

Omaha Public Power District Fort Calhoun Station Unit No. 1

Annual Report For Technical Specification Section 5.9.4.a

January 1, 2009 to December 31, 2009



**Omaha Public Power District
Fort Calhoun Station Unit No. 1**

Annual Report
For
Technical Specifications,
Section 5.9.4.a

January 1, 2009 to December 31, 2009

Annual Radiological Effluent Release Report

This report is submitted in accordance with Section 5.9.4.a of the Technical Specifications of Fort Calhoun Station Unit No. 1, Facility Operating License DPR-40 for the period January 1, 2009 through December 31, 2009. The Effluent Report is presented in the format outlined in Regulatory Guide 1.21, Revision 1.

In addition, this report provides the results of quarterly dose calculations performed in accordance with the Offsite Dose Calculation Manual. Results are presented by quarter for the period January 1, 2009 through December 31, 2009.

Descriptions of any changes made during the preceding twelve months to the Offsite Dose Calculation Manual and/or the Process Control Program for the Fort Calhoun Station are presented.

**PRC RECOMMENDS
APPROVAL**

APR 7 2010

PRC MTG. MINUTES

APPROVED BY:

[Handwritten Signature]

PRC Chairman

4-7-10

Date

Division Manager Nuclear Operations/Plant Manager

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1.0 INTRODUCTION

This Annual Radiological Effluent Release Report, for Fort Calhoun Station Unit No. 1, is submitted as required by Technical Specification 5.9.4.a for the period January 1, 2009 through December 31, 2009.

1.1 Executive Summary

The Radioactive Effluent Monitoring program for the year 2009 was conducted as described in the following report. Major efforts were made to maintain the release of radioactive effluents to the environment as low as reasonably achievable.

The total gaseous activity released for 2009 was 3.50 curies. This was a decrease from the 2008 activity of 3.78 curies.

Dose contributions from gaseous effluents at the unrestricted area boundary were 3.45×10^{-3} mRad maximum gamma air dose and 2.27×10^{-3} mRad maximum beta air dose. This was an increase from the 2008 activity of 1.98×10^{-3} mRad and 1.48×10^{-3} mRad, respectively.

Total activity (excluding tritium, dissolved gases, and alpha) released in 2009 in liquid effluents was 2.67×10^{-3} curies. This was a decrease from the 2008 activity of 1.10×10^{-2} curies due to improved waste management.

The total tritium activity released in 2009 in liquid effluents was 221.0 curies. This was an increase from the 2008 activity of 176.5 curies due to the 2009 refueling outage.

The calculated whole body dose due to liquid effluents at the site discharge from all sources in 2009 was 2.80×10^{-2} mRem. This was a slight increase from the 2008 dose of 2.39×10^{-2} mRem.

The calculated critical organ dose due to liquid effluents at the site discharge from all sources in 2009 was 3.06E-02 mRem. This was a decrease from the 2008 dose of 3.50E-02 mRem.

The Fort Calhoun Station meteorological system achieved a cumulative availability rate of 95.63% for the joint frequency parameters required by Regulatory Guide 1.23 of wind speed, wind direction, and delta temperature.

There were no abnormal releases during 2009.

During 2009 there were no changes to the Offsite Dose Calculations Manual (ODCM) and no changes to the Process Control Program (PCP).

For 2009, the total volume of buried solid radwaste was 75.44 cubic meters. This was a slight increase from the 70.12 cubic meters of solid waste buried in 2008.

The total buried activity for 2009 was 5.39 curies. 2.32 curies came from spent resin. This was a decrease from the 2008 value of 39.79 curies.

Overall, the radioactive effluent monitoring program was conducted in a manner to ensure the activity released and associated dose to the public were maintained as low as reasonably achievable.

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

The ODCM Radiological Effluent Control Specifications applicable to the release of radioactive material in liquid and gaseous effluents are described in the following sections.

2.1.1 Fission and Activation Gases (Noble Gases)

The release rate of radioactive material in airborne effluents shall be controlled such that the instantaneous concentrations of radionuclides do not exceed the values specified in 10 CFR 20 for airborne effluents at the unrestricted area boundary. To support plant operations, Supervisor - System Chemistry may increase this limit up to the limits specified in Technical Specification 5.16.1.g.

Technical Specification 5.16.1.g establishes the administrative control limit on the concentration resulting from radioactive material, other than noble gases, released in gaseous effluents to unrestricted areas conforming to ten times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 1. For noble gases, the concentration shall be limited to five times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 1.

The air dose due to noble gases released in gaseous effluents to areas at or beyond the unrestricted area 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.

2.1.2 Dose - Iodine-131, Radioactive Material in Particulate Form with Half Lives Greater than 8 Days (Other than Noble Gases) and Tritium

- a. The dose to an individual or dose commitment to any organ of an individual in unrestricted areas due to the release of I-131, radioactive material in particulate form with half-lives greater than eight days (other than noble gases), and tritium in airborne effluents shall not exceed 7.5 millirem from all exposure pathways during any calendar quarter.
- b. The dose to an individual or dose commitment to any organ of an individual in unrestricted areas due to the release of I-131, radioactive materials in particulate form with half-lives greater than eight days (other than noble gases), and tritium in airborne effluents shall not exceed 15 millirem from all exposure pathways during any calendar year.

2.1.3 Liquid Effluents

The release rate of radioactive material in liquid effluents shall be controlled such that the instantaneous concentrations for radionuclides, other than dissolved or entrained noble gases, do not exceed the values specified in 10 CFR 20 for liquid effluents at site discharge. To support plant operations, the Supervisor - System Chemistry may increase this limit up to the limit specified in Technical Specifications 5.16.1.b.

Technical Specification 5.16.1.b establishes the administrative control limit on concentration of radioactive material, other than dissolved or entrained noble gases, released in liquid effluents to unrestricted areas conforming to ten times 10 CFR 20.1001-20.2401, Appendix B, Table 2, Column 2. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 $\mu\text{Ci/mL}$ total activity.

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released to unrestricted areas shall be limited to:

- a. During any calendar quarter: Less than or equal to 1.5 mRem to the whole body and less than or equal to 5 mRem to any organ, and

- b. During any calendar year: Less than or equal to 3 mRem to the whole body and less than or equal to 10 mRem to any organ.

2.1.4 Total Dose-Uranium Fuel Cycle

The dose to any individual from uranium fuel cycle sources shall be limited to ≤ 25 mRem to the total body or any organ (except the thyroid, which shall be limited to ≤ 75 mRem) during each calendar year.

2.2 Effluent Concentration Limits (ECL)

2.2.1 Liquid Effluents

The values specified in 10 CFR Part 20, Appendix B, Column 2 are used as the ECL for liquid radioactive effluents released to unrestricted areas. A value of $2.0E-04$ $\mu\text{Ci/mL}$ is used as the ECL for dissolved and entrained noble gases in liquid effluents.

2.2.2 Gaseous Effluents

The values specified in 10 CFR Part 20, Appendix B, Column 1 are used as the ECL for gaseous radioactive effluents released to unrestricted areas.

2.3 Measurements and Approximations of Total Radioactivity

Measurements of total radioactivity in liquid and gaseous radioactive effluents were accomplished in accordance with the sampling and analysis requirements of Tables 3.1 and 3.2 of Part I of the ODCM.

2.3.1 Liquid Radioactive Effluents

Each batch was sampled and analyzed for gamma emitting radionuclides using gamma spectroscopy, prior to release. Composite samples were analyzed monthly and quarterly for the Monitor and Hotel Waste Tanks. Composite samples were analyzed monthly in the onsite laboratory for tritium and gross alpha radioactivity, using liquid scintillation and proportional counting techniques respectively. Composite samples were analyzed quarterly for Sr-89, Sr-90, and Fe-55 by contract

laboratories (Teledyne Brown Engineering and AREVA NP Inc. Environmental Laboratory). A software program was used to project the total body and critical organ dose contribution at the unrestricted area boundary for each release and the percent contribution to the annual objective dose.

For continuous releases from the Steam Generator blowdown, daily grab samples were obtained for weekly, monthly and quarterly composites, in proportion to the rate of blowdown. Samples were analyzed using gamma spectroscopy techniques weekly. Composites were also analyzed monthly in the onsite laboratory for tritium and gross alpha radioactivity using liquid scintillation and proportional counting techniques, respectively. Composite samples were analyzed quarterly for Sr-89, Sr-90, and Fe-55 by contract laboratories (Teledyne Brown Engineering and AREVA NP Inc. Environmental Laboratory).

2.3.2 Gaseous Radioactive Effluents

Each gaseous batch release was sampled and analyzed for radioactivity prior to release. For release of Waste Gas Decay Tanks, noble gas grab samples were analyzed for gamma emitting radionuclides using gamma spectroscopy. For releases from the Containment Building, samples were taken using charcoal and particulate filters, in addition to noble gas and Tritium grab samples, and analyzed for gamma emitting radionuclides prior to each release. The results of the analysis and the total volume of effluent released were used to determine the total amount of radioactivity released in the batch mode. A software program was developed and installed that can project the total body and critical organ dose contribution at the unrestricted area boundary for each release and the percent contribution to the annual objective dose. This program also adds the projected dose to the current actual dose totals in a temporary file, until it is updated with actual release data at the completion of a purge.

Continuous release effluent pathways were continuously sampled using charcoal and particulate filters and analyzed weekly for gamma emitting radionuclides using gamma spectroscopy. Weekly particulate filters were analyzed for gross alpha radioactivity in the onsite laboratory using proportional counting techniques. Quarterly composites of particulate filters were analyzed for Sr-89 and Sr-90 by offsite laboratories (Teledyne Brown Engineering and AREVA NP Inc. Environmental Laboratory).

2.4 Estimation of Total Percent Error

The estimated total percent error is calculated as follows:

$$\text{Total Percent Error} = (E_1^2 + E_2^2 + E_3^2 + \dots + E_n^2)^{0.5}$$

Where E_n = percent error associated with each contributing parameter.

Sample counting error is estimated by the Canberra Genie System Software for samples analyzed by gamma spectroscopy. This calculation can include the error associated with peak area determination, gamma ray abundance, efficiency and half-life. Systematic error is estimated for gaseous and liquid effluent analyses and dilution and wastewater volume.

2.5 Batch Releases

A summary of information for liquid and gaseous batch releases is included in Table III.1.

2.6 Abnormal Releases

Abnormal Releases are defined as unplanned and unmonitored releases of radioactive material from the site.

A summary of information for liquid and gaseous abnormal releases is included in Table III.2.

3.0 GASEOUS EFFLUENTS

The quantities of radioactive material released in gaseous effluents are summarized in Tables III.3, III.4 and III.5. All radioactive materials released in gaseous form are considered to be ground level releases.

4.0 LIQUID EFFLUENTS

The quantities of radioactive material released in liquid effluents are summarized in Tables III.6, III.7 and III.8.

5.0 SOLID WASTES

The quantities of radioactive material released as solid effluents are summarized in Section VI.

6.0 RELATED INFORMATION

6.1 Operability of Liquid and Gaseous Monitoring Instrumentation

During the reporting period there were no instruments used to monitor radioactive effluent releases that failed to meet the reportable instrument operability requirements listed in the ODCM during the reporting period.

6.2 Changes to the Offsite Dose Calculation Manual (ODCM) or Process Control Program (PCP)

During 2009, there were no changes made to the ODCM and no changes made to the PCP.

6.3 New Locations or Modifications for Dose Calculations or Environmental Monitoring

- There were no changes to the Environmental Monitoring program.

6.4 Noncompliance with Radiological Effluent Control Requirements

This section provides a list of any event that did not comply with the applicable requirements of the Radiological Effluent Controls given in the Offsite Dose Calculation Manual (ODCM). Detailed documentation concerning the evaluations and corrective actions is maintained onsite.

6.4.1 Abnormal Gaseous and Liquid Releases

No abnormal releases were made during the calendar year of 2009.

6.4.2 Failure to Meet Specified Sampling Requirements

During 2009, there were no instances in which specified sampling requirements were not met.

6.5 Modifications to Liquid and Gaseous Waste Treatment and Ventilation Exhaust Systems

During the reporting period no design modifications were approved nor implemented involving major changes to the Liquid and Gaseous Waste Treatment Systems.

6.6 Meteorological Monitoring Program

A summary of hourly meteorological data, collected during 2009, is retained onsite. This data is available for review by the Nuclear Regulatory Commission upon request. Joint Frequency tables are included in Section VII, Attachment 2.

Real time hourly meteorological data is used to calculate the annual air effluent dose to individuals. For quarterly estimates during the year an annual average X/Q is used, which is an average of the highest X/Q's calculated for each of the previous two years.

6.7 Assessment of Doses

6.7.1 Doses Due to Liquid Effluents

Total body, skin, and organ dose for liquid releases were calculated in mRem for all significant liquid pathways using the annual configuration of the LADTAP II program. The site discharge location was chosen to present a most conservative estimate of dose for an average adult, teenager, child and infant. A conservative approach is also presented by the assumption that Omaha and Council Bluffs receive all drinking water from the Missouri River.

The LADTAP II program in its annual configuration was also used to calculate the total body and organ doses for the population of 853,274 within a 50-mile radius of the plant (based on the 2000 census). The results of the calculations are listed in Section V.

The doses due to liquid effluents for total body and critical organ are also calculated quarterly using the methods in the ODCM. The results are listed in Section II.

6.7.2 Doses Due to Gaseous Effluents

Total body, skin and organ doses from ground releases were calculated in mRem to an average adult, teenager, child, and infant in each receptor using the annual configuration of the GASPARE II program. Also, the doses to the same groups, in units of mRad due to gamma and beta radiation carried by air, were computed using GASPARE II.

The GASPAR II program in its annual configuration was also used to calculate the ALARA integrated population dose summary for the total body, skin and organ doses in person-rem for all individuals within a 50-mile radius. The results of the calculations are shown in Section IV.

The doses due to gaseous effluents for total body gamma and beta noble gas air dose are calculated quarterly using the methods in the ODCM with an annual average X/Q. The results are listed in Section II.

6.7.3 Doses Due to I-131, Tritium and Particulates with Half Lives Greater than 8 days.

The doses due to I-131, Tritium and Particulates with half lives greater than 8 days for total body and critical organ dose are calculated quarterly using the highest of infant or child dose factors and an annual average X/Q. The results are listed in Section II for inhalation, ground and food.

6.7.4 Direct Radiation Dose to Individuals and Populations

Direct radiation doses attributed to the gamma radiation emitted from the containment structure were not observed above local background at any TLD sample locations for this annual period.

6.7.5 40 CFR 190 Dose Evaluation

ODCM Radiological Effluent Controls require dose evaluations to demonstrate compliance with 40 CFR Part 190 only if calculated yearly doses exceed two times the annual design objectives for liquid and/or gaseous effluents. At no time during 2009 were any of these limits exceeded; therefore, no evaluations were required.

6.8 Groundwater Monitoring Program and Observations

- OPPD conducted groundwater sampling from 19 wells and 2 surface water sites within the site property per NEI 07-07.
- Five new monitoring wells were added to the sampling program; MW-9, MW-10, MW-11, MW-12A, and MW-12B.
- Monitoring well MW-8 was dry during the calendar year

- and was not sampled.
- First quarter lagoon sampling not performed due to weather conditions.
 - Monitoring well MW-7 indicated Sr-90 at a concentration slightly above LLD during the 3rd and 4th quarters. To date, no groundwater pathway is present.

SECTION II
QUARTERLY DOSES FROM EFFLUENTS

Offsite Dose Calculation Manual

January 1, 2009 - December 31, 2009

Quarterly Dose Calculation Results

January 1, 2009 through December 31, 2009

With the implementation of the Fort Calhoun Station Radiological Effluent Technical Specifications (RETS) on October 1, 1985, radiation doses in the unrestricted area from liquid and gaseous effluents must be calculated on a quarterly basis in accordance with the Offsite Dose Calculation Manual (ODCM). These calculations are performed to ensure the annual dose limits delineated in Appendix I of 10 CFR 50 and implemented by RETS are not exceeded. If the results of the quarterly calculations exceed fifty percent (50%) of the annual limits of Appendix I, actions are taken to reduce effluents so that the resultant doses do not exceed the annual limits during the remainder of the year and a special report is submitted to the Nuclear Regulatory Commission. No special reports were required for 2009 calculated doses.

This section presents the results of the quarterly dose calculations performed during the period January 1, 2009 through December 31, 2009. Details are shown as to the types, sources and resultant doses from the effluents, the annual limits and a comparison to the annual limits.

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
 FORT CALHOUN FIRST QUARTER 2009 DOSE PROJECTIONS

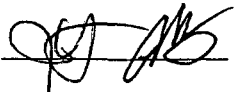
I. Liquid Effluents: -----	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Batch:	3.00E-03	3.31E-03
Continuous:	0.00E+00	0.00E+00
-----	-----	-----
Totals:	3.00E-03	3.31E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
-----	-----	-----
Percent of Quarterly Obj:	0.20 %	0.07 %
ODCM Annual Objective:	3.00E+00	1.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.10 %	0.03 %

II. Gaseous Effluents: -----	Total Body Gamma Dose (mrad) -----	Total Body Beta Dose (mrad) -----
A. Noble Gas Air Dose:	9.54E-04	5.38E-04
ODCM Quarterly Objective:	5.00E+00	1.00E+01
-----	-----	-----
Percent of Quarterly Obj:	0.02 %	0.01 %
ODCM Annual Objective:	1.00E+01	2.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.01 %	0.00 %
B. I-131, H-3, and Particulates with Half-lives > 8 Days:	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Inhalation:	2.69E-04	2.69E-04
Ground and Food:	1.25E-03	1.25E-03
-----	-----	-----
Totals:	1.52E-03	1.52E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
-----	-----	-----
Percent of Quarterly Obj:	0.02 %	0.02 %
ODCM Annual Objective:	1.50E+01	1.50E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.01 %	0.01 %

Reviewed by: 


QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
 FORT CALHOUN SECOND QUARTER 2009 DOSE PROJECTIONS

I. Liquid Effluents: -----	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Batch:	4.85E-03	5.96E-03
Continuous:	0.00E+00	0.00E+00
-----	-----	-----
Totals:	4.85E-03	5.96E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
-----	-----	-----
Percent of Quarterly Obj:	0.32 %	0.12 %
ODCM Annual Objective:	3.00E+00	1.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.26 %	0.09 %
II. Gaseous Effluents: -----	Total Body Gamma Dose (mrad) -----	Total Body Beta Dose (mrad) -----
A. Noble Gas Air Dose:	1.02E-03	5.41E-04
ODCM Quarterly Objective:	5.00E+00	1.00E+01
-----	-----	-----
Percent of Quarterly Obj:	0.02 %	0.01 %
ODCM Annual Objective:	1.00E+01	2.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.02 %	0.01 %
B. I-131, H-3, and Particulates with Half-lives > 8 Days:	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Inhalation:	2.55E-04	2.55E-04
Ground and Food:	1.18E-03	1.18E-03
-----	-----	-----
Totals:	1.44E-03	1.44E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
-----	-----	-----
Percent of Quarterly Obj:	0.02 %	0.02 %
ODCM Annual Objective:	1.50E+01	1.50E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.02 %	0.02 %

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QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
 FORT CALHOUN THIRD QUARTER 2009 DOSE PROJECTIONS

I. Liquid Effluents: -----	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Batch:	8.18E-03	8.81E-03
Continuous:	0.00E+00	0.00E+00
-----	-----	-----
Totals:	8.18E-03	8.81E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
-----	-----	-----
Percent of Quarterly Obj:	0.55 %	0.18 %
ODCM Annual Objective:	3.00E+00	1.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.53 %	0.18 %
II. Gaseous Effluents: -----	Total Body Gamma Dose (mrad) -----	Total Body Beta Dose (mrad) -----
A. Noble Gas Air Dose:	1.10E-03	6.11E-04
ODCM Quarterly Objective:	5.00E+00	1.00E+01
-----	-----	-----
Percent of Quarterly Obj:	0.02 %	0.01 %
ODCM Annual Objective:	1.00E+01	2.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.03 %	0.01 %
B. I-131, H-3, and Particulates with Half-lives > 8 Days:	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Inhalation:	5.16E-04	5.16E-04
Ground and Food:	2.38E-03	2.38E-03
-----	-----	-----
Totals:	2.90E-03	2.90E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
-----	-----	-----
Percent of Quarterly Obj:	0.04 %	0.04 %
ODCM Annual Objective:	1.50E+01	1.50E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.04 %	0.04 %

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QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
 FORT CALHOUN FOURTH QUARTER 2009 DOSE PROJECTIONS

I. Liquid Effluents: -----	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Batch:	8.34E-03	9.92E-03
Continuous:	0.00E+00	0.00E+00
-----	-----	-----
Totals:	8.34E-03	9.92E-03
ODCM Quarterly Objective:	1.50E+00	5.00E+00
-----	-----	-----
Percent of Quarterly Obj:	0.56 %	0.20 %
ODCM Annual Objective:	3.00E+00	1.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.81 %	0.28 %

II. Gaseous Effluents: -----	Total Body Gamma Dose (mrad) -----	Total Body Beta Dose (mrad) -----
A. Noble Gas Air Dose:	7.21E-04	8.11E-04
ODCM Quarterly Objective:	5.00E+00	1.00E+01
-----	-----	-----
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.00E+01	2.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.04 %	0.01 %
B. I-131, H-3, and Particulates with Half-lives > 8 Days:	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Inhalation:	1.11E-03	1.14E-03
Ground and Food:	5.12E-03	7.77E-03
-----	-----	-----
Totals:	6.23E-03	8.91E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
-----	-----	-----
Percent of Quarterly Obj:	0.08 %	0.12 %
ODCM Annual Objective:	1.50E+01	1.50E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.08 %	0.10 %

Reviewed by: 

SECTION III
RADIOLOGICAL EFFLUENT RELEASES
Technical Specification (5.9.4.a)

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January 1, 2009 - December 31, 2009

TABLE III.1
 BATCH LIQUID AND GASEOUS RELEASE SUMMARY
 JANUARY THROUGH DECEMBER 2009

<u>A. Liquid Releases All Sources</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
1. Number of Batch Releases:	20	18	27	81
2. Total Time Period for Batch Releases (min):	2,231	1,914	3,012	20,608
3. Maximum Time Period for Batch Releases (min):	133	130	144	683
4. Average Time Period for Batch Releases (min):	112	106	112	254
5. Minimum Time Period for Batch Releases (min):	95	60	99	30
6. Average Dilution Stream Flow During Periods of Release into the Missouri River (mls/min):	1.068E+09	1.111E+09	9.760E+08	4.551E+08
<u>B. Gaseous Releases All Sources</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
1. Number of Batch Releases:	15	14	14	34
2. Total Time Period for Batch Releases (min):	103,257	99,571	101,439	89,285
3. Maximum Time Period for Batch Releases (min):	8,260	8,834	8,070	9,555
4. Average Time Period for Batch Releases (min):	6,884	7,112	7,246	2,626
5. Minimum Time Period for Batch Releases (min):	315	1,191	445	1

TABLE III.2
 ABNORMAL BATCH LIQUID AND GASEOUS RELEASE SUMMARY
 JANUARY THROUGH DECEMBER 2009

<u>A. Liquid Releases All Sources</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Number of Releases:	0	0	0	0
Total Activity Releases (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>B. Gaseous Releases All Sources</u>				
Number of Releases:	0	0	0	0
Total Activity Releases (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE III.3
GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
A. Fission & Activation Gases				
Total Release (Ci):	6.73E-01	6.44E-01	7.49E-01	1.43E+00
Avg. Release Rate for period (uCi/sec):	8.75E-02	8.28E-02	9.53E-02	1.82E-01
Total Error (%): <u>32.22</u>				
B. Iodines				
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	4.35E-05
Avg. Release Rate for period (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	5.54E-06
Total Error (%): <u>69.87</u>				
C. Particulates				
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	6.43E-07
Avg. Release Rate for period (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	8.18E-08
Total Error (%): <u>54.70</u>				
Gross Alpha:	9.38E-07*	2.12E-06*	2.47E-06*	5.03E-06*
Total Error (%): <u>20.62</u>				
D. Tritium				
Total Release (Ci):	8.20E-01	7.77E-01	1.57E+00	3.36E+00
Avg. Release Rate for period (uCi/sec):	1.07E-01	9.99E-02	2.00E-01	4.28E-01
Total Error (%): <u>25.08</u>				

* Alpha activity attributed to naturally occurring short lived alpha emitters.

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.4
 GASEOUS EFFLUENTS--GROUND LEVEL RELEASES
 JANUARY THROUGH DECEMBER 2009
 Batch Mode

<u>Nuclides (Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Fission & Activation Gases				
AR-41	2.06E-01	2.23E-01	2.39E-01	1.19E-01
KR-85	0.00E+00	0.00E+00	0.00E+00	1.75E-03
KR-85M	1.65E-04	3.12E-05	6.44E-05	2.08E-04
XE-131M	0.00E+00	0.00E+00	0.00E+00	4.28E-04
XE-133	4.50E-01	4.06E-01	4.89E-01	1.03E+00
XE-133M	1.91E-03	3.12E-04	2.37E-03	2.23E-03
XE-135	1.38E-02	1.36E-02	1.87E-02	1.21E-02
Totals for Period:	6.73E-01	6.44E-01	7.49E-01	1.17E+00
Iodines				
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates				
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha				
H-3	1.74E-01	3.24E-01	4.31E-01	2.21E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.5
 GASEOUS EFFLUENTS--GROUND LEVEL RELEASES
 JANUARY THROUGH DECEMBER 2009
 Continuous Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Fission & Activation Gases				
XE-133	0.00E+00	0.00E+00	0.00E+00	8.12E-01
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	8.12E-01
Iodines				
I-131	0.00E+00	0.00E+00	0.00E+00	4.16E-06
I-132	0.00E+00	0.00E+00	0.00E+00	3.54E-05
I-133	0.00E+00	0.00E+00	0.00E+00	3.91E-06
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	4.35E-05
Particulates				
CO-58	0.00E+00	0.00E+00	0.00E+00	6.43E-07
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	6.43E-07
Tritium and Gross Alpha				
ALPHA	9.38E-07	2.12E-06	2.47E-06	5.03E-06
H-3	6.46E-01	4.53E-01	1.14E+00	1.16E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.6
LIQUID EFFLUENTS--SUMMATION OF ALL RELEASES
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
A. Fission & Activation Products				
Total Release (No Tritium, Gas, Alpha) (Ci):	1.69E-04	2.61E-04	2.27E-04	2.01E-03
Avg Diluted Concentration (uCi/mL):	7.11E-11	1.23E-10	7.69E-11	4.58E-10
10 CFR 20, App. B Limit 1.00E-06 uCi/mL	7.11E-03	1.23E-02	7.69E-03	4.58E-02
Percent of Limit (%):				
Total Error (%): <u>43.82</u>				
B. Tritium				
Total Release (Ci):	2.74E+01	4.33E+01	7.53E+01	7.50E+01
Avg Diluted Concentration (uCi/mL):	1.15E-05	2.05E-05	2.55E-05	1.71E-05
10 CFR 20, App. B Limit 1.00E-03 uCi/mL	1.15E+00	2.05E+00	2.55E+00	1.71E+00
Percent of Limit (%):				
Total Error (%): <u>25.22</u>				
C. Dissolved & Entrained Gases				
Total Release (Ci)	0.00E+00	2.97E-05	8.45E-05	2.06E-03
Avg Diluted Concentration (uCi/mL):	0.00E+00	1.40E-11	2.87E-11	4.70E-10
ODCM Limit 2.00E-04	0.00E+00	7.01E-06	1.43E-05	2.35E-04
Percent of Limit (%):				
Total Error (%): <u>39.29</u>				
D. Gross Alpha Radioactivity				
Total Release (Ci):	1.90E-06	0.00E+00	2.13E-05	0.00E+00
Total Error (%): <u>25.08</u>				
E. Volume of Waste Released Prior to Dilution (Liters):	4.16E+05	3.70E+05	5.53E+05	1.54E+06
F. Volume of Dilution Water This Period (Liters):	3.26E+11	3.40E+11	3.56E+11	1.94E+11

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.7
LIQUID EFFLUENTS
JANUARY THROUGH DECEMBER 2009
Batch Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
Fission & Activation Gases				
AG-110M	6.52E-06	1.86E-05	4.23E-07	1.60E-05
BR-82	0.00E+00	0.00E+00	0.00E+00	3.82E-07
CO-58	1.08E-05	1.49E-05	5.83E-05	8.02E-04
CO-60	5.01E-05	4.48E-05	4.10E-05	1.02E-04
CS-134	2.40E-07	9.87E-06	3.22E-06	8.47E-06
CS-137	4.56E-05	1.51E-04	8.80E-05	2.23E-04
I-131	4.71E-06	1.18E-05	1.58E-05	4.59E-04
I-132	0.00E+00	0.00E+00	0.00E+00	4.18E-06
I-133	0.00E+00	0.00E+00	0.00E+00	1.04E-05
MN-54	0.00E+00	0.00E+00	0.00E+00	3.53E-06
NB-95	0.00E+00	1.81E-06	1.29E-07	0.00E+00
SB-122	0.00E+00	0.00E+00	0.00E+00	8.40E-06
SB-124	0.00E+00	0.00E+00	0.00E+00	1.22E-04
SB-125	5.10E-05	8.28E-06	1.99E-05	2.55E-04
SE-75	0.00E+00	0.00E+00	0.00E+00	1.80E-06
TE-132	0.00E+00	0.00E+00	0.00E+00	6.32E-07
Totals for Period:	1.69E-04	2.61E-04	2.27E-04	2.02E-03
Dissolved & Entrained Gases				
KR-85	0.00E+00	0.00E+00	0.00E+00	1.53E-04
KR-87	0.00E+00	0.00E+00	0.00E+00	4.61E-07
XE-133	0.00E+00	2.97E-05	8.41E-05	1.90E-03
XE-133M	0.00E+00	0.00E+00	0.00E+00	2.74E-06
XE-135	0.00E+00	0.00E+00	3.80E-07	7.46E-07
Totals for Period:	0.00E+00	2.97E-05	8.45E-05	2.06E-03
Tritium and Gross Alpha				
ALPHA	1.90E-06	0.00E+00	2.13E-05	0.00E+00
H-3	2.74E+01	4.33E+01	7.53E+01	7.50E+01

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD) values.

TABLE III.8
LIQUID EFFLUENTS
JANUARY THROUGH DECEMBER 2009
Continuous Mode

<u>Nuclides (Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>Fission & Activation Products</u>				
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>Dissolved & Entrained Gases</u>				
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha				
ALPHA	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H-3	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>EAST LAGOON</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0
<u>MW-10</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0
<u>MW-11</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0
<u>MW-12A</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0
<u>MW-12B</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0
<u>MW-1A</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-1B</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>MW-2</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-2A</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-2B</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-3</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-3A</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-3B</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-4A</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>MW-4B</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-5A</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-5B</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-6</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	0	0
Total Gamma	0	0	0	0
<u>MW-7</u>				
Tritium	0	0	0	0
FE-55	0	0	0	0
NI-63	0	0	0	0
Sr-90	0	0	.81	1.35
Total Gamma	0	0	0	0
<u>MW-8</u>				
Tritium				
FE-55				
NI-63				
Sr-90				
Total Gamma				
<u>MW-9</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2009

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>NORTH STORMWATER HDR</u>				
Tritium		0		0
FE-55				
NI-63				
Sr-90				
Total Gamma		0		0
<u>SOUTH STORMWATER HDR</u>				
Tritium		0		0
FE-55				
NI-63				
Sr-90				
Total Gamma		0		0
<u>WEST LAGOON</u>				
Tritium		0	0	0
FE-55				
NI-63				
Sr-90				
Total Gamma		0	0	0

SECTION IV
DOSE FROM GASEOUS EFFLUENTS

Technical Specification 5.9.4.a

GASPAR II OUTPUT

January 1, 2009 - December 31, 2009

Radioactive Effluent Releases - First, Second, Third and Fourth Quarters 2009

GASEOUS EFFLUENTS

Radioactive gaseous releases for the reporting period totaled $3.50\text{E}+00$ curies of inert gas. The gross gaseous activity release rates were $8.75\text{E}-02$ $\mu\text{Ci}/\text{sec}$ for the first quarter, $8.28\text{E}-02$ $\mu\text{Ci}/\text{sec}$ for the second quarter, $9.53\text{E}-02$ $\mu\text{Ci}/\text{sec}$ for the third quarter, and $1.82\text{E}-01$ $\mu\text{Ci}/\text{sec}$ for the fourth quarter.

Radioactive halogens released during the reporting period totaled $4.35\text{E}-05$ curies. The halogen activity release rates were $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the first quarter, $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the second quarter, $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the third quarter and $5.54\text{E}-06$ $\mu\text{Ci}/\text{sec}$ for the fourth quarter.

Radioactive particulates with half-lives greater than eight days released during the reporting period totaled $6.43\text{E}-07$ curies. The particulate activity release rates were $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the first quarter, $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the second quarter, $0.00\text{E}+00$ $\mu\text{Ci}/\text{sec}$ for the third quarter and $8.18\text{E}-08$ $\mu\text{Ci}/\text{sec}$ for the fourth quarter.

Radioactive tritium released during the reporting period totaled 6.53 curies. Gross alpha radioactivity released during the reporting period totaled $1.06\text{E}-05$ curies. Off-site vendor reanalysis of alpha samples indicated that the reported concentration was attributed to short lived, naturally occurring alpha emitters.

POTENTIAL DOSES TO INDIVIDUALS AND POPULATIONS

A. Potential Annual Doses to Individuals from Gaseous Releases

Total body, skin, and organ doses from ground releases were calculated in mRem to an average adult, teenager, child, and infant using the annual configuration of the GASPAR II program. Results to each receptor are shown in Tables IV-A-1 through IV-A-39. Also, the doses to the same groups, Table IV-B-1, in units of mRad, due to gamma and beta radiation carried by air, were computed using GASPAR II. In its annual configuration, GASPAR II assumes that all release rates are entered in curies per year (Ci/yr).

The inputs to GASPAR II for the annual period from January 1, 2009 through December 31, 2009 were as follows:

- (1) All gaseous effluents
- (2) Entrained gases (Ar-41, Xe-131M, Xe-133M, Xe-133, Xe-135M, Xe-135, Kr-85M, Kr-87, and Kr-88) from liquid effluents.
- (3) Annual X/Q at the actual receptor locations, which are corrected for open terrain and plume depletion, are calculated according to Regulatory Guide 1.111. Also included are annual deposition rates corrected for the open terrain factor.
- (4) The production, intake and grazing fractions were as follows: 1.0 for leafy vegetables grown in garden of interest, 0.76 for produce grown in garden of interest, 0.5 for the pasture grazing season of the milk animal, 1.0 for pasture grazing season of the meat animal, and 8 g/m^3 for the air water (humidity) concentrations.
- (5) All dose factors, transport times from receptor to individual, and usage factors are defined by Regulatory Guide 1.109 and NUREG-0172.
- (6) Site specific information, within a five-mile radius of the plant, on types of receptors located in each sector was used. That is, if a cow was not present in a sector, then the milk pathway for that sector was not considered. If it was present, then the actual sector distance was used.

These inputs introduce a most conservative approach for the following reasons:

- (1) The open terrain and deposition corrections increase annual X/Q by a factor ranging between 1.0 and 4.0
- (2) The production, intake, and grazing fractions, as defined in the input definition statement, represent the environment in an extremely conservative manner.

B. Potential Semiannual Doses to Population from Gaseous Releases

The GASPAR II program in its annual configuration was also used to calculate the ALARA integrated population dose summary for the total body, skin, and organ doses in man-rem for all individuals within a 50-mile radius. The population-integrated dose is the summation of the dose received by all individuals and has units of man-thyroid-rem when applied to the summation of thyroid doses. The same inputs were used as in the individual case with the addition of the following:

- (1) A total population of 853,274 (based on the 2000 census) was used to define the sector segments within a 50-mile radius of the plant.
- (2) Production of milk, meat, and vegetation is based on 1973 annual data for Nebraska as recommended by the Nuclear Regulatory Commission for use in GASPAR II.

TABLE IV-A- 1

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 1 RES
 AT 4.36 MILES N

ANNUAL_BETA_AIR_DOSE = 1.02E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.87E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.98E-06	: 2.98E-06	: 2.98E-06	: 2.98E-06	: 2.98E-06	: 2.98E-06	: 3.08E-06	: 7.18E-06
GROUND	: 1.37E-08	: 1.37E-08	: 1.37E-08	: 1.37E-08	: 1.37E-08	: 1.37E-08	: 1.37E-08	: 1.59E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.64E-05	: 1.64E-05	: 5.52E-10	: 1.64E-05	: 1.64E-05	: 1.65E-05	: 1.64E-05	: 1.64E-05
TEEN	: 1.65E-05	: 1.65E-05	: 7.72E-10	: 1.65E-05	: 1.65E-05	: 1.67E-05	: 1.65E-05	: 1.65E-05
CHILD	: 1.46E-05	: 1.46E-05	: 1.04E-09	: 1.46E-05	: 1.46E-05	: 1.48E-05	: 1.46E-05	: 1.46E-05
INFANT	: 8.38E-06	: 8.38E-06	: 7.91E-10	: 8.38E-06	: 8.38E-06	: 8.60E-06	: 8.40E-06	: 8.38E-06

TABLE IV-A- 2

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 2 RES
 AT 1.93 MILES NNE

ANNUAL_BETA_AIR_DOSE = 6.51E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 7.54E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 4.90E-05	: 4.90E-05	: 4.90E-05	: 4.90E-05	: 4.90E-05	: 4.90E-05	: 4.94E-05	: 8.97E-05
GROUND	: 7.15E-08	: 7.15E-08	: 7.15E-08	: 7.15E-08	: 7.15E-08	: 7.15E-08	: 7.15E-08	: 8.29E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 7.14E-05	: 7.14E-05	: 2.94E-09	: 7.14E-05	: 7.14E-05	: 7.22E-05	: 7.14E-05	: 7.14E-05
TEEN	: 7.20E-05	: 7.20E-05	: 4.10E-09	: 7.20E-05	: 7.20E-05	: 7.31E-05	: 7.21E-05	: 7.20E-05
CHILD	: 6.36E-05	: 6.36E-05	: 5.54E-09	: 6.36E-05	: 6.36E-05	: 6.48E-05	: 6.37E-05	: 6.36E-05
INFANT	: 3.66E-05	: 3.66E-05	: 4.22E-09	: 3.66E-05	: 3.66E-05	: 3.77E-05	: 3.66E-05	: 3.66E-05

TABLE IV-A- 3

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 3 RES
 AT 1.52 MILES NE

ANNUAL_BETA_AIR_DOSE = 1.05E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.34E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 8.75E-05	: 8.75E-05	: 8.75E-05	: 8.75E-05	: 8.75E-05	: 8.75E-05	: 8.81E-05	: 1.57E-04
GROUND	: 8.01E-08	: 8.01E-08	: 8.01E-08	: 8.01E-08	: 8.01E-08	: 8.01E-08	: 8.01E-08	: 9.29E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.07E-04	: 1.07E-04	: 4.56E-09	: 1.07E-04	: 1.07E-04	: 1.08E-04	: 1.07E-04	: 1.07E-04
TEEN	: 1.08E-04	: 1.08E-04	: 6.36E-09	: 1.08E-04	: 1.08E-04	: 1.10E-04	: 1.08E-04	: 1.08E-04
CHILD	: 9.54E-05	: 9.54E-05	: 8.58E-09	: 9.54E-05	: 9.54E-05	: 9.72E-05	: 9.55E-05	: 9.54E-05
INFANT	: 5.49E-05	: 5.49E-05	: 6.55E-09	: 5.49E-05	: 5.49E-05	: 5.66E-05	: 5.50E-05	: 5.49E-05

TABLE IV-A- 4

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 4 RES
 AT 4.79 MILES ENE

ANNUAL_BETA_AIR_DOSE = 7.71E-06 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.85E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.11E-06	: 6.60E-06
GROUND	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.83E-09
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.15E-05	: 1.15E-05	: 3.98E-10	: 1.15E-05	: 1.15E-05	: 1.16E-05	: 1.15E-05	: 1.15E-05
TEEN	: 1.16E-05	: 1.16E-05	: 5.56E-10	: 1.16E-05	: 1.16E-05	: 1.17E-05	: 1.16E-05	: 1.16E-05
CHILD	: 1.02E-05	: 1.02E-05	: 7.51E-10	: 1.02E-05	: 1.02E-05	: 1.04E-05	: 1.02E-05	: 1.02E-05
INFANT	: 5.87E-06	: 5.87E-06	: 5.71E-10	: 5.87E-06	: 5.87E-06	: 6.03E-06	: 5.88E-06	: 5.87E-06

TABLE IV-A- 5

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 5 RES
 AT 4.67 MILES E

ANNUAL_BETA_AIR_DOSE = 9.21E-06 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 5.77E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.62E-06	3.62E-06	3.62E-06	3.62E-06	3.62E-06	3.62E-06	3.70E-06	7.86E-06
GROUND	6.25E-09	6.25E-09	6.25E-09	6.25E-09	6.25E-09	6.25E-09	6.25E-09	7.25E-09
INHAL								
ADULT	1.37E-05	1.37E-05	4.75E-10	1.37E-05	1.37E-05	1.38E-05	1.37E-05	1.37E-05
TEEN	1.38E-05	1.38E-05	6.64E-10	1.38E-05	1.38E-05	1.40E-05	1.38E-05	1.38E-05
CHILD	1.22E-05	1.22E-05	8.97E-10	1.22E-05	1.22E-05	1.24E-05	1.22E-05	1.22E-05
INFANT	7.01E-06	7.01E-06	6.82E-10	7.01E-06	7.01E-06	7.20E-06	7.02E-06	7.01E-06

TABLE IV-A- 6

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 6 RES
 AT 4.22 MILES ESE

ANNUAL_BETA_AIR_DOSE = 1.49E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 9.20E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.76E-06	: 5.76E-06	: 5.76E-06	: 5.76E-06	: 5.76E-06	: 5.76E-06	: 5.89E-06	: 1.26E-05
GROUND	: 1.08E-08	: 1.08E-08	: 1.08E-08	: 1.08E-08	: 1.08E-08	: 1.08E-08	: 1.08E-08	: 1.26E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 2.23E-05	: 2.23E-05	: 7.69E-10	: 2.23E-05	: 2.23E-05	: 2.25E-05	: 2.23E-05	: 2.23E-05
TEEN	: 2.25E-05	: 2.25E-05	: 1.07E-09	: 2.25E-05	: 2.25E-05	: 2.28E-05	: 2.25E-05	: 2.25E-05
CHILD	: 1.99E-05	: 1.99E-05	: 1.45E-09	: 1.99E-05	: 1.99E-05	: 2.02E-05	: 1.99E-05	: 1.99E-05
INFANT	: 1.14E-05	: 1.14E-05	: 1.10E-09	: 1.14E-05	: 1.14E-05	: 1.17E-05	: 1.15E-05	: 1.14E-05

TABLE IV-A- 7

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 7 RES
 AT 1.67 MILES SE

ANNUAL_BETA_AIR_DOSE = 1.02E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.87E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 3.08E-05	: 7.18E-05
GROUND	: 2.08E-07	: 2.08E-07	: 2.08E-07	: 2.08E-07	: 2.08E-07	: 2.08E-07	: 2.08E-07	: 2.41E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.64E-04	: 1.64E-04	: 5.75E-09	: 1.64E-04	: 1.64E-04	: 1.65E-04	: 1.64E-04	: 1.64E-04
TEEN	: 1.65E-04	: 1.65E-04	: 8.04E-09	: 1.65E-04	: 1.65E-04	: 1.67E-04	: 1.65E-04	: 1.65E-04
CHILD	: 1.46E-04	: 1.46E-04	: 1.09E-08	: 1.46E-04	: 1.46E-04	: 1.48E-04	: 1.46E-04	: 1.46E-04
INFANT	: 8.38E-05	: 8.38E-05	: 8.23E-09	: 8.38E-05	: 8.38E-05	: 8.61E-05	: 8.40E-05	: 8.38E-05

TABLE IV-A- 8

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 8 RES
 AT 0.65 MILES SSE

ANNUAL_BETA_AIR_DOSE = 1.92E-03 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 2.92E-03 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.92E-03	1.92E-03	1.92E-03	1.92E-03	1.92E-03	1.92E-03	1.93E-03	3.33E-03
GROUND	3.31E-06	3.31E-06	3.31E-06	3.31E-06	3.31E-06	3.31E-06	3.31E-06	3.83E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	1.64E-03	1.64E-03	7.69E-08	1.64E-03	1.64E-03	1.66E-03	1.64E-03	1.64E-03
TEEN	1.65E-03	1.65E-03	1.07E-07	1.65E-03	1.65E-03	1.68E-03	1.65E-03	1.65E-03
CHILD	1.46E-03	1.46E-03	1.44E-07	1.46E-03	1.46E-03	1.49E-03	1.46E-03	1.46E-03
INFANT	8.38E-04	8.38E-04	1.10E-07	8.39E-04	8.39E-04	8.66E-04	8.40E-04	8.38E-04

TABLE IV-A- 9

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 9 RES
 AT 0.73 MILES S

ANNUAL_BETA_AIR_DOSE = 7.00E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.25E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.41E-04	: 9.79E-04
GROUND	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.41E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 7.58E-04	: 7.59E-04	: 3.24E-08	: 7.58E-04	: 7.58E-04	: 7.68E-04	: 7.59E-04	: 7.58E-04
TEEN	: 7.65E-04	: 7.65E-04	: 4.53E-08	: 7.65E-04	: 7.65E-04	: 7.77E-04	: 7.66E-04	: 7.65E-04
CHILD	: 6.76E-04	: 6.76E-04	: 6.11E-08	: 6.76E-04	: 6.76E-04	: 6.89E-04	: 6.77E-04	: 6.76E-04
INFANT	: 3.89E-04	: 3.89E-04	: 4.66E-08	: 3.89E-04	: 3.89E-04	: 4.01E-04	: 3.89E-04	: 3.89E-04

TABLE IV-A-10

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 10 RES
 AT 0.65 MILES SSW

ANNUAL BETA AIR DOSE = 7.52E-04 MILLRADS
 ANNUAL GAMMA AIR DOSE = 1.14E-03 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.53E-04	: 1.30E-03
GROUND	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 7.37E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 6.39E-04	: 6.40E-04	: 3.00E-08	: 6.39E-04	: 6.40E-04	: 6.48E-04	: 6.40E-04	: 6.39E-04
TEEN	: 6.45E-04	: 6.45E-04	: 4.18E-08	: 6.45E-04	: 6.45E-04	: 6.55E-04	: 6.46E-04	: 6.45E-04
CHILD	: 5.70E-04	: 5.70E-04	: 5.64E-08	: 5.70E-04	: 5.70E-04	: 5.81E-04	: 5.71E-04	: 5.70E-04
INFANT	: 3.28E-04	: 3.28E-04	: 4.31E-08	: 3.28E-04	: 3.28E-04	: 3.38E-04	: 3.28E-04	: 3.28E-04

TABLE IV-A-11

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 11 RES
 AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 5.77E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.76E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.75E-04	5.75E-04	5.75E-04	5.75E-04	5.75E-04	5.75E-04	5.78E-04	9.99E-04
GROUND	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.24E-07	4.91E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	4.91E-04	4.91E-04	2.26E-08	4.91E-04	4.91E-04	4.97E-04	4.91E-04	4.91E-04
TEEN	4.95E-04	4.95E-04	3.15E-08	4.95E-04	4.95E-04	5.03E-04	4.96E-04	4.95E-04
CHILD	4.37E-04	4.37E-04	4.25E-08	4.37E-04	4.37E-04	4.46E-04	4.38E-04	4.37E-04
INFANT	2.52E-04	2.52E-04	3.25E-08	2.52E-04	2.52E-04	2.60E-04	2.52E-04	2.52E-04

TABLE IV-A-12

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 12 RES
 AT 1.06 MILES WSW

ANNUAL_BETA_AIR_DOSE = 2.97E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.51E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.96E-04	: 2.96E-04	: 2.96E-04	: 2.96E-04	: 2.96E-04	: 2.96E-04	: 2.98E-04	: 5.15E-04
GROUND	: 1.87E-07	: 1.87E-07	: 1.87E-07	: 1.87E-07	: 1.87E-07	: 1.87E-07	: 1.87E-07	: 2.16E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 2.53E-04	: 2.53E-04	: 1.17E-08	: 2.53E-04	: 2.53E-04	: 2.56E-04	: 2.53E-04	: 2.53E-04
TEEN	: 2.55E-04	: 2.55E-04	: 1.63E-08	: 2.55E-04	: 2.55E-04	: 2.59E-04	: 2.55E-04	: 2.55E-04
CHILD	: 2.25E-04	: 2.25E-04	: 2.19E-08	: 2.25E-04	: 2.25E-04	: 2.30E-04	: 2.26E-04	: 2.25E-04
INFANT	: 1.30E-04	: 1.30E-04	: 1.68E-08	: 1.30E-04	: 1.30E-04	: 1.34E-04	: 1.30E-04	: 1.30E-04

TABLE IV-A-13

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 13 RES
 AT 1.20 MILES W

ANNUAL_BETA_AIR_DOSE = 2.62E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 3.98E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.63E-04	: 4.54E-04
GROUND	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.67E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 2.23E-04	: 2.23E-04	: 1.02E-08	: 2.23E-04	: 2.23E-04	: 2.26E-04	: 2.23E-04	: 2.23E-04
TEEN	: 2.25E-04	: 2.25E-04	: 1.42E-08	: 2.25E-04	: 2.25E-04	: 2.29E-04	: 2.25E-04	: 2.25E-04
CHILD	: 1.99E-04	: 1.99E-04	: 1.92E-08	: 1.99E-04	: 1.99E-04	: 2.03E-04	: 1.99E-04	: 1.99E-04
INFANT	: 1.14E-04	: 1.14E-04	: 1.47E-08	: 1.14E-04	: 1.14E-04	: 1.18E-04	: 1.15E-04	: 1.14E-04

TABLE IV-A-14

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 14 RES
 AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 8.50E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.04E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.85E-05	: 1.23E-04
GROUND	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 6.35E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 8.92E-05	: 8.92E-05	: 3.68E-09	: 8.92E-05	: 8.92E-05	: 9.03E-05	: 8.93E-05	: 8.92E-05
TEEN	: 9.00E-05	: 9.00E-05	: 5.14E-09	: 9.00E-05	: 9.00E-05	: 9.13E-05	: 9.01E-05	: 9.00E-05
CHILD	: 7.95E-05	: 7.95E-05	: 6.94E-09	: 7.95E-05	: 7.95E-05	: 8.10E-05	: 7.96E-05	: 7.95E-05
INFANT	: 4.57E-05	: 4.57E-05	: 5.30E-09	: 4.57E-05	: 4.57E-05	: 4.71E-05	: 4.58E-05	: 4.57E-05

TABLE IV-A-15

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 15 RES
 AT 2.40 MILES NW

ANNUAL_BETA_AIR_DOSE = 8.18E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.29E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.42E-05	1.01E-04
GROUND	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	1.02E-07
INHAL								
ADULT	9.82E-05	9.82E-05	3.84E-09	9.82E-05	9.82E-05	9.93E-05	9.82E-05	9.81E-05
TEEN	9.90E-05	9.90E-05	5.37E-09	9.90E-05	9.90E-05	1.00E-04	9.91E-05	9.90E-05
CHILD	8.75E-05	8.75E-05	7.25E-09	8.75E-05	8.75E-05	8.90E-05	8.76E-05	8.75E-05
INFANT	5.03E-05	5.03E-05	5.52E-09	5.03E-05	5.03E-05	5.18E-05	5.04E-05	5.03E-05

TABLE IV-A-16

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 16 RES
 AT 2.08 MILES NNW

ANNUAL_BETA_AIR_DOSE = 9.51E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.19E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.77E-05	: 7.77E-05	: 7.77E-05	: 7.77E-05	: 7.77E-05	: 7.77E-05	: 7.83E-05	: 1.40E-04
GROUND	: 1.05E-07	: 1.05E-07	: 1.05E-07	: 1.05E-07	: 1.05E-07	: 1.05E-07	: 1.05E-07	: 1.22E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 9.82E-05	: 9.82E-05	: 4.08E-09	: 9.82E-05	: 9.82E-05	: 9.93E-05	: 9.82E-05	: 9.81E-05
TEEN	: 9.90E-05	: 9.90E-05	: 5.69E-09	: 9.90E-05	: 9.90E-05	: 1.00E-04	: 9.92E-05	: 9.90E-05
CHILD	: 8.75E-05	: 8.75E-05	: 7.68E-09	: 8.75E-05	: 8.75E-05	: 8.91E-05	: 8.76E-05	: 8.75E-05
INFANT	: 5.03E-05	: 5.03E-05	: 5.86E-09	: 5.03E-05	: 5.03E-05	: 5.18E-05	: 5.04E-05	: 5.03E-05

TABLE IV-A-17

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 17 VEG
 AT 1.59 MILES NE

ANNUAL_BETA_AIR_DOSE = 9.68E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.22E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.93E-05	: 7.93E-05	: 7.93E-05	: 7.93E-05	: 7.93E-05	: 7.93E-05	: 7.99E-05	: 1.43E-04
GROUND	: 7.16E-08	: 7.16E-08	: 7.16E-08	: 7.16E-08	: 7.16E-08	: 7.16E-08	: 7.16E-08	: 8.31E-08
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.81E-04	: 1.81E-04	: 4.07E-08	: 1.81E-04	: 1.81E-04	: 1.93E-04	: 1.81E-04	: 1.81E-04
TEEN	: 2.06E-04	: 2.07E-04	: 6.02E-08	: 2.06E-04	: 2.07E-04	: 2.22E-04	: 2.06E-04	: 2.06E-04
CHILD	: 3.21E-04	: 3.21E-04	: 1.39E-07	: 3.21E-04	: 3.21E-04	: 3.50E-04	: 3.21E-04	: 3.21E-04

TABLE IV-A-18

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 18 VEG
 AT 4.79 MILES ENE

ANNUAL_BETA_AIR_DOSE = 7.71E-06 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.85E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.05E-06	: 3.11E-06	: 6.60E-06
GROUND	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.17E-09	: 4.83E-09
VEGET	:	:	:	:	:	:	:	:
ADULT	: 2.07E-05	: 2.08E-05	: 2.37E-09	: 2.07E-05	: 2.07E-05	: 2.15E-05	: 2.07E-05	: 2.07E-05
TEEN	: 2.37E-05	: 2.38E-05	: 3.51E-09	: 2.37E-05	: 2.37E-05	: 2.46E-05	: 2.37E-05	: 2.37E-05
CHILD	: 3.69E-05	: 3.69E-05	: 8.07E-09	: 3.69E-05	: 3.69E-05	: 3.85E-05	: 3.69E-05	: 3.69E-05

TABLE IV-A-19

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 19 VEG
 AT 4.67 MILES E

ANNUAL_BETA_AIR_DOSE = 9.21E-06 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 5.77E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.62E-06	: 3.62E-06	: 3.62E-06	: 3.62E-06	: 3.62E-06	: 3.62E-06	: 3.70E-06	: 7.86E-06
GROUND	: 6.25E-09	: 6.25E-09	: 6.25E-09	: 6.25E-09	: 6.25E-09	: 6.25E-09	: 6.25E-09	: 7.25E-09
VEGET	:	:	:	:	:	:	:	:
ADULT	: 2.48E-05	: 2.48E-05	: 3.55E-09	: 2.48E-05	: 2.48E-05	: 2.59E-05	: 2.48E-05	: 2.48E-05
TEEN	: 2.84E-05	: 2.84E-05	: 5.26E-09	: 2.84E-05	: 2.84E-05	: 2.97E-05	: 2.83E-05	: 2.83E-05
CHILD	: 4.40E-05	: 4.41E-05	: 1.21E-08	: 4.40E-05	: 4.40E-05	: 4.65E-05	: 4.40E-05	: 4.40E-05

TABLE IV-A-20

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 20 VEG
 AT 5.00 MILES ESE

ANNUAL BETA AIR DOSE = 1.13E-05 MILLRADS
 ANNUAL GAMMA AIR DOSE = 5.80E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.68E-06	: 8.37E-06
GROUND	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 9.16E-09
VEGET	:	:	:	:	:	:	:	:
ADULT	: 3.23E-05	: 3.24E-05	: 4.48E-09	: 3.23E-05	: 3.23E-05	: 3.37E-05	: 3.23E-05	: 3.23E-05
TEEN	: 3.70E-05	: 3.70E-05	: 6.64E-09	: 3.70E-05	: 3.70E-05	: 3.87E-05	: 3.70E-05	: 3.70E-05
CHILD	: 5.74E-05	: 5.75E-05	: 1.53E-08	: 5.74E-05	: 5.74E-05	: 6.06E-05	: 5.74E-05	: 5.74E-05

TABLE IV-A-21

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 21 VEG
 AT 1.74 MILES SE

ANNUAL_BETA_AIR_DOSE = 1.35E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.58E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 1.03E-04	: 1.03E-04	: 1.03E-04	: 1.03E-04	: 1.03E-04	: 1.03E-04	: 1.04E-04	: 1.88E-04
GROUND	: 1.98E-07	: 1.98E-07	: 1.98E-07	: 1.98E-07	: 1.98E-07	: 1.98E-07	: 1.98E-07	: 2.29E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 2.67E-04	: 2.68E-04	: 1.12E-07	: 2.67E-04	: 2.67E-04	: 3.01E-04	: 2.67E-04	: 2.67E-04
TEEN	: 3.05E-04	: 3.06E-04	: 1.66E-07	: 3.05E-04	: 3.05E-04	: 3.48E-04	: 3.05E-04	: 3.05E-04
CHILD	: 4.74E-04	: 4.75E-04	: 3.83E-07	: 4.74E-04	: 4.74E-04	: 5.54E-04	: 4.74E-04	: 4.74E-04

TABLE IV-A-22

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 22 VEG
 AT 0.94 MILES SSE

ANNUAL_BETA_AIR_DOSE = 6.84E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.01E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.21E-04	: 5.21E-04	: 5.21E-04	: 5.21E-04	: 5.21E-04	: 5.21E-04	: 5.26E-04	: 9.51E-04
GROUND	: 1.47E-06	: 1.47E-06	: 1.47E-06	: 1.47E-06	: 1.47E-06	: 1.47E-06	: 1.47E-06	: 1.71E-06
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.35E-03	: 1.36E-03	: 8.37E-07	: 1.35E-03	: 1.35E-03	: 1.60E-03	: 1.35E-03	: 1.35E-03
TEEN	: 1.54E-03	: 1.55E-03	: 1.24E-06	: 1.54E-03	: 1.54E-03	: 1.86E-03	: 1.54E-03	: 1.54E-03
CHILD	: 2.39E-03	: 2.40E-03	: 2.85E-06	: 2.39E-03	: 2.40E-03	: 2.99E-03	: 2.39E-03	: 2.39E-03

TABLE IV-A-23

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS

SPECIAL LOCATION NO. 23 VEG
 AT 0.73 MILES S

ANNUAL_BETA_AIR_DOSE = 7.00E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.25E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.37E-04	: 5.41E-04	: 9.79E-04
GROUND	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.22E-06	: 1.41E-06
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.37E-03	: 1.38E-03	: 6.94E-07	: 1.37E-03	: 1.38E-03	: 1.58E-03	: 1.37E-03	: 1.37E-03
TEEN	: 1.57E-03	: 1.58E-03	: 1.03E-06	: 1.57E-03	: 1.57E-03	: 1.84E-03	: 1.57E-03	: 1.57E-03
CHILD	: 2.44E-03	: 2.45E-03	: 2.36E-06	: 2.44E-03	: 2.44E-03	: 2.93E-03	: 2.44E-03	: 2.44E-03

TABLE IV-A-24

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 24 VEG
 AT 0.65 MILES SSW

ANNUAL_BETA_AIR_DOSE = 7.52E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.14E-03 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.53E-04	: 1.30E-03
GROUND	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 7.37E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.16E-03	: 1.16E-03	: 3.60E-07	: 1.16E-03	: 1.16E-03	: 1.27E-03	: 1.16E-03	: 1.16E-03
TEEN	: 1.33E-03	: 1.33E-03	: 5.33E-07	: 1.33E-03	: 1.33E-03	: 1.46E-03	: 1.33E-03	: 1.32E-03
CHILD	: 2.06E-03	: 2.06E-03	: 1.23E-06	: 2.06E-03	: 2.06E-03	: 2.31E-03	: 2.06E-03	: 2.06E-03

TABLE IV-A-25

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 25 VEG
 AT 0.75 MILES SW

ANNUAL_BETA_AIR_DOSE = 5.42E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.23E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.40E-04	: 5.40E-04	: 5.40E-04	: 5.40E-04	: 5.40E-04	: 5.40E-04	: 5.43E-04	: 9.39E-04
GROUND	: 4.03E-07	: 4.03E-07	: 4.03E-07	: 4.03E-07	: 4.03E-07	: 4.03E-07	: 4.03E-07	: 4.67E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 8.35E-04	: 8.38E-04	: 2.28E-07	: 8.35E-04	: 8.36E-04	: 9.04E-04	: 8.35E-04	: 8.35E-04
TEEN	: 9.55E-04	: 9.58E-04	: 3.38E-07	: 9.55E-04	: 9.56E-04	: 1.04E-03	: 9.55E-04	: 9.55E-04
CHILD	: 1.48E-03	: 1.49E-03	: 7.77E-07	: 1.48E-03	: 1.48E-03	: 1.65E-03	: 1.48E-03	: 1.48E-03

TABLE IV-A-26

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 26 VEG
 AT 1.21 MILES WSW

ANNUAL_BETA_AIR_DOSE = 1.13E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 5.80E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.58E-05	: 3.58E-05	: 3.58E-05	: 3.58E-05	: 3.58E-05	: 3.58E-05	: 3.68E-05	: 8.37E-05
GROUND	: 1.25E-07	: 1.25E-07	: 1.25E-07	: 1.25E-07	: 1.25E-07	: 1.25E-07	: 1.25E-07	: 1.45E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 3.23E-04	: 3.24E-04	: 7.08E-08	: 3.23E-04	: 3.23E-04	: 3.45E-04	: 3.23E-04	: 3.23E-04
TEEN	: 3.70E-04	: 3.71E-04	: 1.05E-07	: 3.70E-04	: 3.70E-04	: 3.97E-04	: 3.70E-04	: 3.70E-04
CHILD	: 5.74E-04	: 5.75E-04	: 2.41E-07	: 5.74E-04	: 5.75E-04	: 6.24E-04	: 5.74E-04	: 5.74E-04

TABLE IV-A-27

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 27 VEG
 AT 1.20 MILES W

ANNUAL_BETA_AIR_DOSE = 2.62E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 3.98E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.61E-04	: 2.63E-04	: 4.54E-04
GROUND	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.44E-07	: 1.67E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 4.04E-04	: 4.05E-04	: 8.17E-08	: 4.04E-04	: 4.04E-04	: 4.29E-04	: 4.04E-04	: 4.04E-04
TEEN	: 4.62E-04	: 4.63E-04	: 1.21E-07	: 4.62E-04	: 4.62E-04	: 4.93E-04	: 4.62E-04	: 4.62E-04
CHILD	: 7.18E-04	: 7.19E-04	: 2.78E-07	: 7.18E-04	: 7.18E-04	: 7.76E-04	: 7.18E-04	: 7.18E-04

TABLE IV-A-28

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 28 VEG
 AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 8.50E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.04E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.85E-05	: 1.23E-04
GROUND	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 6.35E-08
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.62E-04	: 1.62E-04	: 3.11E-08	: 1.62E-04	: 1.62E-04	: 1.71E-04	: 1.62E-04	: 1.62E-04
TEEN	: 1.85E-04	: 1.85E-04	: 4.61E-08	: 1.85E-04	: 1.85E-04	: 1.97E-04	: 1.85E-04	: 1.85E-04
CHILD	: 2.87E-04	: 2.87E-04	: 1.06E-07	: 2.87E-04	: 2.87E-04	: 3.09E-04	: 2.87E-04	: 2.87E-04

TABLE IV-A-29

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 29 VEG
 AT 2.40 MILES NW

ANNUAL_BETA_AIR_DOSE = 8.18E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.29E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.36E-05	5.42E-05	1.01E-04
GROUND	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	8.81E-08	1.02E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	1.78E-04	1.78E-04	5.01E-08	1.78E-04	1.78E-04	1.93E-04	1.78E-04	1.78E-04
TEEN	2.03E-04	2.04E-04	7.42E-08	2.03E-04	2.03E-04	2.22E-04	2.03E-04	2.03E-04
CHILD	3.16E-04	3.16E-04	1.71E-07	3.16E-04	3.16E-04	3.51E-04	3.16E-04	3.16E-04

TABLE IV-A-30

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 30 VEG
 AT 4.01 MILES NNW

ANNUAL BETA AIR DOSE = 2.80E-05 MILLRADS
 ANNUAL GAMMA AIR DOSE = 4.25E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.79E-05	: 2.79E-05	: 2.79E-05	: 2.79E-05	: 2.79E-05	: 2.79E-05	: 2.80E-05	: 4.84E-05
GROUND	: 2.08E-08	: 2.08E-08	: 2.08E-08	: 2.08E-08	: 2.08E-08	: 2.08E-08	: 2.08E-08	: 2.41E-08
VEGET	:	:	:	:	:	:	:	:
ADULT	: 4.31E-05	: 4.32E-05	: 1.18E-08	: 4.31E-05	: 4.31E-05	: 4.67E-05	: 4.31E-05	: 4.31E-05
TEEN	: 4.93E-05	: 4.94E-05	: 1.74E-08	: 4.93E-05	: 4.93E-05	: 5.38E-05	: 4.93E-05	: 4.93E-05
CHILD	: 7.66E-05	: 7.67E-05	: 4.01E-08	: 7.66E-05	: 7.66E-05	: 8.50E-05	: 7.66E-05	: 7.66E-05

TABLE IV-A-31

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 31 BEEF
 AT 4.91 MILES E

ANNUAL_BETA_AIR_DOSE = 8.45E-06 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 5.02E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	3.14E-06	3.14E-06	3.14E-06	3.14E-06	3.14E-06	3.14E-06	3.21E-06	6.94E-06
GROUND	5.42E-09	5.42E-09	5.42E-09	5.42E-09	5.42E-09	5.42E-09	5.42E-09	6.28E-09
MEAT	:	:	:	:	:	:	:	:
ADULT	3.33E-06	3.33E-06	2.06E-10	3.33E-06	3.33E-06	3.37E-06	3.33E-06	3.33E-06
TEEN	1.98E-06	1.99E-06	1.70E-10	1.98E-06	1.98E-06	2.01E-06	1.98E-06	1.98E-06
CHILD	2.40E-06	2.41E-06	3.10E-10	2.40E-06	2.40E-06	2.45E-06	2.40E-06	2.40E-06

TABLE IV-A-32

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 32 BEEF
 AT 5.00 MILES ESE

ANNUAL_BETA_AIR_DOSE = 1.13E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 5.80E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.58E-06	: 3.68E-06	: 8.37E-06
GROUND	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 7.90E-09	: 9.16E-09
MEAT	:	:	:	:	:	:	:	:
ADULT	: 4.65E-06	: 4.65E-06	: 3.01E-10	: 4.65E-06	: 4.65E-06	: 4.71E-06	: 4.65E-06	: 4.65E-06
TEEN	: 2.77E-06	: 2.77E-06	: 2.48E-10	: 2.77E-06	: 2.77E-06	: 2.81E-06	: 2.77E-06	: 2.77E-06
CHILD	: 3.35E-06	: 3.36E-06	: 4.53E-10	: 3.35E-06	: 3.35E-06	: 3.42E-06	: 3.35E-06	: 3.35E-06

TABLE IV-A-33

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 33 BEEF
 AT 2.60 MILES S

ANNUAL_BETA_AIR_DOSE = 2.44E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.99E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 1.27E-05	: 1.27E-05	: 1.27E-05	: 1.27E-05	: 1.27E-05	: 1.27E-05	: 1.29E-05	: 2.54E-05
GROUND	: 4.60E-08	: 4.60E-08	: 4.60E-08	: 4.60E-08	: 4.60E-08	: 4.60E-08	: 4.60E-08	: 5.33E-08
MEAT	:	:	:	:	:	:	:	:
ADULT	: 8.52E-06	: 8.55E-06	: 1.75E-09	: 8.52E-06	: 8.52E-06	: 8.87E-06	: 8.52E-06	: 8.52E-06
TEEN	: 5.08E-06	: 5.10E-06	: 1.44E-09	: 5.08E-06	: 5.08E-06	: 5.33E-06	: 5.08E-06	: 5.08E-06
CHILD	: 6.15E-06	: 6.16E-06	: 2.64E-09	: 6.15E-06	: 6.15E-06	: 6.54E-06	: 6.15E-06	: 6.15E-06

TABLE IV-A-34

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 34 BEEF
 AT 0.65 MILES SSW

ANNUAL_BETA_AIR_DOSE = 7.52E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.14E-03 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.53E-04	: 1.30E-03
GROUND	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 7.37E-07
MEAT	:	:	:	:	:	:	:	:
ADULT	: 1.67E-04	: 1.67E-04	: 2.40E-08	: 1.67E-04	: 1.67E-04	: 1.71E-04	: 1.67E-04	: 1.67E-04
TEEN	: 9.92E-05	: 9.95E-05	: 1.98E-08	: 9.92E-05	: 9.92E-05	: 1.03E-04	: 9.92E-05	: 9.92E-05
CHILD	: 1.20E-04	: 1.20E-04	: 3.62E-08	: 1.20E-04	: 1.20E-04	: 1.26E-04	: 1.20E-04	: 1.20E-04

TABLE IV-A-35

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 35 BEEF
 AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 5.77E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 8.76E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 5.75E-04	: 5.75E-04	: 5.75E-04	: 5.75E-04	: 5.75E-04	: 5.75E-04	: 5.78E-04	: 9.99E-04
GROUND	: 4.24E-07	: 4.24E-07	: 4.24E-07	: 4.24E-07	: 4.24E-07	: 4.24E-07	: 4.24E-07	: 4.91E-07
MEAT	:	:	:	:	:	:	:	:
ADULT	: 1.28E-04	: 1.28E-04	: 1.60E-08	: 1.28E-04	: 1.28E-04	: 1.31E-04	: 1.28E-04	: 1.28E-04
TEEN	: 7.62E-05	: 7.63E-05	: 1.32E-08	: 7.62E-05	: 7.62E-05	: 7.85E-05	: 7.61E-05	: 7.61E-05
CHILD	: 9.23E-05	: 9.23E-05	: 2.41E-08	: 9.23E-05	: 9.23E-05	: 9.58E-05	: 9.22E-05	: 9.22E-05

TABLE IV-A-36

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 36 BEEF
 AT 2.42 MILES WSW

ANNUAL_BETA_AIR_DOSE = 2.44E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.99E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	1.27E-05	1.27E-05	1.27E-05	1.27E-05	1.27E-05	1.27E-05	1.29E-05	2.54E-05
GROUND	2.05E-08	2.05E-08	2.05E-08	2.05E-08	2.05E-08	2.05E-08	2.05E-08	2.38E-08
MEAT	:	:	:	:	:	:	:	:
ADULT	8.52E-06	8.53E-06	7.80E-10	8.52E-06	8.52E-06	8.68E-06	8.52E-06	8.52E-06
TEEN	5.08E-06	5.09E-06	6.42E-10	5.08E-06	5.08E-06	5.19E-06	5.08E-06	5.08E-06
CHILD	6.15E-06	6.15E-06	1.17E-09	6.15E-06	6.15E-06	6.32E-06	6.15E-06	6.15E-06

TABLE IV-A-37

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 37 BEEF
 AT 3.25 MILES W

ANNUAL_BETA_AIR_DOSE = 1.37E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 7.97E-06 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 4.97E-06	: 4.97E-06	: 4.97E-06	: 4.97E-06	: 4.97E-06	: 4.97E-06	: 5.09E-06	: 1.11E-05
GROUND	: 1.04E-08	: 1.04E-08	: 1.04E-08	: 1.04E-08	: 1.04E-08	: 1.04E-08	: 1.04E-08	: 1.21E-08
MEAT	:	:	:	:	:	:	:	:
ADULT	: 5.42E-06	: 5.43E-06	: 3.97E-10	: 5.42E-06	: 5.42E-06	: 5.50E-06	: 5.42E-06	: 5.42E-06
TEEN	: 3.23E-06	: 3.23E-06	: 3.26E-10	: 3.23E-06	: 3.23E-06	: 3.29E-06	: 3.23E-06	: 3.23E-06
CHILD	: 3.91E-06	: 3.92E-06	: 5.97E-10	: 3.91E-06	: 3.91E-06	: 4.00E-06	: 3.91E-06	: 3.91E-06

TABLE IV-A-38

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 38 BEEF
 AT 2.27 MILES WNW

ANNUAL_BETA_AIR_DOSE = 8.50E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.04E-04 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.80E-05	: 6.85E-05	: 1.23E-04
GROUND	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 5.48E-08	: 6.35E-08
MEAT	:	:	:	:	:	:	:	:
ADULT	: 2.32E-05	: 2.33E-05	: 2.08E-09	: 2.32E-05	: 2.32E-05	: 2.37E-05	: 2.32E-05	: 2.32E-05
TEEN	: 1.38E-05	: 1.39E-05	: 1.71E-09	: 1.38E-05	: 1.38E-05	: 1.41E-05	: 1.38E-05	: 1.38E-05
CHILD	: 1.68E-05	: 1.68E-05	: 3.13E-09	: 1.68E-05	: 1.68E-05	: 1.72E-05	: 1.68E-05	: 1.68E-05

TABLE IV-A-39

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 39 BEEF
 AT 1.82 MILES SSE

ANNUAL_BETA_AIR_DOSE = 1.02E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 4.87E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 2.98E-05	: 3.08E-05	: 7.18E-05
GROUND	: 2.83E-07	: 2.83E-07	: 2.83E-07	: 2.83E-07	: 2.83E-07	: 2.83E-07	: 2.83E-07	: 3.28E-07
MEAT	:	:	:	:	:	:	:	:
ADULT	: 4.26E-05	: 4.28E-05	: 1.08E-08	: 4.26E-05	: 4.26E-05	: 4.48E-05	: 4.26E-05	: 4.26E-05
TEEN	: 2.54E-05	: 2.55E-05	: 8.85E-09	: 2.54E-05	: 2.54E-05	: 2.69E-05	: 2.54E-05	: 2.54E-05
CHILD	: 3.08E-05	: 3.08E-05	: 1.62E-08	: 3.08E-05	: 3.08E-05	: 3.31E-05	: 3.08E-05	: 3.07E-05

TABLE IV-A-40

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 40 COW
 AT 3.44 MILES S

ANNUAL_BETA_AIR_DOSE = 2.10E-05 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 3.18E-05 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 2.09E-05	: 2.09E-05	: 2.09E-05	: 2.09E-05	: 2.09E-05	: 2.09E-05	: 2.10E-05	: 3.63E-05
GROUND	: 2.42E-08	: 2.42E-08	: 2.42E-08	: 2.42E-08	: 2.42E-08	: 2.42E-08	: 2.42E-08	: 2.80E-08
COW MILK	:	:	:	:	:	:	:	:
ADULT	: 1.09E-05	: 1.09E-05	: 5.93E-09	: 1.09E-05	: 1.09E-05	: 1.35E-05	: 1.09E-05	: 1.09E-05
TEEN	: 1.42E-05	: 1.42E-05	: 1.07E-08	: 1.42E-05	: 1.42E-05	: 1.83E-05	: 1.42E-05	: 1.42E-05
CHILD	: 2.25E-05	: 2.25E-05	: 2.60E-08	: 2.25E-05	: 2.25E-05	: 3.06E-05	: 2.25E-05	: 2.25E-05
INFANT	: 3.42E-05	: 3.41E-05	: 5.41E-08	: 3.42E-05	: 3.42E-05	: 5.38E-05	: 3.41E-05	: 3.41E-05

TABLE IV-A-41

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 41 COW
 AT 0.65 MILES SSW

ANNUAL_BETA_AIR_DOSE = 7.52E-04 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 1.14E-03 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.49E-04	: 7.53E-04	: 1.30E-03
GROUND	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 6.36E-07	: 7.37E-07
COW MILK	:	:	:	:	:	:	:	:
ADULT	: 3.91E-04	: 3.91E-04	: 1.56E-07	: 3.91E-04	: 3.91E-04	: 4.59E-04	: 3.91E-04	: 3.91E-04
TEEN	: 5.09E-04	: 5.09E-04	: 2.83E-07	: 5.09E-04	: 5.09E-04	: 6.16E-04	: 5.09E-04	: 5.09E-04
CHILD	: 8.07E-04	: 8.06E-04	: 6.85E-07	: 8.07E-04	: 8.07E-04	: 1.02E-03	: 8.06E-04	: 8.06E-04
INFANT	: 1.22E-03	: 1.22E-03	: 1.42E-06	: 1.22E-03	: 1.22E-03	: 1.74E-03	: 1.22E-03	: 1.22E-03

TABLE IV-B-1

FORT CALHOUN 1

DOSE CONTRIBUTIONS FROM GASEOUS EFFLUENTS
UNRESTRICTED AREA BOUNDARY

REQUIRED BY TECHNICAL SPECIFICATION 5.9.4.a.

ANNUAL FOR JANUARY 1, 2009 TO DECEMBER 31, 2009

MAXIMUM SITE BOUNDARY GAMMA AIR DOSE - 3.45E-03 MILLRADS

MAXIMUM SITE BOUNDARY BETA AIR DOSE - 2.27E-03 MILLRADS

TABLE IV-C-1

FORT CALHOUN ANNUAL 2009, DOSE PROJECTIONS
 ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 3.51E-04	: 3.51E-04	: 3.51E-04	: 3.51E-04	: 3.51E-04	: 3.51E-04	: 3.64E-04	: 9.48E-04
	: 6.51%	: 6.50%	: 99.53%	: 6.51%	: 6.51%	: 6.36%	: 6.74%	: 15.84%
GROUND	: 1.20E-06	: 1.20E-06	: 1.20E-06	: 1.20E-06	: 1.20E-06	: 1.20E-06	: 1.20E-06	: 1.39E-06
	: 0.02%	: 0.02%	: 0.34%	: 0.02%	: 0.02%	: 0.02%	: 0.02%	: 0.02%
INHAL	: 2.30E-03	: 2.30E-03	: 8.50E-08	: 2.30E-03	: 2.30E-03	: 2.33E-03	: 2.31E-03	: 2.30E-03
	: 42.75%	: 42.74%	: 0.02%	: 42.75%	: 42.75%	: 42.26%	: 42.66%	: 38.49%
VEGET	: 1.89E-03	: 1.89E-03	: 1.01E-07	: 1.89E-03	: 1.89E-03	: 1.89E-03	: 1.89E-03	: 1.89E-03
	: 35.04%	: 35.06%	: 0.03%	: 35.04%	: 35.04%	: 34.30%	: 34.94%	: 31.54%
COW MILK	: 4.19E-04	: 4.19E-04	: 2.40E-07	: 4.19E-04	: 4.19E-04	: 5.06E-04	: 4.19E-04	: 4.19E-04
	: 7.77%	: 7.77%	: 0.07%	: 7.78%	: 7.78%	: 9.18%	: 7.75%	: 7.00%
MEAT	: 4.26E-04	: 4.26E-04	: 4.33E-08	: 4.26E-04	: 4.26E-04	: 4.34E-04	: 4.26E-04	: 4.26E-04
	: 7.90%	: 7.91%	: 0.01%	: 7.90%	: 7.90%	: 7.87%	: 7.88%	: 7.11%
TOTAL	: 5.39E-03	: 5.39E-03	: 3.52E-04	: 5.39E-03	: 5.39E-03	: 5.51E-03	: 5.40E-03	: 5.99E-03

SECTION V

DOSE FROM LIQUID EFFLUENTS

LADTAP II OUTPUT

Technical Specification 5.9.4.a

January 1, 2009 - December 31, 2009

Radioactive Effluent Releases - First, Second, Third, and Fourth Quarters 2009

LIQUID EFFLUENTS

During the reporting period, a total of $2.67\text{E}-03$ curies of radioactive liquid materials less tritium, dissolved noble gases, and alpha were released to the Missouri River at an average concentration of $2.26\text{E}-10$ $\mu\text{Ci}/\text{mL}$. This represents $2.26\text{E}-02$ percent of the limits specified in Appendix B to 10 CFR 20 ($1.0\text{E}-06$ $\mu\text{Ci}/\text{mL}$ for unrestricted areas), 221 curies of tritium were discharged at an average diluted concentration of $1.87\text{E}-05$ $\mu\text{Ci}/\text{mL}$ or 1.87 percent of ECL ($1.0\text{E}-03$ $\mu\text{Ci}/\text{mL}$). Gross alpha radioactivity released during the reporting period total $2.32\text{E}-05$ curies. Off-site vendor reanalysis of samples indicated that the reported concentration was attributed to short lived, naturally occurring alpha emitters.

Dilution water during the period amounted to $1.18\text{E}+10$ liters, while liquid waste discharges consisted of $2.88\text{E}+06$ liters of radioactive liquid waste.

A. Potential Annual Doses to Individuals from Liquid Releases

Total body, skin, and organ mRem for liquid releases were calculated for all significant liquid pathways using the annual configuration of the LADTAP II program.

The inputs to LADTAP II for the annual period from January 1, 2009 through December 31, 2009 were as follows:

- (1) All liquid effluents were as described in Section IV except for entrained noble gases (Ar-41, Xe-131M, Xe-133M, Xe-133, Xe-135M, Xe-135, Kr-85M, Kr-87, and Kr-88).
- (2) An average plant discharge rate of 671 cubic feet per second (CFS) was utilized for 2009. The average discharge rate during releases was 421.5 cubic feet per second (CFS).
- (3) Dilution factors (inverse of the mixing ratios) were computed based on Regulatory Guide 1.113 (equation 7 in Section 2.a.1 of Appendix A) for a one dimensional transport model.
- (4) Drinking water transport times of 6.6 hours to the Omaha intake and 7.0 hours to the Council Bluffs intake for the ALARA doses were used. A transport time of 0.0 was used from the plant to the discharge site.
- (5) A shorewidth factor of 0.2 was used.
- (6) All dose factors, transport times from receptor to individual, and usage factors are defined by Regulatory Guide 1.109 and NUREG-0172.

The discharge site was chosen to present the most conservative estimate of mRem dose for an average adult, teenager, child, and infant. A conservative approach is also presented by the assumption that Omaha and Council Bluffs receive all drinking water from the Missouri River.

B. Potential Annual Doses to Population from Liquid Releases

The LADTAP II program in its annual configuration was also used to calculate to total body and organ doses for the population of 853,274 within a 50-mile radius of the plant (based on the 2000 census). The same input was used as in the individual cases with the addition of the following:

- (1) Dilution factors and transport times for the pathways of sport fish, commercial fish, recreation and biota were calculated based on a distance of two miles downstream as approximately the distance to the nearest recreation facility - DeSoto National Wildlife Preserve.
- (2) The total fish harvest for both sport and commercial purposes was calculated using an average commercial fish catch for Nebraska.

LOCATION IS FRESHWATER INTAKE

A D U L T D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		4.94E-04	7.63E-04	5.31E-04	1.49E-04	3.05E-04	1.48E-04	9.81E-05
DRINKING		2.17E-06	6.48E-04	6.47E-04	6.89E-04	6.47E-04	6.46E-04	6.48E-04
SHORELINE	1.41E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06	1.21E-06
SWIMMING		1.55E-08	1.55E-08	1.55E-08	1.55E-08	1.55E-08	1.55E-08	1.55E-08
BOATING		7.74E-09	7.74E-09	7.74E-09	7.74E-09	7.74E-09	7.74E-09	7.74E-09
TOTAL	1.41E-06	4.98E-04	1.41E-03	1.18E-03	8.39E-04	9.53E-04	7.95E-04	7.47E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	7.3	24.00	
DRINKING	730.0	30.8	18.60	
SHORELINE	12.0	7.3	0.00	
SWIMMING	12.0	7.3	0.00	
BOATING	12.0	7.3	0.00	

T E E N A G E R D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		5.29E-04	7.74E-04	3.10E-04	1.27E-04	2.99E-04	1.49E-04	7.43E-05
DRINKING		2.13E-06	4.58E-04	4.56E-04	4.92E-04	4.56E-04	4.55E-04	4.56E-04
SHORELINE	7.86E-06	6.73E-06	6.73E-06	6.73E-06	6.73E-06	6.73E-06	6.73E-06	6.73E-06
SWIMMING		8.65E-08	8.65E-08	8.65E-08	8.65E-08	8.65E-08	8.65E-08	8.65E-08
BOATING		4.32E-08	4.32E-08	4.32E-08	4.32E-08	4.32E-08	4.32E-08	4.32E-08
TOTAL	7.86E-06	5.38E-04	1.24E-03	7.73E-04	6.26E-04	7.61E-04	6.11E-04	5.37E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	7.3	24.00	
DRINKING	510.0	30.8	18.60	
SHORELINE	67.0	7.3	0.00	
SWIMMING	67.0	7.3	0.00	
BOATING	67.0	7.3	0.00	

C H I L D D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		6.65E-04	6.95E-04	1.44E-04	1.20E-04	2.56E-04	1.21E-04	5.24E-05
DRINKING		6.22E-06	8.79E-04	8.74E-04	9.63E-04	8.75E-04	8.74E-04	8.74E-04
SHORELINE	1.64E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06	1.41E-06
SWIMMING		1.81E-08	1.81E-08	1.81E-08	1.81E-08	1.81E-08	1.81E-08	1.81E-08
BOATING		9.03E-09	9.03E-09	9.03E-09	9.03E-09	9.03E-09	9.03E-09	9.03E-09
TOTAL	1.64E-06	6.72E-04	1.58E-03	1.02E-03	1.08E-03	1.13E-03	9.96E-04	9.28E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	7.3	24.00	
DRINKING	510.0	30.8	18.60	
SHORELINE	14.0	7.3	0.00	
SWIMMING	14.0	7.3	0.00	
BOATING	14.0	7.3	0.00	

I N F A N T D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DRINKING		6.53E-06	8.65E-04	8.58E-04	9.98E-04	8.60E-04	8.58E-04	8.58E-04
SHORELINE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	6.53E-06	8.65E-04	8.58E-04	9.98E-04	8.60E-04	8.58E-04	8.58E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	0.0	7.3	24.00	
DRINKING	330.0	30.8	18.60	

LOCATION IS SITE DISCHG.

A D U L T D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		3.61E-03	5.57E-03	3.88E-03	1.08E-03	2.23E-03	1.08E-03	7.16E-04
DRINKING		6.71E-05	2.00E-02	1.99E-02	2.13E-02	1.99E-02	1.99E-02	1.99E-02
SHORELINE	1.03E-05	8.80E-06	8.80E-06	8.80E-06	8.80E-06	8.80E-06	8.80E-06	8.80E-06
SWIMMING		1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07	1.13E-07
BOATING		5.65E-08	5.65E-08	5.65E-08	5.65E-08	5.65E-08	5.65E-08	5.65E-08
TOTAL	1.03E-05	3.68E-03	2.56E-02	2.38E-02	2.24E-02	2.22E-02	2.10E-02	2.07E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	1.0	24.00	
DRINKING	730.0	1.0	12.00	
SHORELINE	12.0	1.0	0.00	
SWIMMING	12.0	1.0	0.00	
BOATING	12.0	1.0	0.00	

T E E N A G E R D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		3.86E-03	5.65E-03	2.26E-03	9.28E-04	2.18E-03	1.09E-03	5.42E-04
DRINKING		6.57E-05	1.41E-02	1.40E-02	1.52E-02	1.40E-02	1.40E-02	1.40E-02
SHORELINE	5.74E-05	4.91E-05	4.91E-05	4.91E-05	4.91E-05	4.91E-05	4.91E-05	4.91E-05
SWIMMING		6.31E-07	6.31E-07	6.31E-07	6.31E-07	6.31E-07	6.31E-07	6.31E-07
BOATING		3.16E-07	3.16E-07	3.16E-07	3.16E-07	3.16E-07	3.16E-07	3.16E-07
TOTAL	5.74E-05	3.97E-03	1.98E-02	1.64E-02	1.62E-02	1.63E-02	1.52E-02	1.46E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	1.0	24.00	
DRINKING	510.0	1.0	12.00	
SHORELINE	67.0	1.0	0.00	
SWIMMING	67.0	1.0	0.00	
BOATING	67.0	1.0	0.00	

C H I L D D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		4.85E-03	5.07E-03	1.05E-03	8.77E-04	1.87E-03	8.82E-04	3.82E-04
DRINKING		1.92E-04	2.71E-02	2.69E-02	2.97E-02	2.70E-02	2.69E-02	2.69E-02
SHORELINE	1.20E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05	1.03E-05
SWIMMING		1.32E-07	1.32E-07	1.32E-07	1.32E-07	1.32E-07	1.32E-07	1.32E-07
BOATING		6.59E-08	6.59E-08	6.59E-08	6.59E-08	6.59E-08	6.59E-08	6.59E-08
TOTAL	1.20E-05	5.05E-03	3.22E-02	2.80E-02	3.06E-02	2.88E-02	2.78E-02	2.73E-02

	USAGE (KG/YR, HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	1.0	24.00	
DRINKING	510.0	1.0	12.00	
SHORELINE	14.0	1.0	0.00	
SWIMMING	14.0	1.0	0.00	
BOATING	14.0	1.0	0.00	

I N F A N T D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
DRINKING		2.01E-04	2.66E-02	2.64E-02	3.09E-02	2.65E-02	2.64E-02	2.64E-02
SHORELINE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL	0.00E+00	2.01E-04	2.66E-02	2.64E-02	3.09E-02	2.65E-02	2.64E-02	2.64E-02

	USAGE (KG/YR, HR/YR)	DILUTION	TIME (HR)	SHOREWIDTH FACTOR=0.2
FISH	0.0	1.0	24.00	
DRINKING	330.0	1.0	12.00	

* * * FISH CONSUMPTION POPULATION DOSES * * *
PERSON-REM

SPORT HARVEST

PATHWAY	AGE GROUP	USAGE	-----DOSE (PERSON-REM)-----						
			BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	6.10E+04	1.43E-03	2.21E-03	1.54E-03	3.39E-04	8.85E-04	4.30E-04	2.81E-04
FISH	TEENAGER	7.12E+03	2.35E-04	3.44E-04	1.38E-04	4.33E-05	1.33E-04	6.62E-05	3.27E-05
FISH	CHILD	4.93E+03	4.74E-04	4.96E-04	1.03E-04	6.39E-05	1.83E-04	8.62E-05	3.72E-05
FISH	TOTAL	7.30E+04	2.14E-03	3.05E-03	1.78E-03	4.46E-04	1.20E-03	5.83E-04	3.51E-04

LOCATION DILUTION CATCH TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 1.68E+02 HR POPULATION=1.24E+04
7.30E+00 7.30E+04 1.69E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) ADULT=6.90E+00 TEEN=5.20E+00 CHILD=2.20E+00

* * * FISH CONSUMPTION POPULATION DOSES * * *
PERSON-REM

COMMERCIAL HARVEST

PATHWAY	AGE GROUP	USAGE	-----DOSE (PERSON-REM)-----						
			BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	4.18E+06	1.63E-04	2.52E-04	1.75E-04	3.51E-05	1.01E-04	4.89E-05	3.18E-05
FISH	TEENAGER	4.88E+05	2.67E-05	3.91E-05	1.57E-05	4.43E-06	1.51E-05	7.53E-06	3.70E-06
FISH	CHILD	3.38E+05	5.39E-05	5.64E-05	1.17E-05	6.44E-06	2.08E-05	9.80E-06	4.22E-06
FISH	TOTAL	5.01E+06	2.44E-04	3.47E-04	2.02E-04	4.59E-05	1.36E-04	6.63E-05	3.97E-05

LOCATION DILUTION CATCH TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 2.40E+02 HR POPULATION=8.53E+05
7.30E+00 7.30E+04 2.41E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) ADULT=6.90E+00 TEEN=5.20E+00 CHILD=2.20E+00

* * * POPULATION WATER CONSUMPTION DOSES * * *

SUPPLIER-OMAHA

		-----DOSE (PERSON-REM)-----							
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	ADULT	1.39E+08	4.13E-04	1.23E-01	1.23E-01	1.31E-01	1.23E-01	1.23E-01	1.23E-01
DRINKING	TEENAGER	1.51E+07	6.31E-05	1.36E-02	1.35E-02	1.45E-02	1.35E-02	1.35E-02	1.35E-02
DRINKING	CHILD	2.48E+07	3.01E-04	4.27E-02	4.24E-02	4.65E-02	4.25E-02	4.24E-02	4.24E-02
DRINKING	TOTAL	1.79E+08	7.78E-04	1.80E-01	1.79E-01	1.92E-01	1.79E-01	1.79E-01	1.79E-01

POPULATION=5.29E+05 DILUTION=3.08E+01 TRANSIT TIME=3.06E+01 HR (INCLUDING 24 HR FOR TREATMENT FACILITY)

AVERAGE INDIVIDUAL CONSUMPTION (L/YR) ADULT=3.70E+02 TEEN=2.60E+02 CHILD=2.60E+02

SUPPLIER-COUNCIL BLUFFS

		-----DOSE (PERSON-REM)-----							
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	ADULT	2.29E+07	6.69E-05	2.00E-02	1.99E-02	2.12E-02	1.99E-02	1.99E-02	1.99E-02
DRINKING	TEENAGER	2.49E+06	1.02E-05	2.20E-03	2.19E-03	2.35E-03	2.19E-03	2.18E-03	2.19E-03
DRINKING	CHILD	4.07E+06	4.87E-05	6.91E-03	6.87E-03	7.53E-03	6.88E-03	6.86E-03	6.87E-03
DRINKING	TOTAL	2.94E+07	1.26E-04	2.91E-02	2.90E-02	3.11E-02	2.90E-02	2.89E-02	2.90E-02

POPULATION=8.70E+04 DILUTION=3.13E+01 TRANSIT TIME=3.10E+01 HR (INCLUDING 24 HR FOR TREATMENT FACILITY)

AVERAGE INDIVIDUAL CONSUMPTION (L/YR) ADULT=3.70E+02 TEEN=2.60E+02 CHILD=2.60E+02

-----CUMULATIVE TOTAL-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	CUMUL TOTAL	2.08E+08	9.03E-04	2.09E-01	2.08E-01	2.23E-01	2.08E-01	2.08E-01	2.08E-01

NEPA DOSES

NOTE--TOTAL NEPA DOSE INCLUDES SPORT CATCH

		-----DOSE (PERSON-REM)-----							
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	1.22E+05	2.87E-03	4.43E-03	3.08E-03	6.47E-04	1.77E-03	8.61E-04	5.61E-04
FISH	TEENAGER	1.42E+04	4.70E-04	6.88E-04	2.76E-04	8.22E-05	2.65E-04	1.32E-04	6.51E-05
FISH	CHILD	9.85E+03	9.48E-04	9.91E-04	2.05E-04	1.21E-04	3.66E-04	1.72E-04	7.42E-05
FISH	TOTAL	1.46E+05	4.29E-03	6.11E-03	3.56E-03	8.50E-04	2.40E-03	1.17E-03	7.00E-04

HYDROSPHERE TRITIUM DOSE

AVERAGE INDIVIDUAL WATER CONSUMPTION = 3.0 L/DAY

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
WATER	TOTAL	2.86E+11	0.00E+00	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03	1.69E-03

* * * RECREATION POPULATION DOSES * * *

LOCATION- DOWN STREAM SWIMMING

DILUTION= 7.30E+00		TRANSIT TIME= 6.70E-01 HR		SWF= 0.2	
DOSE (PERSON-REM)					
PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
SHORELINE	TOTAL POPUL	4.10E+07	4.81E-03	4.12E-03	4.12E-03

LOCATION- DOWN STREAM SWIMMING

DILUTION= 7.30E+00		TRANSIT TIME= 6.70E-01 HR			
DOSE (PERSON-REM)					
PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
SWIMMING	TOTAL POPUL	4.10E+07		5.29E-05	5.29E-05

LOCATION- DOWN STREAM BOATING

DILUTION= 7.30E+00		TRANSIT TIME= 6.70E-01 HR			
DOSE (PERSON-REM)					
PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
BOATING	TOTAL POPUL	4.10E+07		2.64E-05	2.64E-05

* * * DOSE TO BIOTA * * *
MRADS PER YEAR

BIOTA	DILUTION= 1.00E+00		TRANSIT TIME= 0.00E+00 HR
	INTERNAL	EXTERNAL	TOTAL
FISH	1.91E-02	3.22E-02	5.13E-02
INVERTEBRATE	1.52E-02	6.43E-02	7.96E-02
ALGAE	1.74E-02	8.25E-05	1.75E-02
MUSKRAT	1.24E-01	2.15E-02	1.46E-01
RACCOON	3.31E-02	1.61E-02	4.92E-02
HERON	4.32E-01	2.14E-02	4.54E-01
DUCK	1.19E-01	3.22E-02	1.51E-01

SECTION VI

RADIOACTIVE EFFLUENT RELEASES - SOLID RADIOACTIVE WASTE
Technical Specifications 5.9.4.a

January 1, 2009 - December 31, 2009

III. RADIOACTIVE EFFLUENT RELEASES-SOLID RADIOACTIVE
WASTE EFFLUENT AND WASTE DISPOSAL REPORT

January 1, 2009 through December 31, 2009

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

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

1. Type of Waste	Month Shipped	Number of Shipments	Volume Cu.Meter	Curie Content	Est.Total % Error
a. Spent resins, filter sludges, evaporator bottoms, etc.	January	0	0.00E+00	0.00E+00	N/A
	February	0	0.00E+00	0.00E+00	N/A
	March	0	0.00E+00	0.00E+00	N/A
	April	0	0.00E+00	0.00E+00	N/A
	May	0	0.00E+00	0.00E+00	N/A
	June	1	2.69E+00	7.58E-01	20
	July	0	0.00E+00	0.00E+00	N/A
	August	0	0.00E+00	0.00E+00	N/A
	September	0	0.00E+00	0.00E+00	N/A
	October	1	2.55E+00	1.56E+00	20
	November	0	0.00E+00	0.00E+00	N/A
	December	0	0.00E+00	0.00E+00	N/A
Total (Type a)		2	5.24E+00	2.32E+00	20
b. Dry compressable, contaminated equipment, etc.	January	4	5.88E+00	2.20E-01	20
	February	4	6.33E+00	7.77E-02	20
	March	0	0.00E+00	0.00E+00	N/A
	April	4	1.16E+01	1.76E-02	20
	May	1	9.00E-01	0.00E+00	20
	June	4	1.59E+01	2.11E+00	20
	July	1	2.40E-01	1.25E-01	20
	August	2	5.14E+00	1.87E-02	20
	September	1	7.90E-01	3.11E-01	20
	October	4	7.44E+00	5.37E-02	20
	November	0	0.00E+00	0.00E+00	N/A
	December	6	1.60E+01	1.29E-01	20
Total (Type b)		31	7.02E+01	3.07E+00	20

III. RADIOACTIVE EFFLUENT RELEASES-SOLID RADIOACTIVE

(Continued)					
1. Type of Waste	Month Shipped	Number of Shipments	Volume Cu.Meter	Curie Content	Est.Total % Error
c. Irradiated components and other categories.	January	0	0	0	N/A
	February	0	0	0	N/A
	March	0	0	0	N/A
	April	0	0	0	N/A
	May	0	0	0	N/A
	June	0	0	0	N/A
	July	0	0	0	N/A
	August	0	0	0	N/A
	September	0	0	0	N/A
	October	0	0	0	N/A
	November	0	0	0	N/A
	December	0	0	0	N/A
Total	(Type c)	0	0	0	N/A
d. Other	January	0	0	0	N/A
	February	0	0	0	N/A
	March	0	0	0	N/A
	April	0	0	0	N/A
	May	0	0	0	N/A
	June	0	0	0	N/A
	July	0	0	0	N/A
	August	0	0	0	N/A
	September	0	0	0	N/A
	October	0	0	0	N/A
	November	0	0	0	N/A
	December	0	0	0	N/A
Total	(Type d)	0	0	0	N/A

III. RADIOACTIVE EFFLUENT RELEASES-SOLID RADIOACTIVE

(Continued)

B. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (By Type of Waste)

1. Percentage of Curies from Represented Isotopes

	Isotope	Percent	Curies	
a.	Ni-63	47.0%	1.09E+00	All other nuclides constitute less than 1%
	Co-60	22.3%	5.17E-01	
	Fe-55	10.0%	2.31E-01	
	Co-58	9.2%	2.14E-01	
	Cs-137	4.4%	1.02E-01	
	Sb-125	1.5%	3.58E-02	
	Nb-95	1.5%	3.53E-02	
	Mn-54	1.0%	2.63E-02	
b.	Co-58	39.9%	1.22E+00	All other nuclides constitute less than 1%
	Nb-95	14.6%	4.49E-01	
	Cs-137	12.4%	3.79E-01	
	Co-60	8.9%	2.72E-01	
	Fe-55	7.1%	2.19E-01	
	Zr-95	4.9%	1.51E-01	
	Ni-63	2.8%	8.64E-02	
	Ag-110m	2.6%	7.99E-02	
	Cr-51	2.3%	7.10E-02	
	Mn-54	1.4%	4.38E-02	
	Sb-125	1.0%	3.14E-02	
c.	N/A	N/A	N/A	
d.	N/A	N/A	N/A	

C. SOLID WASTE (DISPOSITION)

Number of Shipments	Transportation Mode	Destination
0	Closed Sole Use Vehicle	Barnwell, S.C.
33	Closed Sole Use Vehicle	Clive, Utah

D. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

Number of Shipments	Transportation Mode	Destination
N/A	N/A	N/A

SECTION VII

ATTACHMENT 1

ODCM and PCP revisions for the period January 1, 2009 through December 31, 2009 in accordance with Technical Specification 5.17.d and 5.18.d, the radioactive effluent release report shall include any revisions to the Offsite Dose Calculation Manual (ODCM) and the Process Control Program (PCP).

 0 revision(s) made to the Offsite Dose Calculation Manual (ODCM).

 0 revision(s) made to the Process Control Program (PCP).

January 1, 2009 - December 31, 2009

SECTION VII

ATTACHMENT 2

JOINT FREQUENCY DISTRIBUTION WIND DIRECTION VS. WIND SPEED
BY STABILITY CLASS AND METEOROLOGICAL DATA

(Regulatory Guide 1.21)

January 1, 2009 - December 31, 2009

JOINT FREQUENCY DISTRIBUTION WIND DIRECTION VS. WIND SPEED BY STABILITY CLASS AND METEOROLOGICAL DATA

A. Meteorological Data Recovery

Data availability from the on-site weather tower for the period January 1, 2009 through December 31, 2009 was less than the previous 12 months. The regulatory guide recovery was met with a cumulative recovery rate of 95.63% from the meteorological tower with the remaining 4.37% provided by the National Weather Service. The following table is a summary of the parameters and their respective recovery rates for the period.

Hourly meteorological data used to replace missing tower data for the period January 1, 2009 through December 31, 2009 originated at Eppley Airfield Weather Station, a branch of the National Weather Service. The hourly data was treated in accordance with monthly correction factors and a proceduralized Pasquill-Turner transformation which utilizes solar angle, time of day, cloud cover, and wind speed to determine the Pasquill Class.

The tabulations of the Weather Tower Data for the period January 1, 2009 through December 31, 2009 look appropriate for the season indicated. The Pasquill Classes observed for the twelve-month period are detailed below.

Pasquill Class	A	B	C	D	E	F	G	Total
% Obs.	2.42	3.32	4.16	40.67	32.88	10.18	6.37	100

On the basis of the data and its cross-checks, the weather data as amended is completely valid for use in tabulating atmospheric releases.

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
EXTREMELY UNSTABLE ($\Delta T / \Delta z < -1.9$)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL A
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	1	8	5	0	0	0	14
NNE	0	1	0	0	0	0	1
NE	0	1	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	2	0	0	0	0	2
ESE	0	2	3	0	0	0	5
SE	0	0	7	1	0	0	8
SSE	0	1	8	2	0	0	11
S	0	3	12	4	0	0	19
SSW	0	2	3	2	0	0	8
SW	0	2	2	0	0	0	4
WSW	1	8	6	1	0	0	16
W	6	9	1	0	0	0	16
WNW	1	6	5	1	0	0	13
NW	1	26	20	8	0	0	55
NNW	3	19	8	7	1	0	38
Total	14	90	80	26	1	0	211

Number of Calms 1
Number of Invalid Hours 0
Number of Valid Hours 212

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY UNSTABLE (-1.9 <= delta T/ delta z <= -1.7)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL B
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	4	24	11	0	0	0	46
NNE	0	5	3	0	0	0	8
NE	2	3	3	0	0	0	8
ENE	0	3	1	0	0	0	4
E	0	4	3	0	0	0	7
ESE	0	2	2	0	0	0	4
SE	1	7	4	0	0	0	12
SSE	0	2	10	1	0	0	13
S	2	7	7	6	0	1	23
SSW	4	2	2	3	1	0	12
SW	0	2	1	0	0	0	3
WSW	1	6	1	0	0	0	8
W	7	6	1	0	0	0	14
WNW	5	5	1	0	0	0	11
NW	2	21	18	3	0	0	44
NNW	3	37	28	6	0	0	74
Total	31	136	96	19	1	1	284

Number of Calms 7
Number of Invalid Hours 0
Number of Valid Hours 291

Omaha Public Power District
 Fort Calhoun Nuclear Station
 JOINT FREQUENCY DISTRIBUTION BY EVENTS
 SLIGHTLY UNSTABLE (-1.7 < delta T/ delta z <= -1.5)
 PERIOD OF RECORD: JAN 2009 - DEC 2009
 PASQUILL C
 WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	8	22	19	0	0	0	61
NNE	2	8	2	0	0	0	12
NE	0	5	1	0	0	0	6
ENE	1	4	0	0	0	0	5
E	1	3	3	0	1	0	8
ESE	0	6	4	0	0	0	10
SE	1	6	9	6	4	1	27
SSE	1	6	11	2	0	0	20
S	0	4	10	3	0	0	17
SSW	0	1	5	2	1	0	9
SW	0	2	2	1	0	0	5
WSW	7	3	0	0	0	0	10
W	7	9	0	0	0	0	16
WNW	3	7	2	0	0	0	12
NW	5	11	17	3	0	0	36
NNW	13	45	42	10	0	0	110
Total	49	142	127	27	6	1	352

Number of Calms 12
 Number of Invalid Hours 0
 Number of Valid Hours 364

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
NEUTRAL (-1.5 < delta T/ delta z <= -0.5)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL D
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	100	278	69	3	1	0	451
NNE	67	72	12	0	0	0	151
NE	61	55	6	1	0	0	123
ENE	43	57	8	0	0	0	108
E	38	65	7	1	0	0	111
ESE	21	86	65	14	3	0	189
SE	20	126	150	74	2	2	374
SSE	12	60	131	65	7	3	278
S	10	36	85	76	12	1	220
SSW	11	39	51	47	8	0	156
SW	13	44	13	11	0	0	81
WSW	22	23	9	2	0	0	56
W	31	24	14	1	0	0	70
WNW	25	44	22	0	0	0	91
NW	21	121	128	47	0	0	317
NNW	103	389	246	48	1	0	787
Total	598	1519	1016	390	34	6	3563

Number of Calms 0
Number of Invalid Hours 0
Number of Valid Hours 3563

Omaha Public Power District
 Fort Calhoun Nuclear Station
 JOINT FREQUENCY DISTRIBUTION BY EVENTS
 SLIGHTLY STABLE (-0.5 < delta T/ delta z <= 1.5)
 PERIOD OF RECORD: JAN 2009 - DEC 2009
 PASQUILL E
 WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	67	29	8	1	0	0	105
NNE	49	11	1	0	0	0	64
NE	56	14	2	0	0	0	73
ENE	52	23	6	0	0	0	81
E	51	23	3	0	0	0	78
ESE	56	85	14	5	0	0	160
SE	76	195	119	18	3	0	412
SSE	31	156	127	27	4	0	345
S	26	73	102	34	3	0	239
SSW	18	53	49	38	5	0	164
SW	23	30	25	26	3	0	108
WSW	37	12	6	1	0	0	56
W	60	30	1	0	0	0	92
WNW	92	66	13	1	0	0	177
NW	139	141	48	9	1	0	340
NNW	118	185	65	14	1	0	386
Total	951	1126	589	174	20	0	2860

Number of Calms 20
 Number of Invalid Hours 0
 Number of Valid Hours 2880

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY STABLE (1.5 < delta T/ delta z <= 4.0)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL F
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	13	11	0	0	0	0	24
NNE	23	4	0	0	0	0	28
NE	11	2	0	0	0	0	14
ENE	21	1	0	0	0	0	22
E	35	2	0	0	0	0	38
ESE	60	34	3	0	0	0	101
SE	44	62	12	0	0	0	121
SSE	35	29	1	1	0	0	70
S	22	17	8	0	0	0	47
SSW	25	12	1	0	0	0	42
SW	17	5	10	2	0	0	38
WSW	38	4	1	0	0	0	49
W	59	9	0	0	0	0	81
WNW	96	14	3	0	0	0	119
NW	48	2	0	0	0	0	52
NNW	23	6	2	2	0	0	46
Total	570	214	41	5	0	0	830

Number of Calms 62
Number of Invalid Hours 0
Number of Valid Hours 892

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
EXTREMELY STABLE (delta T/ delta z > 4.0)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL G
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	8	1	0	0	0	0	19
NNE	7	0	0	0	0	0	10
NE	13	0	0	0	0	0	14
ENE	21	0	0	0	0	0	25
E	28	1	0	0	0	0	30
ESE	57	14	0	0	0	0	74
SE	71	10	1	0	0	0	86
SSE	48	1	0	0	0	0	54
S	39	3	0	0	0	0	49
SSW	28	6	0	0	0	0	45
SW	33	0	0	0	0	0	39
WSW	29	1	0	0	0	0	40
W	20	0	0	0	0	0	28
WNW	19	2	0	0	0	0	25
NW	9	0	0	0	0	0	10
NNW	9	0	0	0	0	0	10
Total	439	39	1	0	0	0	479

Number of Calms 79
Number of Invalid Hours 0
Number of Valid Hours 558
Hours Accounted For: 8760

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
EXTREMELY UNSTABLE ($\Delta T / \Delta z < -1.9$)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL A
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	0.01	0.09	0.06	0.00	0.00	0.00	0.16
NNE	0.00	0.01	0.00	0.00	0.00	0.00	0.01
NE	0.00	0.01	0.00	0.00	0.00	0.00	0.01
ENE	0.01	0.00	0.00	0.00	0.00	0.00	0.01
E	0.00	0.02	0.00	0.00	0.00	0.00	0.02
ESE	0.00	0.02	0.03	0.00	0.00	0.00	0.06
SE	0.00	0.00	0.08	0.01	0.00	0.00	0.09
SSE	0.00	0.01	0.09	0.02	0.00	0.00	0.13
S	0.00	0.03	0.14	0.05	0.00	0.00	0.22
SSW	0.00	0.02	0.03	0.02	0.00	0.00	0.09
SW	0.00	0.02	0.02	0.00	0.00	0.00	0.05
WSW	0.01	0.09	0.07	0.01	0.00	0.00	0.18
W	0.07	0.10	0.01	0.00	0.00	0.00	0.18
WNW	0.01	0.07	0.06	0.01	0.00	0.00	0.15
NW	0.01	0.30	0.23	0.09	0.00	0.00	0.63
NNW	0.03	0.22	0.09	0.08	0.01	0.00	0.43
Total	0.16	1.03	0.91	0.30	0.01	0.00	2.41

Percent of Calms 0.01
Percent of Invalid Hours 0.00
Percent of Valid Hours 2.42

Omaha Public Power District
 Fort Calhoun Nuclear Station
 JOINT FREQUENCY DISTRIBUTION BY PERCENT
 MODERATELY UNSTABLE (-1.9 <= delta T/ delta z <= -1.7)
 PERIOD OF RECORD: JAN 2009 - DEC 2009
 PASQUILL B
 WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0- Direct	4.0- 7.9	8.0- 12.9	13.0- 18.9	19.0- 24.0	+24.0	Total
N	0.05	0.27	0.13	0.00	0.00	0.00	0.53
NNE	0.00	0.06	0.03	0.00	0.00	0.00	0.09
NE	0.02	0.03	0.03	0.00	0.00	0.00	0.09
ENE	0.00	0.03	0.01	0.00	0.00	0.00	0.05
E	0.00	0.05	0.03	0.00	0.00	0.00	0.08
ESE	0.00	0.02	0.02	0.00	0.00	0.00	0.05
SE	0.01	0.08	0.05	0.00	0.00	0.00	0.14
SSE	0.00	0.02	0.11	0.01	0.00	0.00	0.15
S	0.02	0.08	0.08	0.07	0.00	0.01	0.26
SSW	0.05	0.02	0.02	0.03	0.01	0.00	0.14
SW	0.00	0.02	0.01	0.00	0.00	0.00	0.03
WSW	0.01	0.07	0.01	0.00	0.00	0.00	0.09
W	0.08	0.07	0.01	0.00	0.00	0.00	0.16
WNW	0.06	0.06	0.01	0.00	0.00	0.00	0.13
NW	0.02	0.24	0.21	0.03	0.00	0.00	0.50
NNW	0.03	0.42	0.32	0.07	0.00	0.00	0.84
Total	0.35	1.55	1.10	0.22	0.01	0.01	3.24

Percent of Calms 0.08
 Percent of Invalid Hours 0.00
 Percent of Valid Hours 3.32

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
SLIGHTLY UNSTABLE (-1.7 < delta T/ delta z <= -1.5)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL C
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	0.09	0.25	0.22	0.00	0.00	0.00	0.70
NNE	0.02	0.09	0.02	0.00	0.00	0.00	0.14
NE	0.00	0.06	0.01	0.00	0.00	0.00	0.07
ENE	0.01	0.05	0.00	0.00	0.00	0.00	0.06
E	0.01	0.03	0.03	0.00	0.01	0.00	0.09
ESE	0.00	0.07	0.05	0.00	0.00	0.00	0.11
SE	0.01	0.07	0.10	0.07	0.05	0.01	0.31
SSE	0.01	0.07	0.13	0.02	0.00	0.00	0.23
S	0.00	0.05	0.11	0.03	0.00	0.00	0.19
SSW	0.00	0.01	0.06	0.02	0.01	0.00	0.10
SW	0.00	0.02	0.02	0.01	0.00	0.00	0.06
WSW	0.08	0.03	0.00	0.00	0.00	0.00	0.11
W	0.08	0.10	0.00	0.00	0.00	0.00	0.18
WNW	0.03	0.08	0.02	0.00	0.00	0.00	0.14
NW	0.06	0.13	0.19	0.03	0.00	0.00	0.41
NNW	0.15	0.51	0.48	0.11	0.00	0.00	1.26
Total	0.56	1.62	1.45	0.31	0.07	0.01	4.02

Percent of Calms 0.14
Percent of Invalid Hours 0.00
Percent of Valid Hours 4.16

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
NEUTRAL (-1.5 < delta T/ delta z <= -0.5)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL D
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	1.14	3.17	0.79	0.03	0.01	0.00	5.15
NNE	0.76	0.82	0.14	0.00	0.00	0.00	1.72
NE	0.70	0.63	0.07	0.01	0.00	0.00	1.40
ENE	0.49	0.65	0.09	0.00	0.00	0.00	1.23
E	0.43	0.74	0.08	0.01	0.00	0.00	1.27
ESE	0.24	0.98	0.74	0.16	0.03	0.00	2.16
SE	0.23	1.44	1.71	0.84	0.02	0.02	4.27
SSE	0.14	0.68	1.50	0.74	0.08	0.03	3.17
S	0.11	0.41	0.97	0.87	0.14	0.01	2.51
SSW	0.13	0.45	0.58	0.54	0.09	0.00	1.78
SW	0.15	0.50	0.15	0.13	0.00	0.00	0.92
WSW	0.25	0.26	0.10	0.02	0.00	0.00	0.64
W	0.35	0.27	0.16	0.01	0.00	0.00	0.80
WNW	0.29	0.50	0.25	0.00	0.00	0.00	1.04
NW	0.24	1.38	1.46	0.54	0.00	0.00	3.62
NNW	1.18	4.44	2.81	0.55	0.01	0.00	8.98
Total	6.83	17.34	11.60	4.45	0.39	0.07	40.67

Percent of Calms 0.00
Percent of Invalid Hours 0.00
Percent of Valid Hours 40.67

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
SLIGHTLY STABLE (-0.5 < delta T/ delta z <= 1.5)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL E
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	0.76	0.33	0.09	0.01	0.00	0.00	1.20
NNE	0.56	0.13	0.01	0.00	0.00	0.00	0.73
NE	0.64	0.16	0.02	0.00	0.00	0.00	0.83
ENE	0.59	0.26	0.07	0.00	0.00	0.00	0.92
E	0.58	0.26	0.03	0.00	0.00	0.00	0.89
ESE	0.64	0.97	0.16	0.06	0.00	0.00	1.83
SE	0.87	2.23	1.36	0.21	0.03	0.00	4.70
SSE	0.35	1.78	1.45	0.31	0.05	0.00	3.94
S	0.30	0.83	1.16	0.39	0.03	0.00	2.73
SSW	0.21	0.61	0.56	0.43	0.06	0.00	1.87
SW	0.26	0.34	0.29	0.30	0.03	0.00	1.23
WSW	0.42	0.14	0.07	0.01	0.00	0.00	0.64
W	0.68	0.34	0.01	0.00	0.00	0.00	1.05
WNW	1.05	0.75	0.15	0.01	0.00	0.00	2.02
NW	1.59	1.61	0.55	0.10	0.01	0.00	3.88
NNW	1.35	2.11	0.74	0.16	0.01	0.00	4.41
Total	10.86	12.85	6.72	1.99	0.23	0.00	32.65

Percent of Calms 0.23
Percent of Invalid Hours 0.00
Percent of Valid Hours 32.88

Omaha Public Power District
 Fort Calhoun Nuclear Station
 JOINT FREQUENCY DISTRIBUTION BY PERCENT
 MODERATELY STABLE ($1.5 < \Delta T / \Delta z \leq 4.0$)
 PERIOD OF RECORD: JAN 2009 - DEC 2009
 PASQUILL F
 WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	0.15	0.13	0.00	0.00	0.00	0.00	0.27
NNE	0.26	0.05	0.00	0.00	0.00	0.00	0.32
NE	0.13	0.02	0.00	0.00	0.00	0.00	0.16
ENE	0.24	0.01	0.00	0.00	0.00	0.00	0.25
E	0.40	0.02	0.00	0.00	0.00	0.00	0.43
ESE	0.68	0.39	0.03	0.00	0.00	0.00	1.15
SE	0.50	0.71	0.14	0.00	0.00	0.00	1.38
SSE	0.40	0.33	0.01	0.01	0.00	0.00	0.80
S	0.25	0.19	0.09	0.00	0.00	0.00	0.54
SSW	0.29	0.14	0.01	0.00	0.00	0.00	0.48
SW	0.19	0.06	0.11	0.02	0.00	0.00	0.43
WSW	0.43	0.05	0.01	0.00	0.00	0.00	0.56
W	0.67	0.10	0.00	0.00	0.00	0.00	0.92
WNW	1.10	0.16	0.03	0.00	0.00	0.00	1.36
NW	0.55	0.02	0.00	0.00	0.00	0.00	0.59
NNW	0.26	0.07	0.02	0.02	0.00	0.00	0.53
Total	6.51	2.44	0.47	0.06	0.00	0.00	9.47

Percent of Calms 0.71
 Percent of Invalid Hours 0.00
 Percent of Valid Hours 10.18

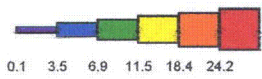
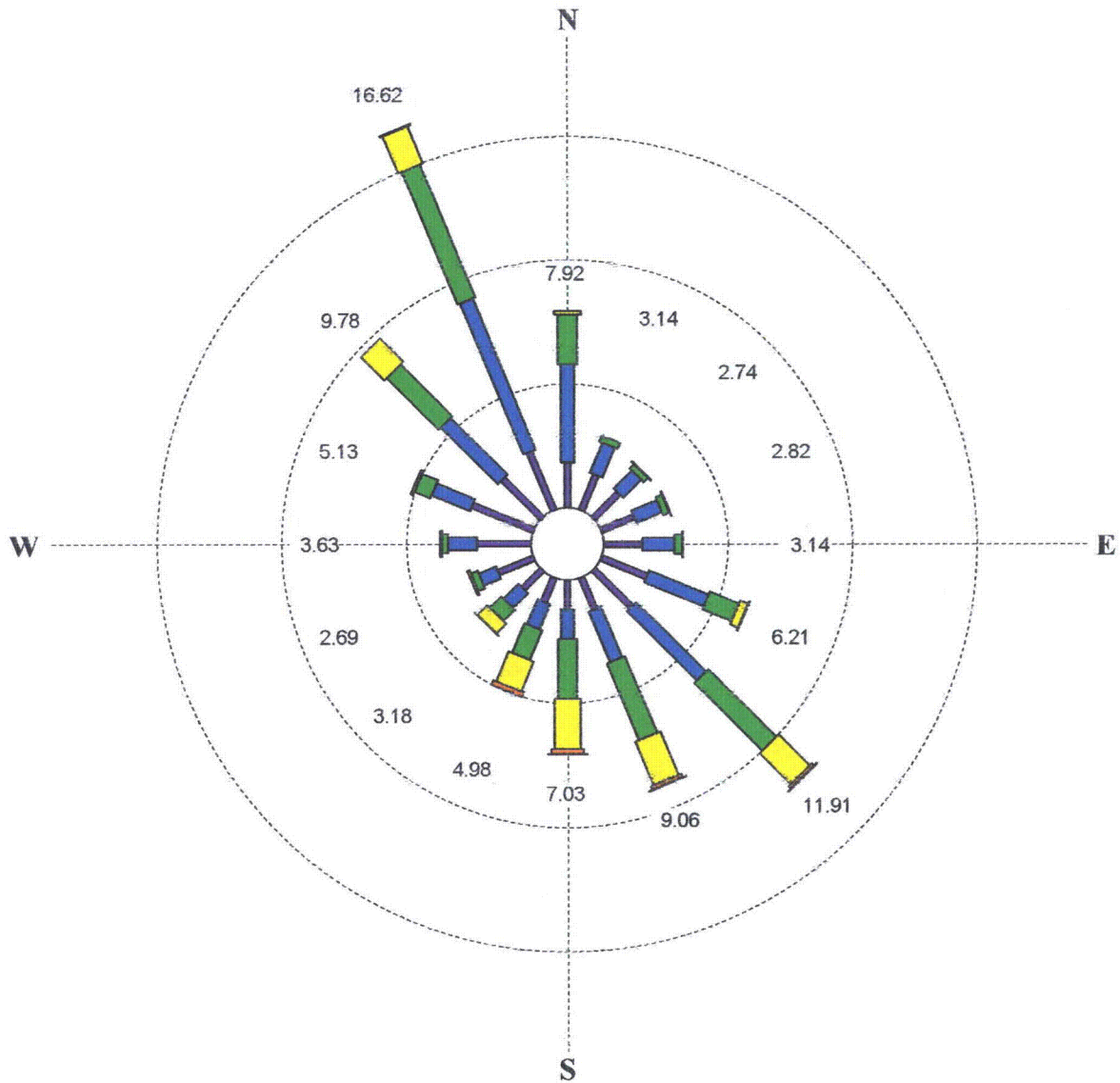
Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
EXTREMELY STABLE ($\Delta T / \Delta z > 4.0$)
PERIOD OF RECORD: JAN 2009 - DEC 2009
PASQUILL G
WIND SPEED (mph) AT 10-m LEVEL

Wind	1.0-	4.0-	8.0-	13.0-	19.0-	+24.0	Total
Direct	3.9	7.9	12.9	18.9	24.0		
N	0.09	0.01	0.00	0.00	0.00	0.00	0.22
NNE	0.08	0.00	0.00	0.00	0.00	0.00	0.11
NE	0.15	0.00	0.00	0.00	0.00	0.00	0.16
ENE	0.24	0.00	0.00	0.00	0.00	0.00	0.29
E	0.32	0.01	0.00	0.00	0.00	0.00	0.34
ESE	0.65	0.16	0.00	0.00	0.00	0.00	0.84
SE	0.81	0.11	0.01	0.00	0.00	0.00	0.98
SSE	0.55	0.01	0.00	0.00	0.00	0.00	0.62
S	0.45	0.03	0.00	0.00	0.00	0.00	0.56
SSW	0.32	0.07	0.00	0.00	0.00	0.00	0.51
SW	0.38	0.00	0.00	0.00	0.00	0.00	0.45
WSW	0.33	0.01	0.00	0.00	0.00	0.00	0.46
W	0.23	0.00	0.00	0.00	0.00	0.00	0.32
WNW	0.22	0.02	0.00	0.00	0.00	0.00	0.29
NW	0.10	0.00	0.00	0.00	0.00	0.00	0.11
NNW	0.10	0.00	0.00	0.00	0.00	0.00	0.11
Total	5.01	0.45	0.01	0.00	0.00	0.00	5.47

Percent of Calms 0.90
Percent of Invalid Hours 0.00
Percent of Valid Hours 6.37

Percent of Hours Accounted For: 100.00

Joint Frequency Distribution 2009 FCS Meterological Tower



Wind Speed (Miles Per Hour)

Calms excluded.
Rings drawn at 5% intervals.
Wind flow is FROM the directions shown.
No observations were missing.