Supplemental Information

### 6.1 Abnormal Releases or Abnormal Discharges

There were no abnormal releases or abnormal discharges during the reporting period.

### 6.2 Non- routine Planned Discharges

There were no non- routine planned discharges during the reporting period.

### 6.3 Radioactive Waste Treatment System Changes

There were no major changes to the liquid or gaseous radwaste treatment system during the reporting period.

### 6.4 Annual Land Use Census Changes

There were no changes identified in the locations for dose calculation. Changes in sample locations identified in the Land Use Census are described in the Annual Radiological Environmental Operating Report.

### 6.5 Effluent Monitoring System Inoperability

There were no effluent radiation monitors out of service for periods in excess of the Limiting Condition for Operation and associated Action statements.

## 6.6 Offsite Dose Calculation Manual Changes

### APA-ZZ-01003 Callaway Offsite Dose Calculation Manual Changes

**Rev. No.**        **20**        **Date**    **April, 2015**

Revised Table 10 to implement the recalculated dispersion parameters using 2009- 2013 meteorology. Deleted Table 11 as described in HPCI1503. Added HPCI1502, HPCI1503, HPCI1504, & HPCI1505 as references. Deleted reference to calculation ZZ-67. Added Independent Spent Fuel Storage Installation (ISFSI) to Appendix A, Figure 1. Conforming changes were made within the text of the document to implement the revisions noted above. Revised Section 6 to describe the recalculation of the long- term dispersion parameters. (CAR 201500947) Deleted Section 8; the following sections were renumbered accordingly.

**Rev. No.**        **21**        **Date**    **May, 2015**

Revised Table 10 to correct typographical errors in the dispersion parameters for the Site Boundary and Nearest Resident. (CAR 201502908)

A copy of the ODCM rev. 20 and rev. 21 is provided under separate cover as ULNRC-6290. Each change in rev. 20 and rev. 21 is identified by markings in the margin of the affected pages, clearly indicating the area of the page that was changed, and the date, i.e., month and year, the change was implemented is shown at the bottom of each page in each document.

## 6.7 Process Control Program Changes

There were no changes to APA-ZZ-01011, "Process Control Program" during the reporting period.

## 6.8 Corrections to Previous Reports

There are two typos in the 2014 Annual Radioactive Effluent Release Report (ARERR). In Appendix D, the sample date for MW-032 and MW-033 are given as 2015. The correct sample date is 2014. The corrected pages are attached in their entirety in Appendix C to this report. The area of change is marked by a vertical line in the left margin.

## 6.9 Other Information Related to Radioactive Effluents

Meteorological Joint Frequency Tables for the monitoring period are attached as Appendix B.



## Appendix A

### Tables of Quantities Released in Liquid and Gaseous Radioactive Effluents and in Solid Radioactive Waste Shipments

### Tables of Doses from the Discharge of Liquid and Gaseous Radioactive Effluents

Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Table A-1: Gaseous Effluents- Summation of All Releases							
Summation of All Releases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Estimated Uncertainty (%) <sup>3</sup>
<b>Fission &amp; Activation Gases</b>	Ci	2.35E-01	6.47E-02	7.10E-02	6.31E-02	4.34E-01	20
<i>Average Release Rate</i>	μCi/s	3.02E-02	8.23E-03	8.93E-03	7.93E-03	1.38E-02	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b><sup>131</sup>Iodine</b>	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	23
<i>Average Release Rate</i>	μCi/s	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b>Particulates</b>	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	30
<i>Average Release Rate</i>	μCi/s	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b>Gross Alpha</b>	Ci	2.83E-07	8.59E-08	2.30E-07	2.17E-07	8.16E-07	
<b><sup>3</sup>H</b>	Ci	6.47E+00	9.65E+00	2.49E+01	7.35E+00	4.84E+01	14
<i>Average Release Rate</i>	μCi/s	8.23E-01	1.23E+00	3.13E+00	9.24E-01	1.53E+00	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b><sup>14</sup>C<sup>4</sup></b>	Ci	3.25E+00	3.25E+00	3.25E+00	3.25E+00	1.30E+01	

<sup>3</sup> Safety Analysis calculation 87-063-00, January 6, 1988<sup>4</sup> <sup>14</sup>C activity is estimated based on EPRI report TR-1021106, *Estimation of <sup>14</sup>C in Nuclear Power Plant Effluents*, December, 2010.

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Table A-1A: Gaseous Effluents- Ground Level Release- Batch Mode						
<b>Fission &amp; Activation Gases</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
<sup>41</sup> Ar	Ci	4.61E-02	6.47E-02	6.33E-02	6.31E-02	2.37E-01
<sup>85</sup> Kr	Ci	1.81E-01	0.00E+00	0.00E+00	0.00E+00	1.81E-01
<sup>131m</sup> Xe	Ci	8.24E-05	0.00E+00	0.00E+00	0.00E+00	8.24E-05
<sup>133m</sup> Xe	Ci	3.61E-05	0.00E+00	0.00E+00	0.00E+00	3.61E-05
<sup>133</sup> Xe	Ci	7.91E-03	0.00E+00	0.00E+00	0.00E+00	7.91E-03
<sup>135</sup> Xe	Ci	0.00E+00	0.00E+00	7.64E-03	0.00E+00	7.64E-03
<b>Total</b>	<b>Ci</b>	<b>2.35E-01</b>	<b>6.47E-02</b>	<b>7.10E-02</b>	<b>6.31E-02</b>	<b>4.34E-01</b>
<b>Iodines &amp; Halogens</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
N/A	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Particulates</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
N/A	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<sup>3</sup> H	Ci	3.74E-02	2.37E-01	1.25E+01	1.25E-01	1.29E+01
<b>Gross α</b>	<b>Ci</b>	<b>0.00E+00</b>	<b>0.00E+00</b>	<b>0.00E+00</b>	<b>0.00E+00</b>	<b>0.00E+00</b>
<sup>14</sup> C	Ci	5.33E-01	5.33E-01	5.33E-01	5.33E-01	2.13E+00

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Table A-1B: Gaseous Effluents- Ground Level Release- Continuous Mode						
<b>Fission &amp; Activation Gases</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
N/A	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Iodines &amp; Halogens</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
N/A	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Particulates</b>	<b>Units</b>	<b>Quarter 1</b>	<b>Quarter 2</b>	<b>Quarter 3</b>	<b>Quarter 4</b>	<b>Total for the year</b>
N/A	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<sup>3</sup> H	Ci	6.43E+00	9.42E+00	1.24E+01	7.22E+00	3.55E+01
<b>Gross α</b>	Ci	2.83E-07	8.59E-08	2.30E-07	2.17E-07	8.16E-07
<sup>14</sup> C	Ci	2.73E+00	2.73E+00	2.73E+00	2.73E+00	1.09E+01

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Table A-2: Liquid Effluents- Summation of All Releases							
Summation of All Liquid Releases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Estimated Uncert. (%) <sup>5</sup>
<b>Fission and Activation Products<sup>6</sup></b>	Ci	7.93E-03	1.78E-02	1.45E-03	1.23E-02	3.96E-02	20
<i>Avg Diluted Conc</i>	μCi/ml	5.11E-08	1.66E-07	6.84E-09	1.01E-07	6.65E-08	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b><sup>3</sup>H</b>	Ci	3.78E+01	1.72E+01	5.92E+02	2.09E+02	8.56E+02	14
<i>Avg Diluted Conc</i>	μCi/ml	2.44E-04	1.60E-04	2.79E-03	1.73E-03	1.44E-03	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b>Dissolved &amp; Entrained Gases</b>	Ci	3.86E-05	0.00E+00	1.88E-04	2.33E-04	4.60E-04	27
<i>Avg Diluted Conc</i>	μCi/ml	2.49E-10	0.00E+00	8.86E-10	1.92E-09	7.72E-10	
<i>% of Limit</i>	%	N/A	N/A	N/A	N/A	N/A	
<b>Gross α</b>	Ci	0.00E+00	2.95E-04	0.00E+00	0.00E+00	2.95E-04	29
<i>Avg Diluted Conc</i>	μCi/ml	0.00E+00	2.75E-09	0.00E+00	0.00E+00	4.95E-10	
<b>Vol Liquid Effluent<sup>7</sup></b>	Liters	5.26E+06	3.69E+06	5.68E+06	3.70E+06	1.83E+07	
<b>Dilution Volume<sup>8</sup></b>	Liters	1.50E+08	1.04E+08	2.06E+08	1.17E+08	5.77E+08	
<b>Avg river flow<sup>9</sup></b>	m <sup>3</sup> /s	1.39E+03	4.19E+03	3.58E+03	3.23E+03	3.10E+03	

<sup>5</sup> Safety Analysis calculation 87-063-00, January 6, 1988<sup>6</sup> Excludes <sup>3</sup>H, noble gases, and gross alpha.<sup>7</sup> Primary system liquid effluent plus secondary liquid effluent, prior to dilution.<sup>8</sup> Does not include Missouri River dilution.<sup>9</sup> Average Missouri River flow for the year at the Hermann, MO monitoring station as reported by the USGS.

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Table A-2A: Liquid Effluents- Batch Mode						
Fission & Activation Products	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for the year
<sup>51</sup> Cr	Ci	1.04E-04	0.00E+00	0.00E+00	0.00E+00	1.04E-04
<sup>55</sup> Fe	Ci	0.00E+00	0.00E+00	0.00E+00	9.62E-03	9.62E-03
<sup>58</sup> Co	Ci	7.41E-06	0.00E+00	0.00E+00	0.00E+00	7.41E-06
<sup>60</sup> Co	Ci	3.69E-04	6.28E-04	4.37E-04	9.79E-04	2.41E-03
<sup>63</sup> Ni	Ci	1.37E-04	1.55E-02	0.00E+00	8.88E-04	1.65E-02
<sup>124</sup> Sb	Ci	5.52E-04	0.00E+00	0.00E+00	0.00E+00	5.52E-04
<sup>125</sup> Sb	Ci	6.72E-03	1.68E-03	1.01E-03	6.47E-04	1.01E-02
<sup>137</sup> Cs	Ci	4.14E-05	2.33E-05	0.00E+00	1.33E-04	1.98E-04
Total	Ci	7.93E-03	1.78E-02	1.45E-03	1.24E-02	3.96E-02
Dissolved & Entrained Gases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total for the year
<sup>133</sup> Xe	Ci	3.86E-05	0.00E+00	1.88E-04	2.33E-04	4.60E-04
Total	Ci	3.86E-05	0.00E+00	1.88E-04	2.33E-04	4.60E-04
<sup>3</sup> H	Ci	3.78E+01	1.72E+01	5.92E+02	2.09E+02	8.56E+02
Gross α	Ci	0.00E+00	2.95E-04	0.00E+00	0.00E+00	2.95E-04

Table A-3: Solid Waste &amp; Irradiated Fuel Shipments

**A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)**

<b>1. TYPE OF WASTE</b>	<b>Units</b>	<b>Period Jan – Jun</b>	<b>Period Jul - Dec</b>	<b>Est. Total Error (%)</b>
<b>Spent resins, filter sludges, evaporator bottoms, etc.</b>	m <sup>3</sup>	0.00E+00	1.48E+01	± 25%
	Ci	0.00E+00	2.38E+02	
<b>Dry compressible waste, contaminated equip., etc.</b>	m <sup>3</sup>	1.05E+02	3.43E+01	± 25%
	Ci	1.56E-01	3.21E+00	
<b>Irradiated components, control rods, etc.</b>	m <sup>3</sup>	0.00E+00	0.00E+00	± 25%
	Ci	0.00E+00	0.00E+00	
<b>Other (low level secondary resin, oily waste)</b>	m <sup>3</sup>	0.00E+00	1.06E+00	± 25%
	Ci	0.00E+00	7.91E-04	

Table A-3: Solid Waste &amp; Irradiated Fuel Shipments (continued)

<b>2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (by Type of Waste)</b>				
<b>a. Spent resins, filters, evaporator bottoms, etc.</b>				
<b>Nuclide</b>	<b>% Abundance</b>	<b>Jan – Jun Ci</b>	<b>% Abundance</b>	<b>Jul – Dec Ci</b>
<sup>60</sup> Co	N/A	N/A	13.19	3.16E+01
<sup>63</sup> Ni	N/A	N/A	61.39	1.47E+02
<sup>55</sup> Fe	N/A	N/A	9.69	2.32E+01
<sup>137</sup> Cs	N/A	N/A	8.40	2.01E+01
<sup>134</sup> Cs	N/A	N/A	1.31	3.13E+00
<b>b. Dry compressible waste, contaminated equipment, etc.</b>				
<sup>60</sup> Co	61.56	9.63E-02	23.23	7.72E-01
<sup>63</sup> Ni	14.48	2.27E-02	31.78	1.06E+00
<sup>137</sup> Cs	4.08	6.39E-03	28.05	9.33E-01
<sup>55</sup> Fe	14.85	2.32E-02	8.91	2.96E-01
<sup>134</sup> Cs	N/A	N/A	1.22	4.05E-02
<sup>3</sup> H	N/A	N/A	2.52	8.38E-02
<sup>54</sup> Mn	N/A	N/A	N/A	N/A
<sup>65</sup> Zn	N/A	N/A	N/A	N/A
<sup>95</sup> Nb	N/A	N/A	N/A	N/A
<sup>125</sup> Sb	2.14	3.35E-03	2.33	4.15E-03
<b>c. Irradiated components, control rods, etc.</b>				
None	N/A	N/A	N/A	N/A
<b>d. Other</b>				
<b>Nuclide</b>	<b>% Abundance</b>	<b>Jan – Jun Ci</b>	<b>% Abundance</b>	<b>Jul – Dec Ci</b>
<sup>60</sup> Co	N/A	N/A	41.1	3.32E-04
<sup>63</sup> Ni	N/A	N/A	24.4	1.98E-04
<sup>137</sup> Cs	N/A	N/A	5.48	4.43E-05
<sup>55</sup> Fe	N/A	N/A	19.3	1.56E-04
<sup>3</sup> H	N/A	N/A	1.23	9.95E-06
<sup>54</sup> Mn	N/A	N/A	1.48	1.20E-05
<sup>58</sup> Co	N/A	N/A	2.28	1.84E-05
<sup>125</sup> Sb	N/A	N/A	1.36	1.10E-05



Table A-3: Solid Waste &amp; Irradiated Fuel Shipments (continued)

3. SOLID WASTE DISPOSITION				
Number of Shipments	Mode of Transport	Destination	Class of Solid Waste Shipped	Type of Container
*5	Hittman Transport	Energy Solutions Services, Inc. Bear Creek, TN	A	IP-1
*3	Hittman Transport	Erwin Resin Solutions, LLC Erwin, TN	B	Liners in a Cask
*3	Hittman Transport	Barnwell Processing Facility Barnwell, SC	A, B, C, N (not classified for disposal)	Drums in a Cask

\*Sent to waste processors for volume reduction before burial.

#### 4. SOLIDIFICATION AGENT

None used.

#### B. IRRADIATED FUEL SHIPMENTS (Disposition)

There were no shipments of irradiated fuel during the reporting period.

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Table A-4: Dose Assessments, 10 CFR 50, Appendix I					
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Yearly total
<b>Liquid Effluent Dose Limit, Total Body (mrem)</b>	1.5	1.5	1.5	1.5	3
Total Body Dose (mrem)	1.49E-04	2.65E-04	8.19E-04	1.02E-03	2.17E-03
% Limit (%)	0.01	0.02	0.05	0.07	0.07
<b>Liquid Effluent Dose Limit, Maximum Organ (mrem)</b>	5	5	5	5	10
Maximum Organ Dose (mrem)	1.98E-04	4.60E-03	8.30E-04	1.32E-03	4.60E-03
% Limit (%)	0.00	0.09	0.02	0.03	0.05
<b>Gaseous Effluent Dose Limit, Gamma Air (mrem)</b>	5	5	5	5	10
Gamma Air Dose (mrad)	2.38E-05	3.30E-05	3.31E-05	3.22E-05	1.22E-04
% Limit (%)	0.00%	0.00%	0.00%	0.00%	0.00%
<b>Gaseous Effluent Dose Limit, Beta Air (mrem)</b>	10	10	10	10	20
Beta Air Dose (mrad)	2.81E-05	1.16E-05	1.24E-05	1.14E-05	6.35E-05
% Limit (%)	0.00%	0.00%	0.00%	0.00%	0.00%
<b>Gaseous Effluent Dose Limit, Maximum Organ (mrem)</b>	7.5	7.5	7.5	7.5	15
Maximum organ dose <sup>10</sup> (mrem)	2.06E-03	3.08E-03	7.93E-03	2.34E-03	1.54E-02
% Limit (%)	0.03	0.04	0.11	0.03	0.10
<b><sup>14</sup>C Maximum Organ Dose (mrem)<sup>11</sup></b>	4.00E-03	4.00E-03	4.00E-03	4.00E-03	1.6E-02

<sup>10</sup> Iodine, <sup>3</sup>H, and particulates with greater than an 8 day half- life.<sup>11</sup> Not included in above totals

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Table A-5: EPA 40 CFR 190 Individual in the Unrestricted Area			
	Whole Body	Thyroid	Max Other Organ
Dose Limit	25 mrem	75 mrem	25 mrem
Dose	2.18E-02	2.17E-02	3.72E-02
% Limit	0.09%	0.03%	0.15%

## Appendix B

*Joint Frequency Tables; Totals of Hours at Each Wind Speed & Direction for the  
period January 1, 2015- December 31, 2015*

## Dispersion Parameters for the Reporting Period

### Nearest Resident

Direction: NNW

Distance: 2900 meters

X/Q, Undecayed and Undepleted:  $1.19\text{E-}06 \text{ sec/m}^3$

X/Q Decayed and Undepleted:  $1.17\text{E-}06 \text{ sec/m}^3$

X/Q Decayed and Depleted:  $9.91\text{E-}07 \text{ sec/m}^3$

D/Q Deposition rate:  $3.36\text{E-}09 \text{ m}^{-2}$

### Site Boundary

Direction: NNW

Distance: 2200 meters

X/Q, Undecayed and Undepleted:  $1.75\text{E-}06 \text{ sec/m}^3$

X/Q Decayed and Undepleted:  $1.73\text{E-}06 \text{ sec/m}^3$

X/Q Decayed and Depleted:  $1.49\text{E-}06 \text{ sec/m}^3$

D/Q Deposition rate:  $5.44\text{E-}09 \text{ m}^{-2}$

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Joint Frequency Distribution												
January- December, 2015												
All Stabilities												
Elevations: Winds 10m    Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	5	38	52	63	115	113	105	67	37	0	0	595
NNE	7	32	52	63	120	108	79	37	11	0	0	509
NE	5	33	63	49	128	65	38	19	11	0	0	411
ENE	2	28	55	46	92	51	23	7	8	0	0	312
E	8	26	55	51	87	66	25	3	1	0	0	322
ESE	7	31	61	69	120	77	38	8	0	0	0	411
SE	7	50	129	157	300	136	21	6	1	0	0	807
SSE	6	48	90	196	501	220	64	36	14	0	0	1175
S	6	31	42	71	274	231	119	65	48	0	0	887
SSW	2	20	40	50	166	169	103	49	18	1	0	618
SW	1	22	34	57	159	129	63	41	17	0	0	523
WSW	1	20	38	48	101	58	21	22	12	2	0	323
W	5	26	40	62	121	91	70	28	20	6	0	469
WNW	6	28	70	69	125	79	53	26	8	1	0	465
NW	3	29	76	68	119	67	40	22	17	0	0	441
NNW	2	25	49	47	133	88	46	41	28	1	0	460
Tot	73	487	946	1166	2661	1748	908	477	251	11	0	8728
Hours of Calm ..... 24												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 8752												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class A Extremely Unstable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	0	0	0	1	0	0	0	0	1
NNE	0	0	0	0	0	3	11	4	2	0	0	20
NE	0	0	0	0	2	0	1	5	1	0	0	9
ENE	0	0	0	0	1	2	2	1	0	0	0	6
E	0	0	0	0	0	2	1	0	0	0	0	3
ESE	0	0	0	0	0	1	1	0	0	0	0	2
SE	0	0	0	0	2	12	2	2	0	0	0	18
SSE	0	0	0	0	2	4	3	4	0	0	0	13
S	0	0	0	0	1	4	7	5	1	0	0	18
SSW	0	0	0	0	5	6	7	11	0	1	0	30
SW	0	0	0	1	3	13	10	8	1	0	0	36
WSW	0	0	0	0	2	5	5	10	1	0	0	23
W	0	0	0	0	1	6	7	6	4	0	0	24
WNW	0	0	0	0	1	8	15	4	2	0	0	30
NW	0	0	0	0	0	7	15	2	3	0	0	27
NNW	0	0	0	0	0	1	3	1	2	0	0	7
Tot	0	0	0	1	20	74	91	63	17	1	0	267
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 267												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class B Moderately Unstable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	0	3	8	7	7	0	0	0	25
NNE	0	0	0	0	5	7	5	4	2	0	0	23
NE	0	0	0	0	7	4	3	2	0	0	0	16
ENE	0	0	0	0	0	6	3	2	1	0	0	12
E	0	0	0	0	0	1	3	0	1	0	0	5
ESE	0	0	0	1	1	3	3	0	0	0	0	8
SE	0	0	0	0	9	13	0	0	0	0	0	22
SSE	0	0	0	1	16	12	6	3	3	0	0	41
S	0	0	0	1	16	6	7	12	2	0	0	44
SSW	0	0	0	0	3	9	13	8	1	0	0	34
SW	0	0	0	1	7	7	6	4	4	0	0	29
WSW	0	0	1	0	7	4	2	1	3	0	0	18
W	0	0	0	1	4	5	4	3	1	0	0	18
WNW	0	0	0	0	5	2	5	5	0	0	0	17
NW	0	0	0	0	4	7	4	0	1	0	0	16
NNW	0	0	0	0	3	10	8	5	4	0	0	30
Tot	0	0	1	5	90	104	79	56	23	0	0	358
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 358												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												



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Joint Frequency Distribution												
January- December, 2015												
Class C Slightly Unstable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	1	11	5	8	9	5	0	0	39
NNE	0	0	0	2	12	10	10	6	0	0	0	40
NE	0	0	0	3	8	4	1	2	0	0	0	18
ENE	0	0	0	2	2	6	2	1	1	0	0	14
E	0	0	0	3	5	4	6	2	0	0	0	20
ESE	0	0	0	2	7	8	7	5	0	0	0	29
SE	0	0	1	1	26	24	2	0	0	0	0	54
SSE	0	0	0	13	26	19	6	8	4	0	0	76
S	0	0	1	5	17	20	7	8	4	0	0	62
SSW	0	0	0	3	19	15	16	6	2	0	0	61
SW	0	0	0	2	12	13	7	6	1	0	0	41
WSW	0	0	0	3	8	5	1	5	0	0	0	22
W	0	0	2	4	6	5	2	3	0	0	0	22
WNW	0	0	0	2	11	10	3	3	3	0	0	32
NW	0	0	0	1	9	7	1	0	0	0	0	18
NNW	0	0	0	0	10	9	4	8	2	0	0	33
Tot	0	0	4	47	189	164	83	72	22	0	0	581
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 581												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class D Neutral based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	8	12	15	47	78	86	50	31	0	0	327
NNE	0	2	17	28	58	76	51	22	7	0	0	261
NE	0	4	18	13	71	43	31	9	10	0	0	199
ENE	0	7	15	15	50	25	16	3	6	0	0	137
E	0	4	11	15	53	46	15	1	0	0	0	145
ESE	1	4	17	22	65	46	24	2	0	0	0	181
SE	0	7	26	35	111	56	10	3	1	0	0	249
SSE	0	3	16	41	82	64	31	16	5	0	0	258
S	1	5	10	23	62	57	50	24	34	0	0	266
SSW	0	4	11	12	42	62	44	17	15	0	0	207
SW	0	3	11	17	53	52	33	19	11	0	0	199
WSW	0	7	5	15	31	22	10	6	7	1	0	104
W	0	3	11	33	57	35	35	16	14	5	0	209
WNW	0	3	8	29	45	44	24	14	3	1	0	171
NW	0	6	20	21	54	33	17	20	13	0	0	184
NNW	0	4	15	14	48	49	29	26	19	1	0	205
Tot	2	74	223	348	929	788	506	248	176	8	0	3302
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 332												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class E Slightly Stable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	2	11	9	24	45	21	3	1	1	0	0	117
NNE	1	7	13	13	36	12	2	1	0	0	0	85
NE	1	6	18	15	35	14	2	1	0	0	0	92
ENE	1	8	21	23	31	12	0	0	0	0	0	96
E	2	9	16	25	25	13	0	0	0	0	0	90
ESE	1	5	20	35	45	19	3	1	0	0	0	129
SE	2	13	39	71	120	31	7	1	0	0	0	284
SSE	1	16	24	46	187	89	18	5	2	0	0	388
S	2	8	13	17	83	95	42	16	7	0	0	283
SSW	1	6	9	13	69	65	23	7	0	0	0	193
SW	0	10	8	18	42	33	7	4	0	0	0	122
WSW	0	1	15	23	36	20	2	0	1	1	0	99
W	1	8	14	13	45	37	21	0	1	1	0	141
WNW	1	7	24	20	41	15	6	0	0	0	0	114
NW	0	7	19	17	34	13	3	0	0	0	0	93
NNW	1	6	17	14	49	17	2	1	1	0	0	108
Tot	17	128	279	387	923	506	141	38	13	2	0	2434
Hours of Calm ..... 7												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 2441												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class F Moderately Stable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	2	13	15	10	9	1	0	0	0	0	0	50
NNE	2	10	9	10	9	0	0	0	0	0	0	40
NE	0	10	14	11	5	0	0	0	0	0	0	40
ENE	0	6	14	5	8	0	0	0	0	0	0	33
E	4	7	27	7	4	0	0	0	0	0	0	49
ESE	4	14	19	9	2	0	0	0	0	0	0	48
SE	1	21	57	45	29	0	0	0	0	0	0	153
SSE	3	14	31	68	156	25	0	0	0	0	0	297
S	1	6	15	18	81	48	6	0	0	0	0	175
SSW	0	4	14	14	27	12	0	0	0	0	0	71
SW	1	3	6	17	37	10	0	0	0	0	0	74
WSW	0	8	14	5	17	2	1	0	0	0	0	47
W	2	10	8	11	8	2	1	0	0	0	0	42
WNW	1	11	22	13	20	0	0	0	0	0	0	67
NW	2	8	17	21	11	0	0	0	0	0	0	59
NNW	1	10	2	11	21	2	0	0	0	0	0	47
Tot	24	155	284	275	444	102	8	0	0	0	0	1292
Hours of Calm ..... 8												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 130												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class G Extremely Stable based on lapse rate												
Elevations: Winds 10m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	1	6	16	13	0	0	0	0	0	0	0	36
NNE	4	13	13	10	0	0	0	0	0	0	0	40
NE	4	13	13	7	0	0	0	0	0	0	0	37
ENE	1	7	5	1	0	0	0	0	0	0	0	14
E	2	6	1	1	0	0	0	0	0	0	0	10
ESE	1	8	5	0	0	0	0	0	0	0	0	14
SE	4	9	6	5	3	0	0	0	0	0	0	27
SSE	2	15	19	27	32	7	0	0	0	0	0	102
S	2	12	3	7	14	1	0	0	0	0	0	39
SSW	1	6	6	8	1	0	0	0	0	0	0	22
SW	0	6	9	1	5	1	0	0	0	0	0	22
WSW	1	4	3	2	0	0	0	0	0	0	0	10
W	2	5	5	0	0	1	0	0	0	0	0	13
WNW	4	7	16	5	2	0	0	0	0	0	0	34
NW	1	8	20	8	7	0	0	0	0	0	0	44
NNW	0	5	15	8	2	0	0	0	0	0	0	30
Tot	30	130	155	103	66	10	0	0	0	0	0	494
Hours of Calm ..... 9												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 53												
Hours of Missing Data ..... 8												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
All Stabilities												
Elevations: Winds 60m    Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	2	11	15	50	69	115	135	129	30	2	558
NNE	0	2	7	14	73	89	98	112	87	10	0	492
NE	0	2	7	18	68	93	82	76	45	12	2	405
ENE	1	2	5	18	52	70	81	78	23	7	2	339
E	0	5	11	17	50	82	101	66	11	0	0	343
ESE	0	4	7	25	57	95	113	78	27	1	0	407
SE	0	9	37	50	162	183	168	101	57	4	0	771
SSE	0	5	18	44	118	171	183	182	127	17	0	865
S	1	6	9	30	74	149	191	190	243	63	8	964
SSW	0	2	7	13	68	123	148	188	263	38	22	872
SW	0	4	11	14	55	82	102	115	200	51	8	642
WSW	0	2	5	20	44	59	75	64	71	29	7	376
W	0	1	7	9	51	72	59	88	119	34	8	448
WNW	0	3	9	8	35	61	79	87	137	36	11	466
NW	1	4	10	12	42	57	91	76	92	39	12	436
NNW	0	5	6	13	35	64	68	73	76	22	7	369
Tot	3	58	167	320	1034	1519	1754	1709	1707	393	89	8753
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 8753												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class A Extremely Unstable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	0	0	0	0	1	0	0	0	1
NNE	0	0	0	0	0	1	3	8	8	0	0	20
NE	0	0	0	0	0	1	0	1	6	0	0	8
ENE	0	0	0	0	0	2	3	1	1	0	0	7
E	0	0	0	0	0	0	2	0	0	0	0	2
ESE	0	0	0	0	0	1	1	1	0	0	0	3
SE	0	0	0	0	0	9	4	0	3	0	0	16
SSE	0	0	0	0	1	0	4	2	3	3	0	13
S	0	0	0	0	1	3	0	3	9	0	1	17
SSW	0	0	0	0	2	6	4	7	12	1	5	37
SW	0	0	0	0	1	4	10	3	11	6	1	36
WSW	0	0	0	0	0	2	4	6	9	8	0	29
W	0	0	0	0	0	1	1	4	6	5	0	17
WNW	0	0	0	0	0	0	1	7	20	3	1	32
NW	0	0	0	0	0	0	1	4	13	3	1	22
NNW	0	0	0	0	0	0	1	3	1	2	0	7
Tot	0	0	0	0	5	30	39	51	102	31	9	267
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 267												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

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Joint Frequency Distribution												
January- December, 2015												
Class B Moderately Unstable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	0	2	4	4	5	7	0	0	22
NNE	0	0	0	0	1	9	5	4	5	1	0	25
NE	0	0	0	0	4	6	1	2	2	0	0	15
ENE	0	0	0	0	0	3	2	4	2	2	0	13
E	0	0	0	0	0	0	2	2	0	0	0	4
ESE	0	0	0	0	1	2	3	2	1	0	0	9
SE	0	0	0	0	4	10	6	0	0	0	0	20
SSE	0	0	0	0	10	11	8	3	5	3	0	40
S	0	0	0	0	6	12	3	6	14	1	0	42
SSW	0	0	0	0	3	7	9	11	11	1	0	42
SW	0	0	0	1	0	10	8	6	5	4	0	34
WSW	0	0	0	1	2	3	5	2	4	2	2	21
W	0	0	0	0	2	1	1	5	3	4	0	16
WNW	0	0	0	0	0	2	4	2	7	3	0	18
NW	0	0	0	0	1	0	3	2	5	1	0	12
NNW	0	0	0	0	0	4	6	6	6	3	0	25
Tot	0	0	0	2	36	84	70	62	77	25	2	358
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 358												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												



Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Joint Frequency Distribution												
January- December, 2015												
Class C Slightly Unstable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	1	6	6	9	6	11	1	0	40
NNE	0	0	0	1	6	9	4	6	10	0	0	36
NE	0	0	0	1	6	5	3	1	2	0	0	18
ENE	0	0	0	1	2	5	3	0	1	1	0	13
E	0	0	0	3	2	2	5	5	2	0	0	19
ESE	0	0	0	2	4	7	5	3	7	0	0	28
SE	0	0	0	2	14	20	4	4	3	0	0	47
SSE	0	0	0	4	23	15	15	7	8	4	0	76
S	0	0	0	2	8	17	15	8	9	3	1	63
SSW	0	0	0	2	11	14	15	6	12	1	1	62
SW	0	0	0	0	6	7	13	7	16	1	1	51
WSW	0	0	0	1	3	4	3	3	1	5	0	20
W	0	0	1	0	5	7	2	4	1	3	0	23
WNW	0	0	1	1	2	6	4	5	8	3	4	34
NW	0	0	0	0	2	4	9	5	3	1	0	24
NNW	0	0	0	0	6	8	2	0	10	1	0	27
Tot	0	0	2	21	106	136	111	70	104	24	7	581
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 581												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Joint Frequency Distribution												
January- December, 2015												
Class D Neutral based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	1	7	8	29	29	57	67	92	28	2	320
NNE	0	1	5	8	35	41	58	53	51	8	0	260
NE	0	2	7	11	33	53	38	30	19	12	2	207
ENE	0	1	2	11	28	27	24	17	11	4	2	127
E	0	1	5	11	31	34	30	27	6	0	0	145
ESE	0	2	3	12	29	48	34	21	13	1	0	163
SE	0	2	14	32	69	47	39	25	22	3	0	253
SSE	0	2	11	23	45	48	36	30	28	4	0	227
S	0	1	5	20	33	37	44	35	52	37	3	267
SSW	0	0	4	6	27	30	37	44	52	23	16	239
SW	0	2	4	9	26	35	29	42	53	23	6	229
WSW	0	0	3	10	15	15	20	17	18	11	4	113
W	0	1	3	7	29	39	20	27	45	12	7	190
WNW	0	1	7	5	23	29	30	24	47	24	5	195
NW	0	2	7	8	26	23	33	22	31	31	10	193
NNW	0	4	4	12	20	28	25	26	33	16	7	175
Tot	0	23	91	193	498	563	554	507	573	237	64	3303
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 333												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Joint Frequency Distribution												
January- December, 2015												
Class E Slightly Stable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	4	2	10	22	28	33	7	1	0	107
NNE	0	0	1	3	20	17	19	28	6	1	0	95
NE	0	0	0	4	17	16	23	25	10	0	0	95
ENE	1	1	2	3	16	20	28	20	1	0	0	92
E	0	3	3	3	9	32	32	11	1	0	0	94
ESE	0	2	2	5	16	23	46	29	6	0	0	129
SE	0	0	7	8	43	66	81	54	25	1	0	285
SSE	0	1	2	9	24	43	57	89	52	3	0	280
S	0	1	1	5	5	30	55	71	101	19	3	291
SSW	0	2	3	3	15	32	43	54	104	8	0	264
SW	0	1	2	3	18	15	21	36	72	10	0	178
WSW	0	0	1	7	13	20	23	21	20	0	1	106
W	0	0	0	1	6	15	19	31	55	9	1	137
WNW	0	1	0	0	4	10	26	32	32	3	1	109
NW	1	1	2	3	8	15	27	25	19	3	1	105
NNW	0	0	2	0	4	14	21	24	9	0	0	74
Tot	2	13	32	59	228	390	549	583	520	58	7	2441
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 2441												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Joint Frequency Distribution												
January- December, 2015												
Class F Moderately Stable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	0	0	2	1	4	5	14	3	0	0	29
NNE	0	1	0	2	6	10	3	8	4	0	0	34
NE	0	0	0	1	6	6	14	9	4	0	0	40
ENE	0	0	0	2	5	9	11	22	1	0	0	50
E	0	1	2	0	5	6	16	12	1	0	0	43
ESE	0	0	2	6	5	7	16	19	0	0	0	55
SE	0	7	11	6	25	24	33	18	3	0	0	127
SSE	0	2	3	4	9	49	56	47	30	0	0	200
S	1	3	3	3	11	29	53	62	48	3	0	216
SSW	0	0	0	1	9	20	28	43	61	4	0	166
SW	0	0	0	1	2	6	18	18	39	6	0	90
WSW	0	1	0	0	9	8	10	9	18	3	0	58
W	0	0	2	0	4	5	12	14	9	1	0	47
WNW	0	1	1	0	4	7	9	10	21	0	0	53
NW	0	0	0	0	2	9	15	11	10	0	0	47
NNW	0	1	0	0	2	8	8	12	14	0	0	45
Tot	1	17	24	28	105	207	307	328	266	17	0	1300
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 130												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

Callaway Energy Center  
2015 Annual Radioactive Effluent Release Report

Joint Frequency Distribution												
January- December, 2015												
Class G Extremely Stable based on lapse rate												
Elevations: Winds 60m Stability 60m												
Wind Direction Sector	Wind Speed Range (m/s)											
	<0.50	0.5- 1	1.1- 1.5	1.6- 2	2.1- 3	3.1- 4	4.1- 5	5.1- 6	6.1- 8	8.1- 10	>10.00	Total
N	0	1	0	2	2	4	12	9	9	0	0	39
NNE	0	0	1	0	5	2	6	5	3	0	0	22
NE	0	0	0	1	2	6	3	8	2	0	0	22
ENE	0	0	1	1	1	4	10	14	6	0	0	37
E	0	0	1	0	3	8	14	9	1	0	0	36
ESE	0	0	0	0	2	7	8	3	0	0	0	20
SE	0	0	5	2	7	7	1	0	1	0	0	23
SSE	0	0	2	4	6	5	7	4	1	0	0	29
S	0	1	0	0	10	21	21	5	10	0	0	68
SSW	0	0	0	1	1	14	12	23	11	0	0	62
SW	0	1	5	0	2	5	3	3	4	1	0	24
WSW	0	1	1	1	2	7	10	6	1	0	0	29
W	0	0	1	1	5	4	4	3	0	0	0	18
WNW	0	0	0	2	2	7	5	7	2	0	0	25
NW	0	1	1	1	3	6	3	7	11	0	0	33
NNW	0	0	0	1	3	2	5	2	3	0	0	16
Tot	0	5	18	17	56	109	124	108	65	1	0	503
Hours of Calm ..... 0												
Hours of Variable Direction ..... 0												
Hours of Valid Data ..... 53												
Hours of Missing Data ..... 7												
Hours in Period ..... 8760												

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## Appendix C

### Corrections to Prior Annual Radioactive Effluent Release Reports

Callaway Energy Center  
2015 Annual Radioactive Effluent Release ReportCallaway Energy Center  
2014 Annual Radioactive Effluent Release ReportTABLE 3:  $^3\text{H}$  RESULTS FOR SAMPLES DURING THE LSI

U1MW-031		U1MW-031		U1MW-031	
Sample Date	$^3\text{H}$ Conc. (pCi/L)	Sample Date	$^3\text{H}$ Conc. (pCi/L)	Sample Date	$^3\text{H}$ Conc. (pCi/L)
25-Jul-14	1,644,880 1,569,566	25-Aug-14	165,440	28-Oct-14	5,703
01-Aug-14	296,323	26-Aug-14	163,544	10-Oct-14	9,476
08-Aug-14	110,120	27-Aug-14	159,459	04-Nov-14	9,024
11-Aug-14	111,262	28-Aug-14	171,980	11-Nov-14	9,233
13-Aug-14	102,716	02-Sep-14	189,259	18-Nov-14	2,435
15-Aug-14	100,448	09-Sep-14	213,378	24-Nov-14	1,477
16-Aug-14	105,979	16-Sep-14	121,001	3-Dec-14	3,782
20-Aug-14	142,203	23-Sep-14	88,573	8-Dec-14	6,507
21-Aug-14	155,603	30-Sep-14	43,326	22-Dec-14	7,615
22-Aug-14	157,542	07-Oct-14	29,693	12-Jan-15	6,269
23-Aug-14	154,238	14-Oct-14	9,125	13-Feb-15	4,553
24-Aug-14	157,665	21-Oct-14	7,927		
U1MW -047		U1MW -058		U1MW -032	
Sample Date	$^3\text{H}$ Conc. (pCi/L)	Sample Date	$^3\text{H}$ Conc. (pCi/L)	Sample Date	$^3\text{H}$ Conc. (pCi/L)
04-Nov-14	5,152	25-Nov-14	5,721	14-Nov-14	<179
11-Nov-14	4,374	22-Dec-14	8,512		
18-Nov-14	4,415	12-Jan-15	7,121		
24-Nov-14	4,846				
3-Dec-14	5,491				
8-Dec-14	5,050				

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U1MW -034		U1MW -036	
Sample Date	<sup>3</sup> H Conc. (pCi/L)	Sample Date	<sup>3</sup> H Conc. (pCi/L)
28-Oct-14	10,451	28-Oct-14	18,674
30-Oct-14	10,304	30-Oct-14	18,195
04-Nov-14	11,086	07-Nov-14	18,577
11-Nov-14	11,727	11-Nov-14	18,698
18-Nov-14	9,968	18-Nov-14	17,697
24-Nov-14	9,902	24-Nov-14	17,222
3-Dec-14	8,318	3-Dec-14	16,094
8-Dec-14	8,226	8-Dec-14	15,143
22-Dec-14	8,950	22-Dec-14	13,849
12-Jan-15	7,748	12-Jan-15	13,295
13-Feb-15	6,701	13-Feb-15	12,732

U1MW -033		U1MW -035		U1MW -037	
Sample Date	<sup>3</sup> H Conc. (pCi/L)	Sample Date	<sup>3</sup> H Conc. (pCi/L)	Sample Date	<sup>3</sup> H Conc. (pCi/L)
14-Nov-14	<179	28-Oct-14	<174	28-Oct-14	<174
		30-Oct-14	229	30-Oct-14	<136
		04-Nov-14	<175		

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