FRNP-RPT-0333

2023 Annual External Radiation Monitoring Report Paducah Gaseous Diffusion Plant, Paducah, Kentucky

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

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2023 Annual External Radiation Monitoring Report Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—March 2024

U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

Prepared by
FOUR RIVERS NUCLEAR PARTNERSHIP, LLC,
managing the
Deactivation and Remediation Project at the
Paducah Gaseous Diffusion Plant
under Contract DE-EM0004895

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ACRONYMS

D&R	deactivation and remediation
DOE	U.S. Department of Energy
DOELAP	U.S. Department of Energy Laboratory Accreditation Program
E	effective dose
ISSC	Infrastructure Support Services Contractor
LA	Limited Area
MEI	maximally exposed individual
ND	not detected
O	order
OSL	optically stimulated luminescence
PPA	Property Protection Area
TLD	thermoluminescent dosimeter
RMD	risk methods detection
WKWMA	West Kentucky Wildlife Management Area

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EXECUTIVE SUMMARY

The dose from the direct radiation pathway is evaluated by its contribution to the U.S. Department of Energy (DOE) total dose limit of 100 millirem (mrem) per year from all relevant pathways (i.e., air, surface water, sediment, direct radiation). For comparison purposes, in 2023, the estimated dose from the direct radiation pathway from the Paducah Site was 5.6E+00 mrem, which represents 5.6% of the DOE annual dose limit and 22.4% of the 25 mrem radioactive waste public dose constraint.

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1. INTRODUCTION

U.S. Department of Energy (DOE) Order (O) 458.1 Chg 1 (LtdChg), *Radiation Protection of the Public and the Environment*, has requirements in place to protect the public and environment from radiation exposure. Energy absorbed from radioactive materials outside the body is referred to as an external dose. At the Paducah Site, external doses come from direct ionizing radiation, which includes natural radioactivity from cosmic and terrestrial sources and man-made radioactive sources. This report summarizes the results of external gamma and neutron radiation monitoring conducted in 2023.

2. BACKGROUND

The external radiation monitoring program is designed to provide exposure data on direct radiation from DOE operations to members of the public. The Deactivation and Remediation (D&R) Contractor uses a surveillance network of thermoluminescent dosimeters (TLDs) and optically stimulated luminescence (OSL) dosimeters to monitor this direct radiation. The surveillance network is divided into five groups, which are used to monitor locations inside the Limited Area (LA), locations outside the LA and inside the Property Protection Area (PPA), locations outside the PPA and inside the DOE boundary, locations outside the DOE boundary, and background locations. The dosimeter locations are also placed in areas that, historically, received the highest radiation exposure. The LA boundary, PPA boundary, DOE boundary, and dosimeter locations are identified in Figure 1.

The primary sources for radiation exposure to areas outside of the LA are the uranium hexafluoride (UF_6) cylinder storage yards, which are also shown in Figure 1.

Historical monitoring for the past five years has shown that the background-corrected external gamma radiation effective dose (E) from routine DOE operations to the maximally exposed individual (MEI) has been 5 millirem (mrem) per year or less and the collective population E has been < 1 person-rem per year for the exposed population.

3. MONITORING AND OBJECTIVES

In 2023, the D&R Contractor conducted routine surveillance of external gamma and neutron radiation exposure to monitor any effects due to past releases of radionuclides and current operations involving radioactive sources (e.g., depleted UF_6 cylinder management). Historical monitoring has shown that the background-corrected external gamma and neutron radiation dose from routine DOE operations at the DOE boundary is under 10 mrem per year E and 1 person-rem per year collective E for the exposed population. Routine surveillance of external gamma radiation with dosimeters is conducted, which provides data to model direct external radiation from sources located on-site consistent with DOE O 458.1. Neutron dosimetry monitoring has been in place near cylinder yards in previous years and is not used to determine public exposure but for information purposes only.

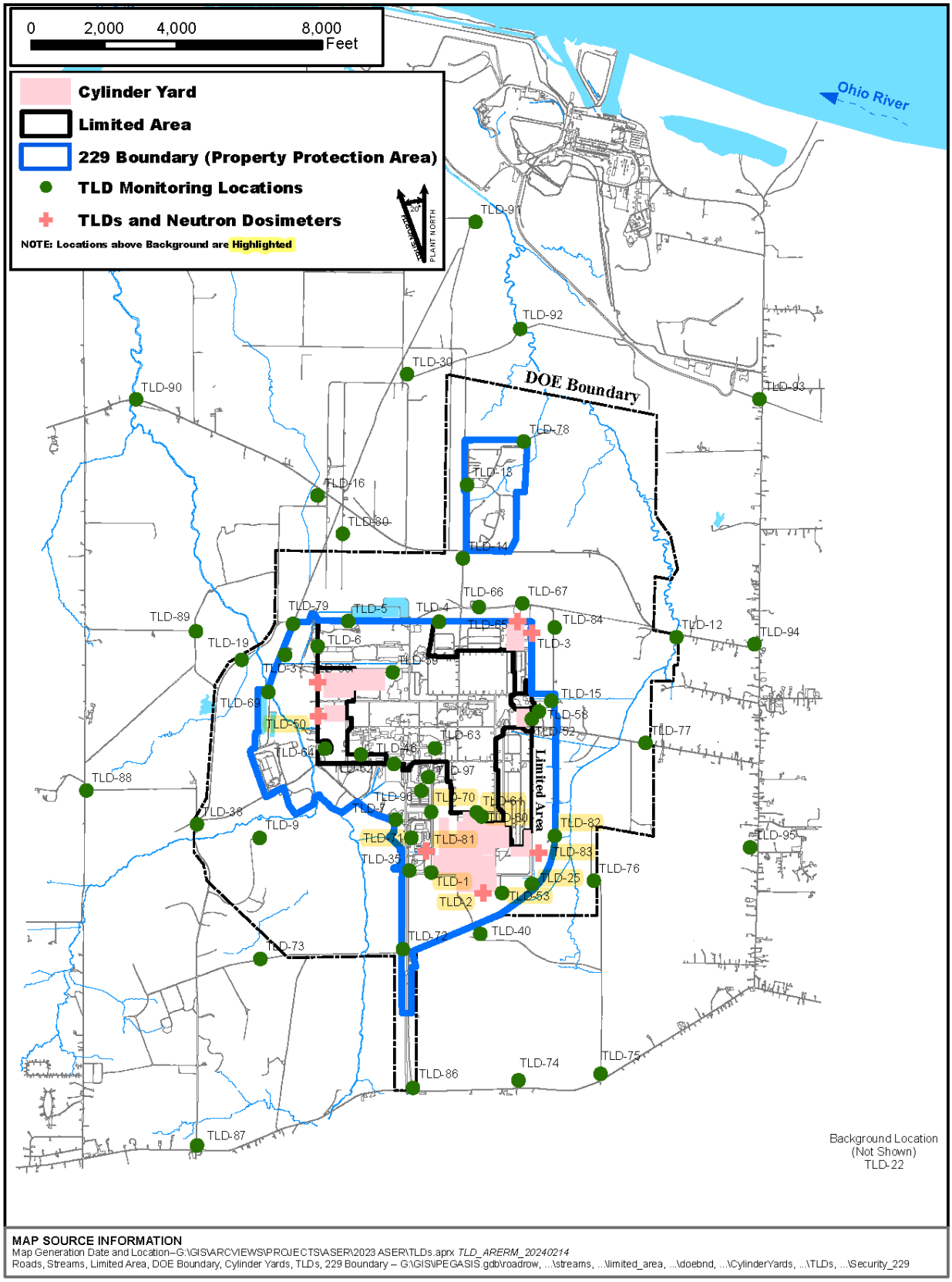

Figure 1. Dosimeter Locations

For 2023 the objectives for external exposure monitoring were the following.

1. Establish the radiation dose potentially received by a member of the public from direct exposure to DOE operations.

2. Calculate the E to a member of the public in areas freely accessible to members of the public.

3. Calculate the E to a member of the public at the DOE boundary.

4. Calculate the E to the MEI member of the public.

4. METHODOLOGY

4.1 MEASUREMENT OF GAMMA RADIATION

The D&R Contractor used the Environmental TLD 110 received from Mirion Technologies, Inc., of Oak Ridge, Tennessee, to measure external gamma radiation. This TLD is manufactured by ThermoRMP and meets American National Standards Institute N545-1975 standards. This type of TLD measures low-level gamma radiation and is designed for outdoor applications. This four-chip TLD includes two calcium fluoride 200 chips and two lithium fluoride 100 chips.

The vendor literature supporting the use of this dosimeter indicates the following:

- Energy response range is 40 kiloelectron volts (keV) to 6 mega-electron volts (MeV); and
- Lower level of detection is 5 milliroentgen (mR) per month and 10 mR per quarter.

Mirion Technologies, Inc., processed the dosimeters received from the D&R Contractor, following their internal processes, protocols, and quality control routines and reported the results to the D&R Contractor.

The vendor reports the gamma radiation exposure in mR, which is a measure of exposure in terms of ionizations in air. The gamma radiation data presented in this report has been converted to mrem using a 1:1 ratio. The D&R Contractor normalized the reported gamma radiation and compared it to a normalized baseline background to determine if the monitoring location had a facility-related dose. Sections 5 through 9 provide the results of this comparison.

4.2 MEASUREMENT OF NEUTRON RADIATION

The D&R Contractor used the Landauer® InLight® Model 2T OSL dosimeter provided by the Infrastructure Support Services Contractor (ISSC). This DOE Laboratory Accreditation Program (DOELAP) accredited dosimeter is the same dosimeter used for personnel monitoring, but the D&R Contractor used it to measure external neutron radiation for information only, because it is minimally affected by environmental factors such as humidity, light, radiofrequency emissions, normal environmental temperatures, and mechanical shock. The ISSC holds the DOELAP-accredited dosimetry program for the Paducah Site.

This type of dosimeter uses a carbon-doped four-chip, aluminum oxide dosimeter that exhibits OSL when exposed to a light-emitting diode array. The OSL dosimeter is combined with an integrated CR-39 neutron chip. This chip is an allyl diglycol carbonate-based, solid-state nuclear track detector that is not sensitive to x-ray, beta, or gamma radiation. The CR-39 neutron chip is intended for fast, intermediate, and thermal

neutrons. The left area of the chip uses a polyethylene radiator for fast neutrons, while the right area uses a boron loaded Teflon™ radiator for fast, intermediate, and thermal neutrons, which records alpha particles that result from neutron interactions in the dosimeter.

The ISSC literature supporting this dosimeter indicates the following:

- Thermal neutron energy range is 0.25 electron volt (eV) to 40 eV;
- Thermal neutron detection range is 10 mrem to 5 rem;
- Fast neutron energy range is 40 keV to 40 MeV; and
- Fast neutron detection range is 20 mrem to 25 rem.

Landauer® processed the dosimeters received from the D&R Contractor for the ISSC, following their internal processes, protocols, and quality control routines, and the ISSC provided reports of the results from Landauer® to the D&R Contractor. The neutron results are reported in mrem and are discussed in Section 10.

4.3 ENVIRONMENTAL DOSIMETER SURVEILLANCE NETWORK

The D&R Contractor used a total of 64 TLD locations, seven OSL locations, and one control location in 2023.

Analysis of the data from this network of environmental dosimeter locations served to monitor changes in external radiation measures over time and any accidental releases of radioactive material related to D&R Contractor operational activities conducted for DOE.

The network of environmental dosimeter locations was divided into the following groups.

- Group 1 was used for background analysis. Group 1 gamma results and data analysis are discussed in Section 5.

- Group 2 TLDs and OSLs were located inside or on the perimeter of the LA. Group 2 gamma results and data analysis are discussed in Section 6, and neutron results are discussed in Section 10.

- Group 3 TLDs and OSLs were located outside the LA and inside the PPA boundary. Group 3 gamma results and data analysis are discussed in Section 7, and neutron results are discussed in Section 10.

- Group 4 TLDs were located outside the PPA and inside the DOE boundary. Group 4 gamma results and data analysis are discussed in Section 8.

- Group 5 TLDs were located outside the DOE boundary. Group 5 gamma results and data analysis are discussed in Section 9.

The control location for the environmental dosimeters was the C-101 dosimetry office, which is located outside the LA boundary but inside the PPA boundary.

The coordinates for monitoring locations were determined using a differential global positioning system, and data were entered into the Paducah Site geographic information system. No dosimeters were placed in radiologically contaminated areas. The monitoring locations are shown in Figure 1 and location descriptions and coordinates are listed in the Appendix.

4.4 DATA COLLECTION

There were a total of 64 TLDs and seven OSLs placed at the monitoring locations. These dosimeters were collected and analyzed quarterly. When the dosimeters were collected, the following quarter's dosimeters were placed at the same locations when possible. The Appendix lists the dosimeter collection dates.

One TLD per quarterly sampling event was designated as a field blank and was carried to all monitoring locations during placement and collection of the TLDs. One control TLD (i.e., trip blank TLD) was retained in the C-101 dosimetry office and then used as a transit blank that accompanied the TLDs when they were shipped off-site for analysis. This control TLD was not subtracted from the dosimeter results.

The TLDs were placed in a wide-mouth, plastic sample bottle when deployed to the monitoring location. A lid was screwed onto the bottle, and a nylon wire tie was wrapped around each bottle under the lid to secure it to a fence or other fixed structure, usually at a height of approximately 3–4 ft aboveground. The sample bottle provided a sturdy weather-resistant package that did not significantly attenuate gamma radiation (i.e., induce a negative bias on the measurement).

The OSLs were placed in a wide-mouth, plastic sample bottle when deployed to the monitoring location. A lid was screwed onto the bottle; a nylon wire tie was wrapped around each bottle under the lid to secure it to a Lucite block, which simulated the albedo effect; and the bottle was attached to a fence or other fixed structure, usually at a height of approximately 3–4 ft aboveground.

Based on process knowledge from historical surveys, the siting of dosimeters outside the bounds of radiological contamination areas, and the Class 3 radiological surveys performed by radiation protection to release the dosimeters prior to shipment to the vendor, the dosimeters were below the DOE release criteria and U.S. Department of Transportation level for regulated materials.

5. GROUP 1

Group 1 collected background information from 11 locations that were unaffected by Paducah Site operations or other site-specific radiation sources.

5.1 2023 GROUP 1 QUARTERLY MEASURED FIELD DOSE

The measured field dose (M_F) was successfully obtained from the Group 1 locations for the first, second, and third quarters. The fourth quarter M_F was not used because the D&R Contractor received notice from the vendor that the transit control dosimeter in the shipment to the D&R Contractor read 23 mrem. This dose was higher than the normal transit control dose for the first, second, and third quarters, which was 2 mrem for each quarter. The D&R Contractor sent another control dosimeter that was received in the original shipment back to the vendor to be read, and its result was also higher than normal at 27 mrem. These results indicated that the dosimeters were exposed to something during transit from the vendor to the D&R Contractor. Because the fourth quarter dosimeters were already in the field when the control dosimeter results were received and the fourth quarter M_F was suspect, the fourth quarter M_F was estimated for each monitoring location using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

Figure 2 shows the Group 1 quarterly M_F and includes decimal places not shown when rounding.

Quarter	1		2		3		4	
TLD Location Number	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)
22	66	15	90	17	90	21	92	18
86	66	14	90	18	90	19	92	17
87	66	13	90	18	90	18	93	16
88	66	13	90	18	90	20	93	17
89	66	14	90	19	90	19	93	17
90	66	15	90	17	90	18	93	17
91	66	13	90	17	90	18	93	16
92	66	12	90	18	90	18	93	16
93	66	14	90	17	90	17	92	16
94	66	15	90	18	90	20	92	18
95	66	14	90	17	90	20	92	17

Figure 2. 2023 Group 1 Quarterly M_F

5.2 2023 GROUP 1 NORMALIZED QUARTERLY MEASURED FIELD DOSE

The M_F was adjusted for a standardized 91-day period. This correction adjusts for the actual number of days of field deployment, which varied due to weather, holidays, and the fact that the number of days in a year is not exactly divisible by four. The normalized quarterly field dose (M_Q) is determined by the following equation.

$$M_Q = M_F \times 91 \text{ days} \div \text{number of days in the field}$$

The corresponding normalized annual dose (M_A), then, is the sum of the four normalized quarterly doses. Figure 3 shows the Group 1 M_Q and M_A and includes decimal places not shown when rounding.

Quarter	1	2	3	4	
Location	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_A (mrem)
22	20.7	17.2	21.2	17.5	76.6
86	19.3	18.2	19.2	16.8	73.5
87	17.9	18.2	18.2	16.0	70.3
88	17.9	18.2	20.2	16.6	73.0
89	19.3	19.2	19.2	17.0	74.7
90	20.7	17.2	18.2	16.3	72.4
91	17.9	17.2	18.2	15.7	69.0
92	16.5	18.2	18.2	15.7	68.6
93	19.3	17.2	17.2	15.8	69.5
94	20.7	18.2	20.2	17.5	76.6
95	19.3	17.2	20.2	16.8	73.5

Figure 3. 2023 Group 1 M_Q and M_A

5.3 BASELINE QUARTERLY AND ANNUAL INFORMATION

Group 1 locations were unaffected by Paducah Site operations or other site-specific radiation sources, so a baseline background dose was established for each monitoring location using quarterly measurements from 2018, 2019, 2020, 2021, and 2022. Each of the quarterly measurements were normalized to a standard 91-day quarter.

Figure 4 shows the Group 1 M_Q for each monitoring location and includes decimal places not shown when rounding.

TLD Location	2018 first quarter M_Q (mrem)	2018 second quarter M_Q (mrem)	2018 third quarter M_Q (mrem)	2018 fourth quarter M_Q (mrem)	2019 first quarter M_Q (mrem)	2019 second quarter M_Q (mrem)	2019 third quarter M_Q (mrem)	2019 fourth quarter M_Q (mrem)	2020 first quarter M_Q (mrem)	2020 second quarter M_Q (mrem)	2020 third quarter M_Q (mrem)	2020 fourth quarter M_Q (mrem)	2021 first quarter M_Q (mrem)	2021 second quarter M_Q (mrem)	2021 third quarter M_Q (mrem)	2021 fourth quarter M_Q (mrem)	2022 first quarter M_Q (mrem)	2022 second quarter M_Q (mrem)	2022 third quarter M_Q (mrem)	2022 fourth quarter M_Q (mrem)
22	20.4	17.5	18.4	24.1	25.2	17.4	17.8	20.9	20.2	23.1	18.7	24.4	20.9	18.2	20.1	22.1	19.8	19.2	19.7	19.3
86	21.5	20.8	20.3	20.4	23.0	16.4	16.8	21.1	16.8	23.4	14.4	24.5	20.9	17.1	18.0	20.5	17.5	18.2	19.7	18.5
87	23.5	18.6	20.3	19.5	23.0	16.4	19.8	20.4	18.4	19.5	17.8	23.5	20.9	17.1	16.9	18.9	17.5	16.2	17.8	16.2
88	23.5	19.7	20.3	21.4	26.3	18.4	18.8	19.3	16.8	22.1	16.6	23.5	20.9	17.1	18.0	18.0	18.7	18.2	19.7	17.7
89	21.5	19.7	21.3	21.4	26.3	16.4	19.8	21.1	18.4	24.7	17.8	24.5	21.8	20.3	19.0	19.7	18.7	18.2	20.6	18.5
90	20.4	18.6	19.4	23.2	23.0	15.3	16.8	20.2	14.5	22.1	16.6	29.4	19.9	17.1	18.0	20.5	18.7	18.2	19.7	17.7
91	22.5	18.6	19.4	22.3	26.3	17.4	18.8	20.2	19.1	23.4	17.8	23.5	21.8	18.2	18.0	17.2	17.5	15.2	18.8	18.5
92	21.5	20.8	24.0	17.6	20.8	15.3	19.8	19.1	17.0	22.1	15.5	19.6	19.0	18.2	18.0	17.2	16.3	16.2	18.8	17.0
93	20.4	17.5	21.3	20.4	25.2	16.4	16.8	18.4	16.1	22.1	17.8	23.5	19.0	17.1	18.0	17.2	18.7	16.2	20.6	18.5
94	21.5	19.7	21.3	20.4	27.4	17.4	16.8	21.1	17.6	27.3	17.8	23.5	20.9	19.3	18.0	21.3	18.7	17.2	22.5	21.6
95	22.5	18.6	19.4	21.4	27.4	16.4	20.8	22.1	20.6	24.7	17.8	24.5	23.7	20.3	19.0	19.7	21.0	17.2	20.6	20.8

Figure 4. Baseline M_Q

5.3.1 Baseline Quarterly Information

The baseline quarterly dose (B_Q), baseline standard deviation dose (S_Q), and coefficient of variation (CV) for each monitoring location were determined using the following equations.

$$B_Q = \text{AVERAGE } (M_{Q1} + M_{Q2} \ldots M_{QN})$$

Where:

M_Q = each quarter's M_Q, shown in Figure 4
N = number of data points for the location

$$S_Q = \text{STDEV } (M_{Q1} + M_{Q2} \ldots M_{QN})$$

Where:

M_Q = each quarter's M_Q, shown in Figure 4
N = number of data points for the location

$$CV = S_Q \div B_Q$$

Figure 5 shows the baseline B_Q, S_Q, and CV for each monitoring location and includes decimal places not shown when rounding.

TLD Location	B_Q (mrem)	S_Q (mrem)	CV $S_Q \div B_Q$
22	20.4	2.3	0.11
86	19.5	2.6	0.13
87	19.1	2.3	0.12
88	19.8	2.5	0.13
89	20.5	2.5	0.12
90	19.5	3.3	0.17
91	19.7	2.7	0.14
92	18.7	2.3	0.12
93	19.1	2.5	0.13
94	20.6	3.0	0.15
95	20.9	2.7	0.13

Figure 5. Baseline B_Q, M_Q, and CV

The B_Q, and S_Q values shown in Figure 5 were used to determine the 90th percentile values for the background. The 90th percentile was chosen to account for inherent variability in the range of normal environmental measurements.

The 90th percentile (σB_Q) value of 20.6 mrem was used as the representative baseline quarterly background dose for comparison to the normalized 2023 dose at each monitoring location and was determined using the following equation.

$$\sigma B_Q = \text{PERCENTILE.INC}\ (B_{Q1}:B_{QN},0.9)$$

Where:

$B_{Q1}:B_{QN}$ = the range from the first B_Q value to the last B_Q value, shown in Figure 5
0.9 = the 90th percentile of the range given in the equation

The 90th percentile (σS_Q) value of 3.0 mrem was used as the representative baseline standard deviation to determine the minimum differential dose for the quarterly measurements and was determined using the following equation.

$$\sigma S_Q = \text{PERCENTILE.INC}\ (S_{Q1}:S_{QN},0.9)$$

Where:

$S_{Q1}:S_{QN}$ = the range from the first S_Q first value to the last S_Q value, shown in Figure 5
0.9 = the 90th percentile of the range given in the equation

The quarterly minimum differential (MDD_Q) dose is the smallest facility-related dose that can be detected during a quarter above the baseline quarterly background. The calculated MDD_Q was 9.0 mrem, and was determined using the following equation.

$$MDD_Q = 3 \times \sigma S_Q$$

5.3.2 Baseline Annual Information

The M_A was determined by summing the quarterly M_Q results shown in Figure 4 for each year.

The annual baseline (B_A) was determined for each monitoring location using the following equation.

$$B_A = \text{AVERAGE } (M_{A1} + M_{A2} \ldots M_{AN})$$

Where:

M_A = each annual E
N = number of data points for the location

The standard deviation (S_A) of the B_A was determined using the following equation:

$$S_A = \text{STDEV } (M_{A1} + M_{A2} \ldots M_{AN})$$

Where:

M_A = each annual E
N = number of data points for the location

The CV was determined using the following equation.

$$CV = S_A \div B_A$$

Figure 6 shows the baseline M_A, B_A, S_A, and CV for each monitoring location and includes decimal places not shown when rounding.

TLD Location	2018 M_A (mrem)	2019 M_A (mrem)	2020 M_A (mrem)	2021 M_A (mrem)	2022 M_A (mrem)	B_A (mrem)	S_A (mrem)	CV $S_A \div B_A$
22	80.5	81.3	86.4	81.3	78.0	81.5	3.0	0.04
86	83.1	77.3	79.1	76.5	73.9	78.0	3.4	0.04
87	82.0	79.6	79.1	73.8	67.7	76.4	5.7	0.07
88	84.9	82.8	79.1	74.0	74.3	79.0	4.9	0.06
89	83.9	83.6	85.3	80.9	76.0	81.9	3.7	0.04
90	81.7	75.4	82.6	75.5	74.3	77.9	3.9	0.05
91	82.8	82.7	83.8	75.2	69.9	78.9	6.1	0.08
92	83.9	75.1	74.2	72.4	68.2	74.8	5.8	0.08
93	79.7	76.8	79.4	71.3	74.0	76.2	3.6	0.05
94	82.9	82.7	86.1	79.4	80.0	82.2	2.7	0.03
95	81.9	86.6	87.6	82.8	79.7	83.7	3.3	0.04

Figure 6. Baseline M_A, B_A, S_A, and CV

The B_A, and S_A values shown in Figure 6 were used to determine the 90th percentile values for the background. The 90th percentile was chosen to account for inherent variability in the range of normal environmental measurements.

The 90th percentile (σB_A) value of 82.2 mrem was used as the representative baseline annual background dose for comparison to the normalized 2023 dose at each monitoring location and was determined using the following equation.

$$\sigma B_A = \text{PERCENTILE.INC } (B_{A1}:B_{AN},0.9)$$

Where:

$B_{A1}:B_{AN}$ = the range from the first B_A value to the last B_A value, shown in Figure 6
0.9 = the 90th percentile of the range given in the equation

The 90th percentile (σS_A) value of 5.8 mrem was used as the representative baseline standard deviation to determine the minimum differential dose for the annual measurements and was determined using the following equation.

$$\sigma S_A = \text{PERCENTILE.INC } (S_{A1}:S_{AN},0.9)$$

Where:

$S_{A1}:S_{AN}$ = the range from the first S_A value to the last S_A value, shown in Figure 6
0.9 = the 90th percentile of the range given in the equation

The annual minimum differential (MDD_A) dose is the smallest facility-related dose that can be detected during a year above the baseline annual background. The calculated MDD_A was 17.3 mrem. The MDD_A was determined using the following equation: $MDD_A = 3 \times \sigma S_A$

5.3.3 Facility-related Dose

The quarterly facility-related dose (F_Q) is the dose received during a quarter by a field dosimeter at a monitoring location due to radiation from the monitored facility. F_Q excludes the background quarterly radiation dose of 20.6 mrem plus the MDD_Q of 9.0 mrem. The F_Q is represented as follows:

If $M_Q > (\sigma B_Q + MDD_Q)$, then $F_Q = M_Q - \sigma B_Q$
If $M_Q \leq (\sigma B_Q + MDD_Q)$, then F_Q = not detected (ND)

The annual facility-related dose (F_A) is the dose received during a year by a field dosimeter at a monitoring location due to radiation from the monitored facility. F_A excludes the background annual radiation dose of 82.2 mrem plus the MDD_A of 17.3 mrem. The F_A is represented as follows:

If $M_A > (\sigma B_A + MDD_A)$, then $F_A = M_A - \sigma B_A$
If $M_A \leq (\sigma B_A + MDD_Q)$, then F_A = ND

5.4 2023 GROUP 1 FACILITY-RELATED DOSE

Group 1 collected gamma data from 11 TLD locations. These locations were unaffected by Paducah Site operations or other site-specific radiation sources.

Figure 7 shows the Group 1 determination of the 2023 F_Q and F_A for each monitoring location and includes decimal places not shown when rounding.

TLD Location	σB_Q (mrem)	2023 M_Q (mrem)				2023 $F_Q = M_Q - B_Q$ (mrem)				σB_A (mrem)	2023 M_A (mrem)	2023 $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
22	20.6	20.7	17.2	21.2	17.5	ND	ND	ND	ND	82.2	76.6	ND
86		19.3	18.2	19.2	16.8	ND	ND	ND	ND		73.5	ND
87		17.9	18.2	18.2	16.0	ND	ND	ND	ND		70.3	ND
88		17.9	18.2	20.2	16.6	ND	ND	ND	ND		73.0	ND
89		19.3	19.2	19.2	17.0	ND	ND	ND	ND		74.7	ND
90		20.7	17.2	18.2	16.3	ND	ND	ND	ND		72.4	ND
91		17.9	17.2	18.2	15.7	ND	ND	ND	ND		69.0	ND
92		16.5	18.2	18.2	15.7	ND	ND	ND	ND		68.6	ND
93		19.3	17.2	17.2	15.8	ND	ND	ND	ND		69.5	ND
94		20.7	18.2	20.2	17.5	ND	ND	ND	ND		76.6	ND
95		19.3	17.2	20.2	16.8	ND	ND	ND	ND		73.5	ND

Figure 7. 2023 Group 1 Facility-related Dose

6. GROUP 2

Group 2 collected gamma data from 11 locations inside or on the perimeter of the LA.

6.1 2023 GROUP 2 QUARTERLY MEASURED FIELD DOSE

The M_F was successfully obtained from the Group 2 locations for the first, second, and third quarters. The fourth quarter M_F was not used because the D&R Contractor received notice from the vendor that the transit control dosimeter in the shipment to the D&R Contractor read 23 mrem. This dose was higher than the normal transit control dose for the first, second, and third quarters, which was 2 mrem for each quarter. The D&R Contractor sent another control dosimeter that was received in the original shipment back to the vendor to be read, and its result was also higher than normal at 27 mrem. These results indicated that the dosimeters were exposed to something during transit from the vendor to the D&R Contractor. Because the fourth quarter dosimeters were already in the field when the control dosimeter results were received and the fourth quarter M_F was suspect, the fourth quarter M_F was estimated for each monitoring location using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

Figure 8 shows the Group 2 quarterly M_F and includes decimal places not shown when rounding.

Quarter	1		2		3		4	
TLD Location Number	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)
3	66	14	90	18	90	20	92	17
4	66	14	90	18	90	19	92	17
5	66	14	90	20	90	20	92	18
6	66	12	90	16	90	16	92	15
52	66	13	90	15	90	15	92	14
59	74	10	87	14	88	14	93	13
60	74	312	87	373	88	307	93	331
61	74	427	87	576	88	573	93	525
62	74	12	87	15	88	15	93	14
63	74	10	87	14	88	15	93	13
65	66	11	90	14	90	14	92	13

Figure 8. 2023 Group 2 Quarterly M_F

6.2 2023 GROUP 2 NORMALIZED QUARTERLY MEASURED FIELD DOSE

Figure 9 shows the Group 2 M_Q and M_A and includes decimal places not shown when rounding.

Quarter	1	2	3	4	
Location	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_A (mrem)
3	19.3	18.2	20.2	17.1	74.9
4	19.3	18.2	19.2	16.8	73.5
5	19.3	20.2	20.2	17.8	77.6
6	16.5	16.2	16.2	14.5	63.4
52	17.9	15.2	15.2	14.2	62.4
59	12.3	14.6	14.5	12.4	53.8
60	383.7	390.1	317.5	323.6	1414.8
61	525.1	602.5	592.5	514.0	2234.1
62	14.8	15.7	15.5	13.7	59.7
63	12.3	14.6	15.5	12.7	55.2
65	15.2	14.2	14.2	12.9	56.3

Figure 9. 2023 Group 2 M_Q and M_A

6.3 2023 GROUP 2 FACILITY-RELATED DOSE

Group 2 collected gamma data from the LA and consisted of 11 TLD locations. The LA is not regularly accessible to members of the public and does not represent actual E to members of the public. Locations 60 and 61 indicate a facility-related dose during the monitoring period. Locations 60 and 61 are close to the

perimeter of the depleted uranium hexafluoride (DUF_6) facility or its operations, such as UF_6 cylinder relocation, so gamma dose rates at these locations are subject to change. Historically, these locations have shown facility-related doses.

Figure 10 shows the Group 2 determination of the 2023 F_Q and F_A for each monitoring location and includes decimal places not shown when rounding.

TLD Location	σB_Q (mrem)	2023 M_Q (mrem)				2023 $F_Q = M_Q - B_Q$ (mrem)				σB_A (mrem)	2023 M_A (mrem)	2023 $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
3	20.6	19.3	18.2	20.2	17.1	ND	ND	ND	ND	82.2	74.9	ND
4		19.3	18.2	19.2	16.8	ND	ND	ND	ND		73.5	ND
5		19.3	20.2	20.2	17.8	ND	ND	ND	ND		77.6	ND
6		16.5	16.2	16.2	14.5	ND	ND	ND	ND		63.4	ND
52		17.9	15.2	15.2	14.2	ND	ND	ND	ND		62.4	ND
59		12.3	14.6	14.5	12.4	ND	ND	ND	ND		53.8	ND
60		383.7	390.1	317.5	323.6	363.1	369.6	296.9	303.0		1414.8	1332.6
61		525.1	602.5	592.5	514.0	504.5	581.9	572.0	493.5		2234.1	2151.9
62		14.8	15.7	15.5	13.7	ND	ND	ND	ND		59.7	ND
63		12.3	14.6	15.5	12.7	ND	ND	ND	ND		55.2	ND
65		15.2	14.2	14.2	12.9	ND	ND	ND	ND		56.3	ND

Figure 10. 2023 Group 2 Facility-related Dose

7. GROUP 3

Group 3 collected gamma data from 24 locations outside the LA boundary and inside the PPA boundary.

7.1 2023 GROUP 3 QUARTERLY MEASURED FIELD DOSE

M_F was successfully obtained from the Group 3 locations for the first, second, and third quarters. The fourth quarter M_F was not used because the D&R Contractor received notice from the vendor that the transit control dosimeter in the shipment to the D&R Contractor read 23 mrem. This dose was higher than the normal transit control dose for the first, second, and third quarters, which was 2 mrem for each quarter. The D&R Contractor sent another control dosimeter that was received in the original shipment back to the vendor to be read, and its result was also higher than normal at 27 mrem. These results indicated that the dosimeters were exposed to something during transit from the vendor to the D&R Contractor. Because the fourth quarter dosimeters were already in the field when the control dosimeter results were received and the fourth quarter M_F was suspect, the fourth quarter M_F was estimated for each monitoring location using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

Figure 11 shows the Group 3 quarterly M_F and includes decimal places not shown when rounding.

Quarter	1		2		3		4	
TLD Location Number	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)
1	66	149	90	214	90	227	93	197
2	66	211	90	292	90	270	93	258
7	66	17	90	22	90	28	92	22
13	66	16	90	19	90	20	93	18
15	66	15	90	14	90	15	92	15
25	66	20	90	28	90	25	92	24
35	66	16	90	24	90	24	92	21
37	66	13	90	17	90	17	92	16
46	66	13	90	15	90	16	92	15
50	66	31	90	48	90	40	92	40
53	66	85	90	92	90	103	93	93
58	66	11	90	14	90	13	92	13
64	66	10	90	16	90	14	92	13
68	66	15	90	19	90	20	92	18
69	66	11	90	14	90	16	92	14
70	66	25	90	37	90	44	93	35
71	66	37	90	38	90	48	93	41
72	66	15	90	17	90	17	93	16
78	66	16	90	21	90	21	93	19
81	66	68	90	92	90	91	93	84
82	66	20	90	25	90	25	93	23
83	66	50	90	57	90	57	92	55
96	66	12	90	17	90	19	93	16
97	70	13	91	14	88	15	93	14

Figure 11. 2023 Group 3 Quarterly M_F

7.2 2023 GROUP 3 NORMALIZED QUARTERLY MEASURED FIELD DOSE

Figure 12 shows the Group 3 M_Q and M_A and includes decimal places not shown when rounding.

Quarter	1	2	3	4	
Location	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_A (mrem)
1	205.4	216.4	229.5	192.4	843.8
2	290.9	295.2	273.0	252.1	1111.3
7	23.4	22.2	28.3	22.1	96.1
13	22.1	19.2	20.2	17.9	79.4
15	20.7	14.2	15.2	14.5	64.5
25	27.6	28.3	25.3	24.1	105.2
35	22.1	24.3	24.3	21.1	91.7
37	17.9	17.2	17.2	15.5	67.8
46	17.9	15.2	16.2	14.5	63.8
50	42.7	48.5	40.4	39.2	171.0
53	117.2	93.0	104.1	91.3	405.7
58	15.2	14.2	13.1	12.5	55.0
64	13.8	16.2	14.2	13.2	57.3
68	20.7	19.2	20.2	17.8	77.9
69	15.2	14.2	16.2	13.5	59.0
70	34.5	37.4	44.5	34.6	150.9
71	51.0	38.4	48.5	40.1	178.1
72	20.7	17.2	17.2	16.0	71.0
78	22.1	21.2	21.2	18.9	83.4
81	93.8	93.0	92.0	81.9	360.7
82	27.6	25.3	25.3	22.8	101.0
83	68.9	57.6	57.6	54.1	238.3
96	16.5	17.2	19.2	15.7	68.6
97	16.9	14.0	15.5	13.7	60.1

Figure 12. 2023 Group 3 M_Q and M_A

7.3 2023 GROUP 3 FACILITY-RELATED DOSE

Group 3 collected gamma data from 24 locations outside the LA boundary and inside the PPA boundary. This area is not regularly accessible to members of the public and does not represent actual E to members of the public. Locations 1, 2, 25, 50, 53, 70, 71, 81, 82, and 83 indicated a facility-related dose during the monitoring period. These locations are close to the perimeter of the DUF_6 facility or its operations, such as UF_6 cylinder relocation, so gamma dose rates at these locations are subject to change. This may explain the fluctuations in dose throughout the monitoring period. Historically, these locations have shown facility-related doses.

Figure 13 shows the Group 3 determination of the 2023 F_Q and F_A for each monitoring location and includes decimal places not shown when rounding.

TLD Location	σB_Q (mrem)	2023 M_Q (mrem)				2023 $F_Q = M_Q - B_Q$ (mrem)				σB_A (mrem)	2023 M_A (mrem)	2023 $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
1	20.6	205.4	216.4	229.5	192.4	184.9	195.8	209.0	171.9	82.2	843.8	761.5
2		290.9	295.2	273.0	252.1	270.4	274.7	252.4	231.6		1111.3	1029.1
7		23.4	22.2	28.3	22.1	ND	ND	ND	ND		96.1	ND
13		22.1	19.2	20.2	17.9	ND	ND	ND	ND		79.4	ND
15		20.7	14.2	15.2	14.5	ND	ND	ND	ND		64.5	ND
25		27.6	28.3	25.3	24.1	ND	ND	ND	ND		105.2	23.0
35		22.1	24.3	24.3	21.1	ND	ND	ND	ND		91.7	ND
37		17.9	17.2	17.2	15.5	ND	ND	ND	ND		67.8	ND
46		17.9	15.2	16.2	14.5	ND	ND	ND	ND		63.8	ND
50		42.7	48.5	40.4	39.2	22.2	28.0	19.9	18.7		171.0	88.7
53		117.2	93.0	104.1	91.3	96.6	72.5	83.6	70.8		405.7	323.4
58		15.2	14.2	13.1	12.5	ND	ND	ND	ND		55.0	ND
64		13.8	16.2	14.2	13.2	ND	ND	ND	ND		57.3	ND
68		20.7	19.2	20.2	17.8	ND	ND	ND	ND		77.9	ND
69		15.2	14.2	16.2	13.5	ND	ND	ND	ND		59.0	ND
70		34.5	37.4	44.5	34.6	13.9	16.9	23.9	14.0		150.9	68.7
71		51.0	38.4	48.5	40.1	30.5	17.9	28.0	19.6		178.1	95.8
72		20.7	17.2	17.2	16.0	ND	ND	ND	ND		71.0	ND
78		22.1	21.2	21.2	18.9	ND	ND	ND	ND		83.4	ND
81		93.8	93.0	92.0	81.9	73.2	72.5	71.5	61.3		360.7	278.4
82		27.6	25.3	25.3	22.8	ND	ND	ND	ND		101.0	18.7
83		68.9	57.6	57.6	54.1	48.4	37.1	37.1	33.5		238.3	156.0
96		16.5	17.2	19.2	15.7	ND	ND	ND	ND		68.6	ND
97		16.9	14.0	15.5	13.7	ND	ND	ND	ND		60.1	ND

Figure 13. 2023 Group 3 Facility-related Dose

7.4 2023 FOOD VENDOR ESTIMATED NORMALIZED DOSE

Group 3 locations 96 and 97 were food vendor locations. Location 96 was not used by a food vendor in 2023, and location 97 was used by four food vendors. Location 97 did not show a facility-related dose, but an estimated E was calculated to show that the food vendors did not receive doses from DOE operations.

7.4.1 Equations Used to Determine Food Vendor Estimated Normalized Dose

Location 97 M_Q for each quarter shown in Figure 12 was divided by 2,184 hours (91 days × 24 hours) to determine an M_Q/hour for the location.

Food Vendor M_Q at the location = (M_Q/hour at location × Number of days Food Vendor at location) ÷ Number of hours/day at location

The background M_Q/hour for each quarter was determined by dividing the baseline background by 2,184 hours.

Background M_Q for time Food Vendor at location = (Background M_Q/hour at location × Number of days Food Vendor at location) ÷ Number of hours/day Food Vendor at location

Net Estimated M_Q = Calculated Food Vendor M_Q – Calculated Background M_Q

Estimated M_Q for Food Vendor = (First quarter Net Estimated M_Q + Second quarter Net Estimated M_Q + Third quarter Net estimated M_Q + Fourth quarter Net Estimated M_Q)

7.4.2 Food Vendor 1 Estimated Normalized Dose

Food Vendor 1 was at location 97 from February 6, 2023, through August 9, 2023.

The estimated M_Q for Food Vendor 1 was determined using the equations shown in Section 7.4.1.

Figure 14 shows the estimated M_Q for Food Vendor 1 at location 97 and includes decimal places not shown when rounding. Since the calculated estimated M_Q is a negative value, 0.0 mrem was assigned to the food vendor.

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
M_Q/hour at location (mrem)	0.008	0.006	0.007	N/A
Number of days Food Vendor at location	36	43	15	N/A
Number of hours/day Food Vendor at location	4	4	4	N/A
Food vendor M_Q at location (mrem)	0.070	0.069	0.027	N/A
Background M_Q/hour at location (mrem)	0.009	0.009	0.009	N/A
Background M_Q for time Food Vendor at location (mrem)	0.085	0.101	0.035	N/A
Net Estimated M_Q (mrem)	-0.015	-0.032	-0.009	N/A
Estimated M_Q for Food Vendor	**-0.056**			

Figure 14. 2023 Food Vendor 1 Estimated M_Q

7.4.3 Food Vendor 2 Estimated Normalized Dose

Food Vendor 2 was at location 97 from September 7, 2023, through January 11, 2024.

The estimated M_Q for Food Vendor 2 was determined using the equations shown in Section 7.4.1.

Figure 15 shows the estimated M_Q for Food Vendor 2 at location 97 and includes decimal places not shown when rounding. Since the calculated estimated M_Q is a negative value, 0.0 mrem was assigned to the food vendor.

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
M_Q/hour at location (mrem)	N/A	N/A	0.007	0.006
Number of days Food Vendor at location	N/A	N/A	6	11
Number of hours/day Food Vendor at location	N/A	N/A	2.5	2.5
Food vendor M_Q at location (mrem)	N/A	N/A	0.017	0.028
Background M_Q/hour at location (mrem)	N/A	N/A	0.009	0.009
Background M_Q for time Food Vendor at location (mrem)	N/A	N/A	0.023	0.041
Net Estimated M_Q (mrem)	N/A	N/A	-0.006	-0.014
Estimated M_Q for Food Vendor	**-0.019**			

Figure 15. 2023 Food Vendor 2 Estimated M_Q

7.4.4 Food Vendor 3 Estimated Normalized Dose

Food Vendor 3 was at location 97 from October 2, 2023, through January 11, 2024.

The estimated M_Q for Food Vendor 3 was determined using the equations shown in Section 7.4.1.

Figure 16 shows the estimated M_Q for Food Vendor 3 at location 97 and includes decimal places not shown when rounding. Since the calculated estimated M_Q is a negative value, 0.0 mrem was assigned to the food vendor.

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
M_Q/hour at location (mrem)	N/A	N/A	0.007	0.006
Number of days Food Vendor at location	N/A	N/A	1	11
Number of hours/day Food Vendor at location	N/A	N/A	3	3
Food vendor M_Q at location (mrem)	N/A	N/A	0.002	0.023
Background M_Q/hour at location (mrem)	N/A	N/A	0.009	0.009
Background M_Q for time Food Vendor at location (mrem)	N/A	N/A	0.003	0.035
Net Estimated M_Q (mrem)	N/A	N/A	-0.001	-0.012
Estimated M_Q for Food Vendor	**-0.012**			

Figure 16. 2023 Food Vendor 3 Estimated M_Q

7.4.5 Food Vendor 4 Estimated Normalized Dose

Food Vendor 4 was at location 97 from October 16, 2023, through January 11, 2024.

The estimated M_Q for Food Vendor 4 was determined using the equations shown in Section 7.4.1.

Figure 17 shows estimated M_Q for Food Vendor 4 at location 97 and includes decimal places not shown when rounding. Since the calculated estimated M_Q is a negative value, 0.0 mrem was assigned to the food vendor.

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
M_Q/hour at location (mrem)	N/A	N/A	N/A	0.006
Number of days Food Vendor at location	N/A	N/A	N/A	11
Number of hours/day Food Vendor at location	N/A	N/A	N/A	2.5
Food vendor M_Q at location (mrem)	N/A	N/A	N/A	0.028
Background M_Q/hour at location (mrem)	N/A	N/A	N/A	0.009
Background M_Q for time Food Vendor at location (mrem)	N/A	N/A	N/A	0.041
Net Estimated M_Q (mrem)	N/A	N/A	N/A	-0.014
Estimated M_Q for Food Vendor	**-0.014**			

Figure 17. 2023 Food Vendor 4 Estimated M_Q

8. GROUP 4

Group 4 collected gamma data from 11 locations outside the PPA boundary and inside the DOE boundary.

8.1 2023 GROUP 4 QUARTERLY MEASURED FIELD DOSE

The M_F was successfully obtained from all of the Group 4 locations for the first and second quarters of 2023, and from all but one location for the third quarter. In the third quarter, the TLD at location 77 was missing on the collection date, so an estimate was performed for this monitoring location. In the fourth quarter, the TLD at location 76 was missing on the collection date.

The fourth quarter M_F was not used because the D&R Contractor received notice from the vendor that the transit control dosimeter in the shipment to the D&R Contractor read 23 mrem. This dose was higher than the normal transit control dose for the first, second, and third quarters, which was 2 mrem for each quarter. The D&R Contractor sent another control dosimeter that was received in the original shipment back to the vendor to be read, and its result was also higher than normal at 27 mrem. These results indicated that the dosimeters were exposed to something during transit from the vendor to the D&R Contractor. Because the fourth quarter dosimeters were already in the field when the control dosimeter results were received and the fourth quarter M_F was suspect, the fourth quarter M_F was estimated for each monitoring location.

The third quarter missing TLD's M_F at location 77 was estimated using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter})$$

The fourth quarter M_F was estimated for each monitoring location using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

Figure 18 shows the Group 4 quarterly M_F and includes decimal places not shown when rounding.

Quarter	1		2		3		4	
TLD Location Number	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)
9	66	12	90	16	90	16	93	15
12	66	13	90	16	90	17	92	15
14	66	13	90	15	90	17	92	15
19	66	14	90	17	90	17	93	16
38	66	13	90	18	90	19	93	17
66	66	13	90	19	90	18	92	17
67	66	14	90	18	90	18	92	17
76	66	13	90	19	90	19	92	17
77	66	13	90	16	90	15	92	15
79	66	14	90	16	90	16	92	15
84	66	14	90	18	90	19	92	17

Figure 18. 2023 Group 4 Quarterly M_F

8.2 2023 GROUP 4 NORMALIZED QUARTERLY MEASURED FIELD DOSE

Figure 19 shows the Group 4 M_Q and M_A and includes decimal places not shown when rounding.

Quarter	1	2	3	4	
Location	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_A (mrem)
9	16.5	16.2	16.2	14.4	63.3
12	17.9	16.2	17.2	15.2	66.5
14	17.9	15.2	17.2	14.8	65.1
19	19.3	17.2	17.2	15.7	69.3
38	17.9	18.2	19.2	16.3	71.6
66	17.9	19.2	18.2	16.5	71.8
67	19.3	18.2	18.2	16.5	72.2
76	17.9	19.2	19.2	16.8	73.2
77	17.9	16.2	14.7	14.3	63.1
79	19.3	16.2	16.2	15.2	66.8
84	19.3	18.2	19.2	16.8	73.5

Figure 19. 2023 Group 4 M_Q and M_A

8.3 2023 GROUP 4 FACILITY-RELATED DOSE

Group 4 collected gamma data from 11 locations outside the PPA boundary and inside the DOE boundary. None of the locations indicated a facility-related dose.

Figure 20 shows the Group 4 determination of the 2023 F_Q and F_A for each monitoring location and includes decimal places not shown when rounding.

TLD Location	σB_Q (mrem)	2023 M_Q (mrem)				2023 $F_Q = M_Q - B_Q$ (mrem)				σB_A (mrem)	2023 M_A (mrem)	2023 $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
9		16.5	16.2	16.2	14.4	ND	ND	ND	ND		63.3	ND
12		17.9	16.2	17.2	15.2	ND	ND	ND	ND		66.5	ND
14		17.9	15.2	17.2	14.8	ND	ND	ND	ND		65.1	ND
19		19.3	17.2	17.2	15.7	ND	ND	ND	ND		69.3	ND
38		17.9	18.2	19.2	16.3	ND	ND	ND	ND		71.6	ND
66	20.6	17.9	19.2	18.2	16.5	ND	ND	ND	ND	82.2	71.8	ND
67		19.3	18.2	18.2	16.5	ND	ND	ND	ND		72.2	ND
76		17.9	19.2	19.2	16.8	ND	ND	ND	ND		73.2	ND
77		17.9	16.2	14.7	14.3	ND	ND	ND	ND		63.1	ND
79		19.3	16.2	16.2	15.2	ND	ND	ND	ND		66.8	ND
84		19.3	18.2	19.2	16.8	ND	ND	ND	ND		73.5	ND

Figure 20. 2023 Group 4 Facility-related Dose

9. GROUP 5

Group 5 collected gamma data from 7 locations outside the DOE boundary.

9.1 2023 GROUP 5 QUARTERLY MEASURED FIELD DOSE

The M_F was successfully obtained from all but one of the Group 5 TLD locations for the first quarter of 2023 and from all of the locations for the second and the third quarters. In the first quarter, the TLD at location 73 was missing on the collection date, so an estimate was performed for this monitoring location.

The fourth quarter M_F was not used because the D&R Contractor received notice from the vendor that the transit control dosimeter in the shipment to the D&R Contractor read 23 mrem. This dose was higher than the normal transit control dose for the first, second, and third quarters, which was 2 mrem for each quarter. The D&R Contractor sent another control dosimeter that was received in the original shipment back to the vendor to be read, and its result was also higher than normal at 27 mrem. These results indicated that the dosimeters were exposed to something during transit from the vendor to the D&R Contractor. Because the fourth quarter dosimeters were already in the field when the control dosimeter results were received and the fourth quarter M_F was suspect, the fourth quarter M_F was estimated for each monitoring location.

The first quarter missing TLD's M_F at location 73 was estimated using the following equation.

$$M_F = \text{Average } (M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

The fourth quarter M_F was estimated for each monitoring location using the following equation.

$$M_F = \text{Average } (M_F \text{ for first quarter} + M_F \text{ for second quarter} + M_F \text{ for third quarter})$$

Figure 21 shows the Group 5 quarterly M_F and includes decimal places not shown when rounding.

Quarter	1		2		3		4	
TLD Location Number	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)	Days in Field	M_F (mrem)
16	66	16	90	20	90	22	93	19
30	66	16	90	21	90	20	93	19
40	66	16	90	22	90	23	93	20
73	66	17	90	17	90	17	93	17
74	66	16	90	20	90	21	92	19
75	66	15	90	18	90	19	92	17
80	66	14	90	17	90	17	93	16

Figure 21. 2023 Group 5 Quarterly M_F

9.2 2023 GROUP 5 NORMALIZED QUARTERLY MEASURED FIELD DOSE

Figure 22 shows the Group 5 M_Q and M_A and includes decimal places not shown when rounding.

Quarter	1	2	3	4	
Location	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_Q (mrem)	M_A (mrem)
16	22.1	20.2	22.2	18.9	83.4
30	22.1	21.2	20.2	18.6	82.1
40	22.1	22.2	23.3	19.9	87.5
73	23.4	17.2	17.2	16.6	74.5
74	22.1	20.2	21.2	18.8	82.3
75	20.7	18.2	19.2	17.1	75.2
80	19.3	17.2	17.2	15.7	69.3

Figure 22. 2023 Group 5 M_Q and M_A

9.3 2023 GROUP 5 FACILITY-RELATED DOSE

Group 5 collected gamma data from seven locations outside the DOE boundary and in the licensed portion of the DOE Reservation. None of the locations indicated a facility-related dose.

Figure 23 shows the Group 5 determination of the 2023 F_Q and F_A for each monitoring location and includes decimal places not shown when rounding.

TLD Location	σB_Q (mrem)	2023 M_Q (mrem)				2023 $F_Q = M_Q - B_Q$ (mrem)				σB_A (mrem)	2023 M_A (mrem)	2023 $F_A = M_A - B_A$ (mrem)
		1	2	3	4	1	2	3	4			
16	20.6	22.1	20.2	22.2	18.9	ND	ND	ND	ND	82.2	83.4	ND
30		22.1	21.2	20.2	18.6	ND	ND	ND	ND		82.1	ND
40		22.1	22.2	23.3	19.9	ND	ND	ND	ND		87.5	ND
73		23.4	17.2	17.2	16.6	ND	ND	ND	ND		74.5	ND
74		22.1	20.2	21.2	18.8	ND	ND	ND	ND		82.3	ND
75		20.7	18.2	19.2	17.1	ND	ND	ND	ND		75.2	ND
80		19.3	17.2	17.2	15.7	ND	ND	ND	ND		69.3	ND

Figure 23. 2023 Group 5 Facility-related Dose

10. 2023 NEUTRON MONITORING AND RESULTS

Locations 2, 3, 50, 65, 68, 81, and 83 were monitored for external neutron radiation using OSL dosimeters. All neutron results but one were collected and reported as "M" (i.e., dose equivalents below the minimum measurable quantity). The second quarter result for location 2 was not reported, so an average of the other three quarters was used, and location 2 was also assigned "M". Therefore, analysis of neutron dose was not required, and no dose equations were used.

11. ANALYSIS AND CONCLUSION

Since the fall of 2001, security controls have been in place to restrict public access to areas adjacent to the LA. In 2019, a PPA boundary fence was added to restrict public access to areas between the LA boundary and the PPA boundary.

In 2023, 12 out of 64 locations showed facility-related doses. All 12 were either within the LA boundary or between the LA boundary and the PPA boundary, which is not regularly accessible to the public. This means the potential external radiation dose calculated from these locations was not representative of the actual public external radiation dose. All 12 locations were the areas with the highest historically measured doses throughout the monitoring period. These locations were adjacent to or in close proximity to the UF_6 cylinder storage yards.

Figure 24 shows the M_A and M_A/hour associated with these 12 locations and includes decimal places not shown when rounding.

Location	M_A (mrem)	M_A/hour (mrem)
1	843.8	0.097
2	1111.3	0.127
25	105.2	0.012
50	171.0	0.020
53	405.7	0.046
60	1414.8	0.162
61	2234.1	0.256
70	150.9	0.017
71	178.1	0.020
81	360.7	0.041
82	101.0	0.012
83	238.3	0.027
	Average	0.070

Figure 24. Locations with Facility-related Dose

11.1 PUBLIC DOSE FROM DIRECT EXPOSURE TO DOE OPERATIONS

In 2023, monitoring locations 1 and 2 showed facility-related doses, and these locations are in close proximity to the PPA boundary. Group 4 monitoring locations are the nearest monitoring locations outside the PPA boundary and inside the DOE boundary, and they are within the West Kentucky Wildlife Management Area (WKWMA). No residences or businesses are located in the WKWMA.

The M_A for Group 4 locations were statistically equivalent to naturally occurring background but below the calculated background for the site. Because dose is inversely proportional to the distance from the source and the nearest private residences to location 1 and 2 are approximately 6,500 and 5,500 ft away, respectively, the potential E at the private residences were also equivalent to naturally occurring background. Therefore, the potential E to a member of the public from direct exposure to DOE operations was 0.0E+00 mrem.

11.2 PUBLIC DOSE IN AREAS FREELY ACCESSIBLE

In 2023, location 14 was freely accessible to members of the public. Location 14 is near Harmony Cemetery and is located north of the LA boundary and south of Ogden Landing Road. The M_A for location 14 was statistically equivalent to naturally occurring background but below the calculated background for the site. Therefore, the potential E to a member of the public at this location was 0.0E+00 mrem.

11.3 PUBLIC DOSE AT THE DOE BOUNDARY

The monitoring location along the DOE boundary with the highest annual dose was location 40, which was located outside the DOE boundary and within the WKWMA, off Dyke Road.

Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, Volume 1. Human Health (RMD) was used to determine a reasonable maximum exposure at this location. RMD Table B.5 lists an adult recreational user exposure frequency of 104 days and exposure duration of 10 hours per day (DOE 2023).

Figure 23 shows an M_A of 87.5 mrem at location 40, and the calculated background was 82.2 mrem. The difference between the dose at location 40 and the calculated background dose is 5.3 mrem (87.5 – 82.2 = 5.3). A standardized quarter is 91 days, and, because there are four quarters in a year, there are 364 days in a standardized year (91 × 4 = 364).

Using this information above and the following equation, a potential E was determined.

(5.3 mrem × 104 days per year × 10 hours per day) ÷ (364 days per year × 24 hours per day) = 0.63 mrem

A member of the public would receive a potential E of 6.3E-01 mrem at the DOE boundary.

11.4 MAXIMALLY EXPOSED INDIVIDUAL DOSE

The MEI scenario was applied to a member of the public passing through accessible portions of the DOE Reservation where areas of highest exposure were visited.

The RMD does not provide reasonable maximum exposure information for this scenario, so the following assumptions were used.

- The accessible portions of the DOE Reservation are outside the PPA boundary.
- The average dose rate of 0.070 mrem per hour is the facility-related dose rate that represents the dose rate to the member of the public (Figure 24).
- The member of the public was an outdoor site visitor with an occupancy factor of 80 hours per year.

Using the assumptions above and the following equation, a potential E was determined.

0.070 mrem per hour × 80 hours = 5.6 mrem

The potential E received by the MEI was 5.6E+00 mrem.

An estimated potential collective E was calculated by multiplying the dose to the MEI from the preceding equation by a total estimated number of visitors hiking within the WKWMA annually (i.e., 150 persons, as listed in the RMD), which resulted in a representative collective dose of 8.4E-01 person-rem as shown by the following equation.

5.6 mrem × 1 rem/1000 mrem × 150 persons = 0.84 person-rem

A review of previous annual external radiation monitoring reports indicates that the MEI and collective population potential E for 2023 was higher than in the previous five years, but is consistent with previous years (FRNP 2019; FRNP 2020; FRNP 2021; FRNP 2022; FRNP 2023).

Figure 25 shows the results from 2018 through 2023 and includes decimal places not shown when rounding.

	2018	2019	2020	2021	2022	2023
MEI potential E	5.0E+00	3.0E+00	4.1E+00	3.6E+00	4.2E+00	5.6E+00
Collective population potential (person-rem/year)	7.5E-01	4.5E-01	6.1E-01	5.4E-01	6.3E-01	8.4E-01

Figure 25. Comparison of MEI and Collective Population Potential E

11.5 CONCLUSION

The dose from the direct radiation pathway is evaluated by its contribution to the DOE total dose limit of 100 mrem per year from all relevant pathways (i.e., air, surface water, sediment, direct radiation). For comparison purposes, in 2023, the estimated dose from the direct radiation pathway from the Paducah Site was 5.6E+00 mrem, which represents 5.6% of the DOE annual dose limit and 22.4% of the 25 mrem radioactive waste public dose constraint.

12. REFERENCES

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APPENDIX

DOSIMETER LOCATIONS AND COLLECTION DATES

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ACRONYMS

DOE	U.S. Department of Energy
KOW	Kentucky Ordinance Works
KPDES	Kentucky Pollutant Discharge Elimination System
NSDD	North-South Diversion Ditch
PGDP	Paducah Gaseous Diffusion Plant
TLD	thermoluminescent dosimeter
WKWMA	West Kentucky Wildlife Management Area

Table A.1. Location Name, Description, and Coordinates

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-1	Paducah Gaseous Diffusion Plant (PGDP) security fence west of C-745-M Cylinder Storage Yard near intersection of Patrol Road and Alabama Avenue near pole 21-20. Outside fence behind the depleted uranium hexafluoride (DUF_6) dirt pile.	N 37 06 16.66	W 088 48 55.18	-4172	-5856
TLD-2	PGDP security fence south of C-745-T Cylinder Storage Yard near pole T20-6J. South cylinder yard perimeter fence.	N 37 06 02.15	W 088 48 43.07	-2740	-6427
TLD-3	PGDP security fence east of C-745-H Cylinder Storage Yard near pole 23-31. Perimeter fence northeast corner.	N 37 07 04.17	W 088 47 57.21	-1399	739
TLD-4	North PGDP security fence near the North-South Diversion Ditch (NSDD).	N 37 07 15.74	W 088 48 25.56	-3957	1052
TLD-5	North PGDP security fence north of C-747-A Cylinder Storage Yard near pole T53A1P26G. North perimeter fence between lagoons.	N 37 07 24.38	W 088 48 54.58	-6464	1068
TLD-6	PGDP security fence west of C-746-P1 Scrap Metal Yard (West) near pole 22-4. 612 perimeter fence.	N 37 07 20.85	W 088 49 07.22	-7303	382
TLD-7	PGDP perimeter fence adjacent to Curlee Road near entrance to U.S. Department of Energy (DOE) building (C-103). Perimeter fence across from entrance to DOE building.	N 37 06 29.15	W 088 49 02.49	-5153	-4400
TLD-9	Northeast corner of fence of old Kentucky Ordnance Works (KOW) water treatment plant, near MW309. Gate to MW305.	N 37 06 37.12	W 088 49 48.11	-8901	-4907
TLD-12	Institutional controls fence near MW191 where Little Bayou Creek crosses U.S. Highway 358. MW191, Little Bayou, and Ogden Landing Road.	N 37 06 49.62	W 088 47 11.44	2588	626
TLD-13	West fence of C-746-U Landfill near entrance gate.	N 37 07 48.17	W 088 48 00.61	-3182	4825

Table A.1. Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-14	Institutional controls fence along the NSDD on west side of 14th street extension near Highway 358 (K003). Fence at NSDD, north of MW353.	N 37 07 29.75	W 088 48 10.58	-3302	2798
TLD-15	Northeast corner of C-755 fence behind C-755-D Electrical Storage.	N 37 06 45.01	W 088 47 58.91	-864	-1129
TLD-16	West Kentucky Wildlife Management Area (WKWMA) Clubhouse on northwest corner porch post. On porch WKWMA headquarters.	N 37 07 59.44	W 088 48 49.76	-7311	4533
TLD-19	Past pond on right "A" sign next to MW426.	N 37 07 24.43	W 088 49 33.11	-9398	2
TLD-22	Outside of the fence of the locked air sampling station at the rear corner of the Bethel Cumberland Presbyterian Church Cemetery.	N 37 00 05.36	W 088 52 36.29	-8159	-46801
TLD-25	On power line tower nearest Dyke Road southeast of C-745-T Cylinder Storage Yard.	N 37 06 00.02	W 088 48 26.49	-1401	-6172
TLD-30	Take the road by PGDP landfills, drive past MW98 and MW235. At intersection, the TLD is hung on the inside of the "Warning Fiber Optic" sign at Boldry School Road, west of MW381.	N 37 08 21.060	W 088 45 09.060	-4836	7876
TLD-35	Kentucky Pollutant Discharge Elimination System (KPDES) Outfall 017 off of the plant access road. KPDES Outfall 017 DUF_6 laydown yard.	N 37 06 21.480	W 088 49 03.960	-4773	-5806
TLD-37	KPDES Outfall 001 behind the Vortec site. K001.	N 37 07 18.600	W 088 49 15.660	-8202	138
TLD-38	Five-Points Creek with concrete bridge, on tree behind the "2A" sign.	N 37 06 43.320	W 088 50 09.000	-10630	-4528
TLD-40	Turn north on Kelly Road off Woodville Road, go about ½ mile on Kelly Road and then turn left, go about ½ mile. TLD is placed with in trees on left. Orange sign on blocked road, east of 57 off Dyke Road.	N 37 05 52.200	W 088 48 52.20	-2818	-7551

Table A.1. Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-46	Truck entrance at receiving C-720 Maintenance and Storage Building.	N 37 06 44.700	W 088 49 00.120	-5198	-2865
TLD-50	West Patrol Road fence across from C-745-A Cylinder Storage Yard.	N 37 07 02.88	W 088 49.15.18	-7287	-1547
TLD-52	East Patrol Road fence across from C-745-E Cylinder Storage Yard.	N 37 06 42.18	W 088 48.07.20	-1397	-1628
TLD-53	Security fence at southeast corner of C-745-T Cylinder Storage Yard. Down fence line away from TLD-2.	N 37 06 00.42	W 088 48.37.02	-2220	-6423
TLD-58	West-central C-755 complex.	N 59 07 98.00	E 22 88 70.74	-1209	-1422
TLD-59	C-752-A Waste Storage Facility break area.	N 59 15 61.62	E 22 78 55.79	-5234	-339
TLD-60	C-333-A Feed Vaporization Facility light pole on fence pole #16.	N 59 02 07.10	E 22 80 71.62	-2919	-4199
TLD-61	West of C-746-Q light pole #14.	N 59 01 58.14	E 22 80 98.35	-2778	-4315
TLD-62	C-743 trailer complex light pole #336, behind trailer #3.	N 59 10 20.18	E 22 73 49.81	-6111	-2607
TLD-63	C-412 health physics break trailer.	N 59 08 36.46	E 22 79 46.95	-4069	-2435
TLD-64	C-764 T-6 Trailer.	N 59 11 77.55	E 22 70 88.88	-7098	-2447
TLD-65	Located outside of north security fence north of C-745-H Cylinder Storage Yard; south of C-762 Gravel Laydown Yard with Metal Shed.	N 37 07 08.54386	W 088 48 00.45376	-1795	1062
TLD-66	Located on tree at southeast corner of New Harmony Cemetery; adjacent to last concrete barrier and large metal post.	N 37 07 15.80859	W 088 48 11.08836	-2856	1457
TLD-67	Located on “No Trespassing” sign, north side of Dyke Road, next to security fence north of C-762 Gravel Laydown Yard with Metal Shed.	N 37 07 12.70502	W 088 47 56.75697	-1658	1560
TLD-68	West security fence west of C-745-B Cylinder Storage Yard and southeast of the Vortec site.	N 37 07 11.60797	W 088 49 11.43416	-7302	-617
TLD-69	Wooden utility pole (T12-15 H) next to gravel road at northeast corner of pond north of C-611 complex.	N 37 07 13.70394	W 088 49 28.37928	-8664	-888

Table A.1. Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-70	Outside of west security fence southeast of C-333, midway between C-810 Parking Area and north DUF_6 security fence.	N 37 06 27.82855	W 088 48 50.25203	-4173	-4189
TLD-71	Outside of west security fence of DUF_6 under security light, northeast of wooden utility pole (11056 KU 78487).	N 37 06 23.05971	W 088 48 59.65074	-4723	-4903
TLD-72	North side of air monitoring station AMD57, northwest of Post 57.	N 37 05 55.32798	W 088 49 15.28582	-4952	-7972
TLD-73	Eastern "Railroad Crossing" sign at train tracks on Acid Road.	N 37 06 06.14205	W 088 50 02.01070	-8883	-8241
TLD-74	Located on "Warning Siren" sign at turnoff north of Magruder Road and Woodville Road intersection.	N 37 05 10.96196	W 088 48 53.61411	-1765	-11586
TLD-75	Located on "Warning Siren" sign at north of Kelley Road and Woodville Road intersection.	N 37 05 04.94525	W 088 48 26.65157	496	-11409
TLD-76	Located on "Tract A" sign below power lines, south side of Kelley Road in sharp curve between Woodville Road and McCaw Road.	N 37 05 55.05466	W 088 48 06.27328	310	-6082
TLD-77	Located on "Warning Siren" sign north side of McCaw Road east of Kelley Road intersection.	N 37 06 25.46598	W 088 47 33.66599	1737	-2287
TLD-78	Northeast corner of C-746-U landfill security fence.	N 37 07 54.00752	W 088 47 37.45924	-1622	6020
TLD-79	Located on left post of the "Wildlife Management" gate on New Waterline Road southwest of plant gate 41A west of C-612.	N 37 07 28.86304	W 88 49 12.50003	-7981	993
TLD-80	Located on "cattle" gate west of MW453 and MW454 on gravel road east of New Waterline Road.	N 37 07 47.29850	W 088 48 46.10944	-6612	3477
TLD-81	Southeast corner of DUF_6 security fence next to gate V1 east of New Waterline east of C-1100 Administration Building.	N 37 06 18.33947	W 088 48 56.42591	-4314	-5262
TLD-82	Short pole east of Dyke Road north of KPDES Outfall 13.	N 37 06 10.13175	W 088 48 13.53048	-765	-4851

Table A.1. Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-83	Large metal power pole west of Dyke Road south of KPDES Outfall 13.	N 37 06 07.30640	W 088 48 20.71726	-1214	-5319
TLD-84	Located at MW496 on the east side of Dyke Road.	N 37 07 03.50589	W 088 47 49.26485	-769	894
TLD-86	Plant entrance, gravel construction road. Right side on “orange warning signal” sign.	N 37 5 18.8622	W 088 49 28.2282	-4676	-11794
TLD-87	KOW entrance north of Woodville Road north of Kevil Eagles. Right side on “orange warning signal” sign.	N 37 05 24.2802	W 088 50 43.9548	-10629	-13381
TLD-88	Bethel Church Road KOW entrance. North of Massey Road, right side on yellow post.	N 37 07 05.4876	W 088 50 37.9608	-13677	-3597
TLD-89	Bobo Road, off Bethel Church Road. Continue east 200 yards past end of asphalt. At intersection on “orange warning signal” sign.	N 37 07 35.9976	W 088 49 44.3922	-10657	788
TLD-90	Bridge on Ogden Landing Road east of Lamb’s garage. On northeast corner of bridge on “contaminated creek” sign.	N 37 08 54.6714	W 088 47 27.2472	-12310	7182
TLD-91	Boldry School Road on KOW at Shawnee plant entrance. On Cattle Gate Road on hill, right side.	N 37 08 40.9884	W 088 49 36.5232	-2952	12069
TLD-92	Second road on right past C-746-U Landfill, cross Iron Bridge, on ICM-02DOE Notice sign on the left.	N 37 08 23.18	W 088 47 25.41	-1717	9125
TLD-93	MW100, north on Metropolis Lake Road past railroad tracks on left side on well bollard.	N 37 08 09.0744	W 088 46 50.9304	4874	7186
TLD-94	Residence; corner of Ogden Landing Road and Metropolis Lake Road.	N 37 05 48.9294	W 088 47 12.4332	4740	436
TLD-95	West McCracken Health Clinic, Metropolis Lake Road. On light pole in southwest corner of parking lot.	N 37 06 40.5468	W 088 46 47.2872	4617	-5167

Table A.1. Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Latitude (DMS)	West or East Longitude (DMS)	X coordinate (ft.)	Y coordinate (ft.)
TLD-96	C-810 Parking Lot on Swift and Staley Inc. "Operations and Maintenance Parking Only" sign. Fourth sign—TLD facing south toward DUF_6 facility.	N 37 06 34.11	W 88 48 50.9616	-4447	-3610
TLD-97	East side of C-100 Administration Building on light pole T13-A.	N 37 06 36.9649	W 88 48 47.1533	-4256	-3233
TLD-FB	Taken along while placing and collecting all other samples—stored in "lead box" at C-101 dosimetry office.	Not applicable (N/A)	N/A	N/A	N/A
TLD-TB	Stored in "lead box" at C-101 dosimetry office.	N/A	N/A	N/A	N/A

Table A.2. First Quarter Issue and Collection Dates

Date/Time Issued Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
2/6/23 13:04 4790-625	MQ	4/13/23 09:33	MQ	TLD-1	Not applicable (N/A)
2/6/23 12:50 4793-626 and 2882	MQ	4/13/23 09:02	MQ	TLD-2	N/A
2/6/23 12:26 4794-627 and 2883	MQ	4/13/23 08:25	MQ	TLD-3	N/A
2/6/23 14:00 4795-628	MQ	4/13/23 10:49	MQ	TLD-4	N/A
2/6/23 13:56 4796-629	MQ	4/13/23 10:39	MQ	TLD-5	N/A
2/6/23 13:48 4797-630	MQ	4/13/23 10:32	MQ	TLD-6	N/A
2/6/23 13:23 4798-631	MQ	4/13/23 1001	MQ	TLD-7	N/A
2/6/23 10:02 4799-632	MQ	4/13/23 14:50	MQ	TLD-9	N/A
2/6/23 09:00 4800-633	MQ	4/13/23 13:17	MQ	TLD-12	N/A
2/6/23 09:04 4801-634	MQ	4/13/23 08:20	MQ	TLD-13	N/A
2/6/23 13:04 4790-625	MQ	4/13/23 09:33	MQ	TLD-14	N/A
2/6/23 12:50 4793-626	MQ	4/13/23 09:02	MQ	TLD-15	N/A
2/6/23 09:31 4804-637	MQ	4/13/23 14:14	MQ	TLD-16	N/A
2/6/23 09:55 4805-638	MQ	4/13/23 14:35	MQ	TLD-19	N/A
2/6/23 08:01 4806-639	MQ	4/13/23 12:34	MQ	TLD-22	N/A
2/6/23 12:43 4807-640	MQ	4/13/23 08:55	MQ	TLD-25	N/A
2/6/23 09:24 4808-641	MQ	4/13/23 14:07	MQ	TLD-30	N/A
2/6/23 13:20 4809-642	MQ	4/13/23 09:59	MQ	TLD-35	N/A
2/6/23 13:45 4810-643	MQ	4/13/23 10:30	MQ	TLD-37	N/A
2/6/23 10: 00 4811-644	MQ	4/13/23 14:47	MQ	TLD-38	N/A
2/6/23 12:47 4812-645	MQ	4/13/23 08:58	MQ	TLD-40	N/A
2/6/23 13:27 4813-646	MQ	4/13/23 10:04	MQ	TLD-46	N/A
2/6/23 13:40 4814-647 and 2884	MQ	4/13/23 10:25	MQ	TLD-50	N/A
2/6/23 11:59 4815-648	MQ	4/13/23 07:50	MQ	TLD-52	N/A

Table A.2. First Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
2/6/23 12:55 4816-649	MQ	4/13/23 09:03	MQ	TLD-53	N/A
2/6/23 12:02 4818-651	MQ	4/13/23 08:01	MQ	TLD-58	N/A
2/2/23 14:40 4819-652	MQ	4/17/23 08:02	BH	TLD-59	N/A
2/2/23 14:29 4820-653	MQ	4/17/23 08:17	BH	TLD-60	N/A
2/2/23 14:31 4821-654	MQ	4/17/23 08:19	BH	TLD-61	N/A
2/2/23 14:47 4822-655	MQ	4/17/23 07:50	BH	TLD-62	N/A
2/2/23 15:10 4823-656	MQ	4/17/23 08:14	BH	TLD-63	N/A
2/6/23 14:50 4824-657	MQ	4/13/23 10:56	MQ	TLD-64	N/A
2/6/23 12:27 4825-658 and 2885	MQ	4/13/23 0830	MQ	TLD-65	N/A
2/6/23 12:17 4826-659	MQ	4/13/23 08:14	MQ	TLD-66	N/A
2/6/23 12:14 4827-660	MQ	4/13/23 08:12	MQ	TLD-67	N/A
2/6/23 13:42 4828-661 and 2886	MQ	4/13/23 10:27	MQ	TLD-68	N/A
2/6/23 13:36 4829-662	MQ	4/13/23 10:17	MQ	TLD-69	N/A
2/6/23 13:14 4830-663	MQ	4/13/23 09:54	MQ	TLD-70	N/A
2/6/23 13:12 4831-664	MQ	4/13/23 0950	MQ	TLD-71	N/A
2/6/23 13:01 4832-665	MQ	4/13/23 09:10	MQ	TLD-72	N/A
2/6/23 10:09 4833-666	MQ	Discovered missing on 4/13/2023	MQ	TLD-73	Estimate will be performed based on results of other quarters.
2/6/23 08:34 4834-667	MQ	4/13/23 12:51	MQ	TLD-74	N/A
2/6/23 08:36 4835-668	MQ	4/13/23 12:54	MQ	TLD-75	N/A
2/6/23 08:41 4836-669	MQ	4/13/23 12:58	MQ	TLD-76	N/A
2/6/23 08:45 4837-670	MQ	4/13/23 13:03	MQ	TLD-77	N/A
2/6/23 09:07 4838-671	MQ	4/13/23 13:20	MQ	TLD-78	N/A
2/6/23 13:52 4839-672	MQ	4/13/23 10:35	MQ	TLD-79	N/A
2/6/23 09:29 4840-673	MQ	4/13/23 14:12	MQ	TLD-80	N/A

Table A.2. First Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
2/6/23 13:07 4841-674 and 2887	MQ	4/13/23 09:38	MQ	TLD-81	N/A
2/6/23 12:35 4842-675	MQ	4/13/23 08:44	MQ	TLD-82	N/A
2/6/23 12:41 4843-676 and 2888	MQ	4/13/23 08:50	MQ	TLD-83	N/A
2/6/23 12:12 4844-677	MQ	4/13/23 08:10	MQ	TLD-84	N/A
2/6/23 08:31 4846-679	MQ	4/13/23 12:49	MQ	TLD-86	N/A
2/6/23 10:14 4847-680	MQ	4/13/23 15:07	MQ	TLD-87	N/A
2/6/23 09:48 4848-681	MQ	4/13/23 14:29	MQ	TLD-88	N/A
2/6/23 09:44 4849-682	MQ	4/13/23 14:25	MQ	TLD-89	N/A
2/6/23 09:40 4850-683	MQ	4/13/23 14:20	MQ	TLD-90	N/A
2/6/23 09:20 4851-684	MQ	4/13/23 14:03	MQ	TLD-91	N/A
2/6/23 09:13 4852-685	MQ	4/13/23 13:55	MQ	TLD-92	N/A
2/6/23 08:54 4853-686	MQ	4/13/23 13:11	MQ	TLD-93	N/A
2/6/23 08:58 4854-687	MQ	4/13/23 13:14	MQ	TLD-94	N/A
2/6/23 08:49 4855-688	MQ	4/13/23 13:06	MQ	TLD-95	N/A
2/6/23 13:17 4856-689	MQ	4/13/23 09:56	MQ	TLD-96	N/A
2/2/23 14:19 4859-692	MQ	4/13/23 15:17	BH	TLD-97	N/A
2/6/23 15:00 4857-690	BH	4/17/23 08:30	BH	TLD-FB	N/A
2/2/23 11:30 4858-691	BH	4/13/23 07:30	BH	TLD-TB	N/A

Table A.3. Second Quarter Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
04/13/23 09:35 5894-625	MQ	7/12/2023 9:47	BH	TLD-1	N/A
04/13/23 09:02 5897-626 and 2882	MQ	7/12/2023 9:32	BH	TLD-2	N/A
04/13/23 08:25 5898-627 and 2883	MQ	7/12/2023 07:57	BH	TLD-3	N/A
04/13/23 10:49 5899-628	MQ	7/12/2023 10:42	BH	TLD-4	N/A
04/13/23 10:39 5900-629	MQ	7/12/2023 10:36	BH	TLD-5	N/A
04/13/23 10:32 5901-630	MQ	7/12/2023 10:27	BH	TLD-6	N/A
04/13/23 10:01 5902-631	MQ	7/12/2023 10:03	BH	TLD-7	N/A
04/13/23 14:50 5903-632	MQ	7/12/2023 15:00	BH	TLD-9	N/A
04/13/23 13:17 5904-633	MQ	7/12/2023 13:29	BH	TLD-12	N/A
04/13/23 08:20 5905-634	MQ	7/12/2023 13:36	BH	TLD-13	N/A
04/13/23 08:22 5906-635	MQ	7/12/2023 07:51	BH	TLD-14	N/A
04/13/23 08:05 5907-636	MQ	7/12/2023 07:41	BH	TLD-15	N/A
04/13/23 14:14 5908-637	MQ	7/12/2023 14:16	BH	TLD-16	N/A
04/13/23 14:35 5909-638	MQ	7/12/2023 14:45	BH	TLD-19	N/A
04/13/23 12:34 5910-639	MQ	7/12/2023 12:35	BH	TLD-22	N/A
04/13/23 08:55 5911-640	MQ	7/12/2023 9:26	BH	TLD-25	N/A
04/13/23 14:07 5912-641	MQ	7/12/2023 14:01	BH	TLD-30	N/A
04/13/23 09:59 5913-642	MQ	7/12/2023 10:01	BH	TLD-35	N/A
04/13/23 10:30 5914-643	MQ	7/12/2023 10:23	BH	TLD-37	N/A
04/13/23 14:47 5915-644	MQ	7/12/2023 14:53	BH	TLD-38	N/A
04/13/23 08:58 5916-645	MQ	7/12/2023 9:30	BH	TLD-40	N/A
04/13/23 10:04 5917-646	MQ	7/12/2023 10:06	BH	TLD-46	N/A
04/13/23 10:25 5918-647 and 2884	MQ	7/12/2023 10:19	BH	TLD-50	N/A
04/13/23 07:50 5919-648	MQ	7/12/2023 7:35	BH	TLD-52	N/A

Table A.3. Second Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
04/13/23 09:03 5920-649	MQ	7/12/2023 9:35	BH	TLD-53	N/A
04/13/23 08:01 5922-651	MQ	7/12/2023 7:39	BH	TLD-58	N/A
04/17/23 08:02 5923-652	MQ	7/13/2023 8:26	BH	TLD-59	N/A
04/17/23 08:17 5924-653	MQ	7/13/2023 8:11	BH	TLD-60	N/A
04/17/23 08:19 5925-654	MQ	7/13/2023 8:12	BH	TLD-61	N/A
04/17/23 07:50 5926-655	MQ	7/13/2023 8:33	BH	TLD-62	N/A
04/17/23 08:14 5927-656	MQ	7/13/2023 8:16	BH	TLD-63	N/A
04/13/23 10:56 5928-657	MQ	7/12/2023 10:52	BH	TLD-64	N/A
04/13/23 08:30 5929-658 and 2885	MQ	7/12/2023 07:59	BH	TLD-65	N/A
04/13/23 08:14 5930-659	MQ	7/12/2023 7:49	BH	TLD-66	N/A
04/13/23 08:12 5931-660	MQ	7/12/2023 7:47	BH	TLD-67	N/A
04/13/23 10:27 5932-661 and 2886	MQ	7/12/2023 10:21	BH	TLD-68	N/A
04/13/23 10:17 5933-662	MQ	7/12/2023 10:11	BH	TLD-69	N/A
04/13/23 09:54 5934-663	MQ	7/12/2023 9:54	BH	TLD-70	N/A
04/13/23 09:50 5935-664	MQ	7/12/2023 9:51	BH	TLD-71	N/A
04/13/23 09:10 5936-665	MQ	7/12/2023 9:42	BH	TLD-72	N/A
04/13/23 15:00 5937-666	MQ	7/12/2023 15:09	BH	TLD-73	N/A
04/13/23 12:51 5938-667	MQ	7/12/2023 12:59	BH	TLD-74	N/A
04/13/23 12:54 5939-668	MQ	7/12/2023 13:02	BH	TLD-75	N/A
04/13/23 12:58 5940-669	MQ	7/12/2023 13:08	BH	TLD-76	N/A
04/13/23 13:03 5941-670	MQ	7/12/2023 13:13	BH	TLD-77	N/A
04/13/23 13:20 5942-671	MQ	7/12/2023 13:39	BH	TLD-78	N/A
04/13/23 10:35 5943-672	MQ	7/12/2023 10:32	BH	TLD-79	N/A
04/13/23 14:12 5944-673	MQ	7/12/2023 14:12	BH	TLD-80	N/A

Table A.3. Second Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
04/13/23 09:38 5945-674 and 2887	MQ	7/12/2023 09:49	BH	TLD-81	N/A
04/13/23 08:44 5946-675	MQ	7/12/2023 8:15	BH	TLD-82	N/A
04/13/23 08:50 5947-676 and 2888	MQ	7/12/2023 09:21	BH	TLD-83	N/A
04/13/23 08:10 5948-677	MQ	7/12/2023 7:46	BH	TLD-84	N/A
04/13/23 12:49 5950-679	MQ	7/12/2023 12:53	BH	TLD-86	N/A
04/13/23 15:07 5951-680	MQ	7/12/2023 15:21	BH	TLD-87	N/A
04/13/23 14:29 5952-681	MQ	7/12/2023 14:31	BH	TLD-88	N/A
04/13/23 14:25 5953-682	MQ	7/12/2023 14:26	BH	TLD-89	N/A
04/13/23 14:20 5954-683	MQ	7/12/2023 14:21	BH	TLD-90	N/A
04/13/23 14:03 5955-684	MQ	7/12/2023 13:55	BH	TLD-91	N/A
04/13/23 13:55 5956-685	MQ	7/12/2023 13:48	BH	TLD-92	N/A
04/13/23 13:11 5957-686	MQ	7/12/2023 13:22	BH	TLD-93	N/A
04/13/23 13:14 958-687	MQ	7/12/2023 13:26	BH	TLD-94	N/A
04/13/23 13:06 5959-688	MQ	7/12/2023 13:16	BH	TLD-95	N/A
04/13/23 09:56 5960-689	MQ	7/12/2023 9:58	BH	TLD-96	N/A
04/13/23 15:17 5963-692	MQ	7/13/2023 8:41	BH	TLD-97	N/A
04/17/23 08:30 5961-690	BH	7/13/2023 9:50	BH	TLD-FB	N/A
04/13/23 07:30 5962-691	BH	7/12/2023 7:30	BH	TLD-TB	N/A

Table A.4. Third Quarter Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/12/2023 09:47 7301-625	BH	10/10/2023 8:24	BH	TLD-1	N/A
7/12/2023 09:32 7304-626 and 2882	BH	10/10/2023 8:05	BH	TLD-2	N/A
7/12/2023 07:57 7305-627 and 2883	BH	10/10/2023 13:01	BH	TLD-3	N/A
7/12/2023 10:42 7306-628	BH	10/10/2023 9:24	BH	TLD-4	N/A
7/12/2023 10:36 7307-629	BH	10/10/2023 9:19	BH	TLD-5	N/A
7/12//20233 10:27 7308-630	BH	10/10/2023 9:05	BH	TLD-6	N/A
7/12/2023 10:03 7309-631	BH	10/10/2023 8:43	BH	TLD-7	N/A
7/12/2023 15:00 7310-632	BH	10/10/2023 14:28	BH	TLD-9	N/A
7/12/2023 13:29 7311-633	BH	10/10/2023 12:50	BH	TLD-12	N/A
7/12/2023 13:36 7312-634	BH	10/10/2023 13:14	BH	TLD-13	N/A
7/12/2023 07:51 7313-635	BH	10/10/2023 13:12	BH	TLD-14	N/A
7/12/2023 07:41 7314-636	BH	10/10/2023 7:36	BH	TLD-15	N/A
7/12/2023 14:16 7315-637	BH	10/10/2023 13:50	BH	TLD-16	N/A
7/12/2023 14:45 7316-638	BH	10/10/2023 14:12	BH	TLD-19	N/A
7/12/2023 12:35 7317-639	BH	10/10/2023 9:53	BH	TLD-22	N/A
7/12/2023 09:26 7318-640	BH	10/10/2023 7:51	BH	TLD-25	N/A
7/12/2023 14:01 7319-641	BH	10/10/2023 13:41	BH	TLD-30	N/A
7/12/2023 10:01 7320-642	BH	10/10/2023 9:36	BH	TLD-35	N/A
7/12/2023 10:23 7321-643	BH	10/10/2023 9:02	BH	TLD-37	N/A
7/12/2023 14:53 7322-644	BH	10/10/2023 14:22	BH	TLD-38	N/A
7/12/2023 09:30 7323-645	BH	10/10/2023 7:55	BH	TLD-40	N/A
7/12/2023 10:06 7324-646	BH	10/10/2023 8:45	BH	TLD-46	N/A
7/12/2023 10:19 7325-647 and 2884	BH	10/10/2023 8:57	BH	TLD-50	N/A
7/12/2023 07:35 7326-648	BH	10/10/2023 7:30	BH	TLD-52	N/A

Table A.4. Third Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/12/2023 09:35 7327-649	BH	10/10/2023 8:10	BH	TLD-53	N/A
7/12/2023 07:39 7329-651	BH	10/10/2023 7:33	BH	TLD-58	N/A
7/13/2023 08:26 7330-652	BH	10/9/2023 14:40	BH	TLD-59	N/A
7/13/2023 08:11 7331-653	BH	10/9/2023 15:00	BH	TLD-60	N/A
07/13/2023 08:12 7332-654	BH	10/9/2023 15:03	BH	TLD-61	N/A
7/13/2023 08:33 7333-655	BH	10/9/2023 15:13	BH	TLD-62	N/A
7/13/2023 08:16 7334-656	BH	10/9/2023 14:50	BH	TLD-63	N/A
7/12/2023 10:52 7335-657	BH	10/10/2023 9:31	BH	TLD-64	N/A
7/12/2023 07:59 7336-658 and 2885	BH	10/10/2023 12:58	BH	TLD-65	N/A
7/12/2023 07:49 7337-659	BH	10/10/2023 13:10	BH	TLD-66	N/A
7/12/2023 07:47 7338-660	BH	10/10/2023 13:09	BH	TLD-67	N/A
7/12/2023 10:21 7339-661 and 2886	BH	10/10/2023 9:00	BH	TLD-68	N/A
7/12/2023 10:11 7340-662	BH	10/10/2023 8:50	BH	TLD-69	N/A
7/12/2023 09:54 7341-663	BH	10/10/2023 8:32	BH	TLD-70	N/A
7/12/2023 09:51 7342-664	BH	10/10/2023 8:30	BH	TLD-71	N/A
7/12/2023 09:42 7343-665	BH	10/10/2023 8:22	BH	TLD-72	N/A
7/12/2023 15:09 7344-666	BH	10/10/2023 14:33	BH	TLD-73	N/A
7/12/2023 12:59 7345-667	BH	10/10/2023 10:09	BH	TLD-74	N/A
7/12/2023 13:02 7346-668	BH	10/10/2023 10:12	BH	TLD-75	N/A
7/12/2023 13:08 7347-669	BH	10/10/2023 12:26	BH	TLD-76	N/A
7/12/2023 13:13 7348-670	BH	Discovered missing on 10/10/23	BH	TLD-77	Estimate will be performed based on results of other quarters.
7/12/2023 13:39 7349-671	BH	10/10/2023 13:17	BH	TLD-78	N/A
7/12/2023 10:32 7350-672	BH	10/10/2023 9:10	BH	TLD-79	N/A
7/12/2023 14:12 7351-673	BH	10/10/2023 13:45	BH	TLD-80	N/A

Table A.4. Third Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/12/2023 09:49 7352-674 and 2887	BH	10/10/2023 8:26	BH	TLD-81	N/A
7/12/2023 08:15 7353-675	BH	10/10/2023 7:42	BH	TLD-82	N/A
7/12/2023 09:21 7354-676 and 2888	BH	10/10/2023 7:45	BH	TLD-83	N/A
7/12/2023 07:46 7355-677	BH	10/10/2023 13:07	BH	TLD-84	N/A
7/12/2023 12:53 7357-679	BH	10/10/2023 10:07	BH	TLD-86	N/A
7/12/2023 15:21 7358-680	BH	10/10/2023 14:44	BH	TLD-87	N/A
7/12/2023 14:31 7359-681	BH	10/10/2023 14:07	BH	TLD-88	N/A
7/12/2023 14:26 7360-682	BH	10/10/2023 14:02	BH	TLD-89	N/A
7/12/2023 14:21 7361-683	BH	10/10/2023 13:55	BH	TLD-90	N/A
7/12/2023 13:55 7362-684	BH	10/10/2023 13:36	BH	TLD-91	N/A
7/12/2023 13:48 7363-685	BH	10/10/2023 13:25	BH	TLD-92	N/A
7/12/2023 13:22 7364-686	BH	10/10/2023 12:46	BH	TLD-93	N/A
7/12/2023 13:26 7365-687	BH	10/10/2023 12:49	BH	TLD-94	N/A
7/12/2023 13:16 7366-688	BH	10/10/2023 12:41	BH	TLD-95	N/A
7/12/2023 09:58 7367-689	BH	10/10/2023 8:40	BH	TLD-96	N/A
7/13/2023 08:41 7370-692	BH	10/9/2023 15:19	BH	TLD-97	N/A
7/13/2023 09:50 7368-690	BH	10/10/2023 15:30	BH	TLD-FB	N/A
7/12/2023 07:30 7369-691	BH	10/9/2023 16:00	BH	TLD-TB	N/A

Table A.5. Fourth Quarter Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/10/2023 08:24 8191-625	BH	1/11/2024 10:26	BH	TLD-1	N/A
10/10/2023 08:05 8194-626 and 2882	BH	1/11/2024 10:10	BH	TLD-2	N/A
10/10/2023 13:01 8195-627 and 2883	BH	1/10/2024 10:13	BH	TLD-3	N/A
10/10/2023 09:24 8196-628	BH	1/10/2024 9:03	BH	TLD-4	N/A
10/10/2023 09:19 8197-629	BH	1/10/2024 8:57	BH	TLD-5	N/A
10/10/2023 09:05 8198-630	BH	1/10/2024 8:45	BH	TLD-6	N/A
10/10/2023 08:43 8199-631	BH	1/10/2024 9:39	BH	TLD-7	N/A
10/10/2023 14:28 8200-632	BH	1/11/2024 9:49	BH	TLD-9	N/A
10/10/2023 12:50 8201-633	BH	1/10/2024 14:34	BH	TLD-12	N/A
10/10/2023 13:14 8202-634	BH	1/11/2024 8:21	BH	TLD-13	N/A
10/10/2023 13:12 8203-635	BH	1/10/2024 10:08	BH	TLD-14	N/A
10/10/2023 07:36 8204-636	BH	1/10/2024 9:56	BH	TLD-15	N/A
10/10/2023 13:50 8205-637	BH	1/11/2024 9:07	BH	TLD-16	N/A
10/10/2023 14:12 8206-638	BH	1/11/2024 9:39	BH	TLD-19	N/A
10/10/2023 09:53 8207-639	BH	1/10/2024 13:20	BH	TLD-22	N/A
10/10/2023 07:51 8208-640	BH	1/10/2024 10:38	BH	TLD-25	N/A
10/10/2023 13:41 8209-641	BH	1/11/2024 9:01	BH	TLD-30	N/A
10/10/2023 09:36 8210-642	BH	1/10/2024 9:43	BH	TLD-35	N/A
10/10/2023 09:02 8211-643	BH	1/10/2024 8:40	BH	TLD-37	N/A
10/10/2023 14:22 8212-644	BH	1/11/2024 9:46	BH	TLD-38	N/A
10/10/2023 07:55 8213-645	BH	1/11/2024 10:06	BH	TLD-40	N/A
10/10/2023 08:45 8214-646	BH	1/10/2024 9:35	BH	TLD-46	N/A
10/10/2023 08:57 8215-647and 2884	BH	1/10/2024 9:20	BH	TLD-50	N/A
10/10/2023 07:30 8216-648	BH	1/10/2024 9:50	BH	TLD-52	N/A

Table A.5. Fourth Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/10/2023 08:10 8217-649	BH	1/11/2024 10:16	BH	TLD-53	N/A
10/10/2023 07:33 8219-651	BH	1/10/2024 9:53	BH	TLD-58	N/A
10/9/2023 14:40 8220- 652	BH	1/10/2024 8:21	BH	TLD-59	N/A
10/9/2023 15:00 8221-653	BH	1/10/2024 14:57	BH	TLD-60	N/A
10/9/2023 15:03 8222-654	BH	1/10/2024 14:59	BH	TLD-61	N/A
10/9/2023 15:13 8223-655	BH	1/10/2024 8:32	BH	TLD-62	N/A
10/9/2023 14:50 8224-656	BH	1/10/2024 14:52	BH	TLD-63	N/A
10/10/2023 09:31 8225-657	BH	1/10/2024 12:45	BH	TLD-64	N/A
10/10/2023 12:58 8226-658 and 2885	BH	1/10/2024 10:18	BH	TLD-65	N/A
10/10/2023 13:10 8227-659	BH	1/10/2024 10:06	BH	TLD-66	N/A
10/10/2023 13:09 8228-660	BH	1/10/2024 10:03	BH	TLD-67	N/A
10/10/2023 09:00 8229-661 and 2886	BH	1/10/2024 9:15	BH	TLD-68	N/A
10/10/2023 08:50 8230-662	BH	1/10/2024 9:28	BH	TLD-69	N/A
10/10/2023 08:32 8231-663	BH	1/11/2024 10:39	BH	TLD-70	N/A
10/10/2023 08:30 8232-664	BH	1/11/2024 10:29	BH	TLD-71	N/A
10/10/2023 08:22 8233-665	BH	1/11/2024 10:23	BH	TLD-72	N/A
10/10/2023 14:33 8234-666	BH	1/11/2024 9:54	BH	TLD-73	N/A
10/10/2023 10:09 8235-667	BH	1/10/2024 13:47	BH	TLD-74	N/A
10/10/2023 10:12 8236-668	BH	1/10/2024 13:51	BH	TLD-75	N/A
10/10/2023 12:26 8237-669	BH	Discovered missing on 1/10/24	BH	TLD-76	Estimate will be performed based on results of other quarters.
10/10/2023 12:37 8238-670	BH	1/10/2024 14:04	BH	TLD-77	N/A
10/10/2023 13:17 8239-671	BH	1/11/2024 8:27	BH	TLD-78	N/A
10/10/2023 09:10 8240-672	BH	1/10/2024 8:49	BH	TLD-79	N/A
10/10/2023 13:45 8241-673	BH	1/11/2024 9:12	BH	TLD-80	N/A

Table A.5. Fourth Quarter Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/10/2023 08:26 8242-674 and 2887	BH	1/11/2024 10:32	BH	TLD-81	N/A
10/10/2023 07:42 8243-675	BH	1/11/2024 10:27	BH	TLD-82	N/A
10/10/2023 07:45 8244-676 and 2888	BH	1/10/2024 10:30	BH	TLD-83	N/A
10/10/2023 13:07 8245-677	BH	1/10/2024 10:01	BH	TLD-84	N/A
10/10/2023 10:07 8247-679	BH	1/10/2024 13:44	BH	TLD-86	N/A
10/10/2023 14:44 8248-680	BH	1/11/2024 10:01	BH	TLD-87	N/A
10/10/2023 14:07 8249-681	BH	1/11/2024 9:31	BH	TLD-88	N/A
10/10/2023 14:02 8250-682	BH	1/11/2024 9:25	BH	TLD-89	N/A
10/10/2023 13:55 8251-683	BH	1/11/2024 9:16	BH	TLD-90	N/A
10/10/2023 13:36 8252-684	BH	1/11/2024 8:51	BH	TLD-91	N/A
10/10/2023 13:25 8253-685	BH	1/11/2024 8:43	BH	TLD-92	N/A
10/10/2023 12:46 8254-686	BH	1/10/2024 14:26	BH	TLD-93	N/A
10/10/2023 12:49 8255-687	BH	1/10/2024 14:32	BH	TLD-94	N/A
10/10/2023 12:41 8256-688	BH	1/10/2024 14:18	BH	TLD-95	N/A
10/10/2023 08:40 8257-689	BH	1/11/2024 10:44	BH	TLD-96	N/A
10/9/2023 15:19 8260-692	BH	1/10/2024 8:10	BH	TLD-97	N/A
10/9/2023 15:30 8258-690	BH	1/11/2024 12:00	BH	TLD-FB	N/A
10/9/2023 16:00 8259-691	BH	1/10/2024 6:30	BH	TLD-TB	N/A

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