

April 27, 2010

ULNRC-05699

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  
2009 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT**



Please find enclosed the 2009 Annual Radioactive Effluent Release Report for Callaway Plant. This document is submitted in accordance with Sections 5.6.3 and 5.5.1 of the Technical Specifications.

If there are any questions, please contact us.

Sincerely,

A handwritten signature in black ink that reads "Scott A. Maglio". The signature is written in a cursive style with a large, sweeping flourish at the end.

Scott A. Maglio  
Regulatory Affairs Manager

DET/nls

Attachment: Annual Radioactive Effluent Release Report

ULNRC-05699

April 27, 2010

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## 2009 Radioactive Effluent Release Report



Docket no. 50-483

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## **1.0 INTRODUCTION**

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This report describes the AmerenUE (Union Electric Co.) Callaway Plant radioactive effluent releases for 2009. It is submitted in accordance with Section 5.6.3 of the Callaway Plant Technical Specifications.

A summary of radioactivity released in liquid and gaseous effluents and solid waste shipped from the Callaway Plant during the period from January 1, 2009 to December 31, 2009 is presented.

All liquid and gaseous effluents discharged during this reporting period complied with federal regulations and the limits in the Offsite Dose Calculation Manual (ODCM).



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## 2.0 SUPPLEMENTAL INFORMATION

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### 2.1 REGULATORY LIMITS

The Radiological Effluent Control (REC) limits applicable to the release of radioactive material in liquid and gaseous effluents are provided below.

#### Fission and Activation Gases (Noble Gases)

The dose rate due to radioactive noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

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

- a. 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,
- b. 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.

#### Radioiodine, Tritium, And Particulates

The dose rate due to Iodine-131 and Iodine-133, tritium and all radionuclides in particulate form with half-lives greater than eight (8) days released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 1500 mrem/yr to any organ.

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

- a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,
- b. During any calendar year: Less than or equal to 15 mrem to any organ.



## Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to 10 times the concentrations specified in 10 CFR 20 Appendix B To Part 20, Table II, Column 2 (Effluent Concentrations) for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 microcuries/ml total activity.

The dose or dose commitment to an Individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

- a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ, and
- b. During any calendar year to less than or equal to 3 mrem to the whole body and to less than or equal to 10 mrem to any organ.

## Uranium Fuel Cycle Sources

The annual (calendar year) dose or dose commitment to any Member of the Public due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

## **2.2 AVERAGE ENERGY**

This requirement is not applicable to the Callaway Plant radiological effluent monitoring program since the release rate limits for fission and activation gases in gaseous effluent are not based on the average energy of the radionuclide mixture.

## **2.3 MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY**

Radionuclide concentrations in liquid and gaseous effluents were obtained by effluent sampling and radiological analysis in accordance with the requirements of Final Safety Analysis Report Table 16.11-1 and Table 16.11-4.

Gamma spectroscopy was the primary analysis technique used to determine the radionuclide composition and concentration of liquid and gaseous effluents. Composite samples were analyzed for Sr-89, Sr-90, Fe-55, Ni-63 and transuranic nuclides by an independent laboratory. Tritium and gross alpha were measured for both liquid and gaseous effluents using liquid scintillation counting and gas flow proportional counting techniques, respectively.

The total radioactivity in effluent releases was determined from the measured concentrations of each radionuclide present and the total volume of effluents discharged.

## 2.4 BATCH RELEASES

Summary information relating to batch releases of gaseous and liquid effluents to the environment from the Callaway Plant during the year 2009 is presented below.

### Liquid

UNITS		JAN- JUN	JUL- DEC
Number of batch releases:	---- 28		28
Total time period for batch releases:	Minutes 14,020		15,322
Maximum time period for batch releases:	Minutes	758	1,118
Average time period for batch releases:	Minutes 501		547
Minimum time	Minutes	463	454

period for batch releases:			
Average Missouri River flow during 2009 <sup>1</sup> :	ft <sup>3</sup> /sec	96,100	76,550

Gaseous

UNITS		JAN - JUN	JUL - DEC
Number of batch releases:	----	33	31
Total time period for batch releases:	Minutes	1,706	10,133
Maximum time period for batch releases:	Minutes	106	8,089
Average time period for batch releases:	Minutes	52	327
Minimum time period for batch releases:	Minutes	20	16

**2.5 ABNORMAL RELEASES**

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<sup>1</sup> <http://waterdata.usgs.gov>, United States Department of Interior – U.S. Geological Survey – USGS Surface Water Daily Data 06934500 Missouri River.

Liquid

Number of releases: 0 Total Activity released: 0

Gaseous

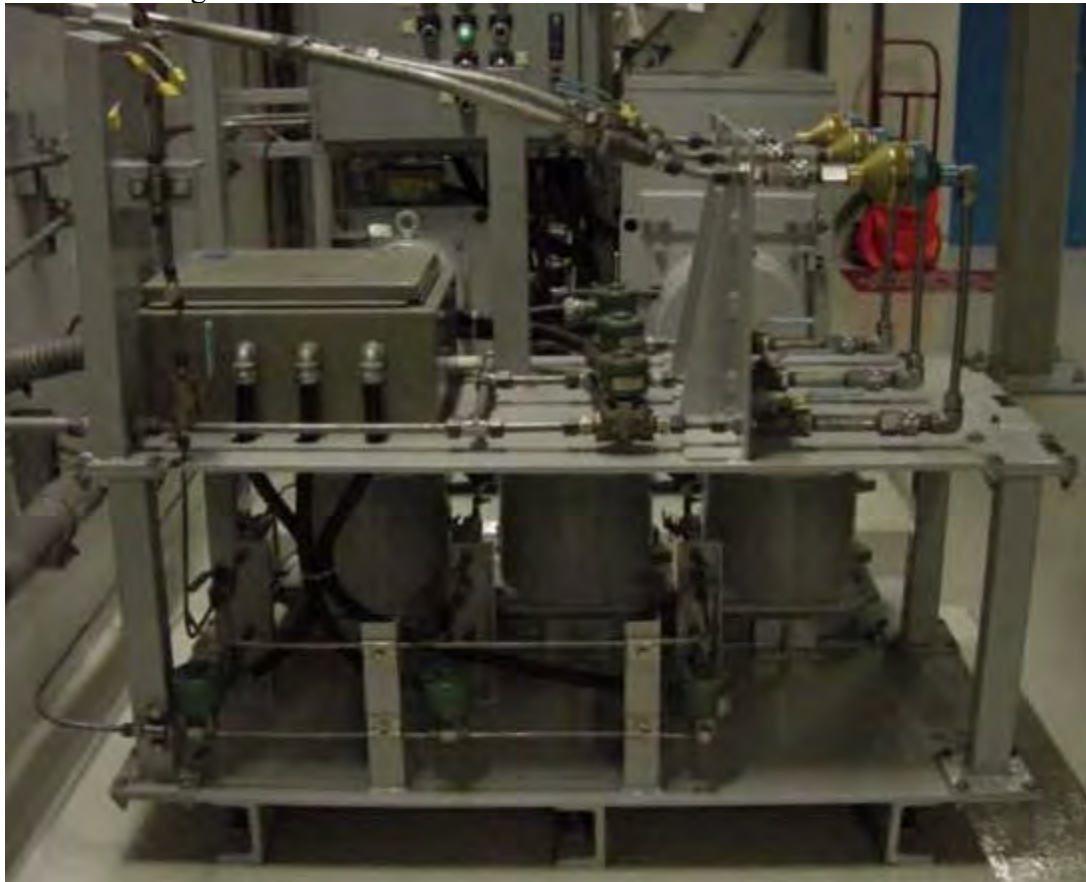
Number of releases: 0 Total Activity released: 0

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### **3.0 SUMMARY OF GASEOUS RADIOACTIVE EFFLUENTS**

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The quantity of radioactive material released in gaseous effluents during the year is summarized in Tables 1A and 1B. During 2009, all gaseous effluents were considered as ground level releases.



Gaseous effluents from the plant are continuously monitored. Shown is instrumentation to provide monitoring and grab sampling for iodine, particulates and noble gas.

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## 4.0 SUMMARY OF LIQUID RADIOACTIVE EFFLUENTS

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The quantity of radioactive material released in liquid effluents during the year is summarized in Tables 2A and 2B. During 2009, there was no continuous release of liquid effluent from the plant.



Liquid effluent releases from the plant are continuously monitored. Shown is a liquid radiation monitor shielded by lead to increase its sensitivity for monitoring discharged water.

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## **5.0 SOLID WASTES**

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The quantities of radioactive material released in shipments of solid waste for burial and of any irradiated fuel transported from the site during the year are summarized in Table 3. The total quantity and radioactivity reported in Table 3 for each waste type was for waste buried and includes wastes buried by waste reprocessors after volume reduction. The activity and fractional abundance of each nuclide was determined for each waste type based upon radiochemical analysis by an independent laboratory. The curie concentration of each nuclide listed in Table 3 was determined as the product of the fractional abundance and the total curies shipped. Those nuclides which comprise at least 1% of the total activity for a particular waste type are presented in Table 3.

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## **6.0 RELATED INFORMATION**

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### **6.1 UNPLANNED RELEASES**

Unplanned releases are:

- 1) Inadvertent or accidental releases of radioactive material.
- 2) Releases of radioactive material via normal pathways without a release permit, proper authorization, or proper sampling and analysis.
- 3) Releases which are conducted in such a manner as to result in significant deviation from the requirements of the release permit.

There were no unplanned releases from Callaway Plant during 2009. Thus, there were no notifications of any unplanned liquid or gaseous radioactive releases from the site to be reported in accordance with the plant technical specifications 5.6.3

pursuant to the reporting requirements of 10CFR50.36a, 10CFR50.72 or 10 CFR20.2203

## **6.2 CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL**

No revisions were made to APA-ZZ-01003, "Callaway Plant Off-Site Dose Calculation Manual" in 2009. FSAR change notice FSAR 08-029, "Revision to replace text references to "CRT" with "Visual Display" to be consistent with industry technology descriptions" was made January 27, 2009. This change updated the FSAR description of radiological monitoring systems in Chapters 11.5.2 and 12.3.4.2.2. with the wording "visual display" replacing the outdated cathode ray tube (CRT) terminology. There were no changes to FSAR Chapter 16.11 since the previous report.

## **6.3 MAJOR CHANGES TO RADWASTE TREATMENT SYSTEMS**

During 2009 there were no major changes to Radwaste systems.

## **6.4 LAND USE CENSUS CHANGES**

No changes were identified in the Callaway Plant 2009 Land Use Census Report that required a change to the location of the nearest resident yielding the highest calculated dose commitment.

## **6.5 INOPERABILITY OF EFFLUENT MONITORING INSTRUMENTATION**

INOPERABILITY and OUT OF SERVICE

Specifications covering the Limiting Conditions of Operations (LCO) for effluent monitoring instrumentation are provided in Chapter 16.11.5.2 of the FSAR. The ACTION section of this Specification implements provisions that when taken (within a specified time) complete requirements to demonstrate operability. When

ACTIONS cannot be met the equipment is removed from service or declared inoperable. This report provides explanation for periods of time when inoperability occurred.

Further, Out of Service times are recorded in the Callaway Equipment Out of Service Log (EOSL) Record. Times of inoperability or periods when radiation monitoring equipment was taken Out of Service are provided below.

It should be noted that the gaseous effluent radiation monitoring instrumentation channels are planned to be Out of Service for short periods for scheduled Channel Operational Tests and Electronic Calibration and other surveillances to satisfy acceptance criteria for the FSAR. During these periods alternate sampling is maintained using a separate monitor or auxiliary sampling equipment.

On 08/24/2009 the containment purge exhaust gas detector GTRE0033 was Out of Service for modifications. Work on job 07006477 included repair to a microprocessor circuit board in the detector's computer controlled RM-80 unit and planned replacement of the vacuum pressure transducer. A modification to replace the obsolete Robinson-Halpern vacuum pressure transducers with Rosemount Model 1153 vacuum pressure transmitters was completed. The Model 1153 series pressure transmitters provide precision pressure measurements in nuclear applications and have shown to be highly reliable.

On 08/26/2009 the Containment Purge Exhaust Gas Detector GTRE0033 repair work extended past original 0930 completion time due to problems with the iodine channel. Also, on this day Operators from the Callaway Work Control Center performed a local leak rate test on the containment purge supply and exhaust penetrations. The work was moved up to 08/26/2009 from 08/27/2009. One of the final steps of the local leak rate test is to open the containment mini-purge inner containment downstream damper, GTHZ0011, to vent the test volume into containment. GTHZ0011 was opened for 16 seconds while the containment purge exhaust gas detector GTRE0033 was not yet operational. This resulted in an unplanned entry into Technical Specification 3.0.3 Limiting Condition Operability Applicability. A Corrective Action Response Report 200906686 documented actions taken to resolve the condition and the changes made to prevent recurrence.

On 10/20/2009 work on job 07006479 was completed to replace the obsolete vacuum pressure transducer with the new Model 1153 Rosemount pressure transmitters on the containment building exhaust plenum unit radiation monitor GTRE0021A. This completed the campaign to upgrade Callaway process radiation monitors with new vacuum pressure transmitters.



From 10/20/2009 08:57 to 10/26/2009 23:14 the Radwaste Building Vent Effluent Monitoring instruments GHRE0010A and GHRE0010B were made inoperable while the Radwaste Building Elevation 2022' Exhaust HEPA Filter Adsorber Unit FGH01 was worked on a scheduled job 09509198 for replacement of the ventilation system filter charcoal bed.

From 12/23/09 08:00 to 12/23/2009 18:37 job 08505097 was worked on the Radwaste Building Exhaust Fans Discharge Header Radiation Transmitter GHRT0010B to perform a calibration the instrumentation loop. This job was completed for the Low and Mid range detector channels and the High range detector check source functioned satisfactorily. However, when the calibration was completed the High Range channel would not return from Blue status (meaning trouble on the channel) to Green status. This resulted in a condition where the monitor was correctly performing it's indication and ODCM sampling for the Low and Middle Range Channels. Without further investigation the exact underlying cause of the Blue status was uncertain. As such the High Range channel which is used for automatic isolation during an off-normal event could not be confirmed to be fully functional.

Following a review by the Engineering Department and the Control Room the monitor was returned to service on 12/23/2009 18:37 with the High Range channel still in its "Blue" status. A new work request, job 09008605 was created to trouble shoot the condition along with a corrective action request (CAR) 200910504 to document the status.

Monitor GHRT0010B operated in this condition for the remaining seven days of the calendar year. When the year ended work request job 09008605 had not been performed and the fix for the Blue status indication was not yet identified.

Review of the Radwaste building operations from 12/23/2010 through 12/31/2010 indicated normal operational activities and there were no discharges (releases) of waste gas from the waste gas decay tanks during this time period.

Confirmation of the normal operability of the GHRT0010 monitor was provided by review of air sample data for the week of 12/23/2009 through 12/31/2009 as recorded in the release permit RP13-2009-G0002:63. The effluent releases (noble gases) during this week are included in this report and contributed 1.48E-04 mrad gamma and 4.11E-04 mrem beta and 5.48E-03 mrem total body to the annual totals in Table 6.

Subsequently, on March 5, 2010 another CAR 201001963 was created to evaluate functionality of monitor GHRE0010B Radwaste Building Exhaust Fans Discharge Header Gas Detector. At this time the System Engineer working with the Instrument & Control Department and instrument vendor determined that the ongoing Blue light status condition for the High Range channel was a condition to cause the entire monitor to be considered inoperable. Readers note - the Inoperability for GHRE0010 was determined retrospectively in March 2010 to include the last seven days in 2009. Therefore, additional information will be provided in the 2010 Annual Radioactive Release Report for the Inoperable periods in 2010.

## **6.6 INSTANCES OF LIQUID HOLDUP TANKS OR WASTE GAS DECAY TANKS EXCEEDING TECHNICAL SPECIFICATION LIMITS**

During 2009 all liquid tanks and waste gas decay tanks were within FSAR limits specified in Radioactive Effluent Controls sections 16.11.1 and 16.11.2.

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## **7.0 METEOROLOGICAL DATA**

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The on-site meteorological data for this reporting period is presented in Table 4. The data is presented as Cumulative Joint Frequency Distributions of wind speed and wind direction by atmospheric stability class for the 10 and 60 meter tower elevations.

### Data Review and Recovery

The on-site meteorological hourly data capture for 2009 was extremely good exceeding 99%.

Notable issues in 2009 were a Meteorological Tower lightning strike and the removal of a line of trees along the road in the vicinity of the tower.

On July 28, 2009 at 17:38 the A Train of the Meteorological Tower was taken Out of Service for repairs due to loss of data due to a lightning strike during a rain storm. The equipment was repaired and restored to operability at 15:07 on July 31, 2009. Lightning damage was done to the 60 meter wind direction sensors on the "A" boom which were replaced and recalibrated. The surge protection equipment prevented any damage to the computer/ data logger equipment.

In May 2009 several trees along the roadway near the Meteorological tower were removed when their height exceeded the 10 to 1 distance-to-height ratio recommended in regulatory guidance. With oversight from the meteorological system engineer and Ameren Vegetation Department the roadside trees nearest to the tower were removed. All trees located around the meteorological tower now meet the standards in regulatory guidance.

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## **8.0 ASSESSMENT OF DOSES**

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Assessment of doses to the maximum exposed individual from gaseous and liquid effluents released was performed in accordance with the ODCM as described in the following sections. For all liquid and airborne effluents released from the Callaway Plant during this year, the annual dose to the maximum exposed individual was less than 1% of the Radiological Effluent Control Limits presented in Section 2.1 of this report.

### **8.1 DOSE AT THE SITE BOUNDARY FROM GASEOUS EFFLUENTS**

The dose at the Site Boundary was due to plume exposure from noble gases, ground plane exposure, and inhalation. It was conservatively assumed that a hypothetical maximum exposed individual was present at the Site Boundary location with the most limiting atmospheric dispersion (based on actual meteorological conditions for the year). Dose was conservatively calculated using a child as the critical age group.

The dose from gaseous effluents at the Site Boundary for 2009 is presented in Table 5.

### **8.2 DOSE TO THE MEMBER OF THE PUBLIC**

The Member of the Public is considered to be a real individual, not occupationally associated with the plant, who uses portions of the plant site for recreational or other purposes not associated with plant operation. This individual's utilization of areas both inside and outside the Site Boundary was characterized for this calculation and is described in the ODCM.

To evaluate total dose from the Uranium Fuel Cycle to any Member of the Public, the critical Member of the Public within the Site Boundary, and the Nearest Resident were each evaluated.

#### Dose To The Nearest Resident From Gaseous Effluent

The dose to the Nearest Resident was due to plume exposure from noble gases, ground plane exposure, and inhalation and ingestion. Dose was calculated at the nearest actual residence with the most limiting atmospheric dispersion (based on actual meteorological conditions for the year). It was conservatively assumed that each ingestion pathway (meat, milk, and vegetation) existed at this location. Dose was conservatively calculated assuming the child as the critical age group. Direct dose from activities within the Site Boundary was negligible and not included in this calculation.

The doses to the Nearest Resident for 2009 are presented in Table 5.

#### Dose To The Member Of The Public From Activities Within The Site Boundary

Based on the land use within the Site Boundary, the Member of the Public with the highest dose was a farmer. Dose from farming activities within the Site Boundary was due to direct radiation exposure, plume exposure from noble gases, ground plane exposure, and inhalation. The current tenant farmer estimates spending 1100 hours per year working within the Site Boundary area. Dose was calculated using the adult as the critical age group.

Dose to the Member of the Public from activities within the Site Boundary is presented in Table 6.

### **8.3 TOTAL DOSE DUE TO THE URANIUM FUEL CYCLE**

There are no other Uranium Fuel Cycle facilities within 8 kilometers of the Callaway Plant. Thus, the total dose to the most likely exposed Member of the Public resulted

from direct radiation exposure and radioactive effluents from the Callaway Plant itself.

The total dose to the Member of the Public (Table 7) was the sum of the dose due to activities within the Site Boundary (Table 6) and the dose due to gaseous effluents at his residence. It was conservatively assumed that each food ingestion pathway exists at his residence and that the adult is the critical age group.

The total dose from the Uranium Fuel Cycle is presented in Table 7.

#### **8.4 DOSE DUE TO LIQUID EFFLUENTS**

Dose due to liquid effluents includes contributions from the maximum exposed individual's recreational activities and consumption of fish. An adult was considered to be the maximum exposed individual in this assessment.

It is conservatively assumed that the hypothetical maximum exposed individual obtained his entire annual fish intake from near the plant discharge.

Total dose due to liquid effluents from Callaway Plant during the year is presented in Table 8.

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES  
ALL AIRBORNE EFFLUENTS

QUARTERS 1 AND 2, 2009

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION GASES

1. TOTAL RELEASE	CURIES	2.24E+01	9.82E+01	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	2.89E+00	1.25E+01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

B. RADIOIODINES

1. TOTAL IODINE-131	CURIES	6.80E-07	1.02E-06	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	8.74E-08	1.30E-07	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

C. PARTICULATES

1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	1.03E-06	9.89E-07	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.32E-07	1.26E-07	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	2.46E-07	4.28E-07	

D. TRITIUM

1. TOTAL RELEASE	CURIES	4.78E+00	7.08E+00	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	6.15E-01	9.00E-01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES  
ALL AIRBORNE EFFLUENTS

QUARTERS 3 AND 4, 2009

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION GASES

1. TOTAL RELEASE	CURIES	4.64E+01	4.26E+01	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	5.84E+00	5.36E+00	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

B. RADIOIODINES

1. TOTAL IODINE-131	CURIES	2.71E-07	1.51E-09	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	3.41E-08	1.90E-10	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

C. PARTICULATES

1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	9.64E-07	1.03E-06	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.21E-07	1.29E-07	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	2.29E-07	2.93E-07	

D. TRITIUM

1. TOTAL RELEASE	CURIES	1.68E+01	6.25E+00	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	2.12E+00	7.87E-01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 1B

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES  
GROUND LEVEL RELEASES  
FISSION GASES, IODINES, AND PARTICULATES

QUARTERS 1 AND 2, 2009

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER

1. FISSION GASES

AR-41	CURIES	0.00E+00	0.00E+00	4.99E-02	4.95E-02
XE-133	CURIES	2.17E+01	9.30E+01	1.57E-01	2.56E-01
XE-135	CURIES	4.82E-01	3.08E+00	2.18E-03	3.72E-03
XE-133M	CURIES	9.36E-02	3.76E-01	1.15E-03	2.28E-03
XE-135M	CURIES	0.00E+00	0.00E+00	1.30E-04	0.00E+00
KR-85M	CURIES	1.11E-03	4.10E-01	0.00E+00	7.25E-05
XE-131M	CURIES	0.00E+00	5.88E-01	0.00E+00	8.16E-04
KR-87	CURIES	0.00E+00	4.10E-01	0.00E+00	0.00E+00
KR-88	CURIES	0.00E+00	3.42E-03	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.22E+01	9.79E+01	2.11E-01	3.13E-01

2. IODINES

I-131	CURIES	6.80E-07	1.02E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	6.80E-07	1.02E-06	0.00E+00	0.00E+00

3. PARTICULATES

NI-63	CURIES	1.03E-06	9.89E-07	0.00E+00	0.00E+00
ALPHA	CURIES	2.46E-07	4.28E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.27E-06	1.42E-06	0.00E+00	0.00E+00

4. TRITIUM

H-3	CURIES	4.68E+00	6.74E+00	9.85E-02	3.35E-01
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TABLE 1B

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES  
GROUND LEVEL RELEASES  
FISSION GASES, IODINES, AND PARTICULATES

QUARTERS 3 AND 4, 2009

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER

1. FISSION GASES

AR-41	CURIES	0.00E+00	0.00E+00	9.70E-01	6.15E-02
XE-133	CURIES	3.78E+01	4.10E+01	6.63E+00	1.88E-01
XE-135	CURIES	5.42E-01	7.22E-01	1.33E-01	1.74E-03
XE-133M	CURIES	2.81E-01	2.70E-01	1.95E-03	7.77E-04
XE-135M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85M	CURIES	3.60E-02	2.35E-02	9.44E-03	0.00E+00
XE-131M	CURIES	0.00E+00	0.00E+00	6.38E-04	0.00E+00
KR-87	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-88	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	3.72E-01
TOTAL FOR PERIOD	CURIES	3.86E+01	4.20E+01	7.74E+00	6.24E-01

2. IODINES

I-131	CURIES	2.71E-07	1.51E-09	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.71E-07	1.51E-09	0.00E+00	0.00E+00

3. PARTICULATES

NI-63	CURIES	9.64E-07	1.03E-06	0.00E+00	0.00E+00
CO-60	CURIES	0.00E+00	0.00E+00	0.00E+00	2.50E-10
ALPHA	CURIES	2.29E-07	2.93E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.19E-06	1.32E-06	0.00E+00	2.50E-10

4. TRITIUM

H-3	CURIES	8.62E+00	5.93E+00	8.20E+00	3.26E-01
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TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES  
ALL LIQUID EFFLUENTS

QUARTERS 1 AND 2, 2009

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	2.17E-02	3.10E-02	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.25E-07	1.74E-07	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

B. TRITIUM

1. TOTAL RELEASE	CURIES	8.72E+01	1.92E+02	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	5.03E-04	1.08E-03	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	CURIES	1.70E-02	3.99E-02	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	9.79E-08	2.23E-07	

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	CURIES	4.44E-05	3.81E-04	29
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E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	1.28E+06	1.27E+06	10
---	-----	----------	----------	----

F. VOLUME OF DILUTION WATER USED	GAL	4.45E+07	4.59E+07	10
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(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES  
ALL LIQUID EFFLUENTS

QUARTERS 3 AND 4, 2009

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	1.24E-02	5.06E-03	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.84E-08	2.30E-08	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

B. TRITIUM

1. TOTAL RELEASE	CURIES	1.23E+02	3.06E+02	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.76E-04	1.39E-03	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	CURIES	1.19E-02	6.88E-03	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	7.52E-08	3.13E-08	

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	CURIES	0.00E+00	2.17E-04	29
------------------	--------	----------	----------	----

E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	1.19E+06	1.37E+06	10
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F. VOLUME OF DILUTION WATER USED	GAL	4.07E+07	5.67E+07	10
----------------------------------	-----	----------	----------	----

(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES  
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 1 AND 2, 2009

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER

1. ALL NUCLIDES

ALPHA	CURIES	0.00E+00	0.00E+00	4.44E-05	3.81E-04
CO-58	CURIES	0.00E+00	0.00E+00	6.54E-03	1.34E-02
CO-60	CURIES	0.00E+00	0.00E+00	1.86E-03	7.54E-03
CS-134	CURIES	0.00E+00	0.00E+00	1.02E-04	3.99E-05
CS-137	CURIES	0.00E+00	0.00E+00	3.04E-04	2.54E-04
H-3	CURIES	0.00E+00	0.00E+00	8.72E+01	1.92E+02
NI-63	CURIES	0.00E+00	0.00E+00	6.28E-03	7.22E-03
SB-124	CURIES	0.00E+00	0.00E+00	3.67E-04	3.16E-05
SB-125	CURIES	0.00E+00	0.00E+00	6.17E-03	2.25E-03
XE-133	CURIES	0.00E+00	0.00E+00	1.59E-02	3.77E-02
XE-131M	CURIES	0.00E+00	0.00E+00	1.09E-03	2.13E-03
CR-51	CURIES	0.00E+00	0.00E+00	6.78E-05	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	3.60E-05	1.08E-04
CO-57	CURIES	0.00E+00	0.00E+00	1.10E-05	1.57E-04
ZN-65	CURIES	0.00E+00	0.00E+00	0.00E+00	5.35E-05
Y-91M	CURIES	0.00E+00	0.00E+00	0.00E+00	6.68E-06
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	8.73E+01	1.92E+02

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES  
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 3 AND 4, 2009

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. ALL NUCLIDES					
ALPHA	CURIES	0.00E+00	0.00E+00	0.00E+00	2.17E-04
CO-58	CURIES	0.00E+00	0.00E+00	2.63E-03	1.57E-04
CO-60	CURIES	0.00E+00	0.00E+00	3.35E-03	4.32E-04
CS-134	CURIES	0.00E+00	0.00E+00	1.63E-05	1.13E-04
CS-137	CURIES	0.00E+00	0.00E+00	1.14E-04	5.28E-04
H-3	CURIES	0.00E+00	0.00E+00	1.23E+02	3.06E+02
NI-63	CURIES	0.00E+00	0.00E+00	4.37E-03	0.00E+00
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	1.21E-04
SB-125	CURIES	0.00E+00	0.00E+00	1.79E-03	3.66E-03
XE-133	CURIES	0.00E+00	0.00E+00	1.10E-02	6.72E-03
XE-131M	CURIES	0.00E+00	0.00E+00	9.50E-04	1.63E-04
CR-51	CURIES	0.00E+00	0.00E+00	0.00E+00	3.88E-05
MN-54	CURIES	0.00E+00	0.00E+00	1.29E-04	0.00E+00
CO-57	CURIES	0.00E+00	0.00E+00	3.07E-05	0.00E+00
ZN-65	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y-91M	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
I-132	CURIES	0.00E+00	0.00E+00	3.98E-06	0.00E+00
NP-237	CURIES	0.00E+00	0.00E+00	6.31E-07	9.30E-07
XE-135M	CURIES	0.00E+00	0.00E+00	2.15E-05	0.00E+00
SB-122	CURIES	0.00E+00	0.00E+00	0.00E+00	9.45E-06
I-131	CURIES	0.00E+00	0.00E+00	0.00E+00	2.97E-06
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	1.23E+02	3.06E+02

**Table 3 Solid Waste & Irradiated Fuel Shipments 2009**

**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 (%)
a. Spent resins, filter sludges, evaporator bottoms, etc.	m <sup>3</sup> Ci	0.00E+00 0.00E+02	1.69E+01 5.22E+00	± 25%
b. Dry compressible waste, contaminated equip., etc.	m <sup>3</sup> Ci	1.16E+02 4.38E-02	1.30E+02 3.49E-01	± 25%
c. Irradiated components, control rods, etc.	m <sup>3</sup> Ci	0.00E+00 0.00E+00	0.00E+00 0.00E+00	± 25%
d. Other (low level secondary resin, oily waste)	m <sup>3</sup> Ci	5.80E+01 1.58E-02	2.51E+01 1.17E-03	± 25%

**2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (by Type of Waste)**

a. Spent resins, filters, evaporator bottoms, etc.				
Nuclide	% Abundance	Period Jan – Jun Curies	% Abundance	Period Jul – Dec Curies
H-3	0 %	0.00E+00	8.894 %	4.64E-01
Fe-55	0 %	0.00E+00	12.644 %	6.60E-01
Co-60	0 %	0.00E+00	12.698 %	6.62E-01
Co-58	0 %	0.00E+00	1.086 %	5.67E-02
Ni-63	0 %	0.00E+00	25.171 %	1.31E+00
Cs-134	0 %	0.00E+00	9.103 %	4.75E-01
Cs-137	0 %	0.00E+00	29.711 %	1.55E+00
b. Dry compressible waste, contaminated equipment, etc.				
H-3	2.010 %	8.79E-04	1.982 %	6.91E-03
Fe-55	29.553 %	1.29E-02	29.365 %	1.02E-01
Co-58	1.190 %	5.21E-04	1.332 %	4.64E-03
Co-60	15.019 %	6.57E-03	14.855 %	5.18E-02
Ni-63	29.964 %	1.31E-02	29.500 %	1.03E-01
Zr-95	1.403 %	6.14E-04	1.592 %	5.55E-03
Nb-95	2.658 %	1.16E-03	3.366 %	1.17E-02
Cs-134	4.621 %	2.02E-03	4.605 %	1.61E-02
Cs-137	12.292 %	5.38E-03	12.108 %	4.22E-02
c. Irradiated components, control rods, etc.				
N/A	N/A	N/A	N/A	N/A
d. Other				
H-3	1.980 %	3.14E-04	1.846 %	2.15E-05
Fe-55	29.344 %	4.65E-03	27.417 %	3.20E-04
Co-58	1.345 %	2.13E-4	1.358 %	1.58E-05
Co-60	14.838 %	2.35E-03	15.152 %	1.77E-04

**Table 3 Solid Waste & Irradiated Fuel Shipments 2009**

Ni-63	29.454 %	4.67E-03	27.448 %	3.20E-04
Zr-95	1.610 %	2.55E-04	1.564 %	1.82E-05
Nb-95	3.440 %	5.45E-04	3.459 %	4.03E-05
Cs-134	4.603 %	7.30E-04	4.419 %	5.15E-05
Cs-137	12.090 %	1.92E-03	12.185 %	1.42E-04
Ce-144	0 %	0.00E+00	3.802 %	4.43E-05

<b>3. SOLID WASTE DISPOSITION</b>				
Number of Shipments	Mode of Transport	Destination	Class of Solid Waste Shipped	Type of Container
6*	Truck	Energy Solutions Bear Creek	A	Intermodal Container
3*	Truck	Energy Solutions Gallaher Road	A	Intermodal Container/B-25 boxes/Flatbed
1*	Cask	Studsvik	A	Poly Liner

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

<b>4. SOLIDIFICATION AGENT</b>
None used.

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

There were no shipments of irradiated fuel in 2009.

TABLE 4

Meteorological Data  
Averages Using Hourly Averaged Data

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

		UNITS	VALUES	% GOOD DATA
Stability Class		A - G	E	100%
Total Precipitation		CM.	1.50E+02	94%
10 Meter Level:	Wind Speed	Meter/Sec	3.17E+00	99%
	Wind Direction	Degrees	1.89E+02	99%
	Wind Direction Variability	Degrees	1.58E+01	99%
	Reference Temperature	Degrees C	1.22E+01	100%
	Dewpoint	Degrees C	5.97E+00	99%
60 Meter Level:	Wind Speed	Meter/Sec	5.22E+00	99%
	Wind Direction	Degrees	2.03E+02	99%
	Wind Direction Variability	Degrees	9.80E+00	99%
	Dewpoint	Degrees C	NONE	0%
	Temperature Difference 60 - 10	Degrees C	1.99E-02	100%



TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: A

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	1	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	1	0	0	0	1
E	0	0	1	0	0	0	1
ESE	0	0	1	0	0	0	1
SE	0	0	2	1	0	0	3
SSE	0	2	4	3	0	0	9
S	0	2	14	4	0	0	20
SSW	0	8	17	7	1	0	33
SW	0	4	7	3	0	0	14
WSW	0	2	12	4	0	0	18
W	0	1	7	9	3	0	20
WNW	0	0	26	11	0	0	37
NW	0	2	12	5	0	0	19
NNW	0	0	0	0	0	0	0
TOT	0	21	105	47	4	0	177

Hours of Calm Data: 0  
Hours of Invalid Data: 0

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: B

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	4	1	0	0	5
NNE	0	0	2	2	0	0	4
NE	0	1	5	0	0	0	6
ENE	0	5	8	0	0	0	13
E	1	1	5	0	0	0	7
ESE	0	1	2	4	0	0	7
SE	0	7	9	3	1	0	20
SSE	0	7	4	7	2	0	20
S	1	22	16	2	0	0	41
SSW	0	17	30	8	0	0	55
SW	0	14	12	0	0	0	26
WSW	0	5	7	4	1	0	17
W	0	4	11	1	0	0	16
WNW	0	8	16	4	0	0	28
NW	0	6	31	2	0	0	39
NNW	0	0	4	2	0	0	6
TOT	2	98	166	40	4	0	310

Hours of Calm Data: 0  
Hours of Invalid Data: 0

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: C

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	8	13	0	0	0	21
NNE	1	9	5	3	0	0	18
NE	1	24	16	0	0	0	41
ENE	2	30	20	0	0	0	52
E	2	12	4	2	0	0	20
ESE	1	17	18	4	0	0	40
SE	1	37	22	3	0	0	63
SSE	3	25	14	3	2	0	47
S	1	28	25	10	0	0	64
SSW	1	14	32	6	0	0	53
SW	4	16	13	1	0	0	34
WSW	1	12	5	5	0	0	23
W	2	13	21	3	0	0	39
WNW	0	21	15	3	0	0	39
NW	1	25	24	0	1	0	51
NNW	3	17	39	0	0	0	59
TOT	24	308	286	43	3	0	664

Hours of Calm Data: 0  
Hours of Invalid Data: 5

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: D

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	16	113	118	35	2	0	284
NNE	31	102	90	10	0	0	233
NE	27	155	91	5	0	0	278
ENE	14	117	57	2	1	0	191
E	23	72	49	4	0	0	148
ESE	22	76	72	4	1	0	175
SE	22	141	130	15	0	0	308
SSE	24	92	113	21	4	0	254
S	16	68	86	29	2	0	201
SSW	18	54	49	17	0	0	138
SW	18	59	59	31	0	0	167
WSW	26	52	45	33	3	0	159
W	28	52	82	19	8	0	189
WNW	32	64	110	31	0	0	237
NW	23	112	142	25	1	0	303
NNW	19	141	153	23	0	0	336
TOT	359	1470	1446	304	22	0	3601

Hours of Calm Data: 3  
Hours of Invalid Data: 19

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: E

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	30	68	7	0	0	0	105
NNE	37	98	5	0	0	0	140
NE	42	76	13	0	0	0	131
ENE	31	49	1	0	0	0	81
E	38	73	11	0	0	0	122
ESE	42	79	24	0	0	0	145
SE	28	170	115	1	0	0	314
SSE	29	169	106	15	1	0	320
S	22	104	138	12	0	0	276
SSW	14	77	45	2	0	0	138
SW	19	91	16	0	0	0	126
WSW	27	52	12	0	0	0	91
W	29	62	19	0	0	0	110
WNW	38	69	28	0	0	0	135
NW	45	72	19	3	0	0	139
NNW	28	46	15	0	0	0	89
TOT	499	1355	574	33	1	0	2462

Hours of Calm Data: 11  
Hours of Invalid Data: 12

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: F

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	15	22	0	0	0	0	37
NNE	43	38	0	0	0	0	81
NE	49	25	0	0	0	0	74
ENE	26	15	0	0	0	0	41
E	23	9	0	0	0	0	32
ESE	31	14	0	0	0	0	45
SE	29	52	12	0	0	0	93
SSE	29	149	21	0	0	0	199
S	21	72	10	0	0	0	103
SSW	22	33	2	0	0	0	57
SW	23	29	2	0	0	0	54
WSW	16	23	0	0	0	0	39
W	21	6	0	0	0	0	27
WNW	37	17	0	0	0	0	54
NW	29	26	0	0	0	0	55
NNW	16	27	2	0	0	0	45
TOT	430	557	49	0	0	0	1036

Hours of Calm Data: 16  
Hours of Invalid Data: 25

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: G

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	25	1	0	0	0	0	26
NNE	44	7	0	0	0	0	51
NE	32	5	0	0	0	0	37
ENE	11	1	0	0	0	0	12
E	2	0	0	0	0	0	2
ESE	3	0	0	0	0	0	3
SE	11	8	1	0	0	0	20
SSE	21	35	3	0	0	0	59
S	20	11	1	0	0	0	32
SSW	19	2	0	0	0	0	21
SW	11	10	1	0	0	0	22
WSW	6	1	0	0	0	0	7
W	11	1	0	0	0	0	12
WNW	14	1	0	0	0	0	15
NW	25	3	0	0	0	0	28
NNW	30	6	0	0	0	0	36
TOT	285	92	6	0	0	0	383

Hours of Calm Data: 30  
Hours of Invalid Data: 4  
Hours of Good Data: 8693 = 99.2% of Total Hours

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: A

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	0	1	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	1	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	1	1	0	0	2
SE	0	0	0	2	0	0	2
SSE	0	0	4	3	3	0	10
S	0	1	12	4	1	0	18
SSW	0	3	13	5	6	3	30
SW	0	2	10	5	2	1	20
WSW	0	0	3	9	1	2	15
W	0	0	1	7	7	5	20
WNW	0	0	6	13	16	2	37
NW	0	0	7	9	3	1	20
NNW	0	0	1	0	0	0	1
TOT	0	6	58	60	39	14	177

Hours of Calm Data: 0  
Hours of Invalid Data: 0



TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: B

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	0	5	0	0	5
NNE	0	0	2	3	0	0	5
NE	0	1	4	1	0	0	6
ENE	0	3	7	1	0	0	11
E	0	1	7	1	0	0	9
ESE	0	0	2	1	4	0	7
SE	0	2	10	2	1	2	17
SSE	0	1	6	3	7	2	19
S	0	10	15	4	0	0	29
SSW	1	13	26	15	5	2	62
SW	0	7	16	10	0	0	33
WSW	0	3	5	6	1	2	17
W	0	0	8	5	5	0	18
WNW	0	0	16	9	6	1	32
NW	0	1	19	14	1	0	35
NNW	0	0	1	4	0	0	5
TOT	1	42	144	84	30	9	310

Hours of Calm Data: 0  
Hours of Invalid Data: 0

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: C

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	4	8	6	0	0	18
NNE	1	8	14	3	0	0	26
NE	1	7	21	4	0	0	33
ENE	0	20	32	0	0	0	52
E	0	8	11	2	0	0	21
ESE	1	8	19	5	3	0	36
SE	1	12	34	6	1	0	54
SSE	1	20	20	8	2	2	53
S	1	21	20	11	2	1	56
SSW	2	14	23	22	9	0	70
SW	2	8	11	10	2	1	34
WSW	0	10	7	2	2	2	23
W	0	7	12	12	5	0	36
WNW	1	11	22	13	3	2	52
NW	0	11	30	10	0	1	52
NNW	1	8	28	11	0	0	48
TOT	12	177	312	125	29	9	664

Hours of Calm Data: 0  
Hours of Invalid Data: 5

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: D

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4	51	124	64	13	2	258
NNE	14	70	109	49	5	0	247
NE	13	75	130	47	2	1	268
ENE	7	82	105	22	0	0	216
E	12	52	75	23	3	0	165
ESE	9	50	70	30	2	1	162
SE	10	60	125	75	9	2	281
SSE	13	52	117	64	19	4	269
S	5	32	70	58	21	7	193
SSW	9	33	51	45	20	2	160
SW	8	29	46	41	37	6	167
WSW	6	40	36	29	39	12	162
W	7	32	40	73	29	11	192
WNW	11	48	46	79	57	8	249
NW	9	44	116	103	44	6	322
NNW	9	49	132	86	13	1	290
TOT	146	799	1392	888	313	63	3601

Hours of Calm Data: 3  
Hours of Invalid Data: 19

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: E

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	2	14	32	6	0	0	54
NNE	1	20	88	10	0	0	119
NE	7	16	97	20	0	0	140
ENE	6	28	86	5	0	0	125
E	0	27	79	18	0	0	124
ESE	3	27	108	22	0	0	160
SE	0	25	130	120	1	0	276
SSE	6	16	101	123	13	3	262
S	1	18	84	167	13	4	287
SSW	4	17	52	113	18	0	204
SW	4	21	55	65	2	0	147
WSW	6	12	42	33	1	0	94
W	4	14	53	41	1	0	113
WNW	0	15	57	72	4	0	148
NW	3	20	61	42	5	0	131
NNW	0	20	52	14	1	0	87
TOT	47	310	1177	871	59	7	2471

Hours of Calm Data: 2  
Hours of Invalid Data: 12

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: F

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	5	23	10	0	0	38
NNE	1	11	19	4	0	0	35
NE	2	4	26	25	0	0	57
ENE	2	8	66	12	0	0	88
E	0	6	45	4	0	0	55
ESE	1	11	47	3	0	0	62
SE	0	13	31	10	0	0	54
SSE	0	9	51	55	3	0	118
S	2	19	70	62	1	0	154
SSW	4	11	46	53	1	0	115
SW	3	3	15	33	2	0	56
WSW	2	10	24	9	0	0	45
W	6	8	20	8	0	0	42
WNW	0	6	19	15	0	0	40
NW	3	7	27	16	0	0	53
NNW	1	8	20	8	0	0	37
TOT	27	139	549	327	7	0	1049

Hours of Calm Data: 3  
Hours of Invalid Data: 25

TABLE 4

Meteorological Data  
Totals of Hours at Each Wind Speed & Direction

1-JAN-2009 00:00:00.00 to 31-DEC-2009 23:59:59.00

Stability Class: G

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	1	13	4	0	0	18
NNE	2	7	23	1	0	0	33
NE	0	7	14	4	0	0	25
ENE	1	1	27	9	0	0	38
E	1	3	34	1	0	0	39
ESE	3	8	10	0	0	0	21
SE	3	7	1	0	0	0	11
SSE	0	5	9	7	1	0	22
S	1	12	19	17	0	0	49
SSW	0	5	8	11	0	0	24
SW	4	8	8	5	0	0	25
WSW	1	15	8	4	1	0	29
W	4	10	3	1	0	0	18
WNW	3	4	9	5	1	0	22
NW	3	7	3	0	0	0	13
NNW	1	6	12	1	0	0	20
TOT	27	106	201	70	3	0	407

Hours of Calm Data: 6  
Hours of Invalid Data: 4  
Hours of Good Data: 8693 = 99.2% of Total Hours

TABLE 5

DOSE AT THE SITE BOUNDARY AND TO THE NEAREST RESIDENT  
FROM GASEOUS EFFLUENTS

		SITE BOUNDARY		NEAREST RESIDENT	
		LOCATION: 2.20 km NNW		LOCATION: 2.90 km NNW	
		AGE GROUP: CHILD		AGE GROUP: CHILD	
ORGAN	UNITS	DOSE	% LIMIT(a)	DOSE	% LIMIT(b)
1. GAMMA AIR DOSE *	MRAD	2.97E-03	0.03	1.96E-03	N/A
2. BETA AIR DOSE *	MRAD	7.38E-03	0.04	4.88E-03	N/A
3. WHOLE BODY ***	MREM	2.56E-03	N/A	1.69E-03	N/A
4. SKIN ***	MREM	5.79E-03	N/A	3.83E-03	N/A
5. BONE **	MREM	7.79E-09	N/A	5.15E-07	0.00
6. LIVER **	MREM	1.05E-03	N/A	6.14E-03	0.04
7. TOTAL BODY **	MREM	1.05E-03	N/A	6.14E-03	0.04
8. THYROID **	MREM	1.05E-03	N/A	6.31E-03	0.04
9. KIDNEY **	MREM	1.05E-03	N/A	6.14E-03	0.04
10. LUNG **	MREM	1.05E-03	N/A	6.14E-03	0.04
11. GI-LLI **	MREM	1.05E-03	N/A	6.14E-03	0.04

\* Dose from Noble Gases only

\*\* Dose from Tritium, Radioiodines, and Particulates only

\*\*\* Dose from Noble Gases plus Ground Plane dose

(a) Annual dose limits of Offsite Dose Calculation Manual (APA-ZZ-01003)  
of 10 mrad gamma air dose and 20 mrad beta air dose.

(b) Annual dose limits of Offsite Dose Calculation Manual (APA-ZZ-01003)  
of 15 mrem to any organ from I-131, I-133, H-3 and particulate  
radionuclides with half-lives greater than 8 days.

TABLE 6

DOSE TO THE MEMBER OF THE PUBLIC FROM ACTIVITIES  
WITHIN THE SITE BOUNDARY

ORGAN	UNITS	EFFLUENT DOSE WITHIN THE SITE BOUNDARY	DIRECT RADIATION FROM THE UNIT	DIRECT RADIATION FROM OUTSIDE TANKS	TOTAL DOSE FOR THE YEAR
1. SKIN	MREM	1.52E-03	N/A	N/A	1.52E-03
2. BONE	MREM	2.00E-09	8.99E-06	1.35E-04	1.44E-04
3. LIVER	MREM	3.35E-04	8.99E-06	1.35E-04	4.79E-04
4. TOTAL BODY	MREM	1.01E-03	8.99E-06	1.35E-04	1.15E-03
5. THYROID	MREM	3.35E-04	8.99E-06	1.35E-04	4.79E-04
6. KIDNEY	MREM	3.35E-04	8.99E-06	1.35E-04	4.79E-04
7. LUNG	MREM	3.35E-04	8.99E-06	1.35E-04	4.79E-04
8. GI-LLI	MREM	3.35E-04	8.99E-06	1.35E-04	4.79E-04



TABLE 7

TOTAL DOSE DUE TO THE URANIUM FUEL CYCLE  
(MEMBER OF THE PUBLIC)

ORGAN	UNITS	DOSE AT THE RESIDENCE LOCATION	DOSE FROM ACTIVITIES WITHIN SITE BOUNDARY	TOTAL DOSE TO THE MEMBER OF THE PUBLIC	% LIMITS *
1. SKIN	MREM	4.49E-03	1.52E-03	6.00E-03	0.02
2. BONE	MREM	1.46E-07	1.44E-04	1.44E-04	0.00
3. LIVER	MREM	4.38E-03	4.79E-04	4.86E-03	0.02
4. TOTAL BODY	MREM	6.36E-03	1.15E-03	7.51E-03	0.03
5. THYROID	MREM	4.45E-03	4.79E-04	4.92E-03	0.01
6. KIDNEY	MREM	4.38E-03	4.79E-04	4.86E-03	0.02
7. LUNG	MREM	4.38E-03	4.79E-04	4.86E-03	0.02
8. GI-LLI	MREM	4.38E-03	4.79E-04	4.86E-03	0.02

\* Annual dose limits from 40CFR190.10(a) of 25 mrem whole body, 75 mrem to the thyroid, and 25 mrem to any other organ.

TABLE 8

DOSE DUE TO LIQUID EFFLUENTS  
(MEMBER OF THE PUBLIC)

2009

ORGAN	UNITS	DOSE	LIMIT *	% LIMIT
1. BONE	MREM	8.18E-03	10.00	8.18E-02
2. LIVER	MREM	7.67E-03	10.00	7.67E-02
3. TOTAL BODY	MREM	5.67E-03	3.00	1.89E-01
4. THYROID	MREM	1.20E-03	10.00	1.20E-02
5. KIDNEY	MREM	3.27E-03	10.00	3.27E-02
6. LUNG	MREM	1.88E-03	10.00	1.88E-02
7. GI-LLI	MREM	2.20E-03	10.00	2.20E-02

\* Annual dose limits of APA-ZZ-01003, Section 9.4.1.1.