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10 CFR 72.44

April 28, 2025
LIC-25-0006

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

Fort Calhoun Station, Unit No. 1
Renewed Facility Operating License No. DPR-40
NRC Docket No. 50-285

Fort Calhoun Station
Independent Spent Fuel Storage Installation
NRC Docket No. 72-054

Subject: Fort Calhoun Station (FCS) Radiological Effluent Release Report and Radiological Environmental Operating Report

References: FCS Quality Assurance Topical Report (NO-FC-10)

Pursuant to Fort Calhoun Station (FCS), Unit No. 1, Quality Assurance Topical Report (QATR), procedure NO-FC-10 Appendix E, Section E.4.1 and E.4.2, Omaha Public Power District (OPPD) provides the Annual Radiological Effluent Release Report and the Annual Radiological Environmental Operating Report.

The Annual Radiological Effluent Release Report is submitted in accordance with QATR Section E.4.1 and encompasses the period of January 1, 2024 through December 31, 2024. The report is presented in the format outlined in Regulatory Guide 1.21, Revision 1. In addition, the report provides the results of quarterly dose calculations performed in accordance with the Offsite Dose Calculation Manual (ODCM). In accordance with QATR Section E.4.2, Section VII of the Annual Radiological Effluent Release Report includes the revisions to the ODCM made during this period. Section VII of the Annual Radiological Effluent Release Report also includes Process Control Program (PCP) changes made during this period.

The Annual Radiological Environmental Operating Report is submitted in accordance with QATR Section E.4.2 and encompasses the period of January 1, 2024 through December 31, 2024.

No commitments to the NRC are contained in this letter.

Please contact Mr. Benjamin P. Pearson at (531) 226-7249 if you should have any questions.

Respectfully,



Benjamin P. Pearson
Regulatory Assurance & Emergency Planning Manager,

BPP/bpp

Enclosures:

1. Annual Radiological Effluent Release Report
 2. Annual Radiological Environmental Operating Report
-
- c: S. A. Morris, NRC Regional Administrator, Region IV
J. D. Parrott, NRC Senior Project Manager
S. G. Anderson, NRC Senior Health Physicist, Region IV
M. T. Johnson, NRC Senior Health Physicist, Region IV

Enclosure 1

2024 Annual Radiological Effluent Release Report

101 Pages Follow

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

Annual Radioactive Effluent Release Report (ARERR)

January 1, 2024 to December 31, 2024

DOCKET NO. 50-285


OPERATING LICENSE DPR-40

Annual Radiological Effluent Release Report

This report is submitted for the period January 1, 2024 through December 31, 2024. The Effluent Report is presented in the format outlined in Regulatory Guide 1.21, Revision 2.

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, 2024 through December 31, 2024.

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.

DocuSigned by:

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Plant Manager Decommissioning

Ted Maine

4/28/2025 | 12:37 PM CDT

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1.0 INTRODUCTION

This Annual Radiological Effluent Release Report, for Fort Calhoun Station Unit No. 1, is submitted for the period January 1, 2024 through December 31, 2024.

1.1 Executive Summary

The Radioactive Effluent Monitoring program for the year 2024 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 airborne activity released from noble gas was 0.00 curies. This was the same as from 2023. This was due to all fuel being stored safely on the Independent Spent Fuel Storage Installation (ISFSI) pad.

The total airborne activity from Tritium was 3.02E-01 curies. This was an increase from the 2023 activity of 1.69E-02 curies. Increase in airborne activity from tritium was due to concrete demo activities within the containment building and stockpiling of that concrete. This provided more surface area interaction that exchanged tritium from concrete to the atmosphere therefore tritium being detected at a higher activity..

The total airborne activity from Tritium was 3.02E-01 curies. This was an increase from the 2023 activity of 1.69E-02 curies. This increase was due to an increase in water inventory based on decommissioning activities and weather events in 2024.

Dose contributions from airborne effluents at the unrestricted area boundary were: 0.00 mRad gamma air dose, 0.00 mRad beta air dose, 2.69E-03 mRem total body dose, and 2.48E-03 mRem critical organ dose. Gamma and beta doses were the same as from 2023 levels of 0.00 mRad gamma air dose and 0.00 mRad beta air dose, from releasing no noble gases. Whole body and critical organ doses increased from 2023 levels of 1.38E-04 mRem total body dose and 1.38E-04 mRem critical organ dose. This increase is due to the increase in the amount of tritium released.

Total water activity (excluding tritium, dissolved gases, and alpha) released in 2024 in liquid effluents was $1.75\text{E-}03$ curies. This was less than 2023 activity of $1.73\text{E-}02$ curies. This decrease was due to liquid waste generation from open footprints in the RCA and not from processing cavity water.

The total water tritium activity released in 2024 in liquid effluents was $1.71\text{E-}02$ curies. This was a decrease from the 2023 activity of $3.02\text{E-}01$ curies. This decrease was due to the source of the liquid waste generated being from open footprints in the RCA and not from reactor vessel internal work activities and processing cavity water as in 2023.

The calculated whole body dose due to liquid effluents at the site discharge from all sources in 2024 was $6.25\text{E-}01$ mRem which was 20.83% of the annual dose limit. This was a decrease from the 2023 dose of $7.25\text{E-}01$ mRem, which was 24.17% of the annual dose limit. Dose decreased due to an increase in dilution volume during the releases and less activity then previous year.

The calculated critical organ dose due to liquid effluents at the site discharge from all sources in 2024 was $1.17\text{E+}00$ mRem. This was a decrease from the 2023 dose of $4.32\text{E+}00$ mRem. This decrease was due to activity decrease during the releases.

Historical average meteorological data was utilized in the preparation of the ARERR. The Fort Calhoun Station meteorological system for the period January 1, 2015 through December 31, 2019 had a cumulative recovery rate of 78.15% from the station meteorological tower with the remaining 21.85% provided by the National Weather Service, for the joint frequency parameters required by Regulatory Guide 1.23 for wind speed, wind direction, and delta temperature. The low recovery rate was due to the loss of the onsite tower from flood damage.

There were no abnormal releases during 2024.

During 2024 there were no changes to the Off-site Dose Calculations Manual (ODCM), CH-ODCM-0001 or to the Process Control Program, FCSD-RW-PG-101.

For 2024, the total volume of solid radwaste released from the unit was $1.65\text{E+}04$ cubic meters. This was a slight decrease from the $2.05\text{E+}04$ cubic meters of solid waste released from the unit in 2023. The decrease was attributed to a decrease in the volume of Dry Active Waste and Class C Waste shipments.

The total activity released from the unit for 2024 was 1.16E+02 curies, all from Dry Active Waste. This was decrease from the 2023 value of 5.10E+03 curies due to decrease in waste generation of class C waste and normal decommissioning activities.

Overall, the effluent monitoring program was conducted in a manner to ensure the activity released and 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

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.

2.1.2 Doses from H-3 and Radioactive Material in Particulate Form with Half Lives Greater than 8 Days (Other than Noble Gases).

- a. The dose to an individual or dose commitment to any organ of an individual in unrestricted areas due to the release of H-3 and radioactive material in particulate form with half-lives greater than eight days (other than noble gases) 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 H-3 and radioactive materials in particulate form with half-lives greater than eight days (other than noble gases) 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 do not exceed the values specified in 10 CFR 20 for liquid effluents at site discharge. To support facility operations, RP/Chemistry supervision may increase this limit up to the limit specified in QATR Appendix E, E.2.1.3.b.

QATR Appendix E, E.2.1.3.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. The dose or dose commitment to an individual 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 real 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.

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 4.1 and 4.2 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, before release. Composite samples were analyzed monthly and quarterly. 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, Fe-55, Ni-63, and Gross Alpha by a contract laboratory (Teledyne Brown Engineering, Inc.). 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.

2.3.2 Gaseous Radioactive Effluents

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 after a purge.

Continuous release effluent pathways were continuously sampled using 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, Sr-90, and Gross Alpha by a contract laboratory (Teledyne Brown Engineering, Inc.).

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 WASTE Storage and Shipments

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

6.0 RELATED INFORMATION

6.1 Functionality of Liquid and Gaseous Monitoring Instrumentation

During the reporting period, there was no instrument used to monitor radioactive effluent releases that failed to meet the minimum reportable instrument functionality requirements listed in the ODCM during the reporting period.

During the reporting period RM-055, Liquid Radwaste Effluent Monitor, was nonfunctional in February 2024 due to leak being observed 2/8/24 on the casing during its quarterly function test. There were no active releases in progress during the function test and work request was written with issue rectified after issue identified. CR 2024-00016 was written to document the self-revealing equipment issue. Rad monitor returned to service 2/20/24.

6.2 Changes to the Offsite Dose Calculation Manual (ODCM), CH-ODCM-0001 and/or Process Control Program (PCP), FCSD-RW-PG-101

During 2024 there were no changes to the Off-site Dose Calculations Manual (ODCM), CH-ODCM-0001 or to the Process Control Program, FCSD-RW-PG-101.

6.3 New Locations or Modifications for Dose Calculations or Environmental Monitoring

None

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 2024.

6.4.2 Failure to Meet Specified Sampling Requirements

During 2024, 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 made to the Liquid Waste Treatment System.

6.6 Meteorological Monitoring Program

A summary of hourly meteorological data, collected during 2024, is retained onsite and is maintained as documentation as required by Regulatory Guide 1.21 Rev 2. This data is available for review by the Nuclear Regulatory Commission upon request. Joint Frequency tables are included in Section VII, Attachment 2.

The 5 year historical Average χ/Q is utilized to determine the concentrations of radionuclides at the unrestricted area boundary. For quarterly estimates, during the year, an average X/Q is used, which is the highest X/Q calculated using the 5 year historical meteorological data.

6.7 Assessment of Doses

6.7.1 Doses Due to Liquid Effluents

Total body, skin, and organ doses 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 1,053,476 within a 50-mile radius of the plant (based on the 2020 census). The results of the calculations are listed in Section V.

The doses due to liquid effluents for the 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 GASPAR 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 GASPAR 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 average X/Q. The results are listed in Section II.

6.7.3 Doses Due to H-3 and Particulates with Half Lives Greater than 8 days.

The doses due to H-3 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 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 location for this annual period.

6.7.5 40 CFR 190 Dose Evaluation

ODCM Radiological Effluent Controls require dose evaluations and a special report 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 2024 were any of these limits exceeded; therefore, no special report was required.

The external Total Body Dose is comprised of:

- 1) Total Body Dose due to noble gas radionuclides in gaseous effluents
- 2) Dose due to radioactive waste and the ISFSI
- 3) Total Body Dose due to radioactivity deposited on the ground (this dose is accounted for in the determination of the non-noble gas dose and is not considered here)

The Total Body Dose, external is given by:

$$D_{\text{ext}} = D_{\text{tb}} + D_{\text{osf}}$$

Where D_{ext} is the external dose

D_{tb} is the total body dose

D_{osf} is the dose from on-site storage

The Total Dose is then given by:

$$D_{\text{tot}} = D_{\text{ext}} + D_{\text{liq}} + D_{\text{nng}}$$

Where D_{tot} is the total dose

D_{ext} is the external dose

D_{liq} is the dose from liquid effluents

D_{nng} is the dose from non-noble gases

Dose Limits

Total Body, annual 25 mrem

Thyroid, annual 75 mrem

Other Organs, annual 25 mrem

Calculation using REMP TLD Comparison

Indicating TLD station {OTD-1P-(I)}, closest to onsite storage, in mrem/week minus background, in mrem/week

	OTD-1P-(I) mrem/wk	Background mrem/wk	Net mrem/wk	Weeks/qtr	Qtr Dose mrem/qtr
Quarter 1	1.5	1.4	0.1	13	1.3
Quarter 2	1.6	1.6	0.0	13	0.0
Quarter 3	1.8	1.5	0.3	13	3.9
Quarter 4	1.8	1.5	0.3	13	3.9
Dext					9.10

$$D_{\text{ext}} = 9.10 \text{ mrem}$$

Maximum offsite doses from report

$$D_{\text{tbwb}} = 2.69\text{E-}03 \text{ mrem}, D_{\text{tbco}} = 2.48\text{E-}03 \text{ mrem}$$

$$D_{\text{liqwb}} = 6.25\text{E-}01 \text{ mrem} \quad D_{\text{liqco}} = 9.96\text{E-}01 \text{ mrem}$$

$$D_{\text{tot}} \text{ wholebody} = 9.10 + 2.69\text{E-}03 + 6.25\text{E-}01 = 9.73 \text{ mrem}$$

$$D_{\text{tot}} \text{ critical organ} = 9.10 + 2.48\text{E-}03 + 9.96\text{E-}01 = 10.10 \text{ mrem}$$

These reported doses are bounding cases demonstrating compliance. Actual REMP TLD readings do not show any deviation from historical averages for this location, both pre and post-construction of the Steam Generator storage mausoleum and ISFSI. On-site TLDs used for dose monitoring at onsite rad storage facilities do not have identical counterparts at the site boundary or actual offsite receptors. Additionally, the liquid dose pathway, since it is downstream of the indicator location and is not hydro-geologically connected, would produce very conservative results compared to calculating the actual dose.

6.8 Groundwater Monitoring Program and Observations

OPPD conducted groundwater sampling from 17 wells, 2 surface water sites, and 4 stormwater headers within the site property per NEI 07-07. Additionally, Nebraska requirements regarding avoidance of snow runoff were deleted, so stormwater sampling is now performed quarterly, if available. Two wells within the program were decommissioned after completion of 4th quarter sampling due to proximity to excavation activities (MW-1A/B). Two new wells (MW-101A/B) were added to the program to replace those lost, therefore there was no reduction to the program. These wells were developed in the 4th quarter 2024 and first sampling occurring 1st quarter 2025. Both have initial sampling protocols for the next two years. The East & West Lagoon sampling was discontinued after the sanitary lagoons were decommissioned. One flood incident occurred in 2024 that flooded certain wells and storm water outfalls. There was no impact to sampling capabilities based on the short duration of the flood incident.

Ten sample locations in sectors experiencing significant (>10%) wind direction were established to assess potential atmospheric deposition. After an initial sampling regime in all ten sectors displayed no detectable tritium, the sampling program was switched to 2 affected sectors per rain event and an upwind background test. Three rain sampling events were conducted in 2024. No tritium activity above the vendor's Minimum Detectable Activity (MDA) was reported. Stormwater sampling was impacted in the 1st and 3rd quarters by severe weather events that limited ability to obtain samples due to safety considerations and site procedures not allowing work outside during severe weather events (lightning strikes). The region has been in extreme drought, so when rain occurs, much of it was adsorbed by soils so insufficient volume can be collected. No tritium activity above the vendor's Minimum Detectable Activity (MDA) was reported in collected stormwater or rain sampling from 2nd and 4th quarter sampling.

No monitoring had tritium identified above 2 sigma error of MDA. Some Sr-90 results identified < MDA were retained during statistical data review based on historical station shallow well trends. Gamma isotopes and some hard to detect nuclides were reduced to an annual sample frequency (Ni-63, Fe-55, Sr-90 in deep wells) based on 2 years of quarterly sampling with no detections above MDA and Groundwater Protection assessment audit recommendations.

The Fort Calhoun REMP sampling did not detect tritium in samples within the Missouri River downstream at the site boundary or the nearest municipal drinking water facility. No groundwater drinking pathway exist on site. Groundwater monitoring of neighboring drinking wells is performed to have data if a plume were identified on site. No state or federal drinking water limits and no site groundwater protection program administrative limits were exceeded.

SECTION II
QUARTERLY DOSES FROM EFFLUENTS

Offsite Dose Calculation Manual

January 1, 2024 - December 31, 2024

Quarterly Dose Calculation Results

January 1, 2024 through December 31, 2024

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 quarterly per 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 2024 calculated doses.

This section presents the results of the quarterly dose calculations performed during the period January 1, 2024, through December 31, 2024. Details are shown as to the types, sources, and resultant doses from the effluents, the annual limits and a comparison to the annual limits.

FORT CALHOUN STATION
CHEMISTRY FORM

FC-421
R8

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN FIRST QUARTER 2024 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	2.74E-02	4.36E-02
Continuous:	0.00E+00	0.00E+00
Totals:	2.74E-02	4.36E-02
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	1.83 %	0.87 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	0.91 %	0.44 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %
B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	5.87E-06	1.61E-05
Ground and Food:	6.96E-05	1.30E-03
Totals:	7.55E-05	1.32E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.00 %	0.02 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.00 %	0.01 %

FORT CALHOUN STATION
CHEMISTRY FORM

FC-421
R8

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN SECOND QUARTER 2024 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	2.47E-01	3.94E-01
Continuous:	0.00E+00	0.00E+00
Totals:	2.47E-01	3.94E-01
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	16.47 %	7.88 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	9.15 %	4.38 %
II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %
B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	2.43E-05	2.43E-05
Ground and Food:	1.12E-04	1.12E-04
Totals:	1.37E-04	1.37E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.00 %	0.01 %

FORT CALHOUN STATION
CHEMISTRY FORM

FC-421
R8

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN THIRD QUARTER 2024 DOSE PROJECTIONS

I. Liquid Effluents:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Batch:	1.35E-01	2.16E-01
Continuous:	0.00E+00	0.00E+00
Totals:	1.35E-01	2.16E-01
ODCM Quarterly Objective:	1.50E+00	5.00E+00
Percent of Quarterly Obj:	9.00 %	4.32 %
ODCM Annual Objective:	3.00E+00	1.00E+01
YTD Percent of Annual Obj:	13.65 %	6.54 %

II. Gaseous Effluents:	Total Body Gamma Dose (mrad)	Total Body Beta Dose (mrad)
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
YTD Percent of Annual Obj:	0.00 %	0.00 %
B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem)	Critical Organ Dose (mrem)
Inhalation:	7.68E-05	9.38E-05
Ground and Food:	4.10E-04	5.15E-04
Totals:	4.87E-04	6.08E-04
ODCM Quarterly Objective:	7.50E+00	7.50E+00
Percent of Quarterly Obj:	0.01 %	0.01 %
ODCM Annual Objective:	1.50E+01	1.50E+01
YTD Percent of Annual Obj:	0.00 %	0.01 %

FORT CALHOUN STATION
CHEMISTRY FORM

FC-421
R8

QUARTERLY CUMULATIVE DOSE CONTRIBUTION FROM RADIOACTIVE EFFLUENTS
FORT CALHOUN FOURTH QUARTER 2024 DOSE PROJECTIONS

I. Liquid Effluents: -----	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Batch:	4.27E-01	6.80E-01
Continuous:	0.00E+00	0.00E+00
-----2	-----	-----
Totals:	4.27E-01	6.80E-01
ODCM Quarterly Objective:	1.50E+00	5.00E+00
-----	-----	-----
Percent of Quarterly Obj:	28.47 %	13.60 %
ODCM Annual Objective:	3.00E+00	1.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	27.88 %	13.30 %

II. Gaseous Effluents: -----	Total Body Gamma Dose (mrad) -----	Total Body Beta Dose (mrad) -----
A. Noble Gas Air Dose:	0.00E+00	0.00E+00
ODCM Quarterly Objective:	5.00E+00	1.00E+01
-----	-----	-----
Percent of Quarterly Obj:	0.00 %	0.00 %
ODCM Annual Objective:	1.00E+01	2.00E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.00 %	0.00 %
B. I-131, I-133, Tritium, C-14, and Particulates with Half-Lives > 8 Days:	Total Body Dose (mrem) -----	Critical Organ Dose (mrem) -----
Inhalation:	3.74E-04	3.74E-04
Ground and Food:	1.73E-03	1.73E-03
-----	-----	-----
Totals:	2.10E-03	2.10E-03
ODCM Quarterly Objective:	7.50E+00	7.50E+00
-----	-----	-----
Percent of Quarterly Obj:	0.03 %	0.03 %
ODCM Annual Objective:	1.50E+01	1.50E+01
-----	-----	-----
YTD Percent of Annual Obj:	0.02 %	0.02 %

RADIOLOGICAL EFFLUENT RELEASES

Table III.1	Batch Liquid and Gas Release Summary
Table III.2	Abnormal Batch Liquid and Gaseous Release Summary
Table III.3	Gaseous Effluents - Summation of all Releases
Table III.4	Gaseous Effluent Releases - Batch Mode
Table III.5	Gaseous Effluent Releases - Continuous Mode
Table III.6	Liquid Effluents - Summation of all Releases
Table III.7	Liquid Effluent Releases - Batch Mode
Table III.8	Liquid Effluent Releases - Continuous Mode
Table III.9	Groundwater Tritium Results

January 1, 2024 - December 31, 2024

TABLE III.1
BATCH LIQUID AND GASEOUS RELEASE SUMMARY
JANUARY THROUGH DECEMBER 2024

A. Liquid Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
1. Number of Batch Releases:	5	45	40	16	106
2. Total Time Period for Batch Releases(min):	1,257	28,345	25,573	4,841	60,016
3. Maximum Time Period for Batch Releases(min):	328	1,620	6,060	344	6,060
4. Average Time Period for Batch Releases(min):	251	630	639	303	566
5. Minimum Time Period for Batch Releases(min):	144	201	217	258	144
6. Average Dilution Stream Flow During Periods of Release into the Missouri River(mls/min):	9.491E+05	1.560E+07	1.430E+07	2.291E+07	1.552E+07
B. Gaseous Releases All Sources	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	Year
1. Number of Batch Releases:					
2. Total Time Period for Batch Releases(min):					
3. Maximum Time Period for Batch Releases(min):					
4. Average Time Period for Batch Releases(min):					
5. Minimum Time Period for Batch Releases(min):					

TABLE III.2
ABNORMAL BATCH LIQUID AND GASEOUS RELEASE SUMMARY
JANUARY THROUGH DECEMBER 2024

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

TABLE III.3
GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES
JANUARY THROUGH DECEMBER 2024

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>Year</u>
A. Fission & Activation Gases					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%): <u>21.2</u>					
B. Iodines					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%): <u>21.2</u>					
C. Particulates					
Total Release (Ci):	8.92E-06	0.00E+00	4.01E-06	0.00E+00	1.29E-05
Average Release Rate (uCi/sec):	1.13E-06	0.00E+00	5.05E-07	0.00E+00	4.09E-07
Total Error (%): <u>25.816</u>					
Gross Alpha:					
Total Error (%): <u>29.28</u>	6.10E-07	1.90E-06	1.21E-07	1.59E-06	4.22E-06
D. Tritium					
Total Release (Ci):	3.45E-03	1.52E-02	4.81E-02	2.35E-01	3.02E-01
Average Release Rate (uCi/sec):	4.38E-04	1.94E-03	6.05E-03	2.96E-02	9.55E-03
Total Error (%): <u>24.49</u>					
E. Carbon-14					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Release Rate (uCi/sec):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%): <u>29.503</u>					

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 2024
Batch Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>YEAR</u>
Fission & Activation Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Totals for Period:	0.00E+00	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	0.00E+00

Tritium and Gross Alpha

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 2024
Continuous Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>Year</u>
Fission & Activation Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates					
NI-63	8.92E-06	0.00E+00	3.23E-06	0.00E+00	1.21E-05
CO-60	0.00E+00	0.00E+00	7.83E-07	0.00E+00	7.83E-07
Totals for Period:	8.92E-06	0.00E+00	4.01E-06	0.00E+00	1.29E-05
Tritium and Gross Alpha					
H-3	3.45E-03	1.52E-02	4.81E-02	2.35E-01	3.02E-01
ALPHA	6.10E-07	1.90E-06	1.21E-07	1.59E-06	4.22E-06

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 2024

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>Year</u>
A. Fission & Activation Products					
Total Release (No H-3,Gas,Alpha) (Ci):	6.62E-05	5.03E-04	2.83E-04	9.02E-04	1.75E-03
Average Diluted Concentration (uCi/mL):	5.55E-08	9.51E-10	7.64E-10	8.14E-09	1.73E-09
10 CFR 20, App. B Limit 1.00E-06(uCi/mL)					
Percent of Limit (%):	5.55E+00	9.51E-02	7.64E-02	8.14E-01	1.73E-01
Total Error (%):	<u>30.27</u>				
B. Tritium					
Total Release (Ci):	0.00E+00	0.00E+00	3.29E-04	1.67E-02	1.71E-02
Average Diluted Concentration (uCi/mL):	0.00E+00	0.00E+00	8.88E-10	1.51E-07	1.69E-08
10 CFR 20, App. B Limit <u>1.00E-03</u> (uCi/mL)					
Percent of Limit (%):	0.00E+00	0.00E+00	8.88E-05	1.51E-02	1.69E-03
Total Error (%):	<u>49.13</u>				
C. Dissolved & Entrained Gases					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Average Diluted Concentration (uCi/mL):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ODCM Limit <u>2.00E-04</u> (uCi/mL)					
Percent of Limit (%):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%):	<u>18.14</u>				
D. Gross Alpha Radioactivity					
Total Release (Ci):	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Error (%):	<u>27.22</u>				
E. Volume of Waste Released Prior to Dilution (Liters):	2.40E+05	4.54E+06	2.40E+06	9.40E+05	8.12E+06
F. Volume of Dilution Water During Releases (Liters):	9.52E+05	5.25E+08	3.68E+08	1.10E+08	1.00E+09

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

TABLE III.7
LIQUID EFFLUENTS
JANUARY THROUGH DECEMBER 2024
Batch Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>Year</u>
Fission & Activation Gases					
CS-137	5.44E-05	4.92E-04	2.69E-04	8.49E-04	1.66E-03
CO-60	1.18E-05	1.12E-05	1.34E-05	5.38E-05	9.02E-05
Totals for Period:	6.62E-05	5.03E-04	2.83E-04	9.02E-04	1.75E-03
Dissolved & Entrained Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
H-3	0.00E+00	0.00E+00	3.29E-04	1.67E-02	1.71E-02

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD) values.
Reported Alpha activity was attributed to natural short-lived radionuclides. This was confirmed by quarterly offside vendor analysis.

TABLE III.8
LIQUID EFFLUENTS
JANUARY THROUGH DECEMBER 2024
Continuous Mode

<u>Nuclides(Ci)</u>	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>	<u>Year</u>
Fission & Activation Products					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved & Entrained Gases					
Totals for Period:	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium and Gross Alpha					
H-3	0.00E+00	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 2024

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>MW-1A</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-1B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-2</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-3</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-3A</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>MW-3B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<u>MW-4B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-5A</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-6</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NI-63	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Sr-90	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total Gamma	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2024

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>MW-5B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-12A</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-12B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>EAST LAGOON</u>				
Tritium	0.00E+00	0.00E+00		
FE-55				
NI-63				
Sr-90				
Total Gamma	0.00E+00	0.00E+00		
<u>WEST LAGOON</u>				
Tritium	0.00E+00	0.00E+00		
FE-55				
NI-63				
Sr-90				
Total Gamma	0.00E+00	0.00E+00		
<u>NORTH STORMWATER HDR</u>				
Tritium		0.00E+00		0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma		0.00E+00		0.00E+00
<u>SOUTH STORMWATER HDR</u>				
Tritium		0.00E+00		0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma		0.00E+00		0.00E+00
<u>SW-6 ISFSI</u>				
Tritium		0.00E+00		0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma		0.00E+00		0.00E+00
<u>SW-8 NORTH PA</u>				
Tritium		0.00E+00		0.00E+00
FE-55				
NI-63				
Sr-90				
Total Gamma		0.00E+00		0.00E+00

TABLE III.9
GROUNDWATER ANALYSIS RESULTS
pCi/L
JANUARY THROUGH DECEMBER 2024

	<u>1st Quarter</u>	<u>2nd Quarter</u>	<u>3rd Quarter</u>	<u>4th Quarter</u>
<u>MW-16</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-101B</u>				
Tritium				
FE-55				
NI-63				
Sr-90				
Total Gamma				
<u>MW-14</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-13A</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-13B</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-15</u>				
Tritium	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FE-55			0.00E+00	
NI-63			0.00E+00	
Sr-90			0.00E+00	
Total Gamma			0.00E+00	
<u>MW-101A</u>				
Tritium				
FE-55				
NI-63				
Sr-90				
Total Gamma				

NOTE: Values reported as zero are determined to be below the Lower Limit of Detection (LLD).
Only Tritium and Gamma are required for each sampling event.
Hard to detect (HTD) nuclide sampling frequency is per station procedures.
Missed sampling events are covered in the executive summary.

SECTION IV
DOSE FROM GASEOUS EFFLUENTS

GASPAR II OUTPUT

January 1, 2024 - December 31, 2024

Radioactive Effluent Releases - First, Second, Third and Fourth Quarters 2024

GASEOUS EFFLUENTS

Radioactive gaseous releases for the reporting period totaled 0.00E+00 curies of inert gas. The gross gaseous activity release rates were 0.00E+00 $\mu\text{Ci/sec}$ for the first quarter, 0.00E+00 $\mu\text{Ci/sec}$ for the second quarter, 0.00E+00 $\mu\text{Ci/sec}$ for the third quarter, and 0.00E+00 $\mu\text{Ci/sec}$ for the fourth quarter.

No radioactive halogen releases were released during the reporting period from gaseous effluent discharges.

Radioactive particulate releases for the reporting period totaled 1.29E-05 curies. The particulate release rates were 1.13E-06 $\mu\text{Ci/sec}$ for the first quarter, 0.00E+00 $\mu\text{Ci/sec}$ for the second quarter, 5.05E-07 $\mu\text{Ci/sec}$ for the third quarter, and 0.00E+00 $\mu\text{Ci/sec}$ for the fourth quarter.

Radioactive tritium released during the reporting period totaled 3.02E-01 curies.

Off-site vendor analysis of weekly composite samples indicated that no gross alpha radioactivity was released during the reporting period.

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 GASPARD II program. Results of each receptor are shown in Tables IV-A-1 through IV-A-29. 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 GASPARD II. In its annual configuration, GASPARD II assumes that all release rates are entered in curies per year (Ci/yr).

The inputs to GASPARD II for the annual period from January 1, 2024 through December 31, 2024 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 the garden of interest, 0.76 for produce grown in the 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/m³ 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 1,053,476 (based on the 2020 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 2024, DOSE PROJECTIONS
SPECIAL LOCATION NO. 1 RES
AT 4.36 MILES N

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 3.52E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 5.30E-07	: 5.30E-07	: 9.69E-09	: 5.30E-07	: 5.29E-07	: 5.29E-07	: 5.42E-07	: 5.29E-07
TEEN	: 5.35E-07	: 5.35E-07	: 1.30E-08	: 5.35E-07	: 5.34E-07	: 5.34E-07	: 5.54E-07	: 5.34E-07
CHILD	: 4.72E-07	: 4.72E-07	: 1.84E-08	: 4.73E-07	: 4.72E-07	: 4.72E-07	: 4.88E-07	: 4.72E-07
INFANT	: 2.72E-07	: 2.71E-07	: 7.60E-09	: 2.72E-07	: 2.71E-07	: 2.71E-07	: 2.83E-07	: 2.71E-07

TABLE IV-A- 2

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 2 RES
 AT 1.93 MILES NNE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 4.49E-07	: 4.49E-07	: 4.49E-07	: 4.49E-07	: 4.49E-07	: 4.49E-07	: 4.49E-07	: 5.28E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 7.57E-07	: 7.57E-07	: 1.48E-08	: 7.57E-07	: 7.56E-07	: 7.56E-07	: 7.76E-07	: 7.56E-07
TEEN	: 7.64E-07	: 7.64E-07	: 1.99E-08	: 7.65E-07	: 7.63E-07	: 7.63E-07	: 7.93E-07	: 7.63E-07
CHILD	: 6.75E-07	: 6.74E-07	: 2.82E-08	: 6.75E-07	: 6.74E-07	: 6.74E-07	: 6.99E-07	: 6.74E-07
INFANT	: 3.88E-07	: 3.88E-07	: 1.16E-08	: 3.88E-07	: 3.88E-07	: 3.88E-07	: 4.05E-07	: 3.88E-07

TABLE IV-A- 3

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 3 RES
 AT 1.59 MILES NE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 5.52E-07	: 5.52E-07	: 5.52E-07	: 5.52E-07	: 5.52E-07	: 5.52E-07	: 5.52E-07	: 6.49E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 8.26E-07	: 8.26E-07	: 1.83E-08	: 8.26E-07	: 8.25E-07	: 8.25E-07	: 8.49E-07	: 8.25E-07
TEEN	: 8.33E-07	: 8.34E-07	: 2.46E-08	: 8.34E-07	: 8.32E-07	: 8.32E-07	: 8.69E-07	: 8.32E-07
CHILD	: 7.36E-07	: 7.36E-07	: 3.48E-08	: 7.37E-07	: 7.35E-07	: 7.35E-07	: 7.66E-07	: 7.35E-07
INFANT	: 4.23E-07	: 4.23E-07	: 1.44E-08	: 4.24E-07	: 4.23E-07	: 4.23E-07	: 4.44E-07	: 4.23E-07

TABLE IV-A- 4

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 4 RES
 AT 4.79 MILES ENE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.87E-08	: 2.87E-08	: 2.87E-08	: 2.87E-08	: 2.87E-08	: 2.87E-08	: 2.87E-08	: 3.38E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 8.94E-08	: 8.95E-08	: 1.62E-09	: 8.95E-08	: 8.94E-08	: 8.94E-08	: 9.15E-08	: 8.94E-08
TEEN	: 9.03E-08	: 9.03E-08	: 2.17E-09	: 9.03E-08	: 9.02E-08	: 9.02E-08	: 9.34E-08	: 9.02E-08
CHILD	: 7.97E-08	: 7.97E-08	: 3.07E-09	: 7.98E-08	: 7.96E-08	: 7.96E-08	: 8.24E-08	: 7.96E-08
INFANT	: 4.59E-08	: 4.58E-08	: 1.27E-09	: 4.59E-08	: 4.58E-08	: 4.58E-08	: 4.77E-08	: 4.58E-08

TABLE IV-A- 5

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 5 RES
 AT 4.67 MILES E

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 6.90E-08	: 6.90E-08	: 6.90E-08	: 6.90E-08	: 6.90E-08	: 6.90E-08	: 6.90E-08	: 8.12E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.86E-07	: 1.86E-07	: 3.36E-09	: 1.86E-07	: 1.86E-07	: 1.86E-07	: 1.90E-07	: 1.86E-07
TEEN	: 1.87E-07	: 1.88E-07	: 4.52E-09	: 1.88E-07	: 1.87E-07	: 1.87E-07	: 1.94E-07	: 1.87E-07
CHILD	: 1.66E-07	: 1.65E-07	: 6.40E-09	: 1.66E-07	: 1.65E-07	: 1.65E-07	: 1.71E-07	: 1.65E-07
INFANT	: 9.52E-08	: 9.52E-08	: 2.64E-09	: 9.53E-08	: 9.51E-08	: 9.51E-08	: 9.90E-08	: 9.51E-08

TABLE IV-A- 6

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 6 RES
 AT 5.50 MILES ESE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 5.75E-08	: 5.75E-08	: 5.75E-08	: 5.75E-08	: 5.75E-08	: 5.75E-08	: 5.75E-08	: 6.76E-08
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.38E-07	: 1.38E-07	: 2.50E-09	: 1.38E-07	: 1.38E-07	: 1.38E-07	: 1.41E-07	: 1.38E-07
TEEN	: 1.39E-07	: 1.39E-07	: 3.35E-09	: 1.39E-07	: 1.39E-07	: 1.39E-07	: 1.44E-07	: 1.39E-07
CHILD	: 1.23E-07	: 1.23E-07	: 4.75E-09	: 1.23E-07	: 1.23E-07	: 1.23E-07	: 1.27E-07	: 1.23E-07
INFANT	: 7.05E-08	: 7.05E-08	: 1.96E-09	: 7.06E-08	: 7.05E-08	: 7.05E-08	: 7.34E-08	: 7.05E-08

TABLE IV-A- 7

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 7 RES
 AT 1.71 MILES SE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.01E-06	: 2.01E-06	: 2.01E-06	: 2.01E-06	: 2.01E-06	: 2.01E-06	: 2.01E-06	: 2.37E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 3.03E-06	: 3.03E-06	: 6.16E-08	: 3.03E-06	: 3.03E-06	: 3.03E-06	: 3.11E-06	: 3.03E-06
TEEN	: 3.06E-06	: 3.06E-06	: 8.27E-08	: 3.06E-06	: 3.05E-06	: 3.05E-06	: 3.18E-06	: 3.05E-06
CHILD	: 2.70E-06	: 2.70E-06	: 1.17E-07	: 2.70E-06	: 2.70E-06	: 2.70E-06	: 2.80E-06	: 2.70E-06
INFANT	: 1.55E-06	: 1.55E-06	: 4.83E-08	: 1.55E-06	: 1.55E-06	: 1.55E-06	: 1.62E-06	: 1.55E-06

TABLE IV-A- 8

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 8 RES
 AT 0.65 MILES SSE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.59E-05	: 2.59E-05	: 2.59E-05	: 2.59E-05	: 2.59E-05	: 2.59E-05	: 2.59E-05	: 3.04E-05
INHAL	:	:	:	:	:	:	:	:
ADULT	: 3.51E-05	: 3.51E-05	: 7.65E-07	: 3.51E-05	: 3.51E-05	: 3.51E-05	: 3.61E-05	: 3.51E-05
TEEN	: 3.54E-05	: 3.54E-05	: 1.03E-06	: 3.55E-05	: 3.54E-05	: 3.54E-05	: 3.69E-05	: 3.54E-05
CHILD	: 3.13E-05	: 3.13E-05	: 1.46E-06	: 3.13E-05	: 3.12E-05	: 3.12E-05	: 3.25E-05	: 3.12E-05
INFANT	: 1.80E-05	: 1.80E-05	: 6.00E-07	: 1.80E-05	: 1.80E-05	: 1.80E-05	: 1.89E-05	: 1.80E-05

TABLE IV-A- 9

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 9 RES
 AT 0.73 MILES S

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 3.38E-05
INHAL	:	:	:	:	:	:	:	:
ADULT	: 4.40E-05	: 4.41E-05	: 9.48E-07	: 4.41E-05	: 4.40E-05	: 4.40E-05	: 4.52E-05	: 4.40E-05
TEEN	: 4.44E-05	: 4.45E-05	: 1.27E-06	: 4.45E-05	: 4.44E-05	: 4.44E-05	: 4.63E-05	: 4.44E-05
CHILD	: 3.93E-05	: 3.92E-05	: 1.80E-06	: 3.93E-05	: 3.92E-05	: 3.92E-05	: 4.08E-05	: 3.92E-05
INFANT	: 2.26E-05	: 2.26E-05	: 7.44E-07	: 2.26E-05	: 2.26E-05	: 2.26E-05	: 2.36E-05	: 2.26E-05

TABLE IV-A-10

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 10 RES
 AT 0.65 MILES SSW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.09E-05	: 1.09E-05	: 1.09E-05	: 1.09E-05	: 1.09E-05	: 1.09E-05	: 1.09E-05	: 1.29E-05
INHAL	:	:	:	:	:	:	:	:
ADULT	: 1.86E-05	: 1.86E-05	: 3.99E-07	: 1.86E-05	: 1.86E-05	: 1.86E-05	: 1.91E-05	: 1.86E-05
TEEN	: 1.87E-05	: 1.88E-05	: 5.36E-07	: 1.88E-05	: 1.87E-05	: 1.87E-05	: 1.95E-05	: 1.87E-05
CHILD	: 1.66E-05	: 1.66E-05	: 7.59E-07	: 1.66E-05	: 1.65E-05	: 1.65E-05	: 1.72E-05	: 1.65E-05
INFANT	: 9.53E-06	: 9.52E-06	: 3.13E-07	: 9.53E-06	: 9.51E-06	: 9.51E-06	: 9.98E-06	: 9.51E-06

TABLE IV-A-11

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 11 RES
 AT 0.73 MILES SW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.82E-06	: 2.82E-06	: 2.82E-06	: 2.82E-06	: 2.82E-06	: 2.82E-06	: 2.82E-06	: 3.31E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 4.61E-06	: 4.61E-06	: 9.86E-08	: 4.61E-06	: 4.61E-06	: 4.61E-06	: 4.73E-06	: 4.61E-06
TEEN	: 4.65E-06	: 4.65E-06	: 1.32E-07	: 4.66E-06	: 4.65E-06	: 4.65E-06	: 4.85E-06	: 4.65E-06
CHILD	: 4.11E-06	: 4.11E-06	: 1.87E-07	: 4.12E-06	: 4.10E-06	: 4.10E-06	: 4.27E-06	: 4.10E-06
INFANT	: 2.36E-06	: 2.36E-06	: 7.73E-08	: 2.37E-06	: 2.36E-06	: 2.36E-06	: 2.47E-06	: 2.36E-06

TABLE IV-A-12

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 12 RES
 AT 1.06 MILES WSW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.27E-06	: 1.27E-06	: 1.27E-06	: 1.27E-06	: 1.27E-06	: 1.27E-06	: 1.27E-06	: 1.49E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 2.06E-06	: 2.07E-06	: 4.49E-08	: 2.07E-06	: 2.06E-06	: 2.06E-06	: 2.12E-06	: 2.06E-06
TEEN	: 2.08E-06	: 2.08E-06	: 6.03E-08	: 2.09E-06	: 2.08E-06	: 2.08E-06	: 2.17E-06	: 2.08E-06
CHILD	: 1.84E-06	: 1.84E-06	: 8.54E-08	: 1.84E-06	: 1.84E-06	: 1.84E-06	: 1.91E-06	: 1.84E-06
INFANT	: 1.06E-06	: 1.06E-06	: 3.52E-08	: 1.06E-06	: 1.06E-06	: 1.06E-06	: 1.11E-06	: 1.06E-06

TABLE IV-A-13

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 13 RES
 AT 1.27 MILES W

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.24E-06	: 2.24E-06	: 2.24E-06	: 2.24E-06	: 2.24E-06	: 2.24E-06	: 2.24E-06	: 2.64E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 4.27E-06	: 4.27E-06	: 8.86E-08	: 4.27E-06	: 4.26E-06	: 4.26E-06	: 4.38E-06	: 4.26E-06
TEEN	: 4.30E-06	: 4.31E-06	: 1.19E-07	: 4.31E-06	: 4.30E-06	: 4.30E-06	: 4.48E-06	: 4.30E-06
CHILD	: 3.80E-06	: 3.80E-06	: 1.68E-07	: 3.81E-06	: 3.80E-06	: 3.80E-06	: 3.95E-06	: 3.80E-06
INFANT	: 2.19E-06	: 2.19E-06	: 6.95E-08	: 2.19E-06	: 2.18E-06	: 2.18E-06	: 2.29E-06	: 2.18E-06

TABLE IV-A-14

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 14 RES
 AT 2.60 MILES WNW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 3.62E-07	: 3.62E-07	: 3.62E-07	: 3.62E-07	: 3.62E-07	: 3.62E-07	: 3.62E-07	: 4.26E-07
INHAL	:	:	:	:	:	:	:	:
ADULT	: 8.26E-07	: 8.26E-07	: 1.61E-08	: 8.26E-07	: 8.25E-07	: 8.25E-07	: 8.46E-07	: 8.25E-07
TEEN	: 8.33E-07	: 8.34E-07	: 2.17E-08	: 8.34E-07	: 8.32E-07	: 8.32E-07	: 8.65E-07	: 8.32E-07
CHILD	: 7.36E-07	: 7.36E-07	: 3.07E-08	: 7.37E-07	: 7.35E-07	: 7.35E-07	: 7.62E-07	: 7.35E-07
INFANT	: 4.23E-07	: 4.23E-07	: 1.27E-08	: 4.24E-07	: 4.23E-07	: 4.23E-07	: 4.42E-07	: 4.23E-07

TABLE IV-A-15

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 15 RES
 AT 2.40 MILES NW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 9.78E-07	: 9.78E-07	: 9.78E-07	: 9.78E-07	: 9.78E-07	: 9.78E-07	: 9.78E-07	: 1.15E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 2.13E-06	: 2.13E-06	: 4.16E-08	: 2.13E-06	: 2.13E-06	: 2.13E-06	: 2.19E-06	: 2.13E-06
TEEN	: 2.15E-06	: 2.15E-06	: 5.58E-08	: 2.15E-06	: 2.15E-06	: 2.15E-06	: 2.23E-06	: 2.15E-06
CHILD	: 1.90E-06	: 1.90E-06	: 7.91E-08	: 1.90E-06	: 1.90E-06	: 1.90E-06	: 1.97E-06	: 1.90E-06
INFANT	: 1.09E-06	: 1.09E-06	: 3.26E-08	: 1.09E-06	: 1.09E-06	: 1.09E-06	: 1.14E-06	: 1.09E-06

TABLE IV-A-16

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 16 RES
 AT 2.08 MILES NNW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.47E-06	: 2.47E-06	: 2.47E-06	: 2.47E-06	: 2.47E-06	: 2.47E-06	: 2.47E-06	: 2.91E-06
INHAL	:	:	:	:	:	:	:	:
ADULT	: 4.75E-06	: 4.75E-06	: 9.52E-08	: 4.75E-06	: 4.74E-06	: 4.74E-06	: 4.87E-06	: 4.74E-06
TEEN	: 4.79E-06	: 4.79E-06	: 1.28E-07	: 4.80E-06	: 4.79E-06	: 4.79E-06	: 4.98E-06	: 4.79E-06
CHILD	: 4.23E-06	: 4.23E-06	: 1.81E-07	: 4.24E-06	: 4.23E-06	: 4.23E-06	: 4.39E-06	: 4.23E-06
INFANT	: 2.43E-06	: 2.43E-06	: 7.47E-08	: 2.44E-06	: 2.43E-06	: 2.43E-06	: 2.54E-06	: 2.43E-06

TABLE IV-A-17

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 17 VEG
 AT 2.23 MILES NNE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.88E-07	: 2.88E-07	: 2.88E-07	: 2.88E-07	: 2.88E-07	: 2.88E-07	: 2.88E-07	: 3.38E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 9.58E-07	: 9.47E-07	: 2.44E-06	: 1.04E-06	: 8.72E-07	: 8.72E-07	: 8.72E-07	: 8.72E-07
TEEN	: 1.13E-06	: 1.08E-06	: 3.76E-06	: 1.27E-06	: 9.97E-07	: 9.97E-07	: 9.97E-07	: 9.97E-07
CHILD	: 1.88E-06	: 1.61E-06	: 9.25E-06	: 2.05E-06	: 1.55E-06	: 1.55E-06	: 1.55E-06	: 1.55E-06

TABLE IV-A-18

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 18 VEG
 AT 3.20 MILES NE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 8.05E-08	: 8.05E-08	: 8.05E-08	: 8.05E-08	: 8.05E-08	: 8.05E-08	: 8.05E-08	: 9.47E-08
VEGET	:	:	:	:	:	:	:	:
ADULT	: 2.86E-07	: 2.83E-07	: 6.82E-07	: 3.09E-07	: 2.62E-07	: 2.62E-07	: 2.62E-07	: 2.62E-07
TEEN	: 3.37E-07	: 3.22E-07	: 1.05E-06	: 3.74E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07	: 2.99E-07
CHILD	: 5.57E-07	: 4.81E-07	: 2.59E-06	: 6.05E-07	: 4.65E-07	: 4.65E-07	: 4.65E-07	: 4.65E-07

TABLE IV-A-19

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
SPECIAL LOCATION NO. 19 VEG
AT 2.15 MILES SE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.22E-06
VEGET	:	:	:	:	:	:	:	:
ADULT	: 3.18E-06	: 3.13E-06	: 8.77E-06	: 3.48E-06	: 2.86E-06	: 2.86E-06	: 2.86E-06	:
2.86E-06	:	:	:	:	:	:	:	:
TEEN	: 3.76E-06	: 3.58E-06	: 1.35E-05	: 4.24E-06	: 3.28E-06	: 3.28E-06	: 3.28E-06	:
3.28E-06	:	:	:	:	:	:	:	:
CHILD	: 6.27E-06	: 5.30E-06	: 3.33E-05	: 6.89E-06	: 5.09E-06	: 5.09E-06	: 5.09E-06	:
5.09E-06	:	:	:	:	:	:	:	:

TABLE IV-A-20

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
SPECIAL LOCATION NO. 20 VEG
AT 0.94 MILES SSE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.15E-05	: 1.15E-05	: 1.15E-05	: 1.15E-05	: 1.15E-05	: 1.15E-05	: 1.15E-05	: 1.35E-05
VEGET	:	:	:	:	:	:	:	:
ADULT	: 3.21E-05	: 3.16E-05	: 9.75E-05	: 3.55E-05	: 2.86E-05	: 2.86E-05	: 2.86E-05	: 2.86E-05
TEEN	: 3.81E-05	: 3.61E-05	: 1.51E-04	: 4.35E-05	: 3.28E-05	: 3.28E-05	: 3.28E-05	: 3.28E-05
CHILD	: 6.40E-05	: 5.33E-05	: 3.70E-04	: 7.09E-05	: 5.09E-05	: 5.09E-05	: 5.09E-05	: 5.09E-05

TABLE IV-A-21

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 21 VEG
 AT 0.73 MILES S

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 2.88E-05	: 3.38E-05
VEGET	:	:	:	:	:	:	:	:
ADULT	: 8.84E-05	: 8.72E-05	: 2.44E-04	: 9.68E-05	: 7.97E-05	: 7.97E-05	: 7.97E-05	: 7.97E-05
TEEN	: 1.05E-04	: 9.95E-05	: 3.76E-04	: 1.18E-04	: 9.12E-05	: 9.12E-05	: 9.12E-05	: 9.12E-05
CHILD	: 1.74E-04	: 1.48E-04	: 9.25E-04	: 1.92E-04	: 1.42E-04	: 1.42E-04	: 1.42E-04	: 1.42E-04

TABLE IV-A-22

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 22 VEG
 AT 0.99 MILES SSW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 4.43E-06	: 4.43E-06	: 4.43E-06	: 4.43E-06	: 4.43E-06	: 4.43E-06	: 4.43E-06	: 5.21E-06
VEGET	:	:	:	:	:	:	:	:
ADULT	: 1.50E-05	: 1.49E-05	: 3.75E-05	: 1.63E-05	: 1.37E-05	: 1.37E-05	: 1.37E-05	: 1.37E-05
TEEN	: 1.77E-05	: 1.69E-05	: 5.79E-05	: 1.98E-05	: 1.57E-05	: 1.57E-05	: 1.57E-05	: 1.57E-05
CHILD	: 2.94E-05	: 2.53E-05	: 1.42E-04	: 3.20E-05	: 2.43E-05	: 2.43E-05	: 2.43E-05	: 2.43E-05

TABLE IV-A-23

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 23 VEG
 AT 0.76 MILES SW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 3.04E-06
VEGET	:	:	:	:	:	:	:	:
ADULT	: 8.38E-06	: 8.27E-06	: 2.19E-05	: 9.14E-06	: 7.60E-06	: 7.60E-06	: 7.60E-06	: 7.60E-06
TEEN	: 9.90E-06	: 9.44E-06	: 3.39E-05	: 1.11E-05	: 8.69E-06	: 8.69E-06	: 8.69E-06	: 8.69E-06
CHILD	: 1.65E-05	: 1.40E-05	: 8.33E-05	: 1.80E-05	: 1.35E-05	: 1.35E-05	: 1.35E-05	: 1.35E-05

TABLE IV-A-24

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
SPECIAL LOCATION NO. 24 VEG
AT 4.59 MILES WNW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.35E-07
VEGET	:	:	:	:	:	:	:	:
ADULT	: 6.20E-07	: 6.15E-07	: 9.75E-07	: 6.54E-07	: 5.85E-07	: 5.85E-07	: 5.85E-07	: 5.85E-07
TEEN	: 7.23E-07	: 7.03E-07	: 1.51E-06	: 7.77E-07	: 6.70E-07	: 6.70E-07	: 6.70E-07	: 6.70E-07
CHILD	: 1.17E-06	: 1.06E-06	: 3.70E-06	: 1.24E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06	: 1.04E-06

TABLE IV-A-25

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
SPECIAL LOCATION NO. 25 BEEF
AT 4.72 MILES NNE

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 5.29E-08	: 5.29E-08	: 5.29E-08	: 5.29E-08	: 5.29E-08	: 5.29E-08	: 5.29E-08	: 6.22E-08
MEAT	:	:	:	:	:	:	:	:
ADULT	: 3.27E-08	: 3.38E-08	: 5.80E-08	: 3.46E-08	: 3.04E-08	: 3.04E-08	: 3.04E-08	: 3.04E-08
TEEN	: 2.00E-08	: 2.00E-08	: 4.67E-08	: 2.15E-08	: 1.81E-08	: 1.81E-08	: 1.81E-08	: 1.81E-08
CHILD	: 2.54E-08	: 2.30E-08	: 8.94E-08	: 2.69E-08	: 2.20E-08	: 2.20E-08	: 2.20E-08	: 2.20E-08

TABLE IV-A-26

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 26 BEEF
 AT 0.76 MILES SW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 2.59E-06	: 3.04E-06
MEAT	:	:	:	:	:	:	:	:
ADULT	: 1.20E-06	: 1.26E-06	: 2.84E-06	: 1.30E-06	: 1.09E-06	: 1.09E-06	: 1.09E-06	: 1.09E-06
TEEN	: 7.40E-07	: 7.44E-07	: 2.28E-06	: 8.17E-07	: 6.51E-07	: 6.51E-07	: 6.51E-07	: 6.51E-07
CHILD	: 9.55E-07	: 8.38E-07	: 4.38E-06	: 1.03E-06	: 7.88E-07	: 7.88E-07	: 7.88E-07	: 7.88E-07

TABLE IV-A-27

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 27 BEEF
 AT 3.25 MILES W

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 2.01E-07	: 2.01E-07	: 2.01E-07	: 2.01E-07	: 2.01E-07	: 2.01E-07	: 2.01E-07	: 2.37E-07
MEAT	:	:	:	:	:	:	:	:
ADULT	: 1.23E-07	: 1.28E-07	: 2.21E-07	: 1.30E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07	: 1.15E-07
TEEN	: 7.52E-08	: 7.55E-08	: 1.77E-07	: 8.12E-08	: 6.83E-08	: 6.83E-08	: 6.83E-08	: 6.83E-08
CHILD	: 9.57E-08	: 8.66E-08	: 3.40E-07	: 1.01E-07	: 8.27E-08	: 8.27E-08	: 8.27E-08	: 8.27E-08

TABLE IV-A-28

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 28 GOAT
 AT 3.30 MILES SSW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 1.84E-07	: 1.84E-07	: 1.84E-07	: 1.84E-07	: 1.84E-07	: 1.84E-07	: 1.84E-07	: 2.16E-07
GOAT MILK:	:	:	:	:	:	:	:	:
ADULT	: 4.66E-07	: 4.65E-07	: 8.63E-08	: 4.69E-07	: 4.63E-07	: 4.63E-07	: 4.63E-07	: 4.63E-07
TEEN	: 6.08E-07	: 6.05E-07	: 1.52E-07	: 6.13E-07	: 6.03E-07	: 6.03E-07	: 6.03E-07	: 6.03E-07
CHILD	: 9.68E-07	: 9.56E-07	: 3.80E-07	: 9.75E-07	: 9.55E-07	: 9.55E-07	: 9.55E-07	: 9.55E-07
INFANT	: 1.46E-06	: 1.45E-06	: 4.48E-07	: 1.48E-06	: 1.45E-06	: 1.45E-06	: 1.45E-06	: 1.45E-06

TABLE IV-A-29

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
 SPECIAL LOCATION NO. 29 GOAT
 AT 4.20 MILES SW

ANNUAL_BETA_AIR_DOSE = 0.00E+00 MILLRADS
 ANNUAL_GAMMA_AIR_DOSE = 0.00E+00 MILLRADS

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
PLUME	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00	: 0.00E+00
GROUND	: 3.85E-08	: 3.85E-08	: 3.85E-08	: 3.85E-08	: 3.85E-08	: 3.85E-08	: 3.85E-08	: 4.53E-08
GOAT MILK:	:	:	:	:	:	:	:	:
ADULT	: 1.04E-07	: 1.03E-07	: 1.81E-08	: 1.04E-07	: 1.03E-07	: 1.03E-07	: 1.03E-07	: 1.03E-07
TEEN	: 1.35E-07	: 1.34E-07	: 3.17E-08	: 1.36E-07	: 1.34E-07	: 1.34E-07	: 1.34E-07	: 1.34E-07
CHILD	: 2.15E-07	: 2.13E-07	: 7.96E-08	: 2.16E-07	: 2.12E-07	: 2.12E-07	: 2.12E-07	: 2.12E-07
INFANT	: 3.25E-07	: 3.22E-07	: 9.38E-08	: 3.28E-07	: 3.22E-07	: 3.22E-07	: 3.22E-07	: 3.22E-07

TABLE IV-B-1

FORT CALHOUN 1 DOSE CONTRIBUTIONS FROM GASEOUS EFFLUENTS
UNRESTRICTED AREA BOUNDARY
REQUIRED BY TECHNICAL SPECIFICATION 5.9.4.a.
JANUARY 1, 2024 TO DECEMBER 31, 2024

MAXIMUM SITE BOUNDARY GAMMA AIR DOSE - 0.00E+00

MAXIMUM SITE BOUNDARY BETA AIR DOSE - 0.00E+00

TABLE IV-C-1

FORT CALHOUN ANNUAL 2024, DOSE PROJECTIONS
ALARA ANNUAL INTEGRATED POPULATION DOSE SUMMARY (PERSON-REM)

PATHWAY	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
GROUND	: 1.77E-05 : : 10.56% :	: 1.77E-05 : : 10.71% :	: 1.77E-05 : : 10.03% :	: 1.77E-05 : : 10.29% :	: 1.77E-05 : : 10.93% :	: 1.77E-05 : : 10.93% :	: 1.77E-05 : : 10.81% :	: 2.08E-05 : : 12.61% :
INHAL	: 7.64E-05 : : 45.67% :	: 7.64E-05 : : 46.34% :	: 1.42E-06 : : 0.81% :	: 7.64E-05 : : 44.54% :	: 7.63E-05 : : 47.23% :	: 7.63E-05 : : 47.23% :	: 7.80E-05 : : 47.79% :	: 7.63E-05 : : 46.34% :
VEGET	: 5.22E-05 : : 31.20% :	: 5.02E-05 : : 30.46% :	: 1.15E-04 : : 65.08% :	: 5.53E-05 : : 32.23% :	: 4.81E-05 : : 29.78% :	: 4.81E-05 : : 29.78% :	: 4.81E-05 : : 29.46% :	: 4.81E-05 : : 29.21% :
COW MILK	: 9.40E-06 : : 5.62% :	: 8.86E-06 : : 5.37% :	: 2.23E-05 : : 12.66% :	: 1.00E-05 : : 5.83% :	: 8.64E-06 : : 5.35% :	: 8.64E-06 : : 5.35% :	: 8.64E-06 : : 5.29% :	: 8.64E-06 : : 5.25% :
MEAT	: 1.16E-05 : : 6.95% :	: 1.17E-05 : : 7.12% :	: 2.01E-05 : : 11.42% :	: 1.22E-05 : : 7.11% :	: 1.08E-05 : : 6.71% :	: 1.08E-05 : : 6.71% :	: 1.08E-05 : : 6.64% :	: 1.08E-05 : : 6.59% :
TOTAL	1.67E-04	: 1.65E-04	: 1.76E-04	: 1.72E-04	: 1.62E-04	: 1.62E-04	: 1.63E-04	: 1.65E-04

SECTION V

DOSE FROM LIQUID EFFLUENTS LADTAP II OUTPUT

January 1, 2024 - December 31, 2024

Radioactive Effluent Releases - First, Second, Third, and Fourth Quarters 2024

LIQUID EFFLUENTS

During the reporting period, a total of $1.75\text{E-}03$ curies of radioactive liquid materials, less tritium, dissolved noble gases, and alpha were released to the Missouri River at an average concentration of $1.73\text{E-}09$ $\mu\text{Ci/mL}$. This represents $1.73\text{E-}01$ percent of the limits specified in Appendix B to 10 CFR 20 ($1.0\text{E-}06$ $\mu\text{Ci/mL}$ for unrestricted areas). $1.71\text{E-}02$ curies of tritium were discharged at an average diluted concentration of $1.69\text{E-}08$ $\mu\text{Ci/mL}$ or $1.69\text{E-}03$ percent of ECL ($1.0\text{E-}03$ $\mu\text{Ci/mL}$).

No gross alpha radioactivity was identified by Off-site vendor analysis of quarterly liquid composites for the reporting period.

Dilution water during the periods of release amounted to $1.00\text{E+}09$ liters, while liquid waste discharges consisted of $8.12\text{E+}06$ 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, 2024, through December 31, 2024, 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 dilution stream flow during periods of release was 9.92 cubic feet per second (CFS) for 2024. The average discharge rate during releases was 9.14 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 were used for dose calculations.
- (5) A shore width 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 1,053,476 within a 50-mile radius of the plant (based on the 2020 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 SITE

A D U L T D O S E S

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		9.38E-02	1.28E-01	8.41E-02	3.25E-07	4.36E-02	1.45E-02	2.55E-03
DRINKING		3.87E-04	5.32E-04	3.50E-04	2.98E-06	1.82E-04	6.26E-05	2.38E-05
SHORELINE	1.47E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04	1.26E-04
SWIMMING		4.20E-07	4.20E-07	4.20E-07	4.20E-07	4.20E-07	4.20E-07	4.20E-07
BOATING		2.10E-07	2.10E-07	2.10E-07	2.10E-07	2.10E-07	2.10E-07	2.10E-07
TOTAL	1.47E-04	9.43E-02	1.29E-01	8.45E-02	1.30E-04	4.39E-02	1.47E-02	2.70E-03

	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

	DOSE (MREM PER YEAR INTAKE)							
PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.00E-01	1.34E-01	4.66E-02	2.50E-07	4.55E-02	1.77E-02	1.95E-03
DRINKING		3.79E-04	5.07E-04	1.79E-04	2.10E-06	1.74E-04	6.88E-05	1.60E-05
SHORELINE	8.19E-04	7.01E-04	7.01E-04	7.01E-04	7.01E-04	7.01E-04	7.01E-04	7.01E-04
SWIMMING		2.35E-06	2.35E-06	2.35E-06	2.35E-06	2.35E-06	2.35E-06	2.35E-06
BOATING		1.17E-06	1.17E-06	1.17E-06	1.17E-06	1.17E-06	1.17E-06	1.17E-06
TOTAL	8.19E-04	1.02E-01	1.35E-01	4.74E-02	7.07E-04	4.64E-02	1.84E-02	2.67E-03

	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		1.26E-01	1.21E-01	1.79E-02	2.07E-07	3.95E-02	1.42E-02	7.74E-04
DRINKING		1.11E-03	1.07E-03	1.63E-04	4.03E-06	3.50E-04	1.28E-04	1.60E-05
SHORELINE	1.71E-04	1.47E-04	1.47E-04	1.47E-04	1.47E-04	1.47E-04	1.47E-04	1.47E-04
SWIMMING		4.90E-07	4.90E-07	4.90E-07	4.90E-07	4.90E-07	4.90E-07	4.90E-07
BOATING		2.45E-07	2.45E-07	2.45E-07	2.45E-07	2.45E-07	2.45E-07	2.45E-07
TOTAL	1.71E-04	1.28E-01	1.22E-01	1.82E-02	1.52E-04	3.99E-02	1.45E-02	9.37E-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		1.14E-03	1.34E-03	1.02E-04	3.96E-06	3.63E-04	1.50E-04	1.12E-05
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	1.14E-03	1.34E-03	1.02E-04	3.96E-06	3.63E-04	1.50E-04	1.12E-05

	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

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		6.85E-01	9.37E-01	6.14E-01	2.37E-06	3.18E-01	1.06E-01	1.86E-02
DRINKING		1.19E-02	1.64E-02	1.08E-02	9.17E-05	5.62E-03	1.93E-03	7.32E-04
SHORELINE	1.07E-03	9.17E-04	9.17E-04	9.17E-04	9.17E-04	9.17E-04	9.17E-04	9.17E-04
SWIMMING		3.07E-06	3.07E-06	3.07E-06	3.07E-06	3.07E-06	3.07E-06	3.07E-06
BOATING		1.53E-06	1.53E-06	1.53E-06	1.53E-06	1.53E-06	1.53E-06	1.53E-06
TOTAL	1.07E-03	6.98E-01	9.54E-01	6.25E-01	1.02E-03	3.24E-01	1.09E-01	2.03E-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

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		7.33E-01	9.76E-01	3.40E-01	1.82E-06	3.32E-01	1.29E-01	1.42E-02
DRINKING		1.17E-02	1.56E-02	5.52E-03	6.46E-05	5.36E-03	2.12E-03	4.93E-04
SHORELINE	5.98E-03	5.12E-03	5.12E-03	5.12E-03	5.12E-03	5.12E-03	5.12E-03	5.12E-03
SWIMMING		1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.71E-05
BOATING		8.56E-06	8.56E-06	8.56E-06	8.56E-06	8.56E-06	8.56E-06	8.56E-06
TOTAL	5.98E-03	7.50E-01	9.96E-01	3.51E-01	5.21E-03	3.42E-01	1.36E-01	1.98E-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

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		9.23E-01	8.84E-01	1.31E-01	1.51E-06	2.88E-01	1.04E-01	5.65E-03
DRINKING		3.41E-02	3.28E-02	5.03E-03	1.24E-04	1.08E-02	3.95E-03	4.94E-04
SHORELINE	1.25E-03	1.07E-03	1.07E-03	1.07E-03	1.07E-03	1.07E-03	1.07E-03	1.07E-03
SWIMMING		3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06	3.58E-06
BOATING		1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06	1.79E-06
TOTAL	1.25E-03	9.58E-01	9.18E-01	1.37E-01	1.20E-03	3.00E-01	1.09E-01	7.22E-03

	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

DOSE (MREM PER YEAR INTAKE)

PATHWAY	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		3.52E-02	4.14E-02	3.14E-03	1.22E-04	1.12E-02	4.61E-03	3.45E-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	3.52E-02	4.14E-02	3.14E-03	1.22E-04	1.12E-02	4.61E-03	3.45E-04

	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

COMMERCIAL HARVEST

-----DOSE (PERSON-REM)-----									
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	ADULT	5.16E+06	3.82E-02	5.23E-02	3.43E-02	1.32E-07	1.77E-02	5.90E-03	1.04E-03
FISH	TEENAGER	6.03E+05	6.27E-03	8.35E-03	2.91E-03	1.56E-08	2.84E-03	1.10E-03	1.22E-04
FISH	CHILD	4.17E+05	1.27E-02	1.21E-02	1.79E-03	2.07E-08	3.96E-03	1.42E-03	7.76E-05
FISH	TOTAL	6.18E+06	5.72E-02	7.28E-02	3.90E-02	1.69E-07	2.45E-02	8.43E-03	1.24E-03

LOCATION DILUTION CATCH TIME (HR)-INCLUDES FOOD PROCESSING TIME OF 2.40E+02 HR POPULATION=1.05E+06
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

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	5.44E-01	7.45E-01	4.88E-01	1.89E-06	2.53E-01	8.40E-02	1.48E-02
FISH	TEENAGER	1.42E+04	8.93E-02	1.19E-01	4.14E-02	2.22E-07	4.04E-02	1.57E-02	1.73E-03
FISH	CHILD	9.85E+03	1.81E-01	1.73E-01	2.55E-02	2.95E-07	5.63E-02	2.03E-02	1.10E-03
FISH	TOTAL	1.46E+05	8.14E-01	1.04E+00	5.55E-01	2.40E-06	3.49E-01	1.20E-01	1.76E-02

* * * POPULATION WATER CONSUMPTION DOSES * * *

SUPPLIER-OMAHA

-----DOSE (PERSON-REM)-----									
PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	ADULT	1.24E+08	6.58E-02	9.06E-02	5.97E-02	5.07E-04	3.10E-02	1.07E-02	4.05E-03
DRINKING	TEENAGER	1.35E+07	1.01E-02	1.35E-02	4.75E-03	5.56E-05	4.61E-03	1.83E-03	4.24E-04
DRINKING	CHILD	2.21E+07	4.81E-02	4.62E-02	7.09E-03	1.75E-04	1.52E-02	5.57E-03	6.97E-04
DRINKING	TOTAL	1.60E+08	1.24E-01	1.50E-01	7.15E-02	7.37E-04	5.08E-02	1.81E-02	5.17E-03

POPULATION=4.73E+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

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

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
DRINKING	CUMUL TOTAL	1.81E+08	1.40E-01	1.70E-01	8.08E-02	8.34E-04	5.75E-02	2.04E-02	5.84E-03

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	1.30E-07	1.30E-07	1.30E-07	1.30E-07	1.30E-07	1.30E-07

LOCATION- DOWN STREAM SWIMMING

DILUTION= 7.30E+00 TRANSIT TIME= 6.70E-01 HR SWF= 0.2

PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
SWIMMING	TOTAL POPUL	4.10E+07		1.44E-03	1.44E-03

LOCATION- DOWN STREAM BOATING

DILUTION= 7.30E+00 TRANSIT TIME= 6.70E-01 HR

PATHWAY	AGE GROUP	USAGE	DOSE (PERSON-REM)		
			SKIN	TOTAL BODY	THYROID
BOATING	TOTAL POPUL	4.10E+07		7.18E-04	7.18E-04

* * * DOSE TO BIOTA * * *

MRADS PER YEAR

BIOTA	DILUTION=	1.00E+00	TRANSIT TIME=	0.00E+00	HR
	INTERNAL	EXTERNAL	TOTAL		
FISH	2.05E+00	3.35E+00	5.40E+00		
INVERTEBRATE	1.04E+00	6.70E+00	7.73E+00		
ALGAE	5.23E-01	2.24E-03	5.25E-01		
MUSKRAT	1.11E+01	2.23E+00	1.33E+01		
RACCOON	4.15E+00	1.67E+00	5.83E+00		
HERON	6.49E+01	2.23E+00	6.72E+01		
DUCK	1.01E+01	3.35E+00	1.35E+01		

SECTION VI

RADIOACTIVE EFFLUENT RELEASES- SOLID RADIOACTIVE WASTE

January 1, 2024 – December 31, 2024

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

January 1, 2024 through December 31, 2024

A. Resins, Filters, and Evaporator Bottoms

Waste Class	Volume		Curies Shipped
	ft ³	m ³	
A	2.41E+02	6.81E+00	6.24E-02
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
ALL	2.41E+02	6.81E+00	6.24E-02
Major Nuclides for the Above Table: H-3, C-14, Fe-55, Co-60, Ni-63, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244			

B. Dry Active Waste

Waste Class	Volume		Curies Shipped
	ft ³	m ³	
A	5.84E+05	1.65E+04	1.12E+02
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
ALL	5.84E+05	1.65E+04	1.12E+02
Major Nuclides for the Above Table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244			

C. Irradiated Components

Waste Class	Volume		Curies Shipped
	ft ³	m ³	
A	1.15E+01	3.27E-01	3.11E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
ALL	1.15E+01	3.27E-01	3.11E+00
Major Nuclides for the Above Table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244			

D. Other Waste

Waste Class	Volume		Curies Shipped
	ft ³	m ³	
A	3.40E+01	9.64E-01	1.75E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
ALL	3.4E+01	9.64E-01	1.75E+00
Major Nuclides for the Above Table: H-3, C-14, Co-60, Ni-63, Sr-90, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244			

E. Sum of All Low-Level Waste Shipped from Site

Waste Class	Volume		Curies Shipped
	ft ³	m ³	
A	5.84E+05	1.65E+04	1.16E+02
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
Unclassified	0.00E+00	0.00E+00	0.00E+00
ALL	5.84E+05	1.65E+04	1.16E+02
Major Nuclides for the Above Table: H-3, C-14, Fe-55, Co-60, Ni-59, Ni-63, Sr-90, Nb-94, Tc-99, I-129, Cs-137, Pu-238, Pu-239, Pu-240, Pu-241, Am-241, Cm-242, Cm-243, Cm-244			

SECTION VII

ATTACHMENT 1

The annual Radioactive Effluent Release Report shall include any revisions to the Offsite Dose Calculation Manual (ODCM) and the Process Control Program (PCP) for the period January 1, 2024 through December 31, 2024.

 0 revisions were made to the Offside Dose Calculation Manual (ODCM).

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

January 1, 2024- December 31, 2024

SECTION VII

ATTACHMENT 2

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

(Regulatory Guide 1.21)

January 1, 2024 – December 31, 2024

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, 2015 through December 31, 2019 had a cumulative recovery rate of 78.15% from the meteorological tower with the remaining 21.85% provided by Eppler Airfield Weather Station, a branch of the National Weather Service. The following table is a summary of the parameters and their respective recovery rates for the period.

The tabulations of the Weather Tower Data for the period January 1, 2015 through December 31, 2019 look appropriate for the season indicated. The Pasquill Classes observed for the five year period are detailed below.

Pasquill								
Class	A	B	C	D	E	F	G	Total
% Obs.	7.34	3.46	6.37	46.83	22.95	8.56	4.49	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 ($\Delta T / \Delta z \leq -1.9$)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL A
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0	3	19	31	76	97	56	14	13	0	0	309
NNE	1	6	22	20	22	23	6	5	0	0	0	105
NE	0	5	13	5	16	21	8	1	0	0	0	69
ENE	0	5	13	12	18	23	6	0	1	0	0	78
E	0	1	14	11	25	21	7	1	3	0	0	83
ESE	0	2	5	15	34	50	14	7	9	1	0	137
SE	0	2	9	12	21	24	33	18	22	3	1	145
SSE	0	3	3	8	29	34	39	33	53	9	0	211
S	0	1	3	5	19	44	27	26	42	10	2	179
SSW	1	1	4	3	21	32	24	17	30	10	1	144
SW	0	0	4	5	25	20	28	14	12	8	0	116
WSW	0	1	9	6	17	3	3	2	9	0	0	50
W	1	5	6	27	32	17	15	3	5	2	0	113
WNW	0	10	15	27	62	37	26	8	6	0	0	191
NW	0	9	17	15	73	94	122	68	71	12	5	486
NNW	0	6	18	30	146	173	184	126	88	15	4	790
Total	3	60	174	232	636	713	598	343	364	70	13	3206

Number of Calms 9
Number of Invalid Hours 0
Number of Valid Hours 3215

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY UNSTABLE ($-1.9 < \Delta T / \Delta z \leq -1.7$)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL B
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0	15	18	23	52	28	12	4	2	0	0	154
NNE	0	4	10	10	16	4	4	0	0	0	0	48
NE	0	2	8	13	14	8	3	2	0	0	0	50
ENE	0	1	5	14	20	10	7	3	0	0	0	60
E	0	3	4	11	26	12	3	3	0	0	0	62
ESE	0	2	5	3	16	10	12	6	3	2	0	59
SE	0	1	1	7	9	29	31	29	15	2	0	124
SSE	0	5	3	7	4	17	30	15	22	2	0	105
S	0	0	2	6	16	23	23	12	19	8	1	110
SSW	0	3	2	4	8	10	10	13	18	3	0	71
SW	1	2	2	3	11	9	4	2	4	0	0	38
WSW	0	1	4	5	10	5	4	1	1	1	0	32
W	0	0	5	10	7	5	4	1	5	0	0	37
WNW	0	2	6	7	31	9	7	1	6	1	0	70
NW	0	3	9	7	23	27	30	21	18	3	1	142
NNW	0	2	14	21	85	80	57	42	29	4	0	334
Total	1	46	98	151	348	286	241	155	142	26	2	1496

Number of Calms 19
Number of Invalid Hours 0
Number of Valid Hours 1515

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
SLIGHTLY UNSTABLE ($-1.7 < \Delta T / \Delta z \leq -1.5$)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL C
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	1	39	56	75	71	56	24	6	2	0	0	330
NNE	0	13	30	32	29	9	2	2	0	0	0	117
NE	0	7	13	16	22	12	2	1	1	0	0	74
ENE	0	7	14	18	28	16	7	2	0	0	0	92
E	0	11	17	28	26	8	7	2	1	0	0	100
ESE	0	11	15	19	28	21	15	7	7	1	0	124
SE	0	15	26	42	37	38	36	29	16	3	1	243
SSE	0	15	25	36	25	34	32	28	34	10	0	239
S	0	11	16	21	38	48	31	18	16	5	2	206
SSW	0	6	5	23	21	18	17	16	22	3	1	132
SW	0	6	12	11	13	19	14	6	5	3	1	90
WSW	0	3	5	14	11	10	5	5	2	0	0	55
W	0	9	17	20	21	13	4	2	6	1	0	93
WNW	0	6	13	19	24	19	12	5	6	0	0	104
NW	0	8	19	25	45	44	32	23	27	7	0	230
NNW	0	8	27	59	84	102	57	35	30	9	4	415
Total	1	175	310	458	523	467	297	187	175	42	9	2644

Number of Calms 146
Number of Invalid Hours 0
Number of Valid Hours 2790

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 2015 - DEC 2019
PASQUILL D
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	2	88	181	341	605	475	168	94	47	0	0	2001
NNE	2	58	142	148	194	145	47	15	7	1	0	759
NE	2	40	106	111	135	69	38	15	7	3	0	526
ENE	0	37	131	108	153	92	37	13	13	0	0	584
E	1	38	112	159	265	148	58	23	10	2	0	816
ESE	1	45	86	170	301	222	85	39	34	8	1	992
SE	2	31	78	197	497	464	296	174	129	18	6	1892
SSE	2	25	53	164	522	655	497	340	342	34	8	2642
S	1	24	42	101	309	490	453	339	316	66	9	2150
SSW	1	18	32	61	168	200	164	153	151	34	12	994
SW	2	12	37	43	177	139	83	56	50	14	4	617
WSW	1	25	39	48	96	83	48	26	17	2	0	385
W	1	25	39	91	147	112	55	49	36	9	0	564
WNW	6	37	69	72	175	163	111	58	50	2	0	743
NW	3	39	89	113	281	337	302	189	216	48	7	1624
NNW	2	49	171	269	816	768	462	239	209	26	1	3012
Total	29	591	1407	2196	4841	4562	2904	1822	1634	267	48	20301

Number of Calms 212
Number of Invalid Hours 0
Number of Valid Hours 20513

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
SLIGHTLY STABLE ($-0.5 < \Delta T / \Delta z \leq 1.5$)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL E
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	10	55	78	55	81	31	9	2	0	0	0	321
NNE	6	60	46	29	42	6	4	0	1	0	0	194
NE	10	46	64	33	29	3	1	0	0	0	0	186
ENE	5	47	64	35	44	9	5	1	0	0	0	210
E	9	50	79	64	85	22	8	3	2	0	0	322
ESE	8	47	142	131	163	44	14	8	5	0	0	562
SE	10	59	157	206	452	288	131	43	48	6	2	1402
SSE	10	52	76	136	462	370	262	113	67	5	0	1553
S	6	41	42	60	198	250	221	123	88	9	1	1039
SSW	11	45	45	21	74	80	123	95	140	29	4	667
SW	26	39	26	21	45	43	32	43	84	31	6	396
WSW	11	47	37	33	51	46	37	15	15	2	1	295
W	25	86	64	70	104	70	45	18	10	1	1	494
WNW	22	172	142	93	212	103	56	13	9	2	0	824
NW	11	113	158	132	191	108	34	4	6	0	1	758
NNW	13	70	142	168	271	113	26	13	10	1	0	827
Total	193	1029	1362	1287	2504	1586	1008	494	485	86	16	10050

Number of Calms 0

Number of Invalid Hours 0

Number of Valid Hours 10050

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY EVENTS
MODERATELY STABLE ($1.5 < \Delta T / \Delta z \leq 4.0$)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL F
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	8	24	21	27	17	4	1	0	0	0	0	102
NNE	8	27	12	10	1	0	0	0	0	0	0	58
NE	11	22	5	2	0	1	0	0	0	0	0	41
ENE	5	41	26	6	4	0	0	0	0	0	1	83
E	9	59	57	24	22	2	0	0	0	0	0	173
ESE	10	50	101	70	41	21	2	0	0	0	0	295
SE	14	81	124	122	164	62	25	7	0	0	0	599
SSE	23	78	59	96	160	35	4	1	0	0	0	456
S	26	76	24	35	81	52	23	4	1	0	0	322
SSW	39	72	31	15	29	37	27	8	1	0	0	259
SW	36	81	14	11	19	13	15	9	9	2	0	209
WSW	37	77	17	6	9	16	9	0	3	0	0	174
W	38	125	39	25	17	6	1	0	0	0	0	251
WNW	32	129	90	34	44	12	1	0	0	0	0	342
NW	16	54	43	23	25	6	0	0	0	0	0	167
NNW	9	22	21	26	31	12	3	3	3	1	0	131
Total	321	1018	684	532	664	279	111	32	17	3	1	3662

Number of Calms 86
Number of Invalid Hours 0
Number of Valid Hours 3748

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 2015 - DEC 2019
PASQUILL G
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	5	19	9	6	1	1	0	0	0	0	0	41
NNE	13	16	7	3	1	3	0	0	0	0	0	43
NE	13	31	2	1	1	3	0	0	0	0	0	51
ENE	18	49	13	4	1	0	0	1	2	0	0	88
E	20	50	26	9	2	0	0	1	0	0	0	108
ESE	26	87	165	34	8	5	0	0	0	0	0	325
SE	22	101	75	37	20	5	2	0	0	0	0	262
SSE	32	88	56	34	8	1	0	0	0	0	0	219
S	19	84	24	13	14	8	2	2	0	0	0	166
SSW	23	77	13	7	8	8	3	2	0	0	0	141
SW	23	81	7	2	6	6	4	1	0	0	0	130
WSW	24	36	10	3	1	1	0	0	0	0	0	75
W	18	38	13	7	3	0	0	0	0	0	0	79
WNW	6	24	15	7	0	0	0	0	0	0	0	52
NW	9	19	12	5	1	1	0	0	0	0	0	47
NNW	2	10	9	8	3	8	20	2	0	0	0	62
Total	273	810	456	180	78	50	31	9	2	0	0	1889

Number of Calms 79
Number of Invalid Hours 0
Number of Valid Hours 1968

Hours Accounted For: 43799

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 2015 - DEC 2019
PASQUILL A
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.00	0.01	0.04	0.07	0.17	0.22	0.13	0.03	0.03	0.00	0.00	0.71
NNE	0.00	0.01	0.05	0.05	0.05	0.05	0.01	0.01	0.00	0.00	0.00	0.24
NE	0.00	0.01	0.03	0.01	0.04	0.05	0.02	0.00	0.00	0.00	0.00	0.16
ENE	0.00	0.01	0.03	0.03	0.04	0.05	0.01	0.00	0.00	0.00	0.00	0.18
E	0.00	0.00	0.03	0.03	0.06	0.05	0.02	0.00	0.01	0.00	0.00	0.19
ESE	0.00	0.00	0.01	0.03	0.08	0.11	0.03	0.02	0.02	0.00	0.00	0.31
SE	0.00	0.00	0.02	0.03	0.05	0.05	0.08	0.04	0.05	0.01	0.00	0.33
SSE	0.00	0.01	0.01	0.02	0.07	0.08	0.09	0.08	0.12	0.02	0.00	0.48
S	0.00	0.00	0.01	0.01	0.04	0.10	0.06	0.06	0.10	0.02	0.00	0.41
SSW	0.00	0.00	0.01	0.01	0.05	0.07	0.05	0.04	0.07	0.02	0.00	0.33
SW	0.00	0.00	0.01	0.01	0.06	0.05	0.06	0.03	0.03	0.02	0.00	0.26
WSW	0.00	0.00	0.02	0.01	0.04	0.01	0.01	0.00	0.02	0.00	0.00	0.11
W	0.00	0.01	0.01	0.06	0.07	0.04	0.03	0.01	0.01	0.00	0.00	0.26
WNW	0.00	0.02	0.03	0.06	0.14	0.08	0.06	0.02	0.01	0.00	0.00	0.44
NW	0.00	0.02	0.04	0.03	0.17	0.21	0.28	0.16	0.16	0.03	0.01	1.11
NNW	0.00	0.01	0.04	0.07	0.33	0.39	0.42	0.29	0.20	0.03	0.01	1.80
Total	0.01	0.14	0.40	0.53	1.45	1.63	1.37	0.78	0.83	0.16	0.03	7.32

Percent of Calms 0.02
Percent of Invalid Hours 0.00
Percent of Valid Hours 7.34

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 2015 - DEC 2019
PASQUILL B
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.00	0.03	0.04	0.05	0.12	0.06	0.03	0.01	0.00	0.00	0.00	0.35
NNE	0.00	0.01	0.02	0.02	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.11
NE	0.00	0.00	0.02	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.11
ENE	0.00	0.00	0.01	0.03	0.05	0.02	0.02	0.01	0.00	0.00	0.00	0.14
E	0.00	0.01	0.01	0.03	0.06	0.03	0.01	0.01	0.00	0.00	0.00	0.14
ESE	0.00	0.00	0.01	0.01	0.04	0.02	0.03	0.01	0.01	0.00	0.00	0.13
SE	0.00	0.00	0.00	0.02	0.02	0.07	0.07	0.07	0.03	0.00	0.00	0.28
SSE	0.00	0.01	0.01	0.02	0.01	0.04	0.07	0.03	0.05	0.00	0.00	0.24
S	0.00	0.00	0.00	0.01	0.04	0.05	0.05	0.03	0.04	0.02	0.00	0.25
SSW	0.00	0.01	0.00	0.01	0.02	0.02	0.02	0.03	0.04	0.01	0.00	0.16
SW	0.00	0.00	0.00	0.01	0.03	0.02	0.01	0.00	0.01	0.00	0.00	0.09
WSW	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.07
W	0.00	0.00	0.01	0.02	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.08
WNW	0.00	0.00	0.01	0.02	0.07	0.02	0.02	0.00	0.01	0.00	0.00	0.16
NW	0.00	0.01	0.02	0.02	0.05	0.06	0.07	0.05	0.04	0.01	0.00	0.32
NNW	0.00	0.00	0.03	0.05	0.19	0.18	0.13	0.10	0.07	0.01	0.00	0.76
Total	0.00	0.11	0.22	0.34	0.79	0.65	0.55	0.35	0.32	0.06	0.00	3.42

Percent of Calms 0.04
Percent of Invalid Hours 0.00
Percent of Valid Hours 3.46

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 2015 - DEC 2019
PASQUILL C
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.00	0.09	0.13	0.17	0.16	0.13	0.05	0.01	0.00	0.00	0.00	0.75
NNE	0.00	0.03	0.07	0.07	0.07	0.02	0.00	0.00	0.00	0.00	0.00	0.27
NE	0.00	0.02	0.03	0.04	0.05	0.03	0.00	0.00	0.00	0.00	0.00	0.17
ENE	0.00	0.02	0.03	0.04	0.06	0.04	0.02	0.00	0.00	0.00	0.00	0.21
E	0.00	0.03	0.04	0.06	0.06	0.02	0.02	0.00	0.00	0.00	0.00	0.23
ESE	0.00	0.03	0.03	0.04	0.06	0.05	0.03	0.02	0.02	0.00	0.00	0.28
SE	0.00	0.03	0.06	0.10	0.08	0.09	0.08	0.07	0.04	0.01	0.00	0.55
SSE	0.00	0.03	0.06	0.08	0.06	0.08	0.07	0.06	0.08	0.02	0.00	0.55
S	0.00	0.03	0.04	0.05	0.09	0.11	0.07	0.04	0.04	0.01	0.00	0.47
SSW	0.00	0.01	0.01	0.05	0.05	0.04	0.04	0.04	0.05	0.01	0.00	0.30
SW	0.00	0.01	0.03	0.03	0.03	0.04	0.03	0.01	0.01	0.01	0.00	0.21
WSW	0.00	0.01	0.01	0.03	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.13
W	0.00	0.02	0.04	0.05	0.05	0.03	0.01	0.00	0.01	0.00	0.00	0.21
WNW	0.00	0.01	0.03	0.04	0.05	0.04	0.03	0.01	0.01	0.00	0.00	0.24
NW	0.00	0.02	0.04	0.06	0.10	0.10	0.07	0.05	0.06	0.02	0.00	0.53
NNW	0.00	0.02	0.06	0.13	0.19	0.23	0.13	0.08	0.07	0.02	0.01	0.95
Total	0.00	0.40	0.71	1.05	1.19	1.07	0.68	0.43	0.40	0.10	0.02	6.04

Percent of Calms 0.33
Percent of Invalid Hours 0.00
Percent of Valid Hours 6.37

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 2015 - DEC 2019
PASQUILL D
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.00	0.20	0.41	0.78	1.38	1.08	0.38	0.21	0.11	0.00	0.00	4.57
NNE	0.00	0.13	0.32	0.34	0.44	0.33	0.11	0.03	0.02	0.00	0.00	1.73
NE	0.00	0.09	0.24	0.25	0.31	0.16	0.09	0.03	0.02	0.01	0.00	1.20
ENE	0.00	0.08	0.30	0.25	0.35	0.21	0.08	0.03	0.03	0.00	0.00	1.33
E	0.00	0.09	0.26	0.36	0.61	0.34	0.13	0.05	0.02	0.00	0.00	1.86
ESE	0.00	0.10	0.20	0.39	0.69	0.51	0.19	0.09	0.08	0.02	0.00	2.26
SE	0.00	0.07	0.18	0.45	1.13	1.06	0.68	0.40	0.29	0.04	0.01	4.32
SSE	0.00	0.06	0.12	0.37	1.19	1.50	1.13	0.78	0.78	0.08	0.02	6.03
S	0.00	0.05	0.10	0.23	0.71	1.12	1.03	0.77	0.72	0.15	0.02	4.91
SSW	0.00	0.04	0.07	0.14	0.38	0.46	0.37	0.35	0.34	0.08	0.03	2.27
SW	0.00	0.03	0.08	0.10	0.40	0.32	0.19	0.13	0.11	0.03	0.01	1.41
WSW	0.00	0.06	0.09	0.11	0.22	0.19	0.11	0.06	0.04	0.00	0.00	0.88
W	0.00	0.06	0.09	0.21	0.34	0.26	0.13	0.11	0.08	0.02	0.00	1.29
WNW	0.01	0.08	0.16	0.16	0.40	0.37	0.25	0.13	0.11	0.00	0.00	1.70
NW	0.01	0.09	0.20	0.26	0.64	0.77	0.69	0.43	0.49	0.11	0.02	3.71
NNW	0.00	0.11	0.39	0.61	1.86	1.75	1.05	0.55	0.48	0.06	0.00	6.88
Total	0.07	1.35	3.21	5.01	11.05	10.42	6.63	4.16	3.73	0.61	0.11	46.35

Percent of Calms 0.48
Percent of Invalid Hours 0.00
Percent of Valid Hours 46.83

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 2015 - DEC 2019
PASQUILL E
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.02	0.13	0.18	0.13	0.18	0.07	0.02	0.00	0.00	0.00	0.00	0.73
NNE	0.01	0.14	0.11	0.07	0.10	0.01	0.01	0.00	0.00	0.00	0.00	0.44
NE	0.02	0.11	0.15	0.08	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.42
ENE	0.01	0.11	0.15	0.08	0.10	0.02	0.01	0.00	0.00	0.00	0.00	0.48
E	0.02	0.11	0.18	0.15	0.19	0.05	0.02	0.01	0.00	0.00	0.00	0.74
ESE	0.02	0.11	0.32	0.30	0.37	0.10	0.03	0.02	0.01	0.00	0.00	1.28
SE	0.02	0.13	0.36	0.47	1.03	0.66	0.30	0.10	0.11	0.01	0.00	3.20
SSE	0.02	0.12	0.17	0.31	1.05	0.84	0.60	0.26	0.15	0.01	0.00	3.55
S	0.01	0.09	0.10	0.14	0.45	0.57	0.50	0.28	0.20	0.02	0.00	2.37
SSW	0.03	0.10	0.10	0.05	0.17	0.18	0.28	0.22	0.32	0.07	0.01	1.52
SW	0.06	0.09	0.06	0.05	0.10	0.10	0.07	0.10	0.19	0.07	0.01	0.90
WSW	0.03	0.11	0.08	0.08	0.12	0.11	0.08	0.03	0.03	0.00	0.00	0.67
W	0.06	0.20	0.15	0.16	0.24	0.16	0.10	0.04	0.02	0.00	0.00	1.13
WNW	0.05	0.39	0.32	0.21	0.48	0.24	0.13	0.03	0.02	0.00	0.00	1.88
NW	0.03	0.26	0.36	0.30	0.44	0.25	0.08	0.01	0.01	0.00	0.00	1.73
NNW	0.03	0.16	0.32	0.38	0.62	0.26	0.06	0.03	0.02	0.00	0.00	1.89
Total	0.44	2.35	3.11	2.94	5.72	3.62	2.30	1.13	1.11	0.20	0.04	22.95

Percent of Calms 0.00
Percent of Invalid Hours 0.00
Percent of Valid Hours 22.95

Omaha Public Power District
Fort Calhoun Nuclear Station
JOINT FREQUENCY DISTRIBUTION BY PERCENT
MODERATELY STABLE (1.5 < delta T/ delta z <= 4.0)
PERIOD OF RECORD: JAN 2015 - DEC 2019
PASQUILL F
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.02	0.05	0.05	0.06	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.23
NNE	0.02	0.06	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
NE	0.03	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
ENE	0.01	0.09	0.06	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.19
E	0.02	0.13	0.13	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.39
ESE	0.02	0.11	0.23	0.16	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.67
SE	0.03	0.18	0.28	0.28	0.37	0.14	0.06	0.02	0.00	0.00	0.00	1.37
SSE	0.05	0.18	0.13	0.22	0.37	0.08	0.01	0.00	0.00	0.00	0.00	1.04
S	0.06	0.17	0.05	0.08	0.18	0.12	0.05	0.01	0.00	0.00	0.00	0.74
SSW	0.09	0.16	0.07	0.03	0.07	0.08	0.06	0.02	0.00	0.00	0.00	0.59
SW	0.08	0.18	0.03	0.03	0.04	0.03	0.03	0.02	0.02	0.00	0.00	0.48
WSW	0.08	0.18	0.04	0.01	0.02	0.04	0.02	0.00	0.01	0.00	0.00	0.40
W	0.09	0.29	0.09	0.06	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.57
WNW	0.07	0.29	0.21	0.08	0.10	0.03	0.00	0.00	0.00	0.00	0.00	0.78
NW	0.04	0.12	0.10	0.05	0.06	0.01	0.00	0.00	0.00	0.00	0.00	0.38
NNW	0.02	0.05	0.05	0.06	0.07	0.03	0.01	0.01	0.01	0.00	0.00	0.30
Total	0.73	2.32	1.56	1.21	1.52	0.64	0.25	0.07	0.04	0.01	0.00	8.36

Percent of Calms 0.20
Percent of Invalid Hours 0.00
Percent of Valid Hours 8.56

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 2015 - DEC 2019
PASQUILL G
WIND SPEED (m/s) AT 10-m LEVEL

Wind Direct	< 0.5	0.5- 1.0	1.1- 1.5	1.6- 2.0	2.1- 3.0	3.1- 4.0	4.1- 5.0	5.1- 6.0	6.1- 8.0	8.1- 10.0	> 10.0	Total
N	0.01	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
NNE	0.03	0.04	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.10
NE	0.03	0.07	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.12
ENE	0.04	0.11	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
E	0.05	0.11	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
ESE	0.06	0.20	0.38	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.74
SE	0.05	0.23	0.17	0.08	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.60
SSE	0.07	0.20	0.13	0.08	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.50
S	0.04	0.19	0.05	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.38
SSW	0.05	0.18	0.03	0.02	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.32
SW	0.05	0.18	0.02	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.30
WSW	0.05	0.08	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
W	0.04	0.09	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.18
WNW	0.01	0.05	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
NW	0.02	0.04	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
NNW	0.00	0.02	0.02	0.02	0.01	0.02	0.05	0.00	0.00	0.00	0.00	0.14
Total	0.62	1.85	1.04	0.41	0.18	0.11	0.07	0.02	0.00	0.00	0.00	4.31

Percent of Calms 0.18
Percent of Invalid Hours 0.00
Percent of Valid Hours 4.49

Percent of Hours Accounted For: 100.00

Enclosure 2

2024 Annual Radiological Environmental Operating Report

49 Pages Follow

OMAHA PUBLIC POWER DISTRICT

FORT CALHOUN STATION

RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

January 01, 2024 – December 31, 2024

Annual Radiological Environmental Operating Report

This report is submitted for the period January 01, 2024 through December 31, 2024.

In addition, this report provides any observations and anomalies that occurred during the monitoring period.


Reviewed by:

Signed by:


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RP/Chem Supervisor/Specialist
James Hoffman 4/23/2025 | 1:24 PM CDT

Approved by:

DocuSigned by:

C91D0965920745F...

Manager-RP/Chemistry
Daniel Whisler 4/23/2025 | 1:57 PM CDT

DocuSigned by:

7BF6365F747D40C...

Plant Manager Decommissioning
Ted Maine 4/24/2025 | 8:45 AM CDT

Signed by:

60FAECAB8796480...

Senior Director of Nuclear Decommissioning
Tim Uehling 4/27/2025 | 7:48 AM CDT

Annual Radiological Environmental Operating Report

The Fort Calhoun Station (FCS) Annual Radiological Environmental Operating Report for the year 2024. The data provided is consistent with the objectives as specified in Section 6.2.2 of the Offsite Dose Calculation Manual (ODCM), "Annual Radiological Environmental Operating Report." The report is presented as follows:

- 1) An introductory discussion of the implementation of the Radiological Environmental Monitoring Program (REMP), including program observations and environmental impact relevant to the operation of FCS.
- 2) The sample class, sample collection frequency, number of sample locations, and the number of samples collected during this reporting period for each parameter is delineated in Table 1.0, Sample Collection Program.
- 3) A statistical evaluation of REMP data is summarized in Table 2.0, Radiological Environmental Monitoring Program Summary. For each type of sample media and analysis, Table 2.0 presents data separately for all **indicator** locations, all **control** (background) locations, and the location having the highest annual mean result. For each of these classes, Table 2.0 specifies the following:
 - a. The total number of analyses,
 - b. The fraction of analyses yielding detectable results (i.e., results above the highest Lower Limit of Detection (LLD) for this period),
 - c. The maximum, minimum, and average results,
 - d. Locations with the highest annual mean are specified by code, name, and by distance and direction from the center of the plant reactor containment building.
- 4) Table 3.0, Listing of Missed Samples
- 5) Table 4.0, 2024 Land Use Survey
- 6) Review of Environmental Inc. Quality Assurance Program
- 7) Appendix A Interlaboratory Comparison Program
- 8) Appendix B vendor Data Reporting Conventions utilized
- 9) Appendix C Sample Location Maps and Site Map
- 10) Table 5.2, Radiological Environmental Sampling Locations and Media

INTRODUCTION

Radiological Environmental Monitoring Program (REMP) – 2024

This report gives the results of the Radiological Environmental Monitoring Program (REMP) for the year 2024. The REMP is a requirement of the Fort Calhoun Station (FCS) Quality Assurance Topical Report (QATR). It was initiated before plant operation in 1973.

The main purpose of the REMP is to ensure public safety by monitoring plant discharges and assessing the effect, if any, of plant operations on the environment. Samples are collected that would account for various exposure pathways such as ingestion, inhalation, adsorption, and direct exposure. Samples collected regularly include air, surface water, groundwater, milk, vegetation, fish, sediment, and food crops. Direct radiation is measured by thermoluminescent dosimeters (TLDs). These samples and TLDs are sent to an independent vendor laboratory for analysis. The vendor uses analytical methods that are sensitive enough to detect a level of activity far below that which would be considered harmful. Locations for sample collection are based on radiological and meteorological data from the Annual Effluent Release Report and information obtained from the Environmental Land Use Survey.

Most samples, particularly indicator samples, are collected in a circular area within a five-mile radius of plant containment. (However, control locations are usually outside of five miles.) This circle is divided into sixteen equal sectors, each assigned an identification letter “A” through “R” (note: letters “I” and “O” are not used, as they may be mistaken for the numbers “1” and “0”). Sector “A” is centered on North or zero degrees. Sectors are also given directional labels such as “West-Southwest” (“WSW”). Sample locations are listed by number along with their respective distances and direction from plant containment, in the Offsite Dose Calculation Manual (ODCM).

When assessing sample results, data from indicator locations (those most likely to be affected by plant operations) are compared to those from control locations (those least or not likely to be affected). Results from an indicator location that were significantly higher than those from a control location could indicate a plant-attributable effect and could require additional investigation.

The results of the sample analyses, as required by the FCS Offsite Dose Calculation Manual (ODCM), are presented in the attached statistical tables. Sample collection was conducted by plant chemistry/environmental staff. A contracted vendor (Microbic Laboratories Inc.) performed sample analyses, preparation of monthly reports and the statistical evaluation of sample results. All vendor analysis techniques met the sensitivity requirements as stated in the ODCM.

Results for 2024 were within expected ranges and compared closely with historical results. The result details and exceptions are listed in the following sections.

1) **Ambient Gamma Radiation**

Ambient gamma radiation is measured by thermoluminescent dosimeters (TLDs) provided by the vendor laboratory. These dosimeters contain calcium sulfate phosphors and are processed quarterly.

All sample results are within the range of historical data and displayed no more than 14% difference when compared to historical averages. All results were less than 3 sigma standard deviations from historical means. No discrepancy between released effluents and the resultant radiation dose measured was observed. No changes in plant operation/procedures are required based upon observed impacts to the environment to date.

Twelve TLDs were added to the station's ODCM. These TLDs were placed within the owner-controlled area to assist with the determination of 40 CFR 190 doses. These locations are not included in Table 1.0, Sample Collection Program, but are being described to assist reviewers of vendor analysis records.

10-Year Trend Comparison of TLD Locations

Location	Avg. Dose (mr/week)	2024 Avg. Dose (mr/week)
A	1.22	1.20
B	1.37	1.35
C	1.32	1.40
D	1.17	1.45
F	1.31	1.40
G	1.27	1.35
H	1.31	1.50
I	1.45	1.48
J	1.50	1.67
K	1.41	1.38
N	1.51	1.53
O	1.46	1.60
P	1.51	1.68
S	1.59	1.73
L (Control)	1.29	1.47

2) Milk/Pasture

Milk samples or pasture grasses, if milk is temporarily unavailable, are collected monthly for the entire calendar year. Indicator samples are collected from a herd of milk goats at a family farm located approximately 3.3 miles from the plant in Sector K (South-southwest). The control samples are collected from a commercial dairy cow herd located approximately 9.9 miles from the plant in Sector J (South). No indicator milk samples were available in January, October, November, and December due to the dairy owners suspending operations. Pasture grass in place of milk was collected at the indicator location due to unavailability.

3) Fish

Fish are collected on an annual basis. Control samples are collected at a location approximately twenty miles upstream of the plant (river miles 665 – 667). Indicator samples are collected in the immediate vicinity of the power plant (river miles 644 – 646). Several species of fish, important to commercial and recreational interest, representing all levels of the aquatic food chain are collected at both locations.

All sample results are within the range of historical data. Results from both control and indicator locations were less than LLD for all gamma emitters, indicating no plant-related effects.

4) Food Crop

Based on the results of the biennial Land Use Survey, the nearest high deposition pathway for food crops is the Alvin Pechnik Farm in Sector H (0.94 miles, 163°). Accordingly, vegetable samples were collected at Alvin Pechnik Farm for the 2024 REMP.

Samples were comparable with historical results and within the range of results reported from the control location garden at Mohr Dairy.

All results were at the LLD for all non-naturally occurring radionuclides. No plant-related effects were observed.

5) Sediment

River sediment samples were deleted from the program on 6/5/2019 due to shoreline sediment not being a significant pathway and reduced volume of effluent release and activity.

6) Air Monitoring

Air sample results for 2024 were well within historical limits for all locations. Additionally, all indicator locations showed results very similar to the control locations.

All sample results are within the range of historical data. All indicator locations displayed less than 16% difference when compared to the historical average. All 2024 results when compared to historical averages are within the stated vendor error acceptance tolerance.

Results from both control and indicator locations were less than LLD for gamma emitters. Air monitoring for Iodine was stopped on 1/9/2019. No changes in plant operation/procedures are required based upon observed impacts to the environment to date.

10-Year Trend Comparison of Air Sampling Locations

Location	Avg. Beta (pCi/m ³)	2024 Avg. Beta (pCi/m ³)
Sector B	0.026	0.028
Sector D	0.027	0.031
Sector I	0.024	0.025
Sector J	0.025	0.025
Sector K	0.025	0.027
Sector F (Control)	0.027	0.027

7) **Surface Water**

Water samples are collected upstream of the plant (control location) as well as half-mile downstream and at a municipal water treatment plant on the north edge of Omaha.

Results for Cs-134, Cs-137, and other gammas were all less than LLD. All tritium results were less than LLD. No plant-related effects were detected.

8) **Ground Water**

Quarterly residential well water samples are collected at the following four locations: Station No. 15: Smith Farm, Station No. 20: Mohr Dairy, Station No. 74: D. Miller Farm, and Station No. 75: Lomp Acreage. All sample results to date have been at the LLD except gross beta and K-40 due to naturally occurring radionuclides. Gross beta results have ranged from a low of 1.3 pCi/liter to a high of 4.4 pCi/liter, with an average gross beta for the year of 2.91 pCi/liter for indicator locations. Strontium-90 analysis is being conducted on the wells as part of the station's groundwater monitoring protection program. No plant-related effects were detected.

Table 1.0

Sample Collection Program

Sample Class	Collection Frequency	Number of Sample Locations	Samples Collected this Period
Background Radiation (TLDs)	Quarterly	47 ⁴	186 ⁴
Air Particulates	Weekly	6	317
Airborne Iodine	Note 5	-	_ ⁵
Milk	Monthly	2	22 ¹
Surface Water	Monthly	3	36
Groundwater	Quarterly	4	16
Fish	Annually	2	5 ²
Sediment	Note 5	-	_ ⁵
Food Crops	Annually	2	9 ³
Vegetation (Milk)	Monthly	1	4
		TOTAL	595

Note 1: Milk sample collection total does not include 4 vegetation samples performed for milk unavailability. Milk samples are collected monthly for the entire year.

Note 2: Includes one background sample.

Note 3: Variety of samples collected during period

Note 4: Twelve sample locations were added for assessing 40 CFR 190 doses. The results are not included in total REMP samples collected for Table 1.

Note 5: Deleted from program on 1/9/2019.

Table 2.0

Radiological Environmental Monitoring Program Summary

Table 2. Radiological Environmental Monitoring Program Summary

Reporting Period

January-December, 2024

Name of Facility Fort Calhoun Nuclear Power Station - Unit 1

Docket No. 50-285

Location of Facility Washington, Nebraska
(County, State)

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number Non-Routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Background Radiation (TLD) (mR/week)	Gamma 234	0.5	1.5 (230/230) (0.6-2.1)	OTD-3M-(I) 0.37 mi. @ 216°	1.8 (4/4) 1.4-2.0 2.0 (1/1)	1.4 (4/4) (1.2-1.5)	0
Airborne Particulates (pCi/m ³)	GB 317	0.005	0.027 (264/264) (0.003-0.066)	OAP-D-(I) 2.86 mi. @ 305°	0.031 (53/53) (0.015-0.061)	0.028 (53/53) (0.014-0.054)	0
	GS 24						
	Cs-134	0.001	< LLD	-	-	< LLD	0
	Cs-137	0.001	< LLD	-	-	< LLD	0
	Other Gammas	0.001	< LLD	-	-	< LLD	0
Airborne Iodine (pCi/m ³)	I-131 0	0.07	< LLD	-	-	< LLD	0
Milk (pCi/L)	I-131 22	0.5	< LLD	-	-	< LLD	0
	GS 22						
	K-40	150	1566 (9/9) (1443-1695)	Miller Farm 0.8 mi. @ 206 °	1566 (9/9) (1443-1695)	1285 (13/13) (1207-1382)	0
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	15	< LLD	-	-	< LLD	0
	Other Gammas	15	< LLD	-	-	< LLD	0
Ground Water (pCi/L)	GB 16		2.91 (16/16) (1.3-4.4)	Lomp Acreage 0.65 mi. @ 163°	4.3(4/4) (4.1-4.4)	3.2 (3/4) (2.1-4.0)	0
	H-3 16	300	< LLD	-	-	< LLD	0
	Sr-90 16	0.7	< LLD	-	-	< LLD	0
	GS 16						
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	18	< LLD	-	-	< LLD	0
	Other Gammas	15	< LLD	-	-	< LLD	0
Surface Water (pCi/L)	GS 36						
	Cs-134	15	< LLD	-	-	< LLD	0
	Cs-137	18	< LLD	-	-	< LLD	0
	Other Gammas	15	< LLD	-	-	< LLD	0
	H-3 12	300	< LLD	-	-	< LLD	0

Sample Type (Units)	Type and Number of Analyses ^a	LLD ^b	Indicator Locations Mean (F) ^c Range ^c	Location with Highest Annual Mean		Control Locations Mean (F) ^c Range ^c	Number Non-Routine Results ^e
				Location ^d	Mean (F) ^c Range ^c		
Fish (pCi/g wet)	GS 5						
	Mn-54	0.012	< LLD	-	-	< LLD	0
	Co-58	0.022	< LLD	-	-	< LLD	0
	Co-60	0.015	< LLD	-	-	< LLD	0
	Fe-59	0.076	< LLD	-	-	< LLD	0
	Zn-65	0.030	< LLD	-	-	< LLD	0
	Ru-103	0.044	< LLD	-	-	< LLD	0
	Cs-134	0.012	< LLD	-	-	< LLD	0
	Cs-137	0.014	< LLD	-	-	< LLD	0
Sediment pCi/g dry	GS 0						
	Mn-54	0.000	< LLD	-	-	< LLD	0
	Co-58	0.000	< LLD	-	-	< LLD	0
	Co-60	0.000	< LLD	-	-	< LLD	0
	Fe-59	0.000	< LLD	-	-	< LLD	0
	Zn-65	0.000	< LLD	-	-	< LLD	0
	Cs-134	0.000	< LLD	-	-	< LLD	0
	Cs-137	0.000	< LLD	-	-	< LLD	0
Food Crops (pCi/g wet)	GS 9						
	Mn-54	0.023	< LLD	-	-	< LLD	0
	Co-58	0.032	< LLD	-	-	< LLD	0
	Co-60	0.043	< LLD	-	-	< LLD	0
	Fe-59	0.043	< LLD	-	-	< LLD	0
	Zn-65	0.054	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.037	< LLD	-	-	< LLD	0
	Cs-134	0.031	< LLD	-	-	< LLD	0
	Cs-137	0.040	< LLD	-	-	< LLD	0
	Ba-La-140	0.029	< LLD	-	-	< LLD	0
Vegetation (pCi/g wet) Pasture grass in lieu of milk	GS 4						
	Mn-54	0.018	< LLD	-	-	< LLD	0
	Co-58	0.018	< LLD	-	-	< LLD	0
	Co-60	0.030	< LLD	-	-	< LLD	0
	Fe-59	0.064	< LLD	-	-	< LLD	0
	Zn-65	0.063	< LLD	-	-	< LLD	0
	Zr-Nb-95	0.044	< LLD	-	-	< LLD	0
	I-131	0.048	< LLD	-	-	< LLD	0
	Cs-134	0.030	< LLD	-	-	< LLD	0
	Cs-137	0.040	< LLD	-	-	< LLD	0
	Ba-La-140	0.018	< LLD	-	-	< LLD	0

^a GB = gross beta, GS = gamma scan.

^b LLD = nominal lower limit of detection based on a 95% confidence level.

^c Mean and range are based on detectable measurements only (i.e., >LLD) Fraction of detectable measurements at specified locations is indicated in parentheses (F).

^d Locations are specified: (1) by code, (2) by name, and (3) by distance and direction relative to the Reactor Containment Building.

^e Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds the typical pre-operational value for the medium or location.

Table 3.0 Listing of Missed Samples (samples scheduled but not collected)

Sample Type	Date	Location	Reason
AP	01/24/2024	OAP-I	Pumped stopped working after 10hrs due to a tripped fuse. CR 2024-00011
TLD	4/4/2024	OTD-J	Sample lost in field. CR 2024-00039
TLD	10/3/2024	OTD-N	Sample lost in field. CR 2024-00184

Table 4.0 – 2024 Land Use Survey

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Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
A	N	RESIDENCE	WRIGHT	4.36	7016.74	351	CITY REGISTER	X	X			1.30E-07	4.50E-10	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	WRIGHT	4.36	7016.74	351	CITY REGISTER	X	X					
B	NNE	RESIDENCE	RAND,J	1.93	3106.03	12	CITY REGISTER	X				7.00E-07	1.90E-09	
		MILK ANIMAL												
		MEAT ANIMAL	DUGDALE,D	4.72	7596.10	29	CITY REGISTER	X				1.10E-07	2.20E-10	
		VEGETATION	SHEPARD	2.23	3588.84	16	CITY REGISTER	X		X		4.60E-07	1.20E-09	
		GROUNDWATER	RAND,J	1.93	3106.03	12	CITY REGISTER	X						
C	NE	RESIDENCE	THIELE	1.59	2558.86	52	MAIL SURVEY	X				9.60E-07	2.00E-09	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	VENNER, R	3.20	5149.90	48	CITY REGISTER	X				1.70E-07	3.00E-10	
		GROUNDWATER	THIELE	1.59	2558.86	52	MAIL SURVEY	X						
D	ENE	RESIDENCE	MEADE,G	4.79	7708.76	63	MAIL SURVEY	X				8.80E-08	9.70E-11	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												NO GARDEN- NOT SAMPLED
		GROUNDWATER	MEADE,G	4.79	7708.76	63	MAIL SURVEY	X						
E	E	RESIDENCE	LOVE	4.67	7515.64	89	CITY REGISTER	X	X			1.10E-07	1.60E-10	
		MILK ANIMAL												
		MEAT ANIMAL												NO MEAT- NOT SAMPLED
		VEGETATION												
		GROUNDWATER	LOVE	4.67	7515.64	89	CITY REGISTER	X	X					
F	ESE	RESIDENCE	CLEMENCIA, N	5.50	8851.39		CITY REGISTER	X				1.40E-07	1.70E-10	NO WILSON ISLAND- NEW RESIDENT FURTHER AWAY
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	CLEMENCIA, N	5.50	8851.39		CITY REGISTER	X						

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Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
G	SE	RESIDENCE	HOWELL,J	1.71	2751.98	145	CITY REGISTER	X				1.40E-06	4.00E-09	NEW RESIDENT- FURTHER AWAY
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	AMBERG,L	2.15	3460.09	128	MAIL SURVEY	X				7.40E-07	2.00E-09	
		GROUNDWATER	HOWELL,J	1.71	2751.98	145	CITY REGISTER	X						
H	SSE	RESIDENCE	LOMP	.65	1046.07	163	INTERVIEW	X				6.70E-06	6.00E-08	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	PECHNIK,A	.94	1512.78	163	MAIL SURVEY	X				3.00E-06	2.70E-08	
		GROUNDWATER	LOMP	.65	1046.07	163	INTERVIEW	X						
J	S	RESIDENCE	DOWLER	.73	1174.82	175	MAIL SURVEY					4.20E-06	2.70E-08	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION	DOWLER	.73	1174.82	175	MAIL SURVEY					4.20E-06	2.70E-08	
		GROUNDWATER	DOWLER	.73	1174.82	175	MAIL SURVEY							
K	SSW	RESIDENCE	D.MILLER	.65	1046.07	203	INTERVIEW	X				4.30E-06	1.40E-08	
		MILK ANIMAL	C. MILLER	3.30	5310.84	210	INTERVIEW	X				9.10E-08	2.30E-10	
		MEAT ANIMAL												
		VEGETATION	ANDERSON,W	.99	1593.25	196	CITY REGISTER	X				1.70E-06	5.70E-09	
		GROUNDWATER	D.MILLER	.65	1046.07	203	INTERVIEW	X						
L	SW	RESIDENCE	ROBERTSON,D	.73	1174.82	224	MAIL SURVEY	X				3.20E-06	8.50E-09	
		MILK ANIMAL	BARRERA	4.20	6759.24	219	CITY REGISTER	X	X	X		6.40E-08	1.20E-10	
		MEAT ANIMAL	BEHNK, A	.76	1223.10	227	MAIL SURVEY	X	X			3.00E-06	7.80E-09	NEW OWNER-NO CHANGE IN LOCATION
		VEGETATION	BEHNK, A	.76	1223.10	227	MAIL SURVEY	X	X			3.00E-06	7.80E-09	NEW OWNER- LOCATION CLOSER
		GROUNDWATER	ROBERTSON,D	.73	1174.82	224	MAIL SURVEY	X						
M	WSW	RESIDENCE	BENSEN,M	1.06	1705.90	257	CITY REGISTER	X				1.60E-06	4.20E-09	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												NO GARDEN 2024
		GROUNDWATER	BENSEN,M	1.06	1705.90	257	CITY REGISTER	X						
N	W	RESIDENCE	SESEMANN, J	1.27	2043.87		CITY REGISTER	X				1.50E-06	4.10E-09	RESIDENT FURTHER AWAY THAN 2022
		MILK ANIMAL												
		MEAT ANIMAL	ANDERSON,J	3.25	5230.37	281	INTERVIEW	X				1.40E-07	3.00E-10	
		VEGETATION												NO GARDEN 2024
		GROUNDWATER	KEAS, J.	1.30	2092.15	270	MAIL SURVEY	X						

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2024 Environmental Land Use Survey Report

Sector	Dir	Land Use	Owner	Miles	Meters	Deg	Survey Technique	Age Group				XOQ	DOQ	Remarks
								Adult	Teen	Child	Infant			
P	WNW	RESIDENCE	LYTLE	2.60	4184.29	283	MAIL SURVEY	X				3.40E-07	7.80E-10	
		MILK ANIMAL												
		MEAT ANIMAL												NO MEAT 2024
		VEGETATION	BROWN	4.59	7386.89	288	MAIL SURVEY	X				1.30E-07	2.40E-10	
		GROUNDWATER	LYTLE	2.60	4184.29	283	MAIL SURVEY	X						
Q	NW	RESIDENCE	HANSEN,R	2.40	3862.43	318	CITY REGISTER	X				5.20E-07	1.90E-09	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												NO GARDEN
		GROUNDWATER	HANSEN,R	2.40	3862.43	318	CITY REGISTER	X						
R	NNW	RESIDENCE	LONGVIEW PARK	2.08	3347.44	330	CITY REGISTER	X				8.20E-07	3.40E-09	
		MILK ANIMAL												
		MEAT ANIMAL												
		VEGETATION												
		GROUNDWATER	CLARK, D	3.73	6002.85	328		X						

Performed by _____ Reviewed by _____

Review of Environmental Inc., Quality Assurance Program

Fort Calhoun Station contracts with Environmental Inc., Midwest Laboratory (vendor lab) to perform radiological analysis of environmental samples. Environmental Inc. participates in inter-laboratory comparison (cross-check) programs as part of its quality control program. These programs are operated by such agencies as the Department of Energy, which supply blind-spike samples such as milk or water containing concentrations of radionuclides unknown to the testing laboratory. This type of program provides an independent check of the analytical laboratory's procedures and processes and indicates possible weaknesses. In addition, Environmental Inc. has its own in-house QA program for blind-spike and duplicate analyses.

Routine FCS REMP duplicate samples were analyzed by the vendor to verify the reproducibility of results. All duplicates were within the acceptance criteria.

Environmental resource cross check sample ERDW-713 for Gross Alpha failed slightly below the acceptance criteria but no obvious issues could be determined when the data was reviewed. The subsequent ERA stud RAD-138 passed for Gross Alpha and Gross Beta. ERDW-1552 for Ra-226 failed above the acceptance limit and the lab continues its investigation into Ra-226 performance issues. The lab procedure has been revised to more closely follow the EPA method, and a subsequent ERA study will be conducted to validate the procedure change. ERDW-1550 for I-131 failed below the acceptance criteria due to the fact that the calculation of the results that was submitted for the study did not take into account the stable iodine additive when calculating chemical yield or recovery. Once done, the adjusted results were within the acceptance range.

Three DOE MAPEP cross check samples failed in 2024. MADW-457 for failed for Ra-226 but no conclusive reason for the failure could be determined by the lab as the uncertainty overlapped the known activity (reference value). MADW-2183 failed for Cs-137 and K-40. For both failures, the MAPEP results are presented as the known values and expected laboratory precision and control limits as defined by the MAPEP. The known value of "zero" indicates an analysis was included in the testing series as a "false positive" in which MAPEP does not provide an acceptance range. The lab believes that these false positives could have occurred due to a combination of inadequate background subtraction for this sample geometry compounded by a very long analysis time.

No test results failed both the ERA and DOE methodologies for a given sample type. The ordering of additional tests and successful testing after corrections were applied, visibly demonstrates the vendor's commitment to reporting and resolving deficiencies.

These results indicate the vendor's ability to self-identify and correct any deviations from acceptable or expected results. The test results had no impact on Fort Calhoun samples and were documented as such by the vendor. No changes are deemed necessary to the FCS REMP program due to vendor performance.

Appendix A

Interlaboratory/ Intralaboratory Comparison Program Results

Microbac Laboratories - Northbrook (previously Environmental Inc.) has participated in interlaboratory comparison (crosscheck) programs since the formulation of its quality program in December 1971. These programs are operated by agencies and/or companies which supply environmental sample types containing concentrations of radionuclides known to the issuing entity but not to participant laboratories. The purpose of such a program is to provide an independent check on a laboratory's analytical procedures and to alert it of any possible problems.

Participant laboratories measure the concentration of specified radionuclides and report them to the issuing agency. Several months later, the agency reports the known values to the participant laboratories and specifies control limits. Results consistently higher or lower than the known values or outside the control limits indicate a need to check the instruments or procedures used.

Results in Table A-1 were obtained through participation in the RAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the U.S. EPA Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

Table A-2 lists results for thermoluminescent dosimeters (TLDs), via irradiation and evaluation by the University of Wisconsin-Madison Radiation Calibration Laboratory at the University of Wisconsin Medical Radiation Research Center.

Table A-3 lists results of the analyses on intralaboratory "spiked" samples for the past twelve months. All samples are prepared using NIST traceable sources. Data for previous years available upon request.

Table A-4 lists results of the analyses on intralaboratory "blank" samples for the past twelve months. Data for previous years available upon request.

Table A-5 lists analytical results from the intralaboratory "duplicate" program for the past twelve months. Acceptance is based on each result being within 25% of the mean of the two results or the two sigma uncertainties of each result overlap.

The results in Table A-6 were obtained through participation in the Mixed Analyte Performance Evaluation Program.

Results in Table A-7 were obtained through participation in the MRAD PT Study Proficiency Testing Program administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurement Laboratory Quality Assessment Program (EML).

Attachment A lists the laboratory acceptance criteria for various analyses.

Out-of-limit results are explained directly below the result.

Attachment A

ACCEPTANCE CRITERIA FOR INTRALABORATORY "SPIKED" SAMPLES

Analysis	Ratio of lab result to known value.
Gamma Emitters	0.8 to 1.2
Strontium-89, Strontium-90	0.8 to 1.2
Potassium-40	0.8 to 1.2
Gross alpha	0.5 to 1.5
Gross beta	0.8 to 1.2
Tritium	0.8 to 1.2
Radium-226, Radium-228	0.7 to 1.3
Plutonium	0.8 to 1.2
Iodine-129, Iodine-131	0.8 to 1.2
Nickel-63, Technetium-99, Uranium-238	0.7 to 1.3
Iron-55	0.8 to 1.2
Other Analyses	0.8 to 1.2

TABLE A-1. Interlaboratory Comparison Crosscheck program, Environmental Resource Associates (ERA)^a.

RAD study						
Lab Code	Date	Analysis	Concentration (pCi/L)			
			Laboratory Result	ERA Value	Acceptance Limits	Acceptance
RAD-022724M (study dates 2/27/24 - 3/11/24)						
ERDW-323	10/7/2022	Ba-133	67.3 ± 4.1	79.4	62.3 - 97.0	Pass
ERDW-323	10/7/2022	Cs-134	20.6 ± 2.6	30.5	18.2 - 42.8	Pass
ERDW-323	10/7/2022	Cs-137	221 ± 7	212	172 - 252	Pass
ERDW-323	10/7/2022	Co-60	48.8 ± 4.2	51.4	37.1 - 65.7	Pass
ERDW-323	10/7/2022	Zn-65	82.6 ± 9	216	167 - 265	Fail ^b
ERDW-325	10/7/2022	Gr. Alpha	15.4 ± 1.6	16.9	11.1 - 22.7	Pass
ERDW-325	10/7/2022	G. Beta	48.2 ± 1.4	53.0	39.1 - 66.9	Pass
ERDW-321	10/7/2022	Ra-226	15.9 ± 0.9	19.0	16.2 - 21.8	Fail ^c
ERDW-321	10/7/2022	Ra-228	3.81 ± 1.04	2.33	1.04 - 3.60	Fail ^d
ERDW-321	10/7/2022	Uranium	8.745 ± 1.070	8.53	7.10 - 10.0	Pass
ERDW-327	4/10/2023	H-3	12,740 ± 366	12,700	10,500 - 14,900	Pass
RAD-137 Study (study dates 4/08/24 - 5/23/24)						
ERDW-715	4/8/2024	Ba-133	71.2 ± 5.5	65.9	50.1 - 81.7	Pass
ERDW-715	4/8/2024	Cs-134	70.4 ± 9.5	57.8	42.8 - 72.8	Pass
ERDW-715	4/8/2024	Cs-137	188 ± 11	186	149 - 233	Pass
ERDW-715	4/8/2024	Co-60	100 ± 10	98.8	79.7 - 118	Pass
ERDW-715	4/8/2024	Zn-65	231 ± 15	240	188 - 292	Pass
ERDW-713	4/8/2024	Gr. Alpha	39.4 ± 1.9	52.6	39.6 - 65.8	Fail ^e
ERDW-713	4/8/2024	G. Beta	45.5 ± 1.4	46.5	33.9 - 59.1	Pass
ERDW-711	4/8/2024	Ra-226	14.3 ± 0.8	13.4	11.10 - 15.7	Pass
ERDW-711	4/8/2024	Ra-228	6.01 ± 1.19	6.24	4.2 - 8.3	Pass
ERDW-711	4/8/2024	Uranium	63.5 ± 2.4	59.3	52.8 - 65.8	Pass
ERDW-717	4/8/2024	H-3	20,400 ± 448	21,300	18,200 - 24,400	Pass
RAD-138 Study (study dates 7/08/24 - 8/22/24)						
ERDW-1546	7/8/2024	Ba-133	41.4 ± 5.9	38.2	25.2 - 51.2	Pass
ERDW-1546	7/8/2024	Cs-134	18.6 ± 8.0	18.9	7.81 - 30.0	Pass
ERDW-1546	7/8/2024	Cs-137	54.4 ± 13.3	57.0	32.9 - 81.1	Pass
ERDW-1546	7/8/2024	Co-60	82.8 ± 7.1	76.8	59.9 - 93.7	Pass
ERDW-1546	7/8/2024	Zn-65	348 ± 30	312	253 - 371	Pass
ERDW-1548	7/8/2024	Gr. Alpha	9.05 ± 1.26	13.0	7.94 - 18.1	Pass
ERDW-1548	7/8/2024	G. Beta	17.3 ± 1.0	20.6	13.2 - 28.0	Pass
ERDW-1552	7/8/2024	Ra-226	20.4 ± 1.0	17.2	14.6 - 19.8	Fail ^f
ERDW-1552	7/8/2024	Ra-228	3.72 ± 0.96	4.63	2.88 - 6.38	Pass
ERDW-1552	7/8/2024	Uranium	36.2 ± 2.4	36.8	32.5 - 41.1	Pass
ERDW-1554	7/8/2024	H-3	7,840 ± 290	7,550	5,870 - 9,230	Pass
ERDW-1550	7/8/2024	I-131	20.1 ± 0.9	27.9	24.2 - 31.6	Fail ^g

^a Results obtained by Microbac Laboratories Inc. - Northbrook as a participant in the crosscheck program for proficiency testing in drinking water conducted by Environmental Resource Associates (ERA).

^b An incorrect reference date was used in the calculation of the gamma emitters. If the correct date was used, all analytes would have passed ERA acceptance criteria. The Zn-65 result would have been 212 ± 30 pCi/L.

^c No obvious conclusion could be determined for the low result. It's possible that a small leak from the radon bubbler may have allowed radon gas to escape thereby leading to the low result. Subsequent ERA study RAD-137 passed for Ra-226.

^d The batch recovery value as determined by the EPA method could have been biased artificially low thereby causing the result to have a high bias outside the upper acceptance limit. Subsequent ERA studies RAD-137,138 passed for Ra-228.

^e Data was reviewed but no obvious issue could be determined. Subsequent ERA study RAD-138 passed for both Gross Alpha and Gross Beta.

^f The lab continues to investigate the Ra-226 performance issues. The procedure has been revised to more closely follow the EPA method. Results are being compiled and a subsequent ERA study will be ordered to validate the revised procedure.

^g ERA added stable iodine carrier to the PT sample at a concentration of 0.20 mg/L. The calculation of the results that were submitted for this study did not take this added iodine into account when calculating the chemical yield or recovery. Incorporating the ERA added stable iodine into the calculations; recoveries dropped from 88.32% and 90.52% to 64.56% and 66.17%. The adjusted results are: 29.42 pCi/L and 28.06 pCi/L which are both within the acceptance range.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO₄: Dy Cards).^a

				mrem		
Lab Code	Irradiation		Delivered	Reported ^b	Performance ^c	
	Date	Description	Dose	Dose	Quotient (P)	
<u>Environmental, Inc.</u>		Group 1				
2024-25-1	1/6/2025	Spike 1	92.0	91.8	0.00	
2024-25-1	1/6/2025	Spike 2	92.0	89.7	-0.03	
2024-25-1	1/6/2025	Spike 3	92.0	92.0	0.00	
2024-25-1	1/6/2025	Spike 4	92.0	92.9	0.01	
2024-25-1	1/6/2025	Spike 5	92.0	91.8	0.00	
2024-25-1	1/6/2025	Spike 6	92.0	98.0	0.07	
2024-25-1	1/6/2025	Spike 7	92.0	94.6	0.03	
2024-25-1	1/6/2025	Spike 8	92.0	94.2	0.02	
2024-25-1	1/6/2025	Spike 9	92.0	95.4	0.04	
2024-25-1	1/6/2025	Spike 10	92.0	91.3	-0.01	
2024-25-1	1/6/2025	Spike 11	92.0	89.4	-0.03	
2024-25-1	1/6/2025	Spike 12	92.0	97.7	0.06	
2024-25-1	1/6/2025	Spike 13	92.0	94.1	0.02	
2024-25-1	1/6/2025	Spike 14	92.0	92.2	0.00	
2024-25-1	1/6/2025	Spike 15	92.0	92.9	0.01	
2024-25-1	1/6/2025	Spike 16	92.0	91.7	0.00	
2024-25-1	1/6/2025	Spike 17	92.0	87.4	-0.05	
2024-25-1	1/6/2025	Spike 18	92.0	94.7	0.03	
2024-25-1	1/6/2025	Spike 19	92.0	91.0	-0.01	
2024-25-1	1/6/2025	Spike 20	92.0	92.5	0.01	
Mean (Spike 1-20)				92.8	0.01	Pass ^d
Standard Deviation (Spike 1-20)				2.6	0.03	Pass ^d

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37 protocol from a known air kerma rate. TLD's were read and the results were submitted by Microbac Laboratories - Northbrook to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-2. Thermoluminescent Dosimetry, (TLD, CaSO₄: Dy Cards).^a

				mrem		
Lab Code	Irradiation		Delivered	Reported ^b	Performance ^c	
	Date	Description	Dose	Dose	Quotient (P)	
<u>Environmental, Inc.</u>		Group 2				
2024-25-2	1/6/2025	Spike 21	74.0	77.5	0.05	
2024-25-2	1/6/2025	Spike 22	74.0	77.6	0.05	
2024-25-2	1/6/2025	Spike 23	74.0	73.2	-0.01	
2024-25-2	1/6/2025	Spike 24	74.0	75.4	0.02	
2024-25-2	1/6/2025	Spike 25	74.0	75.3	0.02	
2024-25-2	1/6/2025	Spike 26	74.0	77.8	0.05	
2024-25-2	1/6/2025	Spike 27	74.0	73.1	-0.01	
2024-25-2	1/6/2025	Spike 28	74.0	74.0	0.00	
2024-25-2	1/6/2025	Spike 29	74.0	75.8	0.02	
2024-25-2	1/6/2025	Spike 30	74.0	76.5	0.03	
2024-25-2	1/6/2025	Spike 31	74.0	73.5	-0.01	
2024-25-2	1/6/2025	Spike 32	74.0	75.5	0.02	
2024-25-2	1/6/2025	Spike 33	74.0	76.5	0.03	
2024-25-2	1/6/2025	Spike 34	74.0	76.4	0.03	
2024-25-2	1/6/2025	Spike 35	74.0	75.1	0.01	
2024-25-2	1/6/2025	Spike 36	74.0	72.8	-0.02	
2024-25-2	1/6/2025	Spike 37	74.0	76.0	0.03	
2024-25-2	1/6/2025	Spike 38	74.0	74.9	0.01	
2024-25-2	1/6/2025	Spike 39	74.0	75.4	0.02	
2024-25-2	1/6/2025	Spike 40	74.0	70.8	-0.04	
Mean (Spike 21-40)				75.2	0.02	Pass ^d
Standard Deviation (Spike 21-40)				1.8	0.02	Pass ^d

a TLD's were irradiated by the University of Wisconsin-Madison Radiation Calibration Laboratory following ANSI N13.37

protocol from a known air kerma rate. TLD's were read and the results were submitted by Microbac Laboratories - Northbrook to the University of Wisconsin-Madison Radiation Calibration Laboratory for comparison to the delivered dose.

b Reported dose was converted from exposure (R) to Air Kerma (cGy) using a conversion of 0.876. Conversion from air kerma to ambient dose equivalent for Cs-137 at the reference dose point $H^*(10)K_a = 1.20$. mrem/cGy = 1000.

c Performance Quotient (P) is calculated as ((reported dose - conventionally true value) ÷ conventionally true value) where the conventionally true value is the delivered dose.

d Acceptance is achieved when neither the absolute value of the mean of the P values, nor the standard deviation of the P values exceed 0.15.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code ^b	Reference Date	Analysis	Concentration ^a				Ratio Lab/Known
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	Acceptance	
SPDW-60025	1/12/2024	Gr. Alpha	43.3 ± 2.4	47.9	24.0 - 57.5	Pass	0.90
SPDW-60025	1/12/2024	Gr. Beta	28.9 ± 1.3	28.6	22.9 - 34.3	Pass	1.01
SPDW-60042	2/2/2024	H-3	21,225 ± 459	22,100	17,680 - 26,520	Pass	0.96
SPDW-60059	2/14/2024	Gr. Alpha	37.6 ± 2.8	32.2	16.1 - 38.6	Pass	1.17
SPDW-60059	2/14/2024	Gr. Beta	168 ± 3	160	128.0 - 192.0	Pass	1.05
SPDW-60067	2/13/2024	H-3	20,925 ± 451	22,100	17,680 - 26,520	Pass	0.95
SPDW-60097	2/28/2024	Gr. Alpha	27.7 ± 2.1	32.2	16.1 - 38.6	Pass	0.86
SPDW-60097	2/28/2024	Gr. Beta	160 ± 3	160	128.0 - 192.0	Pass	1.00
SPDW-60100	2/26/2024	H-3	21,582 ± 462	22,100	17,680 - 26,520	Pass	0.98
SPDW-60016	3/7/2024	H-3	20,572 ± 449	22,100	17,680 - 26,520	Pass	0.93
SPDW-60133	3/14/2024	Gr. Alpha	23.6 ± 2.1	32.2	16.1 - 38.6	Pass	0.73
SPDW-60133	3/14/2024	Gr. Beta	171 ± 3	160	128.0 - 192.0	Pass	1.07
SPDW-60150	3/22/2024	H-3	20,618 ± 450	22,100	17,680 - 26,520	Pass	0.93
SPDW-60191	3/21/2024	Ra-226	13.2 ± 0.4	12.3	8.6 - 16.0	Pass	1.07
SPDW-60154	3/25/2024	Ra-228	12.7 ± 1.6	15.4	10.8 - 20.0	Pass	0.82
LCS-W-052924	4/8/2024	Ba-133	55.7 ± 4.3	65.9	52.7 - 79.1	Pass	0.85
LCS-W-052924	4/8/2024	Cs-134	50.1 ± 3.4	57.8	46.2 - 69.4	Pass	0.87
LCS-W-052924	4/8/2024	Cs-137	172 ± 6	186	149 - 223	Pass	0.92
LCS-W-052924	4/8/2024	Co-60	95.3 ± 4.0	99	79.0 - 119	Pass	0.96
LCS-W-052924	4/8/2024	Zn-65	224 ± 12	240	192 - 288	Pass	0.93
SPDW-60184	4/9/2024	Gr. Alpha	21.0 ± 2.0	32.2	16.1 - 38.6	Pass	0.65
SPDW-60184	4/9/2024	Gr. Beta	158 ± 3	160	128.0 - 192.0	Pass	0.99
SPDW-60198	4/15/2024	H-3	20,822 ± 453	22,100	17,680 - 26,520	Pass	0.94
SPDW-60213	4/25/2024	Ra-228	15.4 ± 2.0	15.3	10.7 - 19.9	Pass	1.01
SPDW-60215	4/26/2024	H-3	20,400 ± 447	22,100	17,680 - 26,520	Pass	0.92
SPDW-60267	4/11/2024	Ra-226	10.8 ± 0.3	12.3	8.6 - 16.0	Pass	0.88
SPDW-60236	5/10/2024	H-3	20,415 ± 448	22,100	17,680 - 26,520	Pass	0.92
SPDW-60253	5/16/2024	Ra-228	13.6 ± 1.8	15.3	10.7 - 19.9	Pass	0.89
SPDW-60302	5/29/2024	Gr. Alpha	18.1 ± 1.7	32.2	16.1 - 38.6	Pass	0.56
SPDW-60302	5/29/2024	Gr. Beta	163 ± 3	160	128 - 192	Pass	1.02
SPDW-60307	5/23/2024	Ra-226	13.0 ± 0.5	12.3	8.6 - 16.0	Pass	1.05
SPDW-60294	5/28/2024	H-3	20,840 ± 463	22,100	17,680 - 26,520	Pass	0.94
SPDW-60314	6/6/2024	Ra-228	11.9 ± 1.6	15.3	10.7 - 19.9	Pass	0.78
SPDW-60331	6/10/2024	H-3	20,602 ± 459	22,100	17,680 - 26,520	Pass	0.93
SPDW-60357	5/30/2024	Ra-226	11.8 ± 0.4	12.3	8.6 - 16.0	Pass	0.96
SPDW-60361	6/27/2024	Gr. Alpha	21.7 ± 2.0	32.2	16.1 - 38.6	Pass	0.67
SPDW-60361	6/27/2024	Gr. Beta	151 ± 2	160	128 ± 192	Pass	0.94
SPDW-60425	6/24/2024	Ra-226	12.8 ± 0.4	12.3	8.6 - 16.0	Pass	1.04
SPDW-60393	7/10/2024	H-3	20,368 ± 454	22,100	17,680 - 26,520	Pass	0.92

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

^b Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^c Results are based on single determinations.

^d Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code ^b	Reference Date	Analysis	Concentration ^a				Ratio Lab/Known
			Laboratory results 2s, n=1 ^c	Known Activity	Control Limits ^d	Acceptance	
SPDW-60411	7/22/2024	Gr. Alpha	18.2 ± 1.9	32.2	16.1 - 38.6	Pass	0.57
SPDW-60411	7/22/2024	Gr. Beta	155 ± 3	160	128 - 192	Pass	0.97
SPDW-60417	7/23/2024	U (Natural)	8.14 ± 0.92	7.36	5.15 - 9.57	Pass	1.11
SPDW-60452	7/31/2024	Ra-226	11.5 ± 0.4	12.3	8.6 - 16.0	Pass	0.93
SPDW-60530	8/12/2024	Ra-226	12.3 ± 0.4	12.3	8.6 - 16.0	Pass	1.00
LCS-08/26/24	7/8/2024	Ba-133	31.2 ± 4.3	38.2	30.6 - 45.8	Pass	0.82
LCS-08/26/24	7/8/2024	Cs-134	22.0 ± 3.0	18.9	15.1 - 22.7	Pass	1.16
LCS-08/26/24	7/8/2024	Cs-137	68.0 ± 6.5	57.0	45.6 - 68.4	Pass	1.19
LCS-08/26/24	7/8/2024	Co-60	80.8 ± 5.0	76.8	61.4 - 92.2	Pass	1.05
LCS-08/26/24	7/8/2024	Zn-65	337 ± 15	312	250 - 374	Pass	1.08
LCS-S-09/04/24	3/19/2018	Ac-228	1,122 ± 120	1,240	992 - 1,488	Pass	0.90
LCS-S-09/04/24	3/19/2018	Bi-212	1,105 ± 293	1,240	992 - 1,488	Pass	0.89
LCS-S-09/04/24	3/19/2018	Bi-214	1,563 ± 49	1,760	1,408 - 2,112	Pass	0.89
LCS-S-09/04/24	3/19/2018	Co-60	7,251 ± 94	8,060	6,448 - 9,672	Pass	0.90
LCS-S-09/04/24	3/19/2018	Pb-214	1,489 ± 54	1,850	1,480 - 2,220	Pass	0.80
SPDW-60527	9/10/2024	H-3	20,297 ± 453	22,100	17,680 - 26,520	Pass	0.92
SPDW-60546	9/13/2024	S-90	15.9 ± 1.0	15.4	12.3 - 18.5	Pass	1.03
SPDW-60559	9/25/2024	Gr. Alpha	7.5 ± 1.1	13.0	6.5 - 15.6	Pass	0.58
SPDW-60559	9/25/2024	Gr. Beta	21.5 ± 1.3	20.6	16.5 - 24.7	Pass	1.04
SPDW-60584	10/9/2024	H-3	20,016 ± 452	22,100	17,680 - 26,520	Pass	0.91
LCS-W-090324	4/8/2024	Ba-133	65.5 ± 5.8	65.9	53 - 79	Pass	0.99
LCS-W-090324	4/8/2024	Cs-134	54.5 ± 5.1	57.8	46 - 69	Pass	0.94
LCS-W-090324	4/8/2024	Cs-137	189 ± 12	186	149 - 223	Pass	1.02
LCS-W-090324	4/8/2024	Co-60	101 ± 9	98.8	79 - 119	Pass	1.02
LCS-W-090324	4/8/2024	Zn-65	260 ± 25	240	192 - 288	Pass	1.08
LCS-W-10/03/24	8/1/2023	Cs-134	288 ± 5	305	244 - 366	Pass	0.94
LCS-W-10/03/24	8/1/2023	Cs-137	257 ± 8	235	188 - 282	Pass	1.09
LCS-W-10/03/24	8/1/2023	Co-57	550 ± 16	521	417 - 625	Pass	1.06
LCS-W-10/03/24	8/1/2023	Mn-54	364 ± 16	343	274 - 412	Pass	1.06
LCS-W-10/03/24	8/1/2023	Zn-65	489 ± 28	516	413 - 619	Pass	0.95
LCS-W-10/05/24	7/12/2021	Ba-133	42.5 ± 3.5	45.5	36 - 55	Pass	0.93
LCS-W-10/05/24	7/12/2021	Cs-134	88.1 ± 6.2	87.5	70 - 105	Pass	1.01
LCS-W-10/05/24	7/12/2021	Cs-137	219 ± 6	208	166 - 250	Pass	1.05
LCS-W-10/05/24	7/12/2021	Co-60	88.8 ± 5.1	87.1	70 - 105	Pass	1.02
LCS-AP-10/05/24	8/1/2022	Cs-137	52.1 ± 2.0	47.5	38 - 57	Pass	1.10
LCS-AP-10/05/24	8/1/2022	Co-57	99.8 ± 6.5	94.5	76 - 113	Pass	1.06
LCS-AP-10/05/24	8/1/2022	Co-60	59.9 ± 2.1	57.0	46 - 68	Pass	1.05
LCS-AP-10/05/24	8/1/2022	Mn-54	61.2 ± 7.7	58.9	47 - 71	Pass	1.04
LCS-AP-10/05/24	8/1/2022	Zn-65	43.1 ± 13.5	49.4	40 - 59	Pass	0.87

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg).

^b Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^c Results are based on single determinations.

^d Acceptance criteria are listed in Attachment A of this report.

TABLE A-3. Intralaboratory "Spiked" Samples

Lab Code ^b	Reference Date	Analysis	Concentration ^a		Control Limits ^d	Acceptance	Ratio Lab/Known
			Laboratory results 2s, n=1 ^c	Known Activity			
LCS-S-092424	3/19/2018	K-40	9,021 ± 385	10,600	8,480 - 12720	Pass	0.85
LCS-S-092424	3/19/2018	Cs-134	4,450 ± 235	5,330	4,264 - 6396	Pass	0.83
LCS-S-092424	3/19/2018	Cs-137	3,773 ± 55	4,210	3,368 - 5052	Pass	0.90
LCS-S-092424	3/19/2018	Co-60	6,958 ± 96	8,060	6,448 - 9672	Pass	0.86
LCS-S-092424	3/19/2018	Pb-214	1,638 ± 59	1,850	1,480 - 2220	Pass	0.89
LCS-S-092424	3/19/2018	Bi-214	1,608 ± 50	1,760	1,408 - 2112	Pass	0.91
LCS-S-092424	3/19/2018	Ac-228	1,105 ± 117	1,240	992 - 1488	Pass	0.89
LCS-S-101424	2/1/2024	Co-60	15,340 ± 87	17,820	14,256 - 21,384	Pass	0.86
LCS-S-101424	2/1/2024	Cs-134	8,700 ± 62	8,694	6,955 - 10,433	Pass	1.00
LCS-S-101424	2/1/2024	Cs-137	37,330 ± 26	41,850	33,480 - 50,220	Pass	0.89
LCS-S-101424	2/1/2024	K-40	11,550 ± 411	13,095	10,476 - 15,714	Pass	0.88
LCS-S-101424	2/1/2024	Mn-54	8,080 ± 125	8,964	7,171 - 10,757	Pass	0.90
LCS-S-101424	2/1/2024	Zn-65	16,260 ± 273	18,981	15,185 - 22,777	Pass	0.86
LCS-W-1014224	2/1/2024	Co-57	544 ± 24	554	443 - 664	Pass	0.98
LCS-W-1014224	2/1/2024	Cs-134	281 ± 8	289	231 - 347	Pass	0.97
LCS-W-1014224	2/1/2024	Cs-137	254 ± 11	257	205 - 308	Pass	0.99
LCS-W-1014224	2/1/2024	Mn-54	369 ± 21	365	292 - 437	Pass	1.01
LCS-W-1014224	2/1/2024	Zn-65	501 ± 38	489	391 - 586	Pass	1.03
LCS-VE-100524	2/1/2024	Co-57	544 ± 5	521	417 - 625	Pass	1.04
LCS-VE-100524	2/1/2024	Cs-134	281 ± 8	305	244 - 366	Pass	0.92
LCS-VE-100524	2/1/2024	Cs-137	254 ± 11	235	188 - 282	Pass	1.08
LCS-VE-100524	2/1/2024	Zn-65	501 ± 38	516	413 - 619	Pass	0.97
LCS-VE-100524	2/1/2024	Mn-54	369 ± 21	343	274 - 411	Pass	1.08
SPDW-60583	10/9/2024	H-3	20,016 ± 452	22,100	17,680 - 26,520	Pass	0.91
SPDW-60604	10/25/2024	H-3	19,814 ± 447	22,100	17,680 - 26,520	Pass	0.90
SPDW-60622	11/14/2024	Gr. Alpha	12.5 ± 2.9	13.0	6.5 - 15.6	Pass	0.96
SPDW-60622	11/14/2024	Gr. Beta	17.8 ± 2.3	20.6	16.5 - 24.7	Pass	0.86
SPDW-60635	10/10/2024	Ra-226	14.9 ± 0.5	12.3	8.6 - 16.0	Pass	1.21
SPDW-60631	12/2/2024	H-3	20,384 ± 453	22,100	17,680 - 26,520	Pass	0.92
SPDW-60641	12/17/2024	H-3	21,520 ± 468	22,100	17,680 - 26,520	Pass	0.97

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m3), charcoal (pCi/charcoal canister), and solid samples (pCi/kg). vegetation (pCi/sample)

^b Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^c Results are based on single determinations.

^d Acceptance criteria are listed in Attachment A of this report.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code ^b	Sample Type	Collection Date	Analysis ^c	Concentration ^a		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66σ)		
				LLD	Activity ^d	
SPDW-60024	Water	1/12/2024	Gr. Alpha	0.70	0.14 ± 0.50	2
SPDW-60024	Water	1/12/2024	Gr. Beta	0.83	-0.60 ± 0.56	4
SPW-3913	Water	2/2/2024	Tc-99	11.8	-12.3 ± 7.0	200
SPDW-60041	Water	2/2/2024	H-3	177	68 ± 96	200
SPDW-60058	Water	2/14/2024	Gr. Alpha	0.51	-0.10 ± 0.35	2
SPDW-60058	Water	2/14/2024	Gr. Beta	0.71	0.19 ± 0.50	4
SPDW-60147	Water	2/21/2024	Ra-226	0.04	0.18 ± 0.03	2
SPDW-60099	Water	2/26/2024	H-3	179	-89 ± 84	200
SPDW-60097	Water	2/28/2024	Gr. Alpha	0.53	0.29 ± 0.39	2
SPDW-60097	Water	2/28/2024	Gr. Beta	0.79	-0.42 ± 0.54	4
SPDW-60141	Water	3/19/2024	I-131	0.18	-0.10 ± 0.10	1
SPDW-60149	Water	3/22/2024	H-3	174	-2 ± 86	200
SPDW-60115	Water	3/7/2024	H-3	175	20 ± 85	200
SPDW-60129	Water	3/11/2024	Ra-228	0.74	0.07 ± 0.35	2
SPDW-60132	Water	3/14/2024	Gr. Alpha	0.51	-0.20 ± 0.34	2
SPDW-60132	Water	3/14/2024	Gr. Beta	0.75	-0.07 ± 0.52	4
SPDW-60190	Water	3/21/2024	Ra-226	0.04	-0.14 ± 0.03	2
SPDW-60155	Water	3/25/2024	Ra-228	1.46	-0.13 ± 0.66	2
SPDW-60183	Water	4/9/2024	Gr. Alpha	0.66	-0.09 ± 0.46	2
SPDW-60183	Water	4/9/2024	Gr. Beta	0.76	0.11 ± 0.54	4
SPDW-60266	Water	4/11/2024	Ra-226	0.04	-0.15 ± 0.03	2
SPDW-60197	Water	4/15/2024	H-3	174	53 ± 84	200
SPDW-60212	Water	4/25/2024	Ra-228	0.90	0.03 ± 0.42	2
SPDW-60214	Water	4/26/2024	H-3	170	27 ± 80	200
SPDW-60235	Water	5/10/2024	H-3	174	-7 ± 81	200
SPDW-60252	Water	5/16/2024	Ra-228	0.68	0.72 ± 0.39	2
SPDW-60294	Water	5/28/2024	H-3	188	-43 ± 88	200
SPDW-60295	Water	5/28/2024	Sr-89	0.62	0.16 ± 0.44	5
SPDW-60295	Water	5/28/2024	Sr-90	0.66	-0.20 ± 0.28	1
SPDW-60301	Water	5/29/2024	Gr. Alpha	0.49	-0.16 ± 0.33	2
SPDW-60301	Water	5/29/2024	Gr. Beta	0.76	0.14 ± 0.54	4
SPDW-60306	Water	5/23/2024	Ra-228	0.17	-0.30 ± 0.38	2
SPDW-60356	Water	5/30/2024	Ra-226	0.04	0.12 ± 0.03	2
SPDW-60313	Water	6/6/2024	Ra-228	0.76	-0.01 ± 0.35	2
SPDW-60330	Water	6/10/2024	H-3	183	12 ± 85	200
SPDW-60340	Water	6/17/2024	I-131	0.15	-0.04 ± 0.08	1
SPDW-60360	Water	6/27/2024	Gr. Alpha	0.46	-0.12 ± 0.31	2
SPDW-60360	Water	6/27/2024	Gr. Beta	0.75	0.10 ± 0.53	4
SPDW-60424	Water	6/24/2024	Ra-226	0.04	-0.14 ± 0.09	2

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m³), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

^b Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^c I-131(G); iodine-131 as analyzed by gamma spectroscopy.

^d Activity reported is a net activity result.

TABLE A-4. Intralaboratory "Blank" Samples

Lab Code ^b	Sample Type	Collection Date	Analysis ^c	Concentration ^a		Acceptance Criteria (4.66 σ)
				Laboratory results (4.66σ)		
				LLD	Activity ^d	
SPDW-60392	Water	7/10/2024	H-3	183	-28 ± 83	200
SPDW-60411	Water	7/22/2024	Gr. Alpha	0.42	-0.06 ± 0.29	2
SPDW-60411	Water	7/22/2024	Gr. Beta	0.71	0.40 ± 0.51	4
SPDW-60416	Water	7/23/2024	U (Natural)	0.56	-0.16 ± 0.66	1
SPDW-60418	Water	7/24/2024	Ra-228	0.65	0.93 ± 0.40	2
SPDW-60451	Water	7/31/2024	Ra-226	0.07	0.02 ± 0.06	2
SPW-1901	Water	8/6/2024	Ni-63	87	-144 ± 51	200
SPDW-60462	Water	8/16/2024	Ra-228	0.58	0.08 ± 0.28	2
SPDW-60529	Water	8/12/2024	Ra-226	0.04	-0.07 ± 0.03	2
SPDW-60522	Water	9/5/2024	I-131	0.11	-0.09 ± 0.07	1
SPDW-60526	Water	9/10/2024	H-3	183	9 ± 86	200
SPDW-60592	Water	9/11/2024	Ra-226	0.06	-0.11 ± 0.05	2
SPDW-60545	Water	9/13/2024	Sr-89	0.56	-0.06 ± 0.43	5
SPDW-60545	Water	9/13/2024	Sr-90	0.52	0.06 ± 0.25	1
SPDW-60560	Water	9/26/2024	H-3	180	88 ± 89	200
SPDW-60594	Water	10/16/2024	Ra-228	0.73	0.43 ± 0.39	2
SPDW-60634	Water	10/10/2024	Ra-226	0.05	-0.07 ± 0.04	2
MB-102124	Water	10/21/2024	Co-57	4.76	0.87 ± 2.53	10
MB-102124	Water	10/21/2024	Cs-134	3.88	-3.36 ± 2.68	10
MB-102124	Water	10/21/2024	Cs-137	5.73	1.08 ± 2.64	10
MB-102124	Water	10/21/2024	Mn-54	5.17	0.03 ± 2.65	10
MB-102124	Water	10/21/2024	Zn-65	6.83	-1.76 ± 5.61	10
SPDW-60614	Water	11/8/2024	H-3	185	-29 ± 84	200
SPDW-60630	Water	12/2/2024	H-3	184	-12 ± 86	200
MB-120924	Water	12/9/2024	Co-57	1.08	0.04 ± 0.66	10
MB-120924	Water	12/9/2024	Cs-134	1.06	0.22 ± 0.61	10
MB-120924	Water	12/9/2024	Cs-137	1.39	0.65 ± 0.68	10
MB-120924	Water	12/9/2024	Mn-54	0.93	0.07 ± 0.55	10
MB-120924	Water	12/9/2024	Zn-65	2.28	0.33 ± 1.12	10
MB-121224	Water	12/12/2024	Co-57	1.56	-1.64 ± 1.28	10
MB-121224	Water	12/12/2024	Cs-134	1.85	-2.84 ± 1.36	10
MB-121224	Water	12/12/2024	Cs-137	1.39	-0.10 ± 1.44	10
MB-121224	Water	12/12/2024	Mn-54	2.56	1.81 ± 1.30	10
MB-121224	Water	12/12/2024	Zn-65	3.05	-6.22 ± 2.99	10
SPDW-60638	Water	12/12/2024	I-131	0.17	-0.19 ± 0.08	1
SPDW-60641	Water	12/17/2024	H-3	182	3 ± 85	200

^a Liquid sample results are reported in pCi/Liter, air filters (pCi/m³), charcoal (pCi/charcoal canister), and solid samples (pCi/g).

^b Laboratory codes : W & SPW (Water), MI (milk), AP (air filter), SO (soil), VE (vegetation), CH (charcoal canister), F (fish), U (urine).

^c I-131(G); iodine-131 as analyzed by gamma spectroscopy.

^d Activity reported is a net activity result.

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code ^b	Collection Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
DW-60006	1/5/2024	Gr. Alpha	2.03 ± 0.83	1.59 ± 0.83	1.81 ± 0.59	Pass
DW-60006	1/5/2024	Gr. Beta	1.36 ± 0.58	1.22 ± 0.62	1.29 ± 0.42	Pass
W-41	1/5/2024	Ra-226	1.67 ± 0.35	1.03 ± 0.35	1.35 ± 0.25	Pass
W-41	1/5/2024	Ra-228	4.19 ± 0.85	3.45 ± 0.83	3.82 ± 0.59	Pass
W-62	1/8/2024	Ra-226	0.54 ± 0.30	0.12 ± 0.41	0.33 ± 0.25	Pass
DW-60018	1/16/2024	Gr. Alpha	1.75 ± 0.74	0.98 ± 0.80	1.37 ± 0.54	Pass
W-125,126	1/16/2024	Ra-226	0.37 ± 0.18	0.66 ± 0.27	0.52 ± 0.16	Pass
DW-60034,60035	1/29/2024	Gr. Alpha	2.10 ± 0.74	1.41 ± 0.79	1.76 ± 0.54	Pass
DW-60034,60035	1/29/2024	Gr. Beta	1.13 ± 0.57	0.57 ± 0.57	0.85 ± 0.40	Pass
DW-60049,60050	2/5/2024	Gr. Alpha	0.61 ± 1.02	1.20 ± 0.87	0.90 ± 0.67	Pass
DW-60049,60050	2/5/2024	Gr. Beta	0.99 ± 0.64	1.19 ± 0.07	1.09 ± 0.32	Pass
DW-60054,60055	2/8/2024	Gr. Beta	0.25 ± 0.53	0.62 ± 0.61	0.44 ± 0.40	Pass
DW-60071,60072	2/16/2024	Ra-226	2.33 ± 0.21	1.73 ± 0.17	2.03 ± 0.14	Pass
DW-60071,60072	2/16/2024	Ra-228	0.48 ± 0.42	0.60 ± 0.45	0.54 ± 0.31	Pass
DW-60107,60108	3/2/2024	Gr. Alpha	1.26 ± 0.98	1.59 ± 0.99	1.42 ± 0.70	Pass
DW-60107,60108	3/2/2024	Gr. Beta	0.63 ± 0.57	0.14 ± 0.59	0.38 ± 0.41	Pass
DW-60120,60121	3/8/2024	Gr. Beta	1.15 ± 0.56	1.04 ± 0.58	1.10 ± 0.40	Pass
LW-582,583	3/19/2024	Be-7	3.80 ± 0.70	1.76 ± 0.60	2.78 ± 0.46	Pass
SWT-708,709	3/26/2024	H-3	186 ± 90	136 ± 87	161 ± 62	Pass
SW-624,625	4/2/2024	H-3	1,174 ± 133	1,302 ± 138	1,238 ± 96	Pass
AP-865,866	4/3/2024	Be-7	0.040 ± 0.007	0.053 ± 0.008	0.047 ± 0.005	Pass
DW-60180,60181	4/5/2024	Ra-226	0.97 ± 0.25	1.30 ± 0.21	1.135 ± 0.16	Pass
DW-60180,60181	4/5/2024	Ra-228	0.85 ± 0.48	1.34 ± 0.54	1.095 ± 0.36	Pass
WW-949,950	4/16/2024	H-3	229 ± 94	136 ± 90	183 ± 65	Pass
S-886,887	4/18/2024	Pb-214	0.93 ± 0.04	0.94 ± 0.04	0.93 ± 0.03	Pass
S-886,887	4/18/2024	Ac-228	0.82 ± 0.08	0.83 ± 0.06	0.82 ± 0.05	Pass
DW-60206,60207	4/19/2024	Ra-226	2.35 ± 0.27	3.49 ± 0.25	2.92 ± 0.18	Pass
DW-60203,60204	4/19/2024	Gr. Alpha	2.12 ± 0.64	1.74 ± 0.73	1.93 ± 0.49	Pass
DW-60206,60207	4/19/2024	Ra-228	0.50 ± 0.59	-0.21 ± 0.53	0.15 ± 0.40	Pass
WW-1075,1076	4/30/2024	H-3	278 ± 107	311 ± 109	294 ± 76	Pass
SG-1017,1018	5/1/2024	Gr. Alpha	27.2 ± 4.00	32.0 ± 4.00	29.6 ± 2.83	Pass
SG-1017,1018	5/1/2024	Gr. Beta	25.7 ± 1.80	24.5 ± 1.90	25.1 ± 1.31	Pass
SG-1017,1018	5/1/2024	Pb-214	3.28 ± 0.14	4.61 ± 0.11	3.95 ± 0.09	Pass
SG-1017,1018	5/1/2024	Ac-228	4.86 ± 0.18	4.98 ± 0.37	4.92 ± 0.21	Pass
DW-60273,60274	5/21/2024	Ra-228	2.12 ± 0.63	1.33 ± 0.45	1.73 ± 0.39	Pass
XW-1138,1139	5/31/2024	H-3	732 ± 124	688 ± 122	710 ± 87	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code ^b	Collection		Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
AP-060324A,B	6/3/2024	Gr. Beta	0.021 ± 0.005	0.018 ± 0.005	0.020 ± 0.003	Pass
AP-061224A,B	6/12/2024	Gr. Beta	0.009 ± 0.003	0.011 ± 0.003	0.010 ± 0.002	Pass
AP-061724A,B	6/17/2024	Gr. Beta	0.031 ± 0.005	0.023 ± 0.005	0.027 ± 0.004	Pass
AP-062524A,B	6/25/2024	Gr. Beta	0.033 ± 0.003	0.034 ± 0.003	0.034 ± 0.002	Pass
SG-1432,1433	6/24/2024	Ra-226	2.36 ± 0.09	2.36 ± 0.08	2.36 ± 0.06	Pass
SG-1432,1433	6/24/2024	Ra-228	1.67 ± 0.14	1.69 ± 0.15	1.68 ± 0.10	Pass
SG-1472,1473	7/1/2024	Gr. Alpha	36.0 ± 4.5	36.8 ± 4.5	36.4 ± 3.2	Pass
SG-1472,1473	7/1/2024	Gr. Beta	30.4 ± 2.1	31.2 ± 2.2	30.8 ± 1.5	Pass
SG-1472,1473	7/1/2024	Pb-214	2.64 ± 0.11	3.11 ± 0.09	2.88 ± 0.07	Pass
SG-1472,1473	7/1/2024	Ac-228	5.55 ± 0.21	5.79 ± 0.25	5.67 ± 0.16	Pass
SG-1474,1475	7/1/2024	Gr. Alpha	43.6 ± 5.7	37.5 ± 5.4	40.6 ± 3.9	Pass
SG-1474,1475	7/1/2024	Gr. Beta	40.6 ± 2.8	34.2 ± 2.7	37.4 ± 1.9	Pass
SG-1474,1475	7/1/2024	Pb-214	3.58 ± 0.10	3.93 ± 0.10	3.76 ± 0.07	Pass
SG-1474,1475	7/1/2024	Ac-228	4.21 ± 0.15	4.13 ± 0.16	4.17 ± 0.11	Pass
AP-070324A,B	7/3/2024	Gr. Beta	0.013 ± 0.003	0.014 ± 0.003	0.013 ± 0.002	Pass
W-1592,1593	7/9/2024	Gr. Alpha	1.23 ± 0.67	0.36 ± 0.54	0.80 ± 0.43	Pass
W-1592,1593	7/9/2024	Gr. Beta	1.45 ± 0.60	0.60 ± 0.53	1.03 ± 0.40	Pass
AP-071024A,B	7/10/2024	Gr. Beta	0.024 ± 0.003	0.025 ± 0.003	0.024 ± 0.002	Pass
S-1613,1614	7/11/2024	Pb-214	197 ± 1	200 ± 1	199 ± 1	Pass
S-1613,1614	7/11/2024	Ac-228	134 ± 1	143 ± 1	139 ± 1	Pass
AP-071724A,B	7/17/2024	Gr. Beta	0.038 ± 0.001	0.032 ± 0.003	0.035 ± 0.001	Pass
SG-1722,1723	7/22/2024	Gr. Beta	16.4 ± 3.4	17.5 ± 3.4	16.9 ± 2.4	Pass
SG-1722,1723	7/22/2024	Gr. Alpha	25.5 ± 6.9	17.5 ± 6.0	21.5 ± 4.6	Pass
SG-1722,1723	7/22/2024	K-40	6.99 ± 1.04	5.75 ± 0.86	6.37 ± 0.67	Pass
SG-1722,1723	7/22/2024	Pb-214	7.62 ± 0.18	8.10 ± 0.25	7.86 ± 0.15	Pass
SG-1722,1723	7/22/2024	Ac-228	4.72 ± 0.34	4.76 ± 0.36	4.74 ± 0.24	Pass
DW-60413,60414	7/22/2024	Gr. Alpha	1.71 ± 0.79	0.93 ± 0.81	1.32 ± 0.56	Pass
DW-60413,60414	7/22/2024	Gr. Beta	1.18 ± 0.58	1.26 ± 0.59	1.22 ± 0.41	Pass
AP-080524A,B	8/5/2024	Gr. Beta	0.025 ± 0.003	0.025 ± 0.003	0.025 ± 0.002	Pass
AP-081324A,B	8/13/2024	Gr. Beta	0.030 ± 0.004	0.028 ± 0.004	0.029 ± 0.003	Pass
AP-082124A,B	8/21/2024	Gr. Beta	0.034 ± 0.003	0.030 ± 0.003	0.032 ± 0.002	Pass
AP-082824A,B	8/28/2024	Gr. Beta	0.033 ± 0.003	0.034 ± 0.003	0.033 ± 0.002	Pass
AP-090924A,B	9/9/2024	Gr. Beta	0.025 ± 0.005	0.026 ± 0.005	0.026 ± 0.003	Pass
SO-2132,2133	9/9/2024	Be-7	0.39 ± 0.11	0.53 ± 0.22	0.46 ± 0.12	Pass
SO-2132,2133	9/9/2024	K-40	14.78 ± 0.27	14.52 ± 0.52	14.65 ± 0.29	Pass
SO-2132,2133	9/9/2024	Cs-137	0.10 ± 0.01	0.08 ± 0.02	0.09 ± 0.01	Pass
SO-2132,2133	9/9/2024	Tl-208	0.44 ± 0.03	0.43 ± 0.02	0.44 ± 0.02	Pass
SO-2132,2133	9/9/2024	Bi-212	1.40 ± 0.34	1.25 ± 0.15	1.32 ± 0.19	Pass
SO-2132,2133	9/9/2024	Bi-214	1.01 ± 0.03	0.90 ± 0.04	0.95 ± 0.02	Pass
SO-2132,2133	9/9/2024	Pb-212	1.29 ± 0.02	1.18 ± 0.03	1.24 ± 0.02	Pass
SO-2132,2133	9/9/2024	Pb-214	0.88 ± 0.03	1.07 ± 0.03	0.98 ± 0.02	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code ^b	Collection Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
SO-2132,2133	9/9/2024	Ra-226	2.38 ± 0.36	2.31 ± 0.16	2.34 ± 0.20	Pass
SO-2132,2133	9/9/2024	Ac-228	1.33 ± 0.10	1.33 ± 0.06	1.33 ± 0.06	Pass
SS-2206,2207	9/17/2024	Be-7	0.29 ± 0.06	0.23 ± 0.10	0.26 ± 0.06	Pass
SS-2206,2207	9/17/2024	K-40	6.54 ± 0.29	6.19 ± 0.20	6.37 ± 0.18	Pass
SS-2206,2207	9/17/2024	Tl-208	0.20 ± 0.02	0.22 ± 0.02	0.21 ± 0.01	Pass
SS-2206,2207	9/17/2024	Bi-212	0.65 ± 0.14	0.69 ± 0.19	0.67 ± 0.12	Pass
SS-2206,2207	9/17/2024	Bi-214	0.68 ± 0.02	0.61 ± 0.02	0.65 ± 0.02	Pass
SS-2206,2207	9/17/2024	Pb-212	0.51 ± 0.02	0.59 ± 0.02	0.55 ± 0.01	Pass
SS-2206,2207	9/17/2024	Pb-214	0.73 ± 0.03	0.63 ± 0.02	0.68 ± 0.02	Pass
SS-2206,2207	9/17/2024	Ra-226	1.12 ± 0.12	1.25 ± 0.19	1.18 ± 0.11	Pass
SS-2206,2207	9/17/2024	Ac-228	0.66 ± 0.05	0.65 ± 0.06	0.66 ± 0.04	Pass
VE-2111,2112	9/10/2024	Be-7	0.56 ± 0.17	0.59 ± 0.18	0.58 ± 0.12	Pass
VE-2111,2112	9/10/2024	K-40	4.62 ± 0.40	5.21 ± 0.41	4.91 ± 0.29	Pass
AP-091624A,B	9/16/2024	Gr. Beta	0.044 ± 0.004	0.043 ± 0.004	0.044 ± 0.002	Pass
SS-2206,2207	9/17/2024	Be-7	0.29 ± 0.06	0.23 ± 0.10	0.26 ± 0.06	Pass
SS-2206,2207	9/17/2024	K-40	6.54 ± 0.29	6.19 ± 0.20	6.37 ± 0.18	Pass
SS-2206,2207	9/17/2024	Tl-208	0.20 ± 0.02	0.22 ± 0.02	0.21 ± 0.01	Pass
SS-2206,2207	9/17/2024	Bi-212	0.65 ± 0.14	0.69 ± 0.19	0.67 ± 0.12	Pass
SS-2206,2207	9/17/2024	Bi-214	0.68 ± 0.02	0.61 ± 0.02	0.65 ± 0.02	Pass
SS-2206,2207	9/17/2024	Pb-212	0.51 ± 0.02	0.59 ± 0.02	0.55 ± 0.01	Pass
SS-2206,2207	9/17/2024	Pb-214	0.73 ± 0.03	0.63 ± 0.02	0.68 ± 0.02	Pass
SS-2206,2207	9/17/2024	Ra-226	1.12 ± 0.12	1.25 ± 0.19	1.18 ± 0.11	Pass
SS-2206,2207	9/17/2024	Ac-228	0.66 ± 0.05	0.65 ± 0.06	0.66 ± 0.04	Pass
VE-2111,2112	9/10/2024	Be-7	0.56 ± 0.17	0.59 ± 0.18	0.58 ± 0.12	Pass
VE-2111,2112	9/10/2024	K-40	4.62 ± 0.40	5.21 ± 0.41	4.91 ± 0.29	Pass
AP-092524A,B	9/25/2024	Gr. Beta	0.036 ± 0.003	0.033 ± 0.003	0.035 ± 0.002	Pass
AP-2773,2774	9/30/2024	Be-7	0.067 ± 0.008	0.075 ± 0.066	0.071 ± 0.033	Pass
SG-2353,2354	10/3/2024	K-40	3.68 ± 0.34	2.79 ± 0.59	3.24 ± 0.34	Pass
SG-2353,2354	10/3/2024	Tl-208	0.13 ± 0.01	0.14 ± 0.03	0.13 ± 0.01	Pass
SG-2353,2354	10/3/2024	Pb-212	0.36 ± 0.02	0.27 ± 0.03	0.32 ± 0.02	Pass
SG-2353,2354	10/3/2024	Pb-214	1.64 ± 0.05	1.21 ± 0.08	1.43 ± 0.05	Pass
SG-2353,2354	10/3/2024	Bi-214	1.56 ± 0.05	1.32 ± 0.10	1.44 ± 0.06	Pass
SG-2353,2354	10/3/2024	Ac-228	2.62 ± 0.09	2.20 ± 0.19	2.41 ± 0.11	Pass
SG-2362,2363	10/4/2024	Gr. Alpha	31.50 ± 3.70	23.00 ± 3.30	27.25 ± 2.48	Pass
SG-2362,2363	10/4/2024	Gr. Beta	24.70 ± 1.70	19.60 ± 1.60	22.15 ± 1.17	Pass
SG-2362,2363	10/4/2024	Ra-226	4.08 ± 0.23	4.03 ± 0.18	4.06 ± 0.15	Pass
SG-2362,2363	10/4/2024	Ra-228	5.90 ± 0.41	5.85 ± 0.34	5.88 ± 0.27	Pass
S-2541,2542	10/11/2024	K-40	14.20 ± 0.44	14.82 ± 0.44	14.51 ± 0.31	Pass
S-2541,2542	10/11/2024	Cs-137	0.08 ± 0.01	0.10 ± 0.01	0.09 ± 0.01	Pass
S-2541,2542	10/11/2024	Tl-208	0.26 ± 0.02	0.27 ± 0.02	0.27 ± 0.01	Pass
S-2541,2542	10/11/2024	Pb-212	0.75 ± 0.03	0.54 ± 0.03	0.64 ± 0.02	Pass

TABLE A-5. Intralaboratory "Duplicate" Samples

Lab Code ^b	Collection Date	Analysis	Concentration ^a		Averaged Result	Acceptance
			First Result	Second Result		
S-2541,2542	10/11/2024	Bi-212	1.17 ± 0.29	0.83 ± 0.16	1.00 ± 0.16	Pass
S-2541,2542	10/11/2024	Pb-214	1.28 ± 0.05	1.07 ± 0.05	1.17 ± 0.04	Pass
S-2541,2542	10/11/2024	Ac-228	0.88 ± 0.08	0.85 ± 0.08	0.86 ± 0.06	Pass
S-2752,2753	10/24/2024	K-40	15.24 ± 0.33	15.54 ± 0.31	15.39 ± 0.22	Pass
S-2752,2753	10/24/2024	Cs-137	0.09 ± 0.09	0.10 ± 0.09	0.09 ± 0.06	Pass
S-2752,2753	10/24/2024	Tl-208	0.33 ± 0.01	0.34 ± 0.01	0.34 ± 0.01	Pass
S-2752,2753	10/24/2024	Pb-212	0.93 ± 0.02	0.98 ± 0.02	0.96 ± 0.01	Pass
S-2752,2753	10/24/2024	Bi-212	1.15 ± 0.12	1.13 ± 0.12	1.14 ± 0.08	Pass
S-2752,2753	10/24/2024	Pb-214	1.33 ± 0.03	1.19 ± 0.03	1.26 ± 0.02	Pass
S-2752,2753	10/24/2024	Bi-214	1.37 ± 0.04	1.19 ± 0.03	1.28 ± 0.03	Pass
S-2752,2753	10/24/2024	Ra-226	2.61 ± 0.36	2.28 ± 0.15	2.45 ± 0.20	Pass
S-2752,2753	10/24/2024	Ac-228	1.10 ± 0.07	1.10 ± 0.04	1.10 ± 0.04	Pass
F-2899,2900	11/6/2024	K-40	2.38 ± 0.35	3.06 ± 0.13	2.72 ± 0.18	Pass
SW-2815,2816	11/5/2024	H-3	265 ± 100	214 ± 97	240 ± 70	Pass
SW-3046,3047	12/4/2024	H-3	109 ± 91	178 ± 94	144 ± 65	Pass
W-3067,3068	12/3/2024	H-3	206 ± 96	329 ± 102	268 ± 70	Pass
AP-3335,3336	12/30/2024	Be-7	0.034 ± 0.005	0.050 ± 0.005	0.042 ± 0.003	Pass

Note: Duplicate analyses are performed on every twentieth sample received. Results are not listed for those analyses with activities that measure below the LLD.

^a Results are reported in units of pCi/L, except for air filters (pCi/Filter or pCi/m3), food products, vegetation, soil and sediment (pCi/g).

^b AP (Air Particulate), AV (Aquatic Vegetation), BS (Bottom Sediment), CF (Cattle Feed), CH (Charcoal Canister), DW (Drinking Water), E (Egg), F (Fish), G (Grass), LW (Lake Water), MI (Milk), P (Precipitation), PM (Powdered Milk), S (Solid), SG (Sludge), SO (Soil), SS (Shoreline Sediment), SW (Surface Water), SWT (Surface Water Treated), SWU (Surface Water Untreated), U (Urine), VE (Vegetation), W (Water), WW (Well Water).

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code ^b	Reference		Concentration ^a			
	Date	Analysis	Laboratory result	Known Activity	Acceptance Range ^c	Acceptance
MADW-429	2/1/2024	Gross Alpha	0.641 ± 0.048	1.01	0.30 - 1.72	Pass
MADW-429	2/1/2024	Gross Beta	4.71 ± 0.08	5.6	2.79 - 8.36	Pass
MADW-457	2/1/2024	Cs-134	0.09 ± 0.19	0	NA ^c	Pass
MADW-457	2/1/2024	Cs-137	11.1 ± 0.4	9.7	6.8 - 12.6	Pass
MADW-457	2/1/2024	Co-57	26.4 ± 0.4	25.4	17.8 - 33.0	Pass
MADW-457	2/1/2024	Co-60	11.2 ± 0.3	10.27	7.19 - 13.35	Pass
MADW-457	2/1/2024	Mn-54	8.23 ± 0.39	7.36	5.15 - 9.57	Pass
MADW-457	2/1/2024	Zn-65	0.10 ± 0.30	0	NA ^c	Pass
MADW-457	2/1/2024	K-40	3.16 ± 2.49	0	NA ^c	Pass
MADW-457	2/1/2024	Ra-226	0.46 ± 0.07	0.310	0.217 - 0.403	Fail ^d
MAAP-459	2/1/2024	Cs-134	0.03 ± 0.03	0	NA ^c	Pass
MAAP-459	2/1/2024	Cs-137	1.30 ± 0.07	1.48	1.04 - 1.92	Pass
MAAP-459	2/1/2024	Co-57	0.58 ± 0.03	0.819	0.573 - 1.065	Pass
MAAP-459	2/1/2024	Co-60	1.30 ± 0.06	1.64	1.15 - 2.13	Pass
MAAP-459	2/1/2024	Mn-54	0.51 ± 0.05	0.555	0.389 - 0.722	Pass
MAAP-459	2/1/2024	Zn-65	0.27 ± 0.07	0.332	NA ^e	Pass
MASO-461	2/1/2024	Cs-134	345 ± 2	404	283 - 525	Pass
MASO-461	2/1/2024	Cs-137	1539 ± 7	1550	1085 - 2015	Pass
MASO-461	2/1/2024	Co-57	355 ± 4	401	281 - 521	Pass
MASO-461	2/1/2024	Co-60	619 ± 4	660	462 - 858	Pass
MASO-461	2/1/2024	Mn-54	332 ± 13	332	232 - 432	Pass
MASO-461	2/1/2024	Zn-65	543 ± 9	703	492 - 914	Pass
MASO-461	2/1/2024	K-40	510 ± 20	485	340 - 631	Pass
MAVE-464	2/1/2024	Cs-134	2.97 ± 0.08	3.67	2.57 - 4.77	Pass
MAVE-464	2/1/2024	Cs-137	2.36 ± 0.15	2.57	1.80 - 3.34	Pass
MAVE-464	2/1/2024	Co-57	1.78 ± 0.09	2.53	1.77 - 3.29	Pass
MAVE-464	2/1/2024	Co-60	2.61 ± 0.13	2.96	2.07 - 3.85	Pass
MAVE-464	2/1/2024	Mn-54	0.03 ± 0.07	0	NA ^c	Pass
MAVE-464	2/1/2024	Zn-65	6.41 ± 0.30	8.02	5.61 - 10.43	Pass

TABLE A-6. Department of Energy's Mixed Analyte Performance Evaluation Program (MAPEP).

Lab Code ^b	Reference Date	Analysis	Laboratory result	Concentration ^a		
				Known Activity	Acceptance Range ^c	Acceptance
MADW-2185	8/1/2024	Gross Alpha	0.88 ± 0.01	1.29	0.39 - 2.19	Pass
MADW-2185	8/1/2024	Gross Beta	4.35 ± 0.01	5.09	2.55 - 7.64	Pass
MASO-2187	8/1/2024	Cs-134	330 ± 4	417	292 - 542	Pass
MASO-2187	8/1/2024	Cs-137	1650 ± 11	1650	1155 - 2145	Pass
MASO-2187	8/1/2024	Co-57	311 ± 5	330	231 - 429	Pass
MASO-2187	8/1/2024	Co-60	669 ± 7	700	490 - 910	Pass
MASO-2187	8/1/2024	Mn-54	116 ± 5	113	79 - 147	Pass
MASO-2187	8/1/2024	Zn-65	330 ± 8	415	291 - 540	Pass
MASO-2187	8/1/2024	K-40	531 ± 31	525	368 - 683	Pass
MADW-2183	8/1/2024	Cs-134	19.9 ± 0.3	22.3	15.6 - 29.0	Pass
MADW-2183	8/1/2024	Cs-137	0.99 ± 0.29	0	NA ^{c, e}	Fail
MADW-2183	8/1/2024	Co-57	25.3 ± 0.4	26.4	18.5 - 34.3	Pass
MADW-2183	8/1/2024	Co-60	14.7 ± 0.4	15.0	10.5 - 19.5	Pass
MADW-2183	8/1/2024	Mn-54	0.12 ± 0.16	0	NA ^c	Pass
MADW-2183	8/1/2024	Zn-65	20.6 ± 1.0	22.8	16.00 - 29.60	Pass
MADW-2183	8/1/2024	K-40	8.92 ± 1.23	0	NA ^{c, e}	Fail
MAAP-2191	8/1/2024	Cs-134	0.254 ± 0.030	0.334	0.234 - 0.434	Pass
MAAP-2191	8/1/2024	Cs-137	0.260 ± 0.046	0.269	0.188 - 0.350	Pass
MAAP-2191	8/1/2024	Co-57	-0.0003 ± 0.0126	0	NA ^c	Pass
MAAP-2191	8/1/2024	Co-60	0.333 ± 0.045	0.361	0.253 - 0.469	Pass
MAAP-2191	8/1/2024	Mn-54	-0.003 ± 0.022	0	NA ^c	Pass
MAAP-2191	8/1/2024	Zn-65	-0.002 ± 0.054	0	NA ^c	Pass
MAVE-2189	8/1/2024	Cs-134	2.10 ± 0.07	2.89	2.02 - 3.76	Pass
MAVE-2189	8/1/2024	Cs-137	1.53 ± 0.11	1.91	1.34 - 2.48	Pass
MAVE-2189	8/1/2024	Co-57	0.003 ± 0.023	0	NA ^c	Pass
MAVE-2189	8/1/2024	Co-60	1.54 ± 0.08	2.01	1.41 - 2.61	Pass
MAVE-2189	8/1/2024	Mn-54	2.89 ± 0.15	3.53	2.47 - 4.59	Pass
MAVE-2189	8/1/2024	Zn-65	7.14 ± 0.29	9.13	6.39 - 11.87	Pass

^a Results are reported in units of Bq/kg (soil), Bq/L (water) or Bq/total sample (filters, vegetation).

^b Laboratory codes as follows: MAW (water), MADW (water), MAAP (air filter), MASO (soil) and MAVE (vegetation).

^c MAPEP results are presented as the known values and expected laboratory precision (1 sigma, 1 determination) and control limits as defined by the MAPEP. A known value of "zero" indicates an analysis was included in the testing series as a "false positive". MAPEP does not provide an acceptance range.

^d No conclusive reason for the failure could be determined. The uncertainty overlapped the known activity (reference value).

^e False positive detections could have occurred due to a combination of an inadequate background subtraction for this sample geometry compounded by a very long analysis time.

TABLE A-7. Interlaboratory Comparison Crosscheck Program, Environmental Resource Associates (ERA)^a.

MRAD-40 Study						
Lab Code ^b	Date	Analysis	Concentration ^a		Acceptance Limits ^d	Acceptance
			Laboratory Result	ERA Value ^c		
ERAP-574	3/18/2024	Cs-134	291 ± 4	273	177 - 335	Pass
ERAP-574	3/18/2024	Cs-137	131 ± 6	106	87 - 139	Pass
ERAP-574	3/18/2024	Co-60	1240 ± 8	1120	952 - 1420	Pass
ERAP-574	3/18/2024	Mn-54	< 3.1	< 35.0	0.00 - 35.0	Pass
ERAP-574	3/18/2024	Zn-65	102 ± 9	77.2	63.3 - 118	Pass
ERAP-574	3/18/2024	Sr-90	173 ± 5	158	99.9 - 215	Pass
ERAP-600	3/18/2024	Gross Alpha	110 ± 3	95.9	50.1 - 158	Pass
ERAP-600	3/18/2024	Gross Beta	31.7 ± 1.6	22.2	13.5 - 33.5	Pass

^a Results obtained by Microbac Laboratories - Northbrook as a participant in the crosscheck program for proficiency testing administered by Environmental Resource Associates, serving as a replacement for studies conducted previously by the Environmental Measurements Laboratory Quality Assessment Program (EML).

^b Laboratory code ERAP (air filter). Results are reported in units of (pCi/Filter).

^c The ERA Assigned values for the air filter standards are equal to 100% of the parameter present in the standard as determined by the gravimetric and/or volumetric measurements made during standard preparation as applicable.

^d The acceptance limits are established per the guidelines contained in the Department of Energy (DOE) report EML-564, Analysis of Environmental Measurements Laboratory (EML) Quality Assessment Program (QAP) Data Determination of Operational Criteria and Control Limits for Performance Evaluation Purposes or ERA's SOP for the generation of Performance Acceptance Limits.

APPENDIX B

DATA REPORTING CONVENTIONS

Data Reporting Conventions

1.0. All activities, except gross alpha and gross beta, are decay corrected to collection time or the end of the collection period.

2.0. Single Measurements

Each single measurement is reported as follows: $x \pm s$

where: x = value of the measurement;

s = 2s counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is less than the lower limit of detection L , it is reported as: $<L$,

where L = the lower limit of detection based on 4.66s uncertainty for a background sample.

3.0. Duplicate analyses

3.1 Individual results: For two analysis results; $x_1 \pm s_1$ and $x_2 \pm s_2$

Reported result: $x \pm s$; where $x = (1/2)(x_1 + x_2)$ and $s = (1/2)\sqrt{s_1^2 + s_2^2}$

3.2. Individual results: $<L_1$, $<L_2$ Reported result: $<L$, where L = lower of L_1 and L_2

3.3. Individual results: $x \pm s$, $<L$ Reported result: $x \pm s$ if $x \geq L$; $<L$ otherwise.

4.0. Computation of Averages and Standard Deviations

- 4.1 Averages and standard deviations listed in the tables are computed from all of the individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average \bar{x} and standard deviation s of a set of n numbers $x_1, x_2 \dots x_n$ are defined as follows:

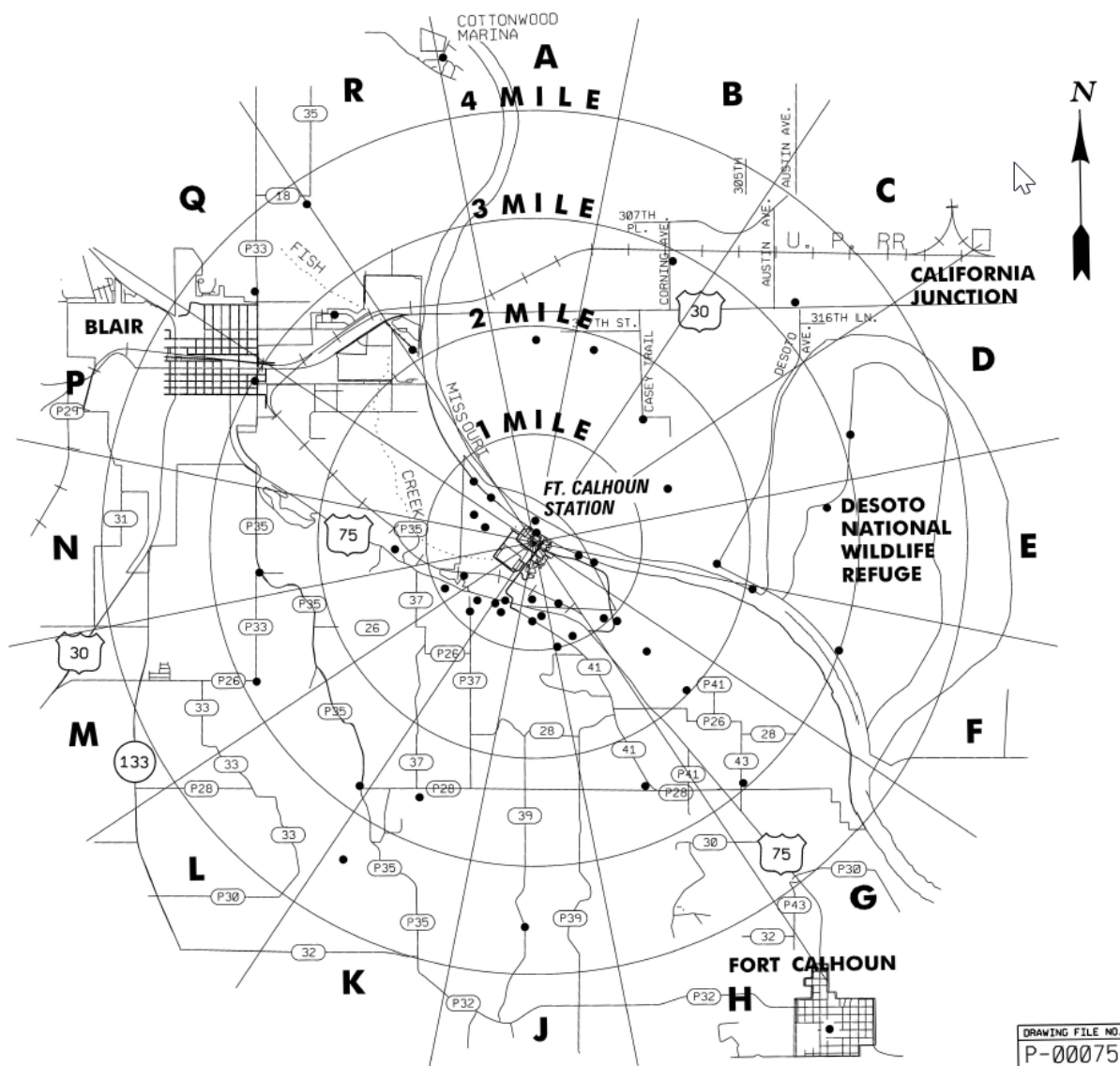
$$\bar{x} = \frac{1}{n} \sum x \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

- 4.2 Values below the highest lower limit of detection are not included in the average.
- 4.3 If all values in the averaging group are less than the highest LLD, the highest LLD is reported.
- 4.4 If all but one of the values are less than the highest LLD, the single value x and associated two sigma error is reported.
- 4.5 In rounding off, the following rules are followed:
- 4.5.1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.
 - 4.5.2. If the figure following those to be retained is equal to or greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.445 is rounded off to 11.45.
- 4.6 Composite samples which overlap the next month or year are reported for the month or year in which most of the sample is collected.

APPENDIX C

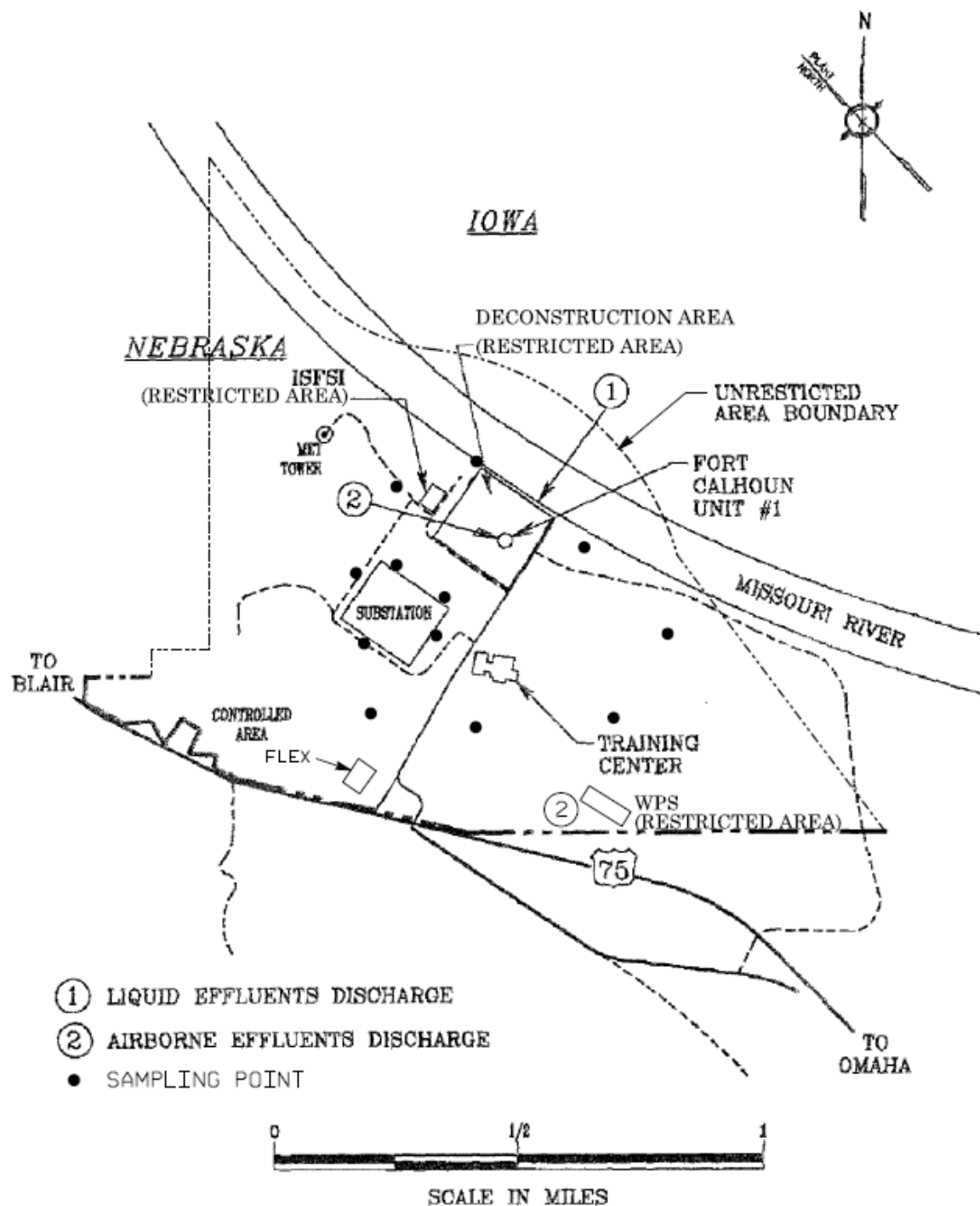
SAMPLE LOCATION MAPS

Environmental Radiological Sampling Points



(*) Locations currently discontinued are not illustrated.

40CFR190 Sampling Points



SITE BOUNDARY MAP

DRAWING FILE NO.
P-00423

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
1	Onsite Station, 110-meter weather tower	0.53	293°/WNW	P		X						
2 ^{C,E}	Onsite Station, adjacent to old plant access road	0.59	207°/SSW	K	X	X						
3	Offsite Station, Intersection of Hwy. 75 and farm access road	0.94	145°/SE	G		X						
4	Blair OPPD office	2.86	305°/NW	Q	X	X						
5 ^A												
6	Fort Calhoun, NE City Hall	5.18	150°/SSE	H		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
7	Fence around intake gate, Desoto Wildlife Refuge	2.07	102°/ESE	F		X						
8	Onsite Station, entrance to Plant Site from Hwy. 75	0.55	191°/S	J		X						
9	Onsite Station, NW of Plant	0.68	305°/NW	Q		X						
10	Onsite Station, WSW of Plant	0.61	242°/WSW	M		X						
11	Offsite Station, SE of Plant	1.07	39°/SE	G		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
12	Metropolitan Utilities Dist., Florence Treatment Plant North Omaha, NE	14.3	154°/SSE	H			X					
13	West bank Missouri River, downstream from Plant discharge	0.45	108°/ESE	F			X		X			
14 ^D	Upstream from Intake Bldg, west bank of river	0.09	4°/N	A			X		X			
15	Smith Farm	1.99	134°/SE	G								X
16 ^A												
17 ^A												

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
18 ^A												
19 ^A												
20 ^{B,D,F}	Mohr Dairy	9.86	186°/S	J				X			X	X
21 ^A												
22	Fish Sampling Area, Missouri River	0.08 (R.M. 645.0)	6°/N	A						X		
23 ^D	Fish Sampling Area, Missouri River	17.9 (R.M. 666.0)	358°/N	A						X		
24 ^A												
25 ^A												
26 ^A												
27 ^A												

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
28	Alvin Pechnik Farm	0.94	163	H							X	
29 ^A												
30 ^A												
31 ^A												
32 ^D	Valley Substation #902	19.6	221°/SW	L	X	X						
33 ^A												
34 ^A												
35	Onsite Farm Field	0.52	118°/ESE	F							X	
36	Offsite Station Intersection Hwy 75/Co. Rd. P37	0.75	227°/SW	L		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sedi-ment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
37	Offsite Station Desoto Township	1.57	144°/SE	G	X	X						
38 ^A												
39 ^A												
40 ^A												
41 ^{B,C}	Dowler Acreage	0.73	175°/S	J	X	X						
42	Sector A-1	1.94	0°/NORTH	A		X						
43	Sector B-1	1.97	16°/NNE	B		X						
44	Sector C-1	1.56	41°/NE	C		X						
45	Sector D-1	1.34	71°/ENE	D		X						
46	Sector E-1	1.54	90°/EAST	E		X						
47	Sector F-1	0.45	108°/ESE	F		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
48	Sector G-1	1.99	134°/SE	G		X						
49	Sector H-1	1.04	159°/SSE	H		X						
50	Sector J-1	0.71	179°/SOUTH	J		X						
51	Sector K-1	0.61	205°/SSW	K		X						
52	Sector L-1	0.74	229°/SW	L		X						
53	Sector M-1	0.93	248°/WSW	M		X						
54	Sector N-1	1.31	266°/WEST	N		X						
55	Sector P-1	0.60	291°/WNW	P		X						
56	Sector Q-1	0.67	307°/NW	Q		X						
57	Sector R-1	2.32	328°/NNW	R		X						
58 ^D	Sector A-2	4.54	350°/NORTH	A		X						
59 ^D	Sector B-2	2.95	26°/NNE	B		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
60 ^D	Sector C-2	3.32	50°/NE	C		X						
61 ^D	Sector D-2	3.11	75°/ENE	D		X						
62 ^D	Sector E-2	2.51	90°/EAST	E		X						
63 ^D	Sector F-2	2.91	110°/ESE	F		X						
64 ^D	Sector G-2	3.00	140°/SE	G		X						
65 ^D	Sector H-2	2.58	154°/SSE	H		X						
66 ^D	Sector J-2	3.53	181°/SOUTH	J		X						
67 ^D	Sector K-2	2.52	205°/SSW	K		X						
68 ^D	Sector L-2	2.77	214°/SW	L		X						
69 ^D	Sector M-2	2.86	243°/WSW	M		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
70 ^D	Sector N-2	2.54	263°/WEST	N		X						
71 ^D	Sector P-2	2.99	299°/WNW	P		X						
72 ^D	Sector Q-2	3.37	311°/NW	Q		X						
73 ^D	Sector R-2	3.81	328°/NNW	R		X						
74	D. Miller Farm	0.65	203°/SSW	K								X
75 ^{B,C}	Lomp Acreage	0.65	163°/SSE	H	X	X						X
76 ^A												
77 ^G	River N-1	0.17	328°/NNW	R		X						
78 ^G	River S-1	0.14	85°/EAST	E		X						
79 ^G	Lagoon S-1	0.24	131°/SE	G		X						
80 ^G	Parking S-1	0.27	158°/SSE	H		X						
81 ^G	Training W-1	0.28	194°/SSW	K		X						

Radiological Environmental Sampling Locations and Media

Table 5.2 - Radiological Environmental Sampling Locations and Media

Sample Station No.	Approximate Collection Sites	Approximate Distance from Center of Containment (miles)	Approximate Direction (degrees from true north)	Sector	Air Monitoring	TLD	Water	Milk	Sediment	Fish	Vegetables and Food Products	Ground-water
					Airborne Particulate							
82 ^G	Switchyard S-1	0.21	219°/SW	L		X						
83 ^G	Switchyard SE-1	0.14	231°/SW	L		X						
84 ^G	Switchyard NE-1	0.18	256°/WSW	M		X						
85 ^G	Switchyard W-1	0.29	233°/WEST	L		X						
86 ^G	Switchyard N-1	0.24	262°/WEST	N		X						
87 ^G	Range S-1	0.20	286°/WNW	P		X						
88 ^G	Mausoleum E-1	0.37	216°/SW	L		X						
89	C, Miller	3.30	210°/SSW	K				X				

Radiological Environmental Sampling Locations and Media

NOTES:

- A. Location is either not in use or currently discontinued and is documented in the table for reference only.
- B. If milk samples are temporarily not available at a sampling site due to mitigating circumstances, then vegetation (broadleaf, pasture grass, etc.) shall be collected as an alternate sample at the site. If there are no milk producers within the entire 5-mile radius of the facility, then vegetation shall be collected monthly, when available, at two offsite locations having the highest calculated annual average ground level D/Q and a background locale. (Reference Off-Site Dose Calculation Manual, Part II, Table 4 "Highest Potential Exposure Pathways for Estimating Dose")
- C. Locations represent highest potential exposure pathways as determined by the biennial Land Use Survey, performed in accordance with Part I, Section 7.3.2, of the Off-Site Dose Calculation Manual and are monitored as such.
- D. Background location (control). All other locations are indicators.
- E. Location for monitoring Sector K High Exposure Pathway Resident Receptor for inhalation.
- F. When broad leaf (pasture grasses) is being collected in lieu of milk, background broad leaf samples will be collected at a background locale.
- G. Location for special interest monitoring general dose to the public per 40CFR190 (Figure 2)