Ameren MISSOURI

Callaway Plant

April 27, 2012

ULNRC-05854

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

40 CFR 190

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
2011 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Please find enclosed the 2011 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.

This letter does not contain new commitments.

If there are any questions, please contact us.

Sincerely,

Luke H. Graessle
Director, Operations Support

HAO/nls

Enclosed: 2011 Annual Radioactive Effluent Release Report

cc: Mr. Elmo E. Collins
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
1600 East Lamar Boulevard
Arlington, TX 76011-4511

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Kaly Kalyanam
Senior Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8G14
Washington, DC 20555-2738

Index and send hardcopy to QA File A160.0761

Hardcopy:

Certrec Corporation
4150 International Plaza Suite 820
Fort Worth, TX 76109
(Certrec receives ALL attachments as long as they are non-safeguards and may be publicly disclosed.)

Electronic distribution for the following can be made via Responses and Reports ULNRC Distribution:

A. C. Heflin
F. M. Diya
C. O. Reasoner III
L. H. Graessle
S. M. Maglio
T. B. Elwood
R. Holmes-Bobo
NSRB Secretary
Mr. Paul Parmenter, Director (SEMA)
Mr. Thomas Mohr, Senior REP Planner (SEMA)
Mr. Tom Masso, REP Planner (SEMA)
Mr. Bill Muilenburg (WCNOC)
Mr. Tim Hope (Luminant Power)
Mr. Ron Barnes (APS)
Mr. Tom Baldwin (PG&E)
Mr. Wayne Harrison (STPNOC)
Ms. Linda Conklin (SCE)
Mr. John O'Neill (Pillsbury Winthrop Shaw Pittman LLP)
Mr. Dru Buntin (DNR)

Callaway Energy Center 2011 Annual Radioactive Effluent Release Report

Facility Operating License NPF-30
Docket No. 50-483

Abstract

The Annual Radioactive Effluent Release Report covers the operation of the Callaway Energy Center during the year 2011. 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. 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 Callaway Energy Center Technical Specification 5.6.3. This report is for the period January 1, 2011 to December 31, 2011.

The dose 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 Radiological 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

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}C released in gaseous effluents was calculated as described in EPRI Technical Report 1021106[1] and is documented in HPCI 12-02[2].

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.

[1] *Estimation of Carbon- 14 in Nuclear Power Plant Gaseous Effluents*, Technical Report 1011106, Electric Power Research Institute, December, 2010.
[2] HPCI 12-02, "Dose to the Member of the Public from the Release of ^{14}C Gaseous Effluents for 2011".

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 X/Q, as described in the ODCM. The organ dose from ^{14}C was calculated as described in EPRI Technical Report 1021106[3] and is documented in HPCI 12-02[4].

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 from direct radiation sources, including dose from outdoor water storage tanks and direct dose due to ^{16}N from operation of the unit, plus the organ dose from inhalation of ^{14}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) 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.

[3] *Estimation of Carbon- 14 in Nuclear Power Plant Gaseous Effluents*, Technical Report 1011106, Electric Power Research Institute, December, 2010.
[4] HPCI 12-02, "Dose to the Member of the Public from the Release of ^{14}C Gaseous Effluents for 2011".

6.4 Annual Land Use Census Changes

The evaluation of the 2011 Land Use Census is documented in HPCI 12-01.[5] There were no changes 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

Specifications covering the Limiting Conditions of Operations (LCO) for effluent monitoring instrumentation are provided in Radiological Effluent Control (REC) 16.11.1. 3 and 16.11.2.4. The ACTION statement implements provisions that when taken as specified complete requirements to demonstrate functionality. When the required ACTION is not met, the equipment is removed from service or declared non- functional. This report provides an explanation for periods of time when inoperability occurred.

REC 16.11.2.4, Table 16.11-5 requires the containment purge system particulate sampler functional during core alterations and movement of irradiated fuel within the containment. On October 23, 2011, with fuel movement in progress, a routine scheduled surveillance of the containment shutdown purge found the flow rate to be 7746 cfm. The allowed flow rate is 20,000 ± 10%. This represented an increase in the ratio of the isokinetic probe inlet velocity to the duct velocity by a factor of 2.6. Per Table C1 of ANSI N13.1-1969, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities", this would have resulted in a loss of >50% of the large particles, therefore the sampling was not isokinetic and the sample may not have been representative of the process stream[6]. The low flow condition was discovered at approximately 04:30 and full flow was restored at approximately 09:44. Containment particulate effluent is filtered through HEPA filters downstream of the sample point and is discharged through the Unit Vent. All particulate effluent discharged through the Unit Vent is sampled by the Unit Vent particulate sampler prior to discharge. The Unit Vent particulate sampler was functional during the period of low containment purge flow rate and the particulate activity discharged via the Unit Vent was normal. All particulate activity discharged through the Unit Vent is accounted in the gaseous effluent tables of this report. The loss of isokinetic sampling for the containment purge exhaust had no effect on the accuracy of the particulate activity shown in the gaseous effluent tables of this report.

6.6 Offsite Dose Calculation Manual Changes

There were no changes to the Offsite Dose Calculation Manual during the reporting period.

6.7 Process Control Program Changes

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

[5] HPCI 12-01, "Evaluation of the 2011 Annual Land Use Census"
[6] CARs 201108757, 201108954 Action 2.2, & 201110696.

6.8 Corrections to Previous Reports

There are no corrections to previous reports.

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

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 (%)[7]**
Fission & Activation Gases	Ci	3.95E+00	2.05E+00	4.22E+00	9.42E+00	1.96E+01	20
Avg Rel Rate	µCi/s	5.07E-01	2.61E-01	5.31E-01	1.19+00	6.21E-01	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
^{131}Iodine	Ci	3.28E-06	6.02E-07	4.92E-08	6.30E-06	1.02E-05	23
Avg Rel Rate	µCi/s	4.22E-07	7.65E-08	6.19E-09	7.93E-07	3.24E-07	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Particulates	Ci	9.27E-07	6.46E-10	3.56E-10	3.71E-06	4.64E-06	30
Avg Rel Rate	µCi/s	1.19E-07	8.22E-11	4.48E-11	4.66E-07	1.46E-07	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Gross Alpha	Ci	2.17E-07	3.36E-07	7.18E-08	2.60E-07	8.85E-07	
^{3}H	Ci	6.09E+00	1.35E+01	1.18E+01	1.10E+01	4.24E+01	14
Avg Rel Rate	µCi/s	7.38E-01	1.72E+00	1.49E+00	1.38E+00	1.33E+00	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
^{14}C [8]	Ci	2.90E+00	2.90E+00	2.90E+00	2.90E+00	1.16E+01	

[7] Safety Analysis calculation 87-063-00, January 6, 1988
[8] ^{14}C activity is estimated based on EPRI report TR-1021106, *Estimation of ^{14}C in Nuclear Power Plant Effluents*, December, 2010.

Table A-1A: Gaseous Effluents- Ground Level Release- Batch Mode						
Fission & Activation Gases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{133}Xe	Ci	1.27E-02	3.43E-02	1.12E-02	7.04E-01	7.62E-01
^{85}Kr	Ci	1.20E+00	0.00E+00	1.30E-02	2.99E+00	4.20E+00
^{135}Xe	Ci	1.90E-03	3.93E-03	1.85E-03	2.71E-02	3.48E-02
^{41}Ar	Ci	4.07E-02	9.67E-02	4.82E-02	4.32E-01	6.18E-01
^{85m}Kr	Ci	0.00E+00	3.27E-05	0.00E+00	0.00E+00	3.27E-05
^{135m}Xe	Ci	0.00E+00	6.45E-05	0.00E+00	0.00E+00	6.45E-05
Total	Ci	1.25E+00	1.35E-01	7.42E-02	4.15E+00	5.61E+00
Iodines & Halogens	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{131}I	Ci	0.00E+00	0.00E+00	0.00E+00	7.23E-07	7.23E-07
^{132}I	Ci	0.00E+00	0.00E+00	0.00E+00	6.20E-05	6.20E-05
Total	Ci	0.00E+00	0.00E+00	0.00E+00	6.28E-05	6.28E-05
Particulates	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{95}Nb	Ci	0.00E+00	0.00E+00	0.00E+00	1.99E-07	1.99E-07
^{58}Co	Ci	0.00E+00	0.00E+00	0.00E+00	5.87E-07	5.87E-07
^{60}Co	Ci	0.00E+00	0.00E+00	0.00E+00	5.94E-07	5.94E-07
^{51}Cr	Ci	0.00E+00	0.00E+00	0.00E+00	2.33E-06	2.33E-06
Total	Ci	0.00E+00	0.00E+00	0.00E+00	3.71E-06	3.71E-06
^{3}H	Ci	3.57E-01	1.75E+00	7.58E-01	3.38E+00	6.25E+00
Gross α	Ci	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
^{14}C	Ci	4.75E-01	4.75E-01	4.75E-01	4.75E-01	1.90E+00

Table A-1B: Gaseous Effluents- Ground Level Release- Continuous Mode						
Fission & Activation Gases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{133}Xe	Ci	2.02E+00	1.68E+00	3.50E+00	4.07E+00	1.13E+01
^{135}Xe	Ci	6.66E-01	2.38E-01	6.50E-01	1.03E+00	2.58E+00
^{41}Ar	Ci	0.00E+00	0.00E+00	0.00E+00	1.35E-01	1.35E-01
^{133m}Xe	Ci	0.00E+00	0.00E+00	0.00E+00	3.36E-02	3.36E-02
^{85m}Kr	Ci	9.19E-03	0.00E+00	0.00E+00	0.00E+00	9.19E-03
Total	Ci	2.69E+00	1.92E+00	4.15E+00	5.27E+00	1.40E+01
Iodines & Halogens	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{131}I	Ci	3.28E-06	6.02E-07	4.92E-08	5.58E-06	9.51E-06
^{132}I	Ci	0.00E+00	0.00E+00	0.00E+00	1.44E-04	1.44E-04
^{133}I	Ci	2.81E-06	0.00E+00	0.00E+00	0.00E+00	2.81E-06
Total	Ci	6.09E-06	6.02E-07	4.92E-08	1.50E-04	1.57E-04
Particulates	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{63}Ni	Ci	9.27E-07	6.46E-10	3.56E-10	0.00E+00	9.28E-07
Total	Ci	9.27E-07	6.46E-10	3.56E-10	0.00E+00	9.28E-07
^{3}H	Ci	5.73E+00	1.17E+01	1.11E+01	7.61E+00	3.61E+01
Gross α	Ci	2.17E-07	3.37E-07	7.18E-08	2.60E-07	8.86E-07
^{14}C	Ci	2.43E+00	2.43E+00	2.43E+00	2.43E+00	9.70E+00

Table A-2: Liquid Effluents- Summation of All Releases							
Summation of All Liquid Releases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total**	**Est. Uncert. (%)[9]**
Fission and Activation Products[10]	Ci	7.18E-03	6.81E-03	2.30E-02	1.01E-01	1.38E-01	20
Avg Diluted Conc	µCi/ ml	4.39E-08	3.89E-08	6.97E-08	3.68E-07	1.46E-07	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
^{3}H	Ci	1.39E+02	2.97E+02	7.19E+02	3.49E+02	1.50E+03	14
Avg Diluted Conc	µCi/ ml	8.51E-04	1.70E-03	2.18E-03	1.27E-03	1.60E-03	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Dissolved & Entrained Gases	Ci	0.00E+00	2.09E-05	3.16E-03	1.39E-02	1.71E-02	27
Avg Diluted Conc	µCi/ ml	0.00E+00	1.19E-10	9.58E-09	5.05E-08	1.81E-08	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Gross α	Ci	0.00E+00	1.43E-04	0.00E+00	2.90E-04	4.33E-04	29
Avg Diluted Conc	µCi/ ml	0.00E+00	8.16E-10	0.00E+00	1.06E-09	4.59E-10	
Vol Liquid Effluent[11]	Liters	4.81E+06	3.82E+06	8.10E+06	8.29E+06	2.50E+07	
Dilution Volume[12]	Liters	1.59E+08	1.71E+08	3.21E+08	2.66E+08	9.18E+08	
Avg river flow[13]	m^3/s	2.69E+03	5.11E+03	5.52E+03	2.17E+03	3.87E+03	

[9] Safety Analysis calculation 87-063-00, January 6, 1988
[10] Excludes ^{3}H, noble gases, and gross alpha.
[11] Primary system liquid effluent plus secondary liquid effluent, prior to dilution.
[12] Does not include Missouri River dilution.
[13] Average Missouri River flow for the year at the Hermann, MO monitoring station as reported by the USGS.

Table A-2A: Liquid Effluents- Batch Mode						
Fission & Activation Products	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{60}Co	Ci	3.23E-04	1.36E-03	9.02E-03	5.64E-02	6.71E-02
^{125}Sb	Ci	5.85E-03	2.07E-03	9.79E-03	2.51E-02	4.28E-02
^{63}Ni	Ci	5.30E-04	2.75E-03	1.62E-03	2.90E-03	7.80E-03
^{131}I	Ci	0.00E+00	0.00E+00	1.33E-03	3.76E-03	5.09E-03
^{124}Sb	Ci	7.10E-05	0.00E+00	0.00E+00	3.59E-03	3.66E-03
^{137}Cs	Ci	1.61E-04	1.83E-04	3.25E-04	8.30E-04	1.50E-03
^{58}Co	Ci	1.03E-04	4.30E-04	2.23E-04	6.82E-04	1.44E-03
^{122}Sb	Ci	2.13E-06	0.00E+00	0.00E+00	1.39E-03	1.39E-03
^{132}I	Ci	0.00E+00	0.00E+00	0.00E+00	1.30E-03	1.30E-03
^{51}Cr	Ci	1.16E-04	0.00E+00	2.03E-04	7.26E-04	1.05E-03
^{129}Te	Ci	0.00E+00	0.00E+00	0.00E+00	9.11E-04	9.11E-04
^{99}Mo	Ci	0.00E+00	0.00E+00	1.71E-04	6.92E-04	8.63E-04
^{99m}Tc	Ci	0.00E+00	0.00E+00	1.71E-04	6.92E-04	8.63E-04
^{54}Mn	Ci	0.00E+00	0.00E+00	1.23E-04	7.04E-04	8.27E-04
^{132}Te	Ci	0.00E+00	0.00E+00	0.00E+00	4.13E-04	4.13E-04
^{144}Ce	Ci	0.00E+00	0.00E+00	0.00E+00	3.76E-04	3.76E-04
^{144}Pr	Ci	0.00E+00	0.00E+00	0.00E+00	3.76E-04	3.76E-04
^{24}Na	Ci	0.00E+00	0.00E+00	0.00E+00	5.69E-05	5.69E-05
^{134}Cs	Ci	1.49E-05	2.71E-05	3.04E-06	9.85E-06	5.49E-05
^{95}Nb	Ci	0.00E+00	0.00E+00	0.00E+00	4.28E-05	4.28E-05
Total	Ci	7.17E-03	6.82E-03	2.30E-02	1.01E-01	1.38E-01

Table A-2A: Liquid Effluents- Batch Mode (continued)						
Dissolved & Entrained Gases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total for the year**
^{133}Xe	Ci	0.00E-00	1.40E-05	3.16E-03	1.39E-02	1.71E-02
^{87}Kr	Ci	0.00E-00	6.87E-06	0.00E-00	0.00E-00	6.87E-06
Total	Ci	0.00E-00	2.09E-05	3.16E-03	1.39E-02	1.71E-02
^{3}H	Ci	1.39E+02	2.97E+02	7.19E+02	3.49E+02	1.50E+03
Gross α	Ci	0.00E-00	1.43E-04	0.00E-00	2.90E-04	4.33E-04

Table A-3: Solid Waste & Irradiated Fuel Shipments

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

1. TYPE OF WASTE	Units	Period Jan – Jun	Period Jul - Dec	Est. Total Error (%)
Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	N/A	7.31E+00 3.99E+00	± 25%
Dry compressible waste, contaminated equip., etc.	m^3 Ci	N/A	2.32E+02 8.21E-01	± 25%
Irradiated components, control rods, etc.	m^3 Ci	N/A	N/A	± 25%
Other (low level secondary resin, oily waste)	m^3 Ci	N/A	N/A	± 25%

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

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (by Type of Waste)				
a. Spent resins, filters, evaporator bottoms, etc.				
Nuclide	**% Abundance**	**Jan – Jun Ci**	**% Abundance**	**Jul – Dec Ci**
^{55}Fe	N/A	N/A	45.160	1.80E+00
^{63}Ni	N/A	N/A	29.193	1.17E+00
^{60}Co	N/A	N/A	14.371	5.74E-01
^{137}Cs	N/A	N/A	5.705	2.28E-01
^{3}H	N/A	N/A	1.747	1.45E-01
b. Dry compressible waste, contaminated equipment, etc.				
^{3}H	N/A	N/A	1.747	1.43E-02
^{55}Fe	N/A	N/A	27.293	2.24E-01
^{58}Co	N/A	N/A	1.767	1.45E-02
^{60}Co	N/A	N/A	17.857	1.47E-01
^{63}Ni	N/A	N/A	28.045	2.30E-01
^{95}Zr	N/A	N/A	1.500	1.23E-02
^{95}Nb	N/A	N/A	2.612	2.14E-02
^{134}Cs	N/A	N/A	4.293	3.52E-02
^{137}Cs	N/A	N/A	12.616	1.04E-01
c. Irradiated components, control rods, etc.				
None	N/A	N/A	N/A	N/A

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

d. Other				
Nuclide	**% Abundance**	**Jan – Jun Ci**	**% Abundance**	**Jul – Dec Ci**
^{3}H	N/A	N/A	3.309	1.59E-01
^{55}Fe	N/A	N/A	42.113	2.03E+00
^{60}Co	N/A	N/A	14.965	7.20E-01
^{63}Ni	N/A	N/A	28.997	1.40E+00
^{134}Cs	N/A	N/A	1.455	7.00E-02
^{137}Cs	N/A	N/A	6.884	3.31E-01

3. SOLID WASTE DISPOSITION				
Number of Shipments	**Mode of Transport**	**Destination**	**Class of Solid Waste Shipped**	**Type of Container**
4	HITTMAN TRANSPORT	DURATEK SERVICES, INC.	A	INTERMODAL CONTAINER
1	TRI STATE MOTOT TRANSIT CO.	DURATEK SERVICES, INC.	A	INTERMODAL CONTAINER
2	HITTMAN TRANSPORT	STUDSVIK PROCESSING FACILITY-ERWIN	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.

Table A-4: Dose Assessments, 10 CFR 50, Appendix I					
	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Yearly total**
Liquid Effluent Dose Limit, Total Body (mrem)	1.5	1.5	1.5	1.5	3
Total Body Dose (mrem)	7.58E-4	1.10E-3	2.01E-3	3.45E-3	7.19E-3
% Limit (%)	0.05	0.07	0.13	0.23	0.24
Liquid Effluent Dose Limit, Maximum Organ (mrem)	5	5	5	5	10
Maximum Organ Dose (mrem)	1.01E-3	1.39E-3	2.42E-3	4.64E-3	9.25E-3
% Limit (%)	0.02	0.03	0.05	0.09	0.09
Gaseous Effluent Dose Limit, Gamma Air (mrem)	5	5	5	5	10
Gamma Air Dose (mrad)	1.28E-04	7.64E-05	8.08E-05	2.49E-04	4.50E-04
% Limit (%)	0.00	0.00	0.00	0.00	0.00
Gaseous Effluent Dose Limit, Beta Air (mrem)	10	10	10	10	20
Beta Air Dose (mrad)	1.86E-04	7.93E-05	1.50E-04	4.22E-04	8.19E-04
% Limit (%)	0.00	0.00	0.00	0.00	0.00
Gaseous Effluent Dose Limit, Maximum Organ (mrem)	7.5	7.5	7.5	7.5	15
Maximum organ dose[14] (mrem)	1.22E-03	2.12E-03	1.82E-03	2.23E-3	7.39E-03
% Limit (%)	0.02	0.03	0.02	0.03	0.05
^{14}C in Gaseous Effluents					
Maximum organ dose (mrem)	2.21E-3	2.21E-3	2.21E-3	2.21E-3	8.84E-3

[14] Iodine, ^{3}H, and particulates with greater than an 8 day half- life.

Table A-5: EPA 40 CFR 190 Individual in the Unrestricted Area			
	Whole Body	**Thyroid**	**Any Other Organ**
Dose Limit	25 mrem	75 mrem	25 mrem
Dose	1.77E-02	1.85E-02	2.50E-02
% Limit	0.07%	0.02%	0.10%

Appendix B

Joint Frequency Tables; Totals of Hours at Each Wind Speed & Direction for the period January 1, 2011- December 31, 2011

Stability Class A							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	0	1	5	1	0	0	7
NNE	1	0	2	2	0	0	5
NE	1	0	0	0	0	0	1
ENE	0	0	1	0	0	0	1
E	0	0	0	1	0	0	1
ESE	0	0	1	1	0	0	2
SE	0	0	4	0	0	0	4
SSE	0	0	2	0	0	0	2
S	0	0	4	1	0	0	5
SSW	0	0	6	2	2	0	10
SW	0	4	14	3	0	0	21
WSW	0	0	7	5	0	0	12
W	0	2	5	7	2	0	16
WNW	0	4	27	9	1	0	41
NW	0	2	9	3	0	0	14
NNW	0	0	6	0	0	0	6
Total	2	13	93	35	5	0	148
Hours of calm data: 1							
Hours of invalid data:0							

Stability Class B							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	10	0	0	0	12
NNE	1	2	8	3	0	0	14
NE	0	0	4	0	0	0	4
ENE	0	1	7	0	0	0	8
E	0	1	0	1	0	0	2
ESE	0	1	3	1	0	0	5
SE	0	0	3	1	0	0	4
SSE	0	1	9	2	0	0	12
S	0	3	14	7	1	0	25
SSW	0	6	18	3	2	0	29
SW	0	6	19	5	0	0	30
WSW	1	5	5	5	0	0	16
W	0	10	2	2	1	0	15
WNW	0	9	8	1	0	0	18
NW	0	2	6	0	0	0	8
NNW	0	3	9	2	0	0	14
Total	2	52	125	33	4	0	216
Hours of calm data: 0							
Hours of invalid data: 1							

Stability Class C							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	0	10	16	3	0	0	29
NNE	0	10	7	1	0	0	18
NE	0	18	4	0	0	0	22
ENE	1	8	12	0	0	0	21
E	1	4	3	1	0	0	9
ESE	1	5	10	3	0	0	19
SE	0	20	19	2	0	0	41
SSE	1	13	20	3	0	0	37
S	2	20	23	4	1	0	50
SSW	0	26	32	9	3	0	70
SW	1	23	24	6	2	0	56
WSW	2	12	4	4	0	0	22
W	2	9	12	4	1	0	28
WNW	0	15	12	4	0	0	31
NW	0	15	5	0	0	0	20
NNW	0	8	10	2	0	0	20
Total	11	216	213	46	7	0	493
Hours of calm data: 0							
Hours of invalid data: 1							

Stability Class D							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	17	161	158	16	1	1	354
NNE	21	128	75	4	0	0	228
NE	15	104	68	2	0	0	189
ENE	19	104	71	2	0	0	196
E	26	92	67	15	0	0	200
ESE	20	113	77	6	0	0	216
SE	15	112	71	5	0	0	203
SSE	18	112	122	18	1	0	271
S	21	88	126	63	1	0	299
SSW	10	78	102	36	5	0	231
SW	20	63	53	17	1	0	154
WSW	13	51	28	7	0	0	99
W	19	55	60	21	0	0	155
WNW	19	78	75	11	0	0	183
NW	22	104	128	20	0	0	274
NNW	15	143	198	33	0	0	389
Total	290	1586	1479	276	9	1	3641
Hours of calm data: 6							
Hours of invalid data: 85							

Stability Class E							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	21	77	16	2	0	0	116
NNE	25	65	7	0	0	0	97
NE	25	45	7	0	0	0	77
ENE	39	35	8	0	0	0	82
E	27	68	8	0	0	0	103
ESE	33	99	22	0	0	0	154
SE	30	167	56	1	0	0	254
SSE	33	183	122	2	0	0	340
S	29	140	183	34	0	0	386
SSW	16	86	67	22	0	0	191
SW	21	68	52	3	0	0	144
WSW	33	61	23	1	0	0	118
W	45	92	31	0	0	0	168
WNW	27	92	18	1	0	0	138
NW	37	75	10	0	0	0	122
NNW	23	56	12	2	0	0	93
Total	464	1409	642	68	0	0	2583
Hours of calm data: 12							
Hours of invalid data: 22							

Stability Class F							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	19	27	0	0	0	0	46
NNE	20	25	0	0	0	0	45
NE	39	2	0	0	0	0	41
ENE	42	11	0	0	0	0	53
E	24	6	0	0	0	0	30
ESE	18	21	0	0	0	0	39
SE	21	62	0	0	0	0	83
SSE	21	179	11	0	0	0	211
S	29	109	9	0	0	0	147
SSW	18	54	11	0	0	0	83
SW	20	38	4	0	0	0	62
WSW	17	14	3	0	0	0	34
W	32	39	0	0	0	0	71
WNW	37	29	1	0	0	0	67
NW	27	24	0	0	0	0	51
NNW	16	23	0	0	0	0	39
Total	400	663	39	0	0	0	1102
Hours of calm data: 21							
Hours of invalid data: 11							

Stability Class G							
	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	19	8	0	0	0	0	27
NNE	20	5	0	0	0	0	25
NE	17	3	0	0	0	0	20
ENE	3	1	0	0	0	0	4
E	7	0	0	0	0	0	7
ESE	7	1	0	0	0	0	8
SE	10	6	0	0	0	0	16
SSE	34	45	2	0	0	0	81
S	24	12	0	0	0	0	36
SSW	15	9	0	0	0	0	24
SW	9	6	0	0	0	0	15
WSW	10	1	1	0	0	0	12
W	6	0	0	0	0	0	6
WNW	13	1	0	0	0	0	14
NW	32	11	0	0	0	0	43
NNW	31	15	0	0	0	0	46
Total	257	124	3	0	0	0	384
Hours of calm data: 25							
Hours of invalid data: 8							
Hours of good data: 8632= 98.5 % of total hours							

Stability Class A							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	0	2	2	2	0	0	6
NNE	1	1	2	3	0	0	7
NE	0	0	0	0	0	0	0
ENE	0	0	1	0	0	0	1
E	0	0	0	1	0	0	1
ESE	0	0	1	1	0	0	2
SE	0	0	0	2	0	0	2
SSE	0	0	1	3	0	0	4
S	0	0	0	5	0	0	5
SSW	0	0	4	2	1	2	9
SW	0	0	10	10	3	0	23
WSW	0	0	0	5	6	0	11
W	0	0	5	2	5	4	16
WNW	0	0	10	18	17	4	49
NW	0	0	2	7	1	0	10
NNW	0	0	0	3	0	0	3
Total	1	3	38	64	33	10	149
Hours of calm data: 0							
Hours of invalid data: 0							

Stability Class B							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	0	1	5	4	0	0	10
NNE	0	2	7	4	0	0	13
NE	0	0	3	0	0	0	3
ENE	0	1	7	1	0	0	9
E	0	2	0	0	0	0	2
ESE	0	0	3	2	0	0	5
SE	0	0	1	2	1	0	4
SSE	0	0	7	5	1	0	13
S	0	3	8	8	4	1	24
SSW	0	0	20	4	2	2	28
SW	0	0	19	8	3	2	32
WSW	0	1	7	3	5	1	17
W	0	0	13	0	3	1	17
WNW	0	2	6	6	3	1	18
NW	0	1	3	5	0	0	9
NNW	0	1	2	7	2	0	12
Total	0	14	111	59	24	8	216
Hours of calm data: 0							
Hours of invalid data: 1							

Stability Class C							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	0	4	14	6	2	0	26
NNE	0	11	10	3	0	0	24
NE	0	8	6	1	0	0	15
ENE	0	7	13	1	0	0	21
E	0	5	2	1	0	0	8
ESE	0	4	8	5	1	0	18
SE	0	9	25	4	1	0	39
SSE	1	10	17	9	1	0	38
S	0	14	22	8	4	1	49
SSW	1	13	27	14	5	5	65
SW	0	9	28	14	6	3	60
WSW	0	8	9	1	2	3	23
W	1	9	8	2	5	5	30
WNW	0	7	10	8	9	0	34
NW	0	7	10	3	1	0	21
NNW	0	3	10	4	1	0	18
Total	3	128	219	84	38	17	489
Hours of calm data: 1							
Hours of invalid data: 4							

Stability Class D							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	79	150	68	5	2	307
NNE	8	87	131	30	1	0	257
NE	9	56	88	31	1	0	185
ENE	8	51	100	29	1	0	189
E	8	50	90	19	8	0	175
ESE	8	53	108	36	9	0	214
SE	8	60	111	40	2	0	221
SSE	9	73	96	75	4	1	258
S	12	53	110	82	41	2	300
SSW	5	43	92	63	27	9	239
SW	8	37	55	31	22	5	158
WSW	8	37	27	23	16	2	113
W	7	29	43	40	23	9	151
WNW	8	50	46	71	29	6	210
NW	6	53	92	118	33	6	308
NNW	4	41	148	121	20	4	338
Total	119	852	1487	877	242	46	3623
Hours of calm data: 0							
Hours of invalid data: 109							

Stability Class E							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	3	24	56	22	2	0	107
NNE	7	16	61	8	0	0	92
NE	4	26	58	12	1	0	101
ENE	3	15	37	5	0	0	60
E	4	24	68	7	0	0	103
ESE	3	23	116	26	1	0	169
SE	2	23	165	80	2	0	272
SSE	2	29	103	129	3	0	266
S	3	22	93	202	42	2	364
SSW	5	16	79	104	30	5	239
SW	3	16	65	76	21	0	181
WSW	0	13	46	38	8	0	105
W	0	20	50	73	8	0	151
WNW	1	19	59	84	6	0	169
NW	3	16	51	47	3	0	120
NNW	3	18	38	20	1	0	80
Total	46	320	1145	933	128	7	2579
Hours of calm data: 1							
Hours of invalid data: 37							

Stability Class F							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	*4-7*	*8-12*	*13-18*	*19-24*	*>24*	*TOTAL*
N	3	6	13	8	0	0	30
NNE	0	9	19	15	0	0	43
NE	2	17	18	10	0	0	47
ENE	4	16	27	2	0	0	49
E	1	9	45	0	0	0	55
ESE	4	9	32	3	0	0	48
SE	1	13	52	18	0	0	84
SSE	2	11	60	43	0	0	116
S	2	14	100	53	0	0	169
SSW	0	13	51	64	3	0	131
SW	1	4	31	44	4	0	84
WSW	2	8	21	19	0	0	50
W	1	10	23	15	0	0	49
WNW	1	5	31	42	0	0	79
NW	2	9	31	20	0	0	62
NNW	2	1	7	13	0	0	23
Total	28	154	561	369	7	0	1119
Hours of calm data: 0							
Hours of invalid data: 15							

Stability Class G							
	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	7	10	8	0	0	27
NNE	5	8	11	7	0	0	31
NE	7	8	10	6	0	0	31
ENE	1	10	19	2	0	0	32
E	3	4	12	0	0	0	19
ESE	1	7	4	0	0	0	12
SE	4	11	7	0	0	0	22
SSE	0	10	13	8	0	0	31
S	2	11	41	9	0	0	63
SSW	1	5	13	10	0	0	29
SW	0	7	19	8	0	0	34
WSW	0	2	12	1	1	0	16
W	0	2	8	2	0	0	12
WNW	0	1	6	3	0	0	10
NW	1	6	5	2	0	0	14
NNW	2	3	12	9	0	0	26
Total	29	102	202	75	1	0	409
Hours of calm data: 0							
Hours of invalid data: 8							
Hours of good data: 8586=98.0% of total hours							