FRNP-RPT-0178

Annual Report on External Radiation Monitoring for Calendar Year 2020 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

FOUR RIVERS NUCLEAR PARTNERSHIP, LLC

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FRNP Classification Support

10-14-2021
Date

FRNP-RPT-0178

Annual Report on External Radiation Monitoring for Calendar Year 2020 at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—March 2021
Revised—October 2021

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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CONTENTS

TABLES

ACRONYMS

ASER	annual site environmental report
CY	calendar year
DAC	Design Analysis and Calculations
DOE	U.S. Department of Energy
DUF_6	depleted uranium hexafluoride
E	effective dose
EMP	environmental monitoring plan
FY	fiscal year
LA	Limited Area
MEI	maximally exposed individual
OSL	optically stimulated luminescence
PGDP	Paducah Gaseous Diffusion Plant
PPA	property protection area
TLD	thermoluminescent dosimeter
WKWMA	West Kentucky Wildlife Management Area

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EXECUTIVE SUMMARY

U.S. Department of Energy (DOE) Order 458.1, *Radiation Protection of the Public and the Environment*, has requirements to protect the public and environment from radiation exposure. Energy absorbed from radioactive materials outside the body results in an external dose. On the Paducah Site, external dose comes from direct ionizing radiation including natural radioactivity from cosmic and terrestrial sources, as well as man-made radioactive sources. Results for external gamma and neutron radiation monitoring conducted in 2020 are summarized in this report.

In 2020, the deactivation and remediation (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 uranium hexafluoride cylinder management).

The primary sources for radiation exposure to areas outside the Paducah Site security fence are the uranium hexafluoride (UF_6) cylinder storage yards, which are located within the secured area, but in close proximity to the perimeter fence. Studies conducted within the cylinder storage yards have shown that the cylinders are sources of both gamma and neutron radiation. The neutrons are produced at moderate energy levels by the alpha-fluorine reaction taking place within the residual UF_6 material. Further studies have indicated that the range of the neutrons is such that the neutron dose rate falls off rapidly with distance.

A surveillance network of thermoluminescent dosimeters (TLD) and optically stimulated luminescence (OSL) dosimeters monitored areas that included locations inside the Paducah Site security fence, Paducah Site perimeter, outfalls, ditches and background locations. Dosimeters were also placed in areas that historically received the highest radiation exposure. The objectives and design of the network are described in CP2-ES-0006, *Environmental Monitoring Plan* (EMP). The EMP is approved by DOE on a fiscal year basis, so the EMPs for fiscal years 2020 and 2021 apply to calendar year (CY) 2020 TLD and OSL monitoring locations.

In CY 2020, 13 locations out of 52 showed results statistically above background with 99.7% confidence. These 13 locations were historically the areas with the highest measured results throughout the monitoring period. All of these locations were adjacent to or in close proximity to uranium hexafluoride (UF_6) cylinder storage yards and are either in the Limited Area (LA) boundary or between the LA boundary and the property protection area (PPA) boundary, which is not regularly accessible to the public. This means the potential external radiation dose calculated from these locations is not representative of the actual public external radiation dose.

The maximally exposed individual (MEI) result for the residential exposure scenario at the nearest local residence was found to be equivalent to a naturally-occurring background. The potential effective dose for this scenario was 0 mrem for CY 2020.

The Paducah Site licensed a portion of the DOE Reservation to the Kentucky Department of Fish and Wildlife Resources for recreational uses. These areas were open to the public for use, but do not have any residences within the Paducah Site boundary. Public traffic was allowed on the main reservation roads outside of the active plant area as a courtesy to the public, and some members of the public visited the DOE Reservation for recreational purposes. Recreational purposes and durations of time spent in the area by the public were less than full-time.

In CY 2020, there were two TLD locations that were accessible to members of the public. These locations were TLD-14 and TLD-96.

- TLD-14 is near Harmony Cemetery and is located north of the LA security fence and south of Ogden Landing Road. In CY 2009, security restrictions were eased to allow regular public access to Harmony Cemetery. In 2020, the monitoring results for TLD-14 were statistically equivalent to the average mean background for CY 2020; however, they were below the calculated average background for the site (see Section 3.5.6). The estimated external radiation dose to a member of the public at this location was 0 millirem (mrem).

- In CY 2020, a food vendor TLD location was established in the C-810 parking lot. The monitoring results for TLD-96 were statistically equivalent to the average mean background for CY 2020. The estimated external radiation dose to the food vendor at this location was 0.54 mrem.

Although there were no results for TLD locations accessible to the public that were statistically above background with 99.7% confidence, the TLD location along the DOE boundary with the highest net annualized dose rate was TLD-40.

- TLD-40 is located outside the DOE boundary and within the West Kentucky Wildlife Management Area (WKWMA) off of Dyke Road. A member of the public would receive an external radiation effective dose of 1.89 mrem/year at this location at the Paducah Site boundary (see Section 3.5.7).

For 2020, the scenario for a potential external radiation effective dose was a member of the public passing through accessible portions of the DOE Reservation where areas of highest exposure were visited 80 hours per year. This scenario showed a member of the public would potentially receive 4.1 mrem/year. This result is consistent with previous results cited in annual site environmental reports (ASERs) (see Table 39).

For 2020, an estimated external radiation effective collective dose was calculated by multiplying the scenario dose in the preceding paragraph by a total estimated number of visitors hiking within the WKMA annually (i.e., 150 persons), which resulted in an estimated external radiation collective effective dose of 0.61 person-rem/year (see Section 3.5.8). This result is consistent with previous results cited in ASERs (see Table 39).

1. INTRODUCTION

U.S. Department of Energy (DOE) Order 458.1, *Radiation Protection of the Public and the Environment*, has requirements to protect the public and environment from radiation exposure. Energy absorbed from radioactive materials outside the body results in an external dose. On the Paducah Site, an external dose comes from direct ionizing radiation including natural radioactivity from cosmic and terrestrial sources as well as man-made radioactive sources. Results for external gamma and neutron radiation monitoring conducted in 2020 are summarized in this report.

In 2020, the deactivation and remediation (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 uranium hexafluoride cylinder management).

The primary sources for radiation exposure to areas outside the Paducah Site security fence are the uranium hexafluoride (UF_6) cylinder storage yards, which are located within the secured area, but are also in close proximity to the perimeter fence. Studies conducted within the cylinder storage yards have shown that the cylinders are sources of both gamma and neutron radiation. The neutrons are produced at moderate energy levels by the alpha-fluorine reaction taking place within the residual UF_6 material. Further studies have indicated that the range of the neutrons is such that the neutron dose rate falls off rapidly with distance.

A surveillance network of thermoluminescent dosimeters (TLDs) and optically stimulated luminescence (OSL) dosimeters monitored areas that included locations inside the Paducah Site security fence, Paducah Site perimeter, outfalls, ditches, and background locations. Dosimeters were also placed in areas that historically received the highest radiation exposure. The objectives and design of the network are described in CP2-ES-0006, *Environmental Monitoring Plan* (EMP). The EMP is approved by DOE on a fiscal year (FY) basis, accordingly the EMPs for FYs 2020 and 2021 apply to calendar year (CY) 2020 TLD and OSL monitoring locations.

2. METHODOLOGY

2.1 MEASUREMENT OF DIRECT RADIATION

The D&R contractor used the Global Dosimetry Solutions Environmental TLD 110 Dosimeter received from Mirion Technologies, Inc. of Irvine, CA, to measure external gamma radiation. This type of TLD measures low-level gamma radiation and is designed for outdoor applications. This TLD includes two calcium fluoride 200 chips and two lithium fluoride 100 chips. Mirion Technologies, Inc. processed the dosimeters received from the D&R Contractor following their internal processes, protocols, and quality control routines.

The D&R contractor used the InLight® Environmental OSL Dosimeter received from Landauer of Glenwood, IL, to measure external neutron radiation. This type of TLD measures radiation exposure with aluminum oxide detectors and includes a CR-39 sensor for neutron detection. Landauer processed the dosimeters received from the D&R Contractor, following their internal processes, protocols, and quality control routines.

2.2 SURVEILLANCE NETWORK

The D&R contractor used a total of 65 TLD locations and 7 OSL locations, along with one control location in 2020 (see Appendix A, Figure A.1, and Table A.1).

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 network of TLD and OSL locations, along with analysis of their data, 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 TLD and OSL locations was divided into the following groups for data analysis:

- Background—There were 13 TLD Locations used for background because they were unaffected by Paducah Site operations or other site-specific radiation sources. These locations were outside of the DOE Property Protection Area (PPA) boundary and include the following TLD locations: TLD-22, TLD-54, TLD-85, TLD-86, TLD-87, TLD-88, TLD-89, TLD-90, TLD-91, TLD-92, TLD-93, TLD-94, and TLD-95.

- Limited Area (LA)—There were 14 TLD locations and 4 OSL locations inside or on the perimeter of the DOE LA. Due to Paducah Site security protocols, the public did not have access to the Paducah Site LA boundary fence; therefore, the external radiation measured at the LA boundary fence were not applicable to members of the public. TLD locations associated with the LA were TLD-3, TLD-4, TLD-5, TLD-6, TLD-46, TLD-50, TLD-52, TLD-59, TLD-60, TLD-61, TLD-62, TLD-63, TLD-65, and TLD-68. OSL locations associated with the LA were TLD-3, TLD-50, TLD-65, and TLD-68.

- Outside the LA boundary and Inside the PPA boundary—There were 20 TLD locations and 3 OSL locations outside the DOE LA and inside the DOE PPA boundary. TLD locations between the LA boundary and the PPA boundary were TLD-1, TLD-2, TLD-7, TLD-13, TLD-15, TLD-25, TLD-35, TLD-37, TLD-53, TLD-58, TLD-64, TLD-69, TLD-70, TLD-71, TLD-72, TLD-78, TLD-81, TLD-82, TLD-83, and TLD-96. OSL locations outside the LA and inside the PPA boundary were TLD-2, TLD-81, and TLD-83.

- Outside the PPA and inside the DOE boundary—There were 11 TLD locations outside the PPA and inside the DOE boundary that were not background locations; these background locations were TLD-9, TLD-12, TLD-14, TLD-19, TLD-38, TLD-66, TLD-67, TLD-76, TLD-77, TLD-79, and TLD-84.

- Outside the DOE boundary—There were 7 TLD locations outside the DOE boundary that were not background TLD locations. TLD locations outside the DOE boundary that were not background locations were TLD-16, TLD-30, TLD-40, TLD-73, TLD-74, TLD-75, and TLD-80.

- Control (C)—Trip blank and field blank stored inside “Lead Box” that is stored in the C-101 Dosimetry Office.

Results of the TLD and OSL data analysis for 2020 are presented in Section 3.

2.3 DATA COLLECTION

TLDs and OSLs were placed at monitoring locations and collected and analyzed quarterly for CY 2020. When TLDs and OSLs were collected, the next quarter's TLDs and OSLs were placed at the same locations when possible. Appendix B lists the TLD and OSL 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 accompanying the TLDs when they were shipped off-site for analysis. TLDs and OSLs including background and trip blank locations were placed as described in Table A.1.

The TLDs were kept in the original flexible protective packaging and placed in a wide-mouth, plastic sample bottle when deployed to the monitoring location. A lid was screwed on the bottle and a nylon wire tie was wrapped around each bottle (i.e., under the lid) to secure it to a fence or other fixed structure, usually at a height approximately 3 to 4 ft aboveground. The plastic packaging and 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 kept in the original flexible protective packaging and placed in a wide-mouth, plastic sample bottle when deployed to the monitoring location. A lid was screwed on the bottle, and a nylon wire tie was wrapped around each bottle (i.e., under the lid) to secure to a lucite block (i.e., to simulate the albedo effect) that was attached to a fence or other fixed structure usually at a height approximately 3 to 4 ft aboveground.

Based on process knowledge from historical surveys and the siting of dosimeters outside the bounds of radiological contamination areas, the dosimeters were noncontaminated and nonregulated for the purposes of handling and shipping (i.e., contamination levels are below DOE release criteria and U.S. Department of Transportation levels for regulated materials).

2.4 TLD AND OSL LOCATION CHANGES

For the first three quarters of CY 2020, the D&R Contractor utilized 64 TLD locations to measure external gamma radiation and 7 OSL locations to measure external neutron radiation.

On October 1, 2020, an additional TLD location, TLD-96, was installed at the C-810 parking lot in order to represent food vendor occupancy. This raised the total TLD locations used to measure external gamma radiation from 64 to 65 locations.

2.5 DATA REPORTING

2.5.1 Direct Gamma Radiation

Direct gamma radiation exposure is reported in the unit milliroentgen (mR), which is a measure of exposure in terms of ionizations in the air.

All the direct gamma radiation data presented in this report has been converted to mrem using a 1 to 1 ratio.

2.5.2 Direct Neutron Radiation

Direct neutron radiation exposure is reported in the unit of mrem.

3. TLD AND OSL RESULTS

Design Analysis and Calculation, DAC-ENV-FA5480-0060 documents the equations, assumptions, and results that were summarized in this report (FRNP 2021).

TLD analytical data can be found in Appendix C.

OSL analytical data can be found in Appendix D.

3.1 FIRST QUARTER TLD AND OSL RESULTS

3.1.1 TLD Results

In the first quarter of CY 2020, 64 TLD locations were monitored for external gamma radiation for an average of 119 days. The number of days the TLDs were at the locations was slightly longer than normal due to the COVID-19 shutdown that began on March 23, 2020, because no personnel were available to collect these TLDs until May 4, 2020.

Results ranged from 17 to 551 mrem.

The background results ranged from 19 to 28 mrem.

The mean background was 24 mrem.

The field blank result was 13 mrem, and the trip blank result was 14 mrem. These results were indistinguishable from background, likely due to storage inside lead shielding where they were kept.

Tables 1 through 5 show the results for the first quarter.

Table 1. First Quarter Results for Background TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
639	22	1/9/2020	5/5/2020	117	26	0.22
650	54	1/8/2020	5/4/2020	117	28	0.24
678	85	1/8/2020	5/4/2020	117	24	0.21
679	86	1/8/2020	5/6/2020	119	22	0.18
680	87	1/8/2020	5/6/2020	119	24	0.20
681	88	1/8/2020	5/6/2020	119	22	0.18
682	89	1/8/2020	5/6/2020	119	24	0.20
683	90	1/8/2020	5/6/2020	119	19	0.16
684	91	1/8/2020	5/6/2020	119	25	0.21
685	92	1/9/2020	5/6/2020	118	22	0.19

Table 1. First Quarter Results for Background TLD Locations (Continued)

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
686	93	1/8/2020	5/6/2020	119	21	0.18
687	94	1/8/2020	5/6/2020	119	23	0.19
688	95	1/8/2020	5/6/2020	119	27	0.23

Table 2. First Quarter Results for the LA TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
627	3	1/8/2020	5/6/2020	119	24	0.20
628	4	1/8/2020	5/5/2020	118	25	0.21
629	5	1/8/2020	5/5/2020	118	27	0.23
630	6	1/8/2020	5/5/2020	118	23	0.19
646	46	1/8/2020	5/5/2020	118	23	0.19
647	50	1/8/2020	5/5/2020	118	50	0.42
648	52	1/8/2020	5/6/2020	119	25	0.21
652	59	1/7/2020	5/5/2020	119	18	0.15
653	60	1/7/2020	5/5/2020	119	469	3.94
654	61	1/7/2020	5/5/2020	119	551	4.63
655	62	1/7/2020	5/5/2020	119	20	0.17
656	63	1/7/2020	5/5/2020	119	17	0.14
658	65	1/8/2020	5/6/2020	119	21	0.18
661	68	1/8/2020	5/5/2020	118	27	0.23

Table 3. First Quarter Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
625	1	1/8/2020	5/6/2020	119	261	2.19
626	2	1/8/2020	5/6/2020	119	321	2.70
631	7	1/8/2020	5/5/2020	118	35	0.30
634	13	1/8/2020	5/6/2020	119	28	0.24
636	15	1/8/2020	5/6/2020	119	19	0.16
640	25	1/8/2020	5/6/2020	119	43	0.36
642	35	1/8/2020	5/5/2020	118	32	0.27
643	37	1/8/2020	5/5/2020	118	23	0.19
649	53	1/8/2020	5/6/2020	119	134	1.13
651	58	1/8/2020	5/6/2020	119	17	0.14

Table 3. First Quarter Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary (Continued)

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
657	64	1/8/2020	5/5/2020	118	18	0.15
662	69	1/8/2020	5/5/2020	118	22	0.19
663	70	1/8/2020	5/6/2020	119	51	0.43
664	71	1/8/2020	5/6/2020	119	44	0.37
665	72	1/8/2020	5/6/2020	119	22	0.18
671	78	1/8/2020	5/6/2020	119	27	0.23
674	81	1/8/2020	5/6/2020	119	130	1.09
675	82	1/8/2020	5/6/2020	119	34	0.29
676	83	1/8/2020	5/6/2020	119	77	0.65

Table 4. First Quarter Results for TLD Locations Outside the PPA and Inside the DOE Boundary[a]

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
632	9	1/8/2020	5/6/2020	119	23	0.19
633	12	1/8/2020	5/6/2020	119	20	0.17
635	14	1/8/2020	5/6/2020	119	23	0.19
638	19	1/8/2020	5/6/2020	119	23	0.19
644	38[b]	1/8/2020	5/5/2020	118	26	0.22
659	66	1/8/2020	5/6/2020	119	24	0.20
660	67	1/8/2020	5/6/2020	119	23	0.19
669	76	1/8/2020	5/6/2020	119	39	0.33
670	77	1/8/2020	5/6/2020	119	26	0.22
672	79	1/8/2020	5/5/2020	118	19	0.16
677	84	1/8/2020	5/6/2020	119	20	0.17

[a] TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 1.
[b] The result for TLD-38 was estimated for this quarter because the TLD was missing. The equation used for the estimate for TLD-38 can be found in DAC-ENV-FA5480-0060.

Table 5. First Quarter Results for the TLD Locations Outside the DOE Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
637	16	1/8/2020	5/6/2020	119	27	0.23
641	30	1/8/2020	5/6/2020	119	26	0.22
645	40	1/8/2020	5/6/2020	119	31	0.26
666	73	1/8/2020	5/6/2020	119	21	0.18

Table 5. First Quarter Results for the TLD Locations Outside the DOE Boundary* (Continued)

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
667	74	1/8/2020	5/6/2020	119	29	0.24
668	75	1/8/2020	5/6/2020	119	27	0.23
673	80	1/8/2020	5/6/2020	119	24	0.20

*All background TLD locations located outside the DOE boundary are not listed in this table because they are listed in Table 1.

3.1.2 OSL Results

In the first quarter of CY 2020, 7 locations were monitored for external neutron radiation for an average of 119 days (see Table 6). The number of days the OSLs were at the locations was slightly longer than normal due to the COVID-19 shutdown that began on March 23, 2020, because no personnel were available to collect these OSLs until May 4, 2020.

All results collected in the first quarter were reported as "M" (i.e., dose equivalents below the minimum measureable quantity), thus analysis of annual neutron dose was not required and no dose equations were used.

Table 6. First Quarter Results for OSL Locations

Landauer Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Total Neutron	Fast Neutron	Thermal Neutron
2882	2	1/8/2020	5/6/2020	119	M	M	M
2883	3	1/8/2020	5/6/2020	119	M	M	M
2884	50	1/8/2020	5/5/2020	118	M	M	M
2885	65	1/8/2020	5/6/2020	119	M	M	M
2886	68	1/8/2020	5/5/2020	118	M	M	M
2887	81	1/8/2020	5/6/2020	119	M	M	M
2888	83	1/8/2020	5/6/2020	119	M	M	M

3.2 SECOND QUARTER TLD AND OSL RESULTS

3.2.1 TLD Results

In the second quarter of CY 2020, 64 TLD locations were monitored for external gamma radiation for an average of 70 days.

Results ranged from 14 to 353 mrem.

The background results ranged from 15 to 34 mrem.

The mean background was 19 mrem.

The field blank result was 13 mrem, and the trip blank result was 13 mrem. These results were indistinguishable from background, likely due to storage inside lead shielding where they were kept.

Tables 7 through 11 show the results for the second quarter.

Table 7. Second Quarter Results for Background TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
639	22	5/5/2020	7/15/2020	71	18	0.25
650	54	5/4/2020	7/15/2020	72	20	0.28
678	85	5/4/2020	7/15/2020	72	19	0.26
679	86	5/6/2020	7/15/2020	70	18	0.26
680	87*	5/6/2020	7/15/2020	70	15	0.22
681	88	5/6/2020	7/15/2020	70	17	0.24
682	89	5/6/2020	7/15/2020	70	19	0.27
683	90	5/6/2020	7/15/2020	70	17	0.24
684	91	5/6/2020	7/15/2020	70	18	0.26
685	92	5/6/2020	7/15/2020	70	17	0.24
686	93	5/6/2020	7/15/2020	70	17	0.24
687	94	5/6/2020	7/15/2020	70	34	0.49
688	95	5/6/2020	7/15/2020	70	19	0.27

*The result for TLD-87 was estimated for this quarter because the TLD was missing. Equation used for the estimate for TLD-87 can be found in DAC-ENV-FA5480-0060.

Table 8. Second Quarter Results for the LA TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
627	3	5/6/2020	7/14/2020	69	16	0.23
628	4	5/5/2020	7/15/2020	71	18	0.25
629	5	5/5/2020	7/15/2020	71	21	0.30
630	6	5/5/2020	7/15/2020	71	16	0.23
646	46	5/5/2020	7/15/2020	71	15	0.21
647	50	5/5/2020	7/15/2020	71	41	0.58
648	52	5/6/2020	7/14/2020	69	17	0.25
652	59	5/5/2020	7/14/2020	70	15	0.21
653	60	5/5/2020	7/14/2020	70	282	4.03
654	61	5/5/2020	7/14/2020	70	353	5.04
655	62	5/5/2020	7/14/2020	70	18	0.26
656	63	5/5/2020	7/14/2020	70	16	0.23
658	65	5/6/2020	7/14/2020	69	15	0.22
661	68	5/5/2020	7/15/2020	71	20	0.28

Table 9. Second Quarter Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
625	1	5/6/2020	7/15/2020	70	131	1.87
626	2	5/6/2020	7/15/2020	70	174	2.49
631	7	5/5/2020	7/15/2020	71	24	0.34
634	13	5/6/2020	7/15/2020	70	19	0.27
636	15	5/6/2020	7/14/2020	69	17	0.25
640	25	5/6/2020	7/14/2020	69	27	0.39
642	35	5/5/2020	7/15/2020	71	21	0.30
643	37	5/5/2020	7/15/2020	71	20	0.28
649	53	5/6/2020	7/15/2020	70	70	1.00
651	58	5/6/2020	7/14/2020	69	14	0.20
657	64	5/5/2020	7/15/2020	71	17	0.24
662	69	5/5/2020	7/15/2020	71	15	0.21
663	70	5/6/2020	7/15/2020	70	34	0.49
664	71	5/6/2020	7/15/2020	70	37	0.53
665	72	5/6/2020	7/15/2020	70	17	0.24
671	78	5/6/2020	7/15/2020	70	20	0.29
674	81	5/6/2020	7/15/2020	70	74	1.06
675	82	5/6/2020	7/14/2020	69	24	0.35
676	83	5/6/2020	7/14/2020	69	48	0.70

Table 10. Second Quarter Results for the TLD Locations Outside the PPA Boundary[a]

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
632	9	5/6/2020	7/15/2020	70	15	0.21
633	12	5/6/2020	7/15/2020	70	18	0.26
635	14	5/6/2020	7/14/2020	69	14	0.20
638	19[b]	5/6/2020	7/15/2020	70	14	0.20
644	38[c]	5/5/2020	7/15/2020	71	16	0.22
659	66	5/6/2020	7/14/2020	69	19	0.28
660	67	5/6/2020	7/14/2020	69	21	0.30
669	76[d]	5/6/2020	7/15/2020	70	18	0.26
670	77	5/6/2020	7/15/2020	70	17	0.24
672	79	5/5/2020	7/15/2020	71	16	0.23
677	84	5/6/2020	7/14/2020	69	15	0.22

[a] TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 7.
[b] The result for TLD-19 was estimated for this quarter because the result was disputed by the D&R Contractor. Equation used for the estimate for TLD-19 can be found in DAC-ENV-FA5480-0060.
[c] The result for TLD-38 was estimated for this quarter because the processing center stated there was an unusual element result observed. Equation used for the estimate for TLD-38 can be found in DAC-ENV-FA5480-0060.
[d] The result for TLD-76 was estimated for this quarter because the TLD was found damaged upon retrieval. Equation used for the estimate for TLD-76 can be found in DAC-ENV-FA5480-0060.

Table 11. Second Quarter Results for the TLD Locations Outside the DOE Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
637	16	5/6/2020	7/15/2020	70	21	0.30
641	30	5/6/2020	7/15/2020	70	20	0.29
645	40	5/6/2020	7/15/2020	70	22	0.31
666	73	5/6/2020	7/15/2020	70	19	0.27
667	74	5/6/2020	7/15/2020	70	22	0.31
668	75	5/6/2020	7/15/2020	70	21	0.30
673	80	5/6/2020	7/15/2020	70	25	0.36

*All background TLD locations located outside the DOE boundary are not listed in this table because they are listed in Table 7.

3.2.2 OSL Results

In the second quarter CY 2020, 7 locations were monitored for external neutron radiation for an average of 70 days (see Table 12).

All neutron results collected in the second quarter were reported as "M" (i.e., dose equivalents below the minimum measureable quantity), thus analysis of annual neutron dose was not required and no dose equations were used.

Table 12. Second Quarter Results for OSL Locations

Landauer Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Total Neutron	Fast Neutron	Thermal Neutron
2882	2	5/6/2020	7/15/2020	70	M	M	M
2883	3	5/6/2020	7/14/2020	69	M	M	M
2884	50	5/5/2020	7/15/2020	71	M	M	M
2885	65	5/6/2020	7/14/2020	69	M	M	M
2886	68	5/5/2020	7/15/2020	71	M	M	M
2887	81	5/6/2020	7/15/2020	70	M	M	M
2888	83	5/6/2020	7/14/2020	69	M	M	M

3.3 THIRD QUARTER TLD AND OSL RESULTS

3.3.1 TLD Results

In the third quarter of CY 2020, 64 TLD locations were monitored for external gamma radiation for an average of 80 days.

Results ranged from 10 to 408 mrem.

The background sample ranged from 13 to 16 mrem.

The mean background was 15 mrem.

The field blank result was 9 mrem, and the trip blank result was 10 mrem. These results were indistinguishable from background, likely due to storage inside lead shielding where they were kept.

Table 13 through Table 17 show the results for the third quarter.

Table 13. Third Quarter Results for Background TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
639	22	7/15/2020	10/1/2020	78	16	0.21
650	54	7/15/2020	10/1/2020	78	16	0.21
678	85	7/15/2020	10/5/2020	82	15	0.18
679	86	7/15/2020	10/5/2020	82	13	0.16
680	87	7/15/2020	10/5/2020	82	16	0.20
681	88	7/15/2020	10/5/2020	82	15	0.18
682	89	7/15/2020	10/5/2020	82	16	0.20
683	90	7/15/2020	10/5/2020	82	15	0.18
684	91	7/15/2020	10/5/2020	82	16	0.20
685	92	7/15/2020	10/5/2020	82	14	0.17
686	93	7/15/2020	10/5/2020	82	16	0.20
687	94	7/15/2020	10/5/2020	82	16	0.20
688	95	7/15/2020	10/5/2020	82	16	0.20

Table 14. Third Quarter Results for the LA TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
627	3	7/14/2020	10/1/2020	79	11	0.14
628	4	7/15/2020	10/1/2020	78	15	0.19
629	5	7/15/2020	10/1/2020	78	16	0.21
630	6	7/15/2020	10/1/2020	78	13	0.17
646	46	7/15/2020	10/1/2020	78	14	0.18
647	50	7/15/2020	10/1/2020	78	34	0.44
648	52	7/14/2020	10/1/2020	79	14	0.18
652	59	7/14/2020	10/5/2020	83	11	0.13
653	60	7/14/2020	10/5/2020	83	245	2.95
654	61	7/14/2020	10/5/2020	83	408	4.92
655	62	7/14/2020	10/5/2020	83	13	0.16
656	63	7/14/2020	10/5/2020	83	11	0.13
658	65	7/14/2020	10/1/2020	79	13	0.16
661	68	7/15/2020	10/1/2020	78	15	0.19

Table 15. Third Quarter Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
625	1	7/15/2020	10/1/2020	78	147	1.88
626	2	7/15/2020	10/1/2020	78	193	2.47
631	7	7/15/2020	10/1/2020	78	19	0.24
634	13	7/15/2020	10/5/2020	82	18	0.22
636	15	7/14/2020	10/1/2020	79	13	0.16
640	25	7/14/2020	10/1/2020	79	22	0.28
642	35	7/15/2020	10/1/2020	78	18	0.23
643	37	7/15/2020	10/1/2020	78	14	0.18
649	53	7/15/2020	10/1/2020	78	78	1.00
651	58	7/14/2020	10/1/2020	79	10	0.13
657	64	7/15/2020	10/1/2020	78	13	0.17
662	69	7/15/2020	10/1/2020	78	13	0.17
663	70	7/15/2020	10/1/2020	78	31	0.40
664	71	7/15/2020	10/1/2020	78	22	0.28
665	72	7/15/2020	10/1/2020	78	16	0.21
671	78	7/15/2020	10/5/2020	82	18	0.22
674	81	7/15/2020	10/1/2020	78	75	0.96
675	82	7/14/2020	10/1/2020	79	21	0.27
676	83	7/14/2020	10/1/2020	79	50	0.63

Table 16. Third Quarter Results for the TLD Locations Outside the PPA and Inside the DOE Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
632	9	7/15/2020	10/5/2020	82	13	0.16
633	12	7/15/2020	10/5/2020	82	13	0.16
635	14	7/14/2020	10/1/2020	79	13	0.16
638	19	7/15/2020	10/5/2020	82	14	0.17
644	38	7/15/2020	10/5/2020	82	14	0.17
659	66	7/14/2020	10/1/2020	79	16	0.20
660	67	7/14/2020	10/1/2020	79	16	0.20
669	76	7/15/2020	10/5/2020	82	17	0.21
670	77	7/15/2020	10/5/2020	82	14	0.17
672	79	7/15/2020	10/1/2020	78	14	0.18
677	84	7/14/2020	10/1/2020	79	13	0.16

*TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 13.

Table 17. Third Quarter Results for the TLD Locations Outside the PPA Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
637	16	7/15/2020	10/5/2020	82	17	0.21
641	30	7/15/2020	10/5/2020	82	18	0.22
645	40	7/15/2020	10/1/2020	78	20	0.26
666	73	7/15/2020	10/5/2020	82	14	0.17
667	74	7/15/2020	10/5/2020	82	17	0.21
668	75	7/15/2020	10/5/2020	82	16	0.20
673	80	7/15/2020	10/5/2020	82	16	0.20

*All Background TLD Locations were located outside the DOE boundary, but are not listed in this table because they are listed in Table 13.

3.3.2 OSL Results

In the third quarter CY 2020, 7 locations were monitored for external neutron radiation for an average of 78 days (see Table 18).

All neutron results collected in the third quarter were reported as "M" (i.e., dose equivalents below the minimum measureable quantity), thus analysis of annual neutron dose was not required and no dose equations were used.

Table 18. Third Quarter Results for OSL Locations

Landauer Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Total Neutron	Fast Neutron	Thermal Neutron
2882	2	7/15/2020	10/1/2020	78	M	M	M
2883	3	7/14/2020	10/1/2020	79	M	M	M
2884	50	7/15/2020	10/1/2020	78	M	M	M
2885	65	7/14/2020	10/1/2020	79	M	M	M
2886	68	7/15/2020	10/1/2020	78	M	M	M
2887	81	7/15/2020	10/1/2020	78	M	M	M
2888	83	7/14/2020	10/1/2020	79	M	M	M

3.4 FOURTH QUARTER TLD AND OSL RESULTS

3.4.1 TLD Results

In the fourth quarter of CY 2020, a new TLD Location, TLD-96, was added to monitor the food vendor location. The addition of this new location increased the number from 64 to 65 TLD locations.

The TLD locations for the fourth quarter were monitored for external gamma radiation for an average of 96 days.

Results ranged from 17 to 574 mrem.

The background results ranged from 20 to 30 mrem.

The mean background was 25 mrem.

The field blank result was 6 mrem, and the trip blank result was 13 mrem. These results were indistinguishable from background, likely due to storage inside lead shielding where they were kept.

Tables 19 through 23 show the results for the fourth quarter.

Table 19. Fourth Quarter Results for Background TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
639	22	10/1/2020	1/6/2021	97	26	0.27
650	54	10/1/2020	1/6/2021	97	27	0.28
678	85	10/5/2020	1/5/2021	92	24	0.26
679	86	10/5/2020	1/6/2021	93	25	0.27
680	87	10/5/2020	1/6/2021	93	24	0.26
681	88	10/5/2020	1/6/2021	93	24	0.26
682	89	10/5/2020	1/6/2021	93	25	0.27
683	90	10/5/2020	1/6/2021	93	30	0.32
684	91	10/5/2020	1/6/2021	93	24	0.26
685	92	10/5/2020	1/6/2021	93	20	0.21
686	93	10/5/2020	1/6/2021	93	24	0.26
687	94	10/5/2020	1/6/2021	93	24	0.26
688	95	10/5/2020	1/6/2021	93	25	0.27

Table 20. Fourth Quarter Results for the LA TLD Locations

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
627	3	10/1/2020	1/7/2021	98	25	0.25
628	4	10/1/2020	1/7/2021	98	24	0.24
629	5	10/1/2020	1/7/2021	98	27	0.27
630	6	10/1/2020	1/7/2021	98	24	0.24
646	46	10/1/2020	1/6/2021	97	23	0.24
647	50	10/1/2020	1/7/2021	98	52	0.53
648	52	10/1/2020	1/7/2021	98	22	0.22
652	59	10/5/2020	1/5/2021	92	19	0.21
653	60	10/5/2020	1/7/2021	94	413	4.38
654	61	10/5/2020	1/7/2021	94	574	6.09

Table 20. Fourth Quarter Results for the LA TLD Locations (Continued)

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
655	62	10/5/2020	1/5/2021	92	22	0.24
656	63	10/5/2020	1/7/2021	94	19	0.20
658	65	10/1/2020	1/7/2021	98	20	0.20
661	68	10/1/2020	1/7/2021	98	22	0.22

Table 21. Fourth Quarter Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
625	1	10/1/2020	1/7/2021	98	232	2.36
626	2	10/1/2020	1/6/2021	97	304	3.13
631	7	10/1/2020	1/6/2021	97	31	0.32
634	13	10/5/2020	1/6/2021	93	25	0.27
636	15	10/1/2020	1/7/2021	98	20	0.20
640	25	10/1/2020	1/6/2021	97	34	0.35
642	35	10/1/2020	1/6/2021	97	26	0.27
643	37	10/1/2020	1/7/2021	98	23	0.23
649	53	10/1/2020	1/6/2021	97	111	1.14
651	58	10/1/2020	1/7/2021	98	20	0.20
657	64	10/1/2020	1/7/2021	98	17	0.17
662	69	10/1/2020	1/7/2021	98	21	0.21
663	70	10/1/2020	1/7/2021	98	47	0.48
664	71	10/1/2020	1/7/2021	98	31	0.32
665	72	10/1/2020	1/6/2021	97	25	0.26
671	78	10/5/2020	1/6/2021	93	28	0.30
674	81	10/1/2020	1/7/2021	98	109	1.11
675	82	10/1/2020	1/6/2021	97	32	0.33
676	83	10/1/2020	1/6/2021	97	73	0.75
689	96*	10/1/2020	1/7/2021	98	25	0.25

*TLD-96 was installed on October 1, 2020, to monitor external gamma radiation at the food vendor location. See Table A.1 for location description.

Table 22. Fourth Quarter Results for the TLD Locations Outside the PPA and Inside the DOE Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
632	9	10/5/2020	1/6/2021	93	23	0.25
633	12	10/5/2020	1/6/2021	93	21	0.23

Table 22. Fourth Quarter Results for the TLD Locations Outside the PPA and Inside the DOE Boundary* (Continued)

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
635	14	10/1/2020	1/7/2021	98	23	0.23
638	19	10/5/2020	1/6/2021	93	21	0.23
644	38	10/5/2020	1/6/2021	93	25	0.27
659	66	10/1/2020	1/7/2021	98	23	0.23
660	67	10/1/2020	1/7/2021	98	27	0.27
669	76	10/5/2020	1/6/2021	93	24	0.26
670	77	10/5/2020	1/6/2021	93	24	0.26
672	79	10/1/2020	1/7/2021	98	22	0.22
677	84	10/1/2020	1/7/2021	98	23	0.23

*TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 19.

Table 23. Fourth Quarter Results for the TLD Locations Outside the DOE Boundary*

Mirion Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Effective Dose (mrem)	Normalized Effective Dose/day
637	16	10/5/2020	1/6/2021	93	27	0.29
641	30	10/5/2020	1/6/2021	93	23	0.25
645	40	10/1/2020	1/6/2021	97	26	0.27
666	73	10/5/2020	1/6/2021	93	22	0.24
667	74	10/5/2020	1/6/2021	93	27	0.29
668	75	10/5/2020	1/6/2021	93	25	0.27
673	80	10/5/2020	1/6/2021	93	24	0.26

*All background TLD locations located outside the DOE boundary are not listed in this table because they are listed in Table 19.

3.4.2 OSL Results

In the fourth quarter CY 2020, 7 locations were monitored for external neutron radiation for an average of 98 days (see Table 24).

All neutron results collected in the fourth quarter were reported as “M” (i.e., dose equivalents below the minimum measureable quantity), thus analysis of annual neutron dose was not required and no dose equations were used.

Table 24. Fourth Quarter Results for OSL Locations

Landauer Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Total Neutron	Fast Neutron	Thermal Neutron
2882	2	10/1/2020	1/6/2021	97	M	M	M
2883	3	10/1/2020	1/7/2021	98	M	M	M

Table 24. Fourth Quarter Results for OSL Locations (Continued)

Landauer Badge Number	TLD Location Number	Start Date	End Date	Exposure Days	Total Neutron	Fast Neutron	Thermal Neutron
2884	50	10/1/2020	1/7/2021	98	M	M	M
2885	65	10/1/2020	1/7/2021	98	M	M	M
2886	68	10/1/2020	1/7/2021	98	M	M	M
2887	81	10/1/2020	1/7/2021	98	M	M	M
2888	83	10/1/2020	1/6/2021	97	M	M	M

3.5 ANNUAL TLD AND OSL RESULTS

3.5.1 Annualized TLD Results Summary

The TLD locations for CY 2020 were monitored for external gamma radiation for an average of 365 days. This average excludes TLD location TLD-96 since it was not in place until October 1, 2020. Table 24 shows the results of the annualized results for TLD-96. Assumptions and dose equations related to TLD-96 are found in DAC-ENV-FA5480-0060.

Annualized results ranged from 61 to 1885 mrem.

The annualized background results ranged from 74 to 97 mrem.

The annualized mean background was 83 mrem.

Tables 25 through 30 show the annualized results for CY 2020.

Table 25. Annual Results for Background TLD Locations

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
22	86	363	87	83	4	0.010	0.000
54	91	364	91	83	8	0.023	0.001
85	82	363	83	83	0	-0.001	0.000
86	78	364	78	83	-5	-0.013	-0.001
87	79	364	80	83	-3	-0.009	0.000
88	78	364	78	83	-5	-0.013	-0.001
89	84	364	84	83	1	0.004	0.000
90	81	364	81	83	-2	-0.004	0.000

Table 25. Annual Results for Background TLD Locations (Continued)

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
91	83	364	83	83	0	0.001	0.000
92	73	363	74	83	-9	-0.026	-0.001
93	78	364	78	83	-5	-0.013	-0.001
94	97	364	97	83	14	0.040	0.002
95	87	364	87	83	4	0.012	0.001

Table 26. Annual Results for the LA TLD Locations

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
3	76	365	76	83	-7	-0.019	-0.001
4	82	365	82	83	-1	-0.002	0.000
5	91	365	91	83	8	0.022	0.001
6	76	365	76	83	-7	-0.019	-0.001
46	75	364	75	83	-8	-0.021	-0.001
50	177	365	177	83	94	0.258	0.011
52	78	365	78	83	-5	-0.013	-0.001
59	63	364	63	83	-20	-0.054	-0.002
60	1409	366	1408	83	1325	3.620	0.151
61	1886	366	1885	83	1802	4.923	0.205
62	73	364	73	83	-10	-0.026	-0.001
63	63	366	63	83	-20	-0.055	-0.002
65	69	365	69	83	-14	-0.038	-0.002
68	84	365	84	83	1	0.003	0.000

Table 27. Annual Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
1	771	365	773	83	690	1.884	0.079
2	992	364	997	83	914	2.497	0.104
7	109	364	110	83	27	0.072	0.003
13	90	364	90	83	7	0.020	0.001

Table 27. Annual Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary (Continued)

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
15	69	365	69	83	-14	-0.038	-0.002
25	126	364	127	83	44	0.119	0.005
35	97	364	97	83	14	0.040	0.002
37	80	365	80	83	-3	-0.008	0.000
53	393	364	395	83	312	0.852	0.036
58	61	365	61	83	-22	-0.060	-0.002
64	65	365	65	83	-18	-0.049	-0.002
69	71	365	71	83	-12	-0.032	-0.001
70	163	365	163	83	80	0.219	0.009
71	134	365	134	83	51	0.140	0.006
72	80	364	80	83	-3	-0.007	0.000
78	93	364	93	83	10	0.029	0.001
81	388	365	389	83	306	0.835	0.035
82	111	364	112	83	29	0.078	0.003
83	248	364	249	83	166	0.454	0.019
96	*	*	*	83	*	*	*

*See Table 28.

Table 28. Annual Results for TLD-96

Potential Estimated Dose for Food Vendor	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Lost Days
Effective Dose mrem/day	0.25	0.25	0.25	0.25	0.25
# of Days Food Vendor On-site	43	18	44	56	-16
# hours/day	24	24	24	24	24
# of Hours/day Food Vendor on site	4	4	4	4	4
Food Vendor mrem/hour	0.45	0.19	0.46	0.58	-0.17
Annualized mean background	83.31	83.31	83.31	83.31	83.31
background mrem/day	0.23	0.23	0.23	0.23	0.23
background mrem/hour	0.41	0.17	0.42	0.53	-0.15
Food vendor mrem	1.79	0.75	1.83	2.33	-0.67
Food Vendor background mrem	1.63	0.68	1.67	2.12	-0.61
Net Estimated Effective Dose (mrem)	0.16	0.07	0.16	0.21	-0.06
Net Annual Effective Dose (mrem)	0.54				

The estimated external radiation dose to the Food Vendor for CY 2020 was 0.54 mrem.

Table 29. Annual Results for the TLD Locations Outside the PPA and Inside the DOE Boundary*

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
9	74	364	74	83	-9	-0.024	-0.001
12	72	364	72	83	-11	-0.029	-0.001
14	73	365	73	83	-10	-0.027	-0.001
19	72	364	72	83	-11	-0.030	-0.001
38	80	364	81	83	-2	-0.006	0.000
66	82	365	82	83	-1	-0.002	0.000
67	87	365	87	83	4	0.011	0.000
76	98	364	99	83	16	0.044	0.002
77	81	364	81	83	-2	-0.004	0.000
79	71	365	71	83	-12	-0.032	-0.001
84	71	365	71	83	-12	-0.032	-0.001

*TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 25.

Table 30. Annual Results for the TLD Locations Outside the DOE Boundary*

TLD Location Number	Total Monitored Effective Dose (mrem)	Total Exposure Days	Annualized Effective Dose (mrem)	Mean Background (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
16	92	364	92	83	9	0.026	0.001
30	87	364	87	83	4	0.012	0.001
40	99	364	99	83	16	0.045	0.002
73	76	364	76	83	-7	-0.018	-0.001
74	95	364	95	83	12	0.034	0.001
75	89	364	89	83	6	0.018	0.001
80	89	364	89	83	6	0.018	0.001

*All background TLD locations located outside the DOE boundary are not listed in this table because they are listed in Table 25.

3.5.2 Determination of TLD Results Statistically Above Background at 99.7% Confidence

To determine the TLD results that were statistically above background, the standard deviation of the background measurements was calculated using a normal distribution. The result was a standard deviation of 6.33 mrem.

In order to ensure dose from D&R contractor activities are reported accurately and to reduce the potential of reporting false positives, results greater than three standard deviations from the annual mean background measurement are considered to be above background with 99.7% confidence. The result for 3 standard deviations is 19 mrem ($6.33 \times 3 = 18.99$).

The annual mean background was 83 mrem. The result for the annual mean background plus 3 standard deviations provides an upper range result of 102 mrem ($83 + 19 = 102$).

TLD locations where the annualized effective dose equaled or exceeded 102 mrem are listed in Tables 31 and 32.

There were no TLD locations outside the PPA boundary (i.e., areas accessible to the public) that were statistically above background.

Table 31. LA TLD Locations with Results Statistically Above Background*

TLD Location Number	Annualized Effective Dose (mrem)	Mean Background (mrem)	Mean Background Plus 3 Standard Deviations (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
50	177	83	102	94	0.258	0.011
60	1408	83	102	1325	3.620	0.151
61	1885	83	102	1802	4.923	0.205

*These TLD locations are not accessible to the public. The dose measurements in these locations resulted from DOE operations.

Table 32. TLD Locations Outside the LA Boundary and Inside the PPA Boundary with Results Statistically Above Background*

TLD Location Number	Annualized Effective Dose (mrem)	Mean Background (mrem)	Mean Background Plus 3 Standard Deviations (mrem)	Net Annualized Effective Dose (mrem)	Net Annualized mrem/day	Net Annualized mrem/hour
1	773	83	102	690	1.884	0.079
2	997	83	102	914	2.497	0.104
7	110	83	102	27	0.072	0.003
25	127	83	102	44	0.119	0.005
53	395	83	102	312	0.852	0.036
70	163	83	102	80	0.219	0.009
71	134	83	102	51	0.140	0.006
81	389	83	102	306	0.835	0.035
82	112	83	102	29	0.078	0.003
83	249	83	102	166	0.454	0.019

*These TLD locations are not regularly accessible to the public. The dose measurements in these locations resulted from DOE operations.

3.5.3 Annualized OSL Results Summary

The OSL locations for CY 2020 were monitored for external neutron radiation for an average of 365 days. All neutron results collected in CY 2020 were reported as “M” (i.e., dose equivalents below the minimum measureable quantity), thus analysis of annual neutron dose was not required and no dose equations were used.

3.5.4 Analysis of the Annual TLD and OSL Results

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 CY 2020, 13 locations out of 52 showed results statistically above background with 99.7% confidence. These 13 locations were consistently the areas with the highest measured results throughout the monitoring period. All of these locations were adjacent to or in close proximity to UF_6 cylinder storage yards and are either in 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 is not representative of the actual public external radiation dose.

Although there were no results for TLD locations accessible to the public that were statistically above background with 99.7% confidence, the TLD location outside the DOE boundary with the highest net annualized dose rate was TLD-40, which is located outside the DOE boundary and within the West Kentucky Wildlife Management Area (WKWMA) off of Dyke Road.

Sections 3.5.5 through 3.5.9 present results for the five objectives listed in the EMP.

3.5.5 Calculate the Effective Dose to the Maximally Exposed Individual of the Public for the Resident Scenario

The maximally exposed individual (MEI) result for the residential exposure scenario at the nearest local residence (a TLD is located at this residence) was found to be equivalent to a naturally-occurring background.

The potential effective dose for this scenario was 0 mrem for CY 2020.

3.5.6 Calculate the Effective Dose to a Member of the Public in Areas Freely Accessible to Members of the Public

The Paducah Site licenses a portion of the DOE Reservation to the Kentucky Department of Fish and Wildlife Resources for recreational uses. These areas are open to the public for use but do not have any residences within the Paducah site boundary. Public traffic is allowed on the main reservation roads outside of the active plant area as a courtesy to the public, and some members of the public visit the DOE Reservation for various reasons, which includes hunting. It is anticipated that any use would be limited to recreational purposes and durations of time spent in the area by the public would be less than full-time.

In CY 2020, there were two TLD locations that were accessible to members of the public. These locations were TLD-14 and TLD-96.

- TLD-14 is near Harmony Cemetery and is located north of the LA security fence and south of Ogden Landing Road. In CY 2009, security restrictions were eased to allow regular public access to Harmony Cemetery. In 2020, the monitoring results for TLD-14 were statistically equivalent to the average mean background for CY 2020; however, it was below the calculated average background for the site. The estimated external radiation dose to a member of the public at this location was 0 mrem.

- In CY 2020, a food vendor location was established in the C-810 parking lot. The monitoring results for TLD-96 were statistically equivalent to the average mean background for CY 2020. The estimated external radiation dose to the food vendor at this location was 0.54 mrem (see Table 28).

3.5.7 Calculate the Effective Dose to a Member of the Public at the Paducah Site Boundary

Although there were no results for TLD locations accessible to the public that were statistically above background with 99.7% confidence, the TLD location along the DOE boundary with the highest net annualized dose rate was TLD-40, which is located outside the DOE boundary and within the WKWMA off of Dyke Road.

The calculation of a maximum reasonable dose at this location, was determined by the following equation.

16 mrem per year × 104 days per year × 10 hours per day) ÷ (366 days per year × 24 hours/day) = 1.89 mrem/year

A member of the public would receive an estimated external radiation effective dose of 1.89 mrem/year at the Paducah Site boundary.

3.5.8 Establish the Potential Dose a Member of the Public May Receive While Visiting or Passing Through the Paducah Site

This applies to visitors accessing the Paducah Site in the area closed for public access, but outside DOE-controlled areas, as defined by DOE Order 458.1.

For CY 2020, the estimated scenario for potential external radiation effective dose received by a member of the public while visiting or passing through Paducah Site is determined by the following equation:

Table 31 and Table 32 Average of the Net Annualized mrem/hour × 80 hours (i.e., from DAC-ENV-FA5480-0060)

0.051 mrem/hour × 80 hours per year = 4.08 mrem/year

The estimated potential external radiation effective dose received by a member of the public passing through accessible portions of the DOE Reservation would receive 4.08 mrem/year in a scenario where areas of highest exposure are visited 80 hours per year.

For 2020, an estimated potential external radiation collective dose has been calculated by multiplying the dose to the MEI from the preceding paragraph by a total estimated number of visitors hiking within the WKWMA annually (i.e., 150 persons), which resulted in a representative collective dose of 0.612 person-rem/year.

4.08 mrem/year × 1 rem/1000 mrem × 150 persons = 0.612 person-rem/year.

3.5.9 Establish the Potential Radiation Dose from Direct Exposure to DOE Operations at the boundary of the DOE Perimeter Fence

Based on the results of measurements in areas accessible to the public or near the closest local residence, external radiation levels were found to be equivalent to background levels; therefore, the effective dose received by a member of the public from DOE operations is below the applicable DOE limit of 100 mrem within a year, in accordance with DOE O 458.1.

4. PREVIOUS TLD AND OSL ANNUALIZED RESULTS COMPARISON TO CURRENT YEAR ANNUALIZED RESULTS

This section presents the results of a comparison between previous TLD and OSL annualized results and current year TLD and OSL annualized results. In previous years, the comparison was performed between the current year and the preceding year. The report for this year will begin comparison of a minimum of five years of data comparison in order to align with information required in the annual site evaluation report (ASER) submitted to DOE.

4.1 COMPARISON OF OSL ANNUALIZED RESULTS

All neutron results collected from 2016 through 2019 were reported as "M" (i.e., dose equivalents below the minimum measureable quantity). For CY 2020, all neutron results were also reported as "M."

4.2 COMPARISON OF TLD ANNUALIZED RESULTS

Tables 33 through 38 present the results of comparison between average results from 2015 through 2019 with 2020 results.

A new TLD location, TLD-96, was added in 2020 to monitor the food vendor location, so no comparison data was available.

4.2.1 Comparison of Annualized Results for Background TLD Locations

A review of the background TLD locations from 2015 to 2020 indicate there was one minor location change for location TLD-92 that occurred in 2018, but TLD-92 still represented the same area. No other TLD locations changed.

Table 33 shows the annual results of background minimums, maximums, means, standard deviations, 3 sigma values, and lower and upper ranges for 2015 through 2020, and compares the results of the averages of 2015 through 2019 with the results from 2020.

Table 33. Comparison of Annual Background Information

Annual Background Information	2015	2016	2017	2018	2019	2015 to 2019 Average*	2020*	Increase or Decrease from Average to 2020*	% Change*
Background Minimum (mrem)	78	77	82	77	75	78	74	-4.2	-5.7%
Background Maximum (mrem)	104	92	94	124	86	100	97	-2.6	-2.7%
Annualized Mean Background (mrem)	91	85	87	87	80	86	83	-3.0	-3.6%
Standard Deviation	6.55	4.52	3.50	11.41	3.79	5.95	6.33	0.4	5.9%
3 sigma	19.64	13.57	10.49	34.24	11.36	17.86	19.00	1.1	6.0%
Lower Range	71.30	71.10	76.88	52.46	68.72	68.09	64.31	-3.8	-5.9%
Upper Range	110.59	98.23	97.87	120.94	91.44	103.82	102.32	-1.5	-1.5%

*Includes decimal places not shown when rounding to two significant digits.

Table 34 presents the results of comparison between average results from 2015 through 2019 with 2020 results for individual Background TLD locations.

Table 34. Comparison of Annualized Results for Background TLD Locations

TLD Location Number	Average Annualized Effective Dose (mrem)*	2020 Annualized Effective Dose (mrem)*	Increase or Decrease from Average to 2020*	% Change*
22	83	87	3	3.6%
54	98	91	-7	-7.4%
85	78	83	5	5.5%
86	86	78	-8	-9.6%
87	83	80	-3	-3.9%
88	85	78	-6	-8.0%
89	86	84	-2	-2.3%
90	89	81	-7	-9.0%
91	86	83	-2	-2.6%
92	85	74	-12	-16%
93	84	78	-6	-7.8%
94	86	97	11	12%
95	88	87	-1	-0.6%

*Includes decimal places not shown when rounding to two significant digits.

4.2.2 Comparison of Annualized Results for the Limited Area TLD Locations

A review of the LA TLD locations from 2015 to 2020 indicate there were no TLD location changes for the TLD locations listed in Table 35.

Table 35 presents the results of comparison between average results from 2015 through 2019 with 2020 results.

TLD locations where the text is in **bold** indicate where the 2020 annualized results were above the maximum background with 99.7% confidence. The highlighted cells are the TLD locations closest to the perimeter of the DUF_6 facility or operations. Radiation dose rates at these highlighted areas are subject to change as a result of DUF_6 plant operations such as UF_6 cylinder relocation, which may explain the dose increases and decreases shown in this table.

Table 35. Comparison of Annualized Results for the LA TLD Locations

TLD Location Number	Average Annualized Effective Dose (mrem)	2020 Annualized Effective Dose (mrem)	Increase or Decrease from Average to 2020*	% Change*
3	84	76	-8	-10%
4	81	82	1	1.2%
5	90	91	2	1.8%

Table 35. Comparison of Annualized Results for the LA TLD Locations (Continued)

TLD Location Number	Average Annualized Effective Dose (mrem)	2020 Annualized Effective Dose (mrem)	Increase or Decrease from Average to 2020*	% Change*
6	75	76	1	1.6%
46	77	75	-1	-1.8%
50	173	**177**	**4**	**2.3%**
52	75	78	3	3.8%
59	69	63	-6	-9.5%
60	1236	**1408**	**172**	**12%**
61	2384	**1885**	**-500**	**-27%**
62	71	73	3	3.5%
63	68	63	-5	-7.6%
65	71	69	-2	-2.3%
68	83	84	1	1.7%

*Includes decimal places not shown when rounding to two significant digits.

4.2.3 Comparison of Annualized Results for TLD Locations Outside the Limited Area Boundary and Inside the Property Protection Area Boundary

A review of the TLD locations outside the LA boundary and inside the PPA boundary from 2015 to 2020 indicate that there was one minor location change for location TLD-19 that occurred in 2018, but TLD-19 still represents the same area. No other TLD locations changed.

Table 36 presents the results of comparison between average results from 2015 through 2019 with 2020 results.

TLD locations where the text is in **bold** indicate where the 2020 annualized results were above the maximum background with 99.7% confidence. The highlighted cells are the TLD locations closest to the perimeter of the DUF_6 facility or operations. Radiation dose rates at these highlighted areas are subject to change as a result of DUF_6 plant operations such as UF_6 cylinder relocation, which may explain the dose increases and decreases shown in this table.

Table 36. Comparison of Annualized Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary

TLD Location Number	Average Annualized Effective Dose (mrem)[a]	2020 Annualized Effective Dose (mrem)[a]	Increase or Decrease from Average to 2020[a]	% Change[a]
1	793	**773**	**-21**	**-2.7%**
2	1048	**997**	**-51**	**-5.1%**
7	112	**110**	**-2**	**-2.3%**
13	90	90	1	0.7%
15	69	69	0	0.3%
25	115	**127**	**12**	**9.3%**
35	105	97	-7	-7.3%
37	82	80	-2	-2.5%

Table 36. Comparison of Annualized Results for TLD Locations Outside the LA Boundary and Inside the PPA Boundary (Continued)

TLD Location Number	Average Annualized Effective Dose (mrem)[a]	2020 Annualized Effective Dose (mrem)[a]	Increase or Decrease from Average to 2020[a]	% Change[a]
53	401	**395**	-7	**-1.7%**
58	67	61	-6	-9.7%
64	70	65	-5	-7.4%
69	71	71	1	0.9%
70	182	**163**	**-18**	**-11%**
71	145	**134**	**-11**	**-7.8%**
72	84	80	-3	-4.2%
78	94	93	0	-0.3%
81	382	**389**	**7**	**1.8%**
82	**110**	**112**	**2**	**1.6%**
83	221	**249**	**28**	**11%**
96	[b]	25	[b]	[b]

[a] Includes decimal places not shown when rounding to two significant digits.
[b] TLD-96 is a new location installed on October 1, 2020. No comparison data is available.

4.2.4 Comparison of Annualized Results for TLD Locations Outside the PPA and Inside the DOE Boundary

A review of the TLD locations outside the PPA boundary from 2015 to 2020 indicate no TLD locations changed.

Table 37 presents the results of comparison between average results from 2015 through 2019, with 2020 results.

Table 37. Comparison of Annualized Results for the TLD Locations Outside the PPA and Inside the DOE Boundary[a]

TLD Location Number	Average Annualized Effective Dose (mrem)[b]	2020 Annualized Effective Dose (mrem)[b]	Increase or Decrease from Average to 2020[b]	% Change[b]
9	74	74	0	0.0%
12	75	72	-3	-4.1%
14	75	73	-2	-2.4%
19	82	72	-10	-14%
38	86	81	-5	-6.0%
66	83	82	-1	-1.4%
67	88	87	-1	-0.9%
76	83	99	16	16%
77	81	81	1	1.1%
79	78	71	-7	-10%
84	74	71	-3	-4.2%

[a] TLD-86 is located outside the PPA and inside the DOE boundary; however, it is not listed in this table because it is a background location. It is listed in Table 34.
[b] Includes decimal places not shown when rounding to two significant digits.

4.2.5 Comparison of Annualized Results for TLD Locations Outside the DOE Boundary

A review of the TLD locations outside the DOE boundary from 2015 to 2020 indicate no TLD locations changed.

Table 38 presents the results of comparison between average results from 2015 through 2019 with 2020 results.

Table 38. Comparison of Annualized Results for the TLD Locations Outside the PPA Boundary[a]

TLD Location Number	Average Annualized Effective Dose (mrem)[b]	2020 Annualized Effective Dose (mrem)[b]	Increase or Decrease from Average to 2020[b]	% Change[b]
16	95	92	-3	-2.9%
30	85	87	3	3.3%
40	103	99	-3	-3.1%
74	92	95	3	3.2%
75	87	89	2	2.3%
80	81	89	8	9.3%

[a] All background TLD locations located outside the DOE boundary are not listed in this table because they are listed in Table 34.
[b] Includes decimal places not shown when rounding to two significant digits.

4.2.6 Comparison of Annual Site Environmental Reports Direct Radiation Pathway

A review of previous ASERs indicate the direct radiation pathway for CY 2020 is consistent with previous years.

Table 39 presents the results of the direct radiation pathway from 2015 through 2020.

Table 39. Comparison of Potential Radiological Dose to the MEI for the Direct Radiation Pathway

Direct Radiation Pathway	2015	2016	2017	2018	2019	2020
Dose to MEI (mrem/year)	5.1E+00	4.2E+00	3.8E+00	5.0E+00	3.0E+00	4.1E+00
Percent of DOE 100 mrem/year Limit	5.1%	4.2%	3.8%	5.0%	3.0%	4.1%
Estimated Collective (Population Dose) (person-rem/year)	7.7E-01	6.4E-01	5.6E-01	7.5E-01	4.5E-01	6.1E-01
Population within 50 miles*	150	150	150	150	150	150

*Population dose for direct radiation is based on a representative assumption using the estimated visitors hiking in the WKWMA only.

5. REFERENCES

CP2-ES-0006/FR5, *Environmental Monitoring Plan Fiscal Year 2020 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

CP2-ES-0006/FR6, *Environmental Monitoring Plan Fiscal Year 2021 Paducah Gaseous Diffusion Plant, Paducah, Kentucky*.

DOE (U.S Department of Energy) 2020. *Methods for Conducting Risk Assessments and Risk Evaluations at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky Volume 1. Human Health.* DOE/LX/07-0107&D2/R11/V1, June.

FPDP (Fluor Paducah Deactivation Project) 2016a. *Annual Report on External Radiation Monitoring for Calendar Year 2015, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FPDP-RPT-0015, June.

FPDP 2016b. *Paducah Site Annual Site Environmental Report for Calendar Year 2015*, FPDP-RPT-0020, September.

FPDP 2017a. *Annual Report on External Radiation Monitoring for Calendar Year 2016, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FPDP-RPT-0082, August.

FPDP 2017b. *Paducah Site Annual Site Environmental Report for Calendar Year 2016*, FPDP-RPT-0091, September.

FRNP (Four Rivers Nuclear Partnership, LLC) 2018a. *Paducah Site Annual Site Environmental Report for Calendar Year 2017*, FRNP-RPT-0022, September.

FRNP 2018b. *Annual Report on External Radiation Monitoring for Calendar Year 2017, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0023/FR1, May.

FRNP 2019. *Annual Report on External Radiation Monitoring for Calendar Year 2018, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-0077, March.

FRNP 2020a. *Paducah Site Annual Site Environmental Report for Calendar Year 2018,* FRNP-RPT-0083, February.

FRNP 2020b. *Annual Report on External Radiation Monitoring for Calendar Year 2019, Paducah Gaseous Diffusion Plant, Paducah, Kentucky*, FRNP-RPT-00133, May.

FRNP 2020c. *Paducah Site Annual Site Environmental Report for Calendar Year 2019*, FRNP-RPT-0137, October.

FRNP 2021. *2020 Annual External Radiation Monitoring Report*, DAC-ENV-FA5480-0060, Four Rivers Nuclear Partnership, LLC, Paducah, KY, March.

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APPENDIX A

MONITORING LOCATIONS AND DESCRIPTIONS

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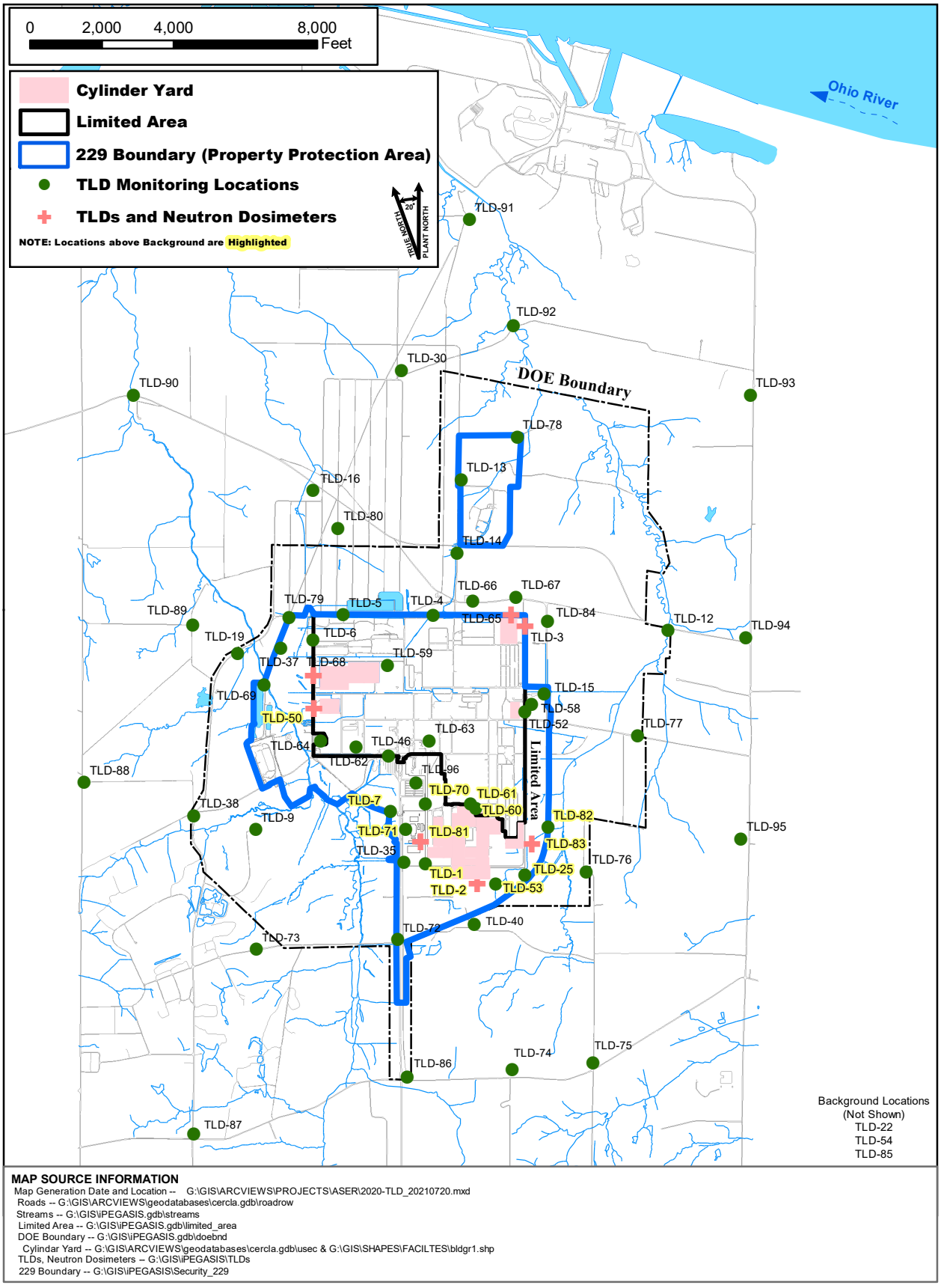

Figure A.1. Dosimeter Locations in the Vicinity of the Paducah Site

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

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
TLD-1	PGDP security fence west of C-745-M near intersection of Patrol Road and Alabama Avenue near pole 21-20. Outside fence behind 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 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 near pole 23-31. Perimeter fence NE corner	N 37 07 04.17	W 088 47 57.21	-1399	739
TLD-4	North PGDP security fence near North-South Diversion Ditch.	N 37 07 15.74	W 088 48 25.56	-3957	1052
TLD-5	North PGDP security fence north of C-747-A near pole T53A1P26G. North perimeter fence between lagoon	N 37 07 24.38	W 088 48 54.58	-6464	1068
TLD-6	West PGDP security fence west of C-746-P1 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 DOE building (C-103). Perimeter fence across from entrance to DOE bldg.	N 37 06 29.15	W 088 49 02.49	-5153	-4400
TLD-9	Northeast corner of fence of old KOW water treatment plant, near Monitoring Well 309. Gate to MW305	N 37 06 37.12	W 088 49 48.11	-8901	-4907
TLD-12	Institutional controls fence near Monitoring Well 191 where Little Bayou Creek crosses Hwy 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. TLD Location Name, Description, and Coordinates (Continued)

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
TLD-14	Institutional controls fence along North-South Diversion Ditch on west side of 14th street extension near Highway 358 (K003). Fence at North-South ditch, 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	N 37 06 45.01	W 088 47 58.91	-864	-1129
TLD-16	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 MW 426	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	N 37 06 00.02	W 088 48 26.49	-1401	-6172
TLD-30	Take the road by the PGDP landfills, drive past Monitoring Well 98 and Monitoring Well 235. 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	Outfall 017 off of Plant Access Road. Outfall 017 DUF_6 laydown yard	N 37 06 21.480	W 088 49 03.960	-4773	-5806
TLD-37	KPDES Outfall 001 behind Vortec facility. K001	N 37 07 18.600	W 088 49 15.660	-8202	138
TLD-38	Five-Points Creek with concrete bridge, on tree behind 2A sign.	N 37 06 43.320	W 088 50 09.000	-10630	-4528

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

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
TLD-40	Turn north on Kelly Road off Woodville Road, go about 1/2 mile on Kelly Road and turn left, go about 1/2 mile, TLD placed 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
TLD-46	Truck entrance at receiving C-720	N 37 06 44.700	W 088 49 00.120	-5198	-2865
TLD-50	West Patrol Road fence across from C-745-A	N 37 07 02.88	W 088 49.15.18	-7287	-1547
TLD-52	East Patrol Road fence across from C-745-E.	N 37 06 42.18	W 088 48.07.20	-1397	-1628
TLD-53	Security fence at southeast corner of C-745-T Yard. Down fence line away from TLD-2.	N 37 06 00.42	W 088 48.37.02	-2220	-6423
TLD-54	Residence; Jalusian Trail	N 57 87 72.16	E 23 93 13.48	45296	-25254
TLD-58	West Central C-755 Complex	N 59 07 98.00	E 22 88 70.74	-1209	-1422
TLD-59	C-752-A Break Area	N 59 15 61.62	E 22 78 55.79	-5234	-339
TLD-60	C-333-A 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 HP 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 Yard; South of C-762 Laydown Yard	N 37 07 08.54386	W 088 48 00.45376	-1795	1062

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

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
TLD-66	Located on tree @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 Laydown yard	N 37 07 12.70502	W 088 47 56.75697	-1658	1560
TLD-68	West Security Fence West of C-745-B Cylinder Yard and Southeast of 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 @Northeast corner of pond North of C-611	N 37 07 13.70394	W 088 49 28.37928	-8664	-888
TLD-70	Outside of West Security Fence Southeast of C-333, midway between C810 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 @train tracks on Acid Road	N 37 06 06.14205	W 088 50 02.01070	-8883	-8241
TLD-74	Located on "Warning Siren" sign @turnoff North of Magruder and Woodville intersection	N 37 05 10.96196	W 088 48 53.61411	-1765	-11586
TLD-75	Located on "Warning Siren" sign @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 and McCaw Roads	N 37 05 55.05466	W 088 48 06.27328	310	-6082

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

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
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 MW 453 and MW 454 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	N 37 06 18.33947	W 088 48 56.42591	-4314	-5262
TLD-82	Short pole East of Dyke Road North of Outfall 13	N 37 06 10.13175	W 088 48 13.53048	-765	-4851
TLD-83	Large metal power pole West of Dyke Road South of Outfall 13	N 37 06 07.30640	W 088 48 20.71726	-1214	-5319
TLD-84	Located @MW496 on the East Side of Dyke Road	N 37 07 03.50589	W 088 47 49.26485	-769	894
TLD-85	Residence; corner of Springwell and Buckner Lane	N 37 03 27.9036	W 088 40 43.9638	39082	-7750
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 of 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

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

Location Name	Location Description	North Long	West or East Lat	Xcoord	Ycoord
TLD-90	Bridge on Ogden Landing Road east of Lamb's garage. On NE 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	First left road past C-746-U Landfill, cross Iron Bridge, on ICM-01 Notice Sign across from MW 133	N 37 08 23.18	W 088 47 25.41	-1717	9125
TLD-93	MW 100, 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 SW corner of parking lot	N 37 06 40.5468	W 088 46 47.2872	4617	-5167
TLD-96	C-810 Parking Lot on SST O&M Parking Only sign. Fourth sign—TLD facing south towards DUF_6 facility.	N 37 06 34.11	W 88 48 50.9616	-4447	-3610
TLD-FB	Taken along while placing and collecting all other samples—stored in "lead box" at C-101 Dosimetry office	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

APPENDIX B

TLD AND OSL ISSUE AND COLLECTION DATES

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TABLES

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Table B.1. First Quarter TLD and OSL Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
01/08/2020 09:45 3096-625	AW	5/6/2020 10:06	AW	TLD-1	N/A
01/08/2020 09:30 3099-626 2882	AW	5/6/2020 9:30	AW	TLD-2	N/A
01/08/2020 08:18 3100-627 2883	AW	5/6/2020 8:55	AW	TLD-3	N/A
01/08/2020 12:47 3101-628	AW	5/5/2020 15:35	AW	TLD-4	N/A
01/08/2020 12:41 3102-629	AW	5/5/2020 15:22	AW	TLD-5	N/A
01/08/2020 12:28 3103-630	AW	5/5/2020 15:12	AW	TLD-6	N/A
01/08/2020 10:11 3104-631	AW	5/5/2020 15:54	AW	TLD-7	N/A
01/08/2020 15:03 3105-632	AW	5/6/2020 14:24	AW	TLD-9	N/A
01/08/2020 13:53 3106-633	AW	5/6/2020 12:51	AW	TLD-12	N/A
01/08/2020 14:02 3107-634	AW	5/6/2020 12:55	AW	TLD-13	N/A
01/08/2020 08:08 3108-635	AW	5/6/2020 8:44	AW	TLD-14	N/A
01/08/2020 07:56 3109-636	AW	5/6/2020 8:33	AW	TLD-15	N/A
01/08/2020 14:35 3110-637	AW	5/6/2020 13:34	AW	TLD-16	N/A
1/08/2020 14:54 3111-638	AW	5/6/2020 14:01	AW	TLD-19	N/A
01/09/2020 09:03 3112-639	AW	5/5/2020 14:22	AW	TLD-22	N/A
01/08/2020 09:17 3113-640	AW	5/6/2020 9:19	AW	TLD-25	N/A
01/08/2020 14:25 3114-641	AW	5/6/2020 13:26	AW	TLD-30	N/A
01/08/2020 10:06 3115-642	AW	5/5/2020 15:57	AW	TLD-35	N/A
01/08/2020 10:45 3116-643	AW	5/5/2020 15:08	AW	TLD-37	N/A
01/08/2020 15:00 3117-644	AW	Lost	AW	TLD-38	Estimate will be performed based on results of other quarters.
01/08/2020 09:19 3118-645	AW	5/6/2020 19:25	AW	TLD-40	N/A
01/08/2020 10:13 3119-646	AW	5/5/2020 15:48	AW	TLD-46	N/A
01/08/2020 10:36 3120-647 2884	AW	5/5/2020 15:02	AW	TLD-50	N/A
01/08/2020 0742 3121-648	AW	5/6/2020 8:19	AW	TLD-52	N/A

Table B.1. First Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
01/08/2020 09:35 3122-649	AW	5/6/2020 9:35	AW	TLD-53	N/A
01/08/2020 15:41 3123-650	AW	5/4/2020 17:15	AW	TLD-54	N/A
01/08/2020 07:50 3124-651	AW	5/6/2020 8:30	AW	TLD-58	N/A
01/07/2020 14:33 3125-652	AW	5/5/2020 13:28	AW	TLD-59	N/A
01/07/2020 13:55 3126-653	AW	5/5/2020 13:15	AW	TLD-60	N/A
01/07/2020 14:00 3127-654	AW	5/5/2020 13:13	AW	TLD-61	N/A
01/07/2020 15:40 3128-655	AW	5/5/2020 13:40	AW	TLD-62	N/A
01/07/2020 14:20 3129-656	AW	5/5/2020 13:19	AW	TLD-63	N/A
01/08/2020 13:05 3130-657	AW	5/5/2020 15:20	AW	TLD-64	N/A
01/08/2020 08:54 3131-658 2885	AW	5/6/2020 8:59	AW	TLD-65	N/A
01/08/2020 08:05 3132-659	AW	5/6/2020 8:42	AW	TLD-66	N/A
01/08/2020 08:03 3133-660	AW	5/6/2020 8:40	AW	TLD-67	N/A
01/08/2020 10:37 3134-661 2886	AW	5/5/2020 15:05	AW	TLD-68	N/A
01/08/2020 10:25 3135-662	AW	5/5/2020 14:50	AW	TLD-69	N/A
01/08/2020 10:03 3136-663	AW	5/6/2020 10:17	AW	TLD-70	N/A
01/08/2020 09:58 3137-664	AW	5/6/2020 10:15	AW	TLD-71	N/A
01/08/2020 09:43 3138-665	AW	5/6/2020 10:12	AW	TLD-72	N/A
01/08/2020 15:08 3139-666	AW	5/6/2020 14:30	AW	TLD-73	N/A
01/08/2020 13:22 3140-667	AW	5/6/2020 12:10	AW	TLD-74	N/A
01/08/2020 13:26 3141-668	AW	5/6/2020 12:15	AW	TLD-75	N/A
01/08/2020 13:32 3142-669	AW	5/6/2020 12:22	AW	TLD-76	N/A
01/08/2020 13:36 3143-670	AW	5/6/2020 12:30	AW	TLD-77	N/A
01/08/2020 14:05 3144-671	AW	5/6/2020 13:00	AW	TLD-78	N/A
01/08/2020 12:30 3145-672	AW	5/5/2020 15:18	AW	TLD-79	N/A

Table B.1. First Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
01/08/2020 14:36 3146-673	AW	5/6/2020 13:32	AW	TLD-80	N/A
01/08/2020 09:48 3147-674 2887	AW	5/6/2020 10:10	AW	TLD-81	N/A
01/08/2020 09:07 3148-675	AW	5/6/2020 9:06	AW	TLD-82	N/A
01/08/2020 09:13 3149-676 2888	AW	5/6/2020 9:16	AW	TLD-83	N/A
01/08/2020 07:59 3150-677	AW	5/6/2020 8:37	AW	TLD-84	N/A
01/08/2020 10:20 3151-678	AW	5/4/2020 17:00	SO	TLD-85	N/A
01/08/2020 13:18 3152-679	AW	5/6/2020 12:01	AW	TLD-86	N/A
01/08/2020 15:14 3153-680	AW	5/6/2020 14:35	AW	TLD-87	N/A
01/08/2020 14:48 3154-681	AW	5/6/2020 13:53	AW	TLD-88	N/A
01/08/2020 14:45 3155-682	AW	5/6/2020 13:48	AW	TLD-89	N/A
01/08/2020 14:38 3156-683	AW	5/6/2020 13:44	AW	TLD-90	N/A
01/08/2020 14:20 3157-684	AW	5/6/2020 13:19	AW	TLD-91	N/A
01/09/2020 09:30 3158-685	AW	5/6/2020 13:10	AW	TLD-92	N/A
01/08/2020 14:46 3159-686	AW	5/6/2020 12:41	AW	TLD-93	N/A
01/08/2020 13:51 3160-687	AW	5/6/2020 12:40	AW	TLD-94	N/A
1/08/2020 13:40 3161-688	AW	5/6/2020 12:34	AW	TLD-95	N/A
1/09/2020 09:45 3162-689	AW	5/6/2020 15:00	AW	TLD-FB	N/A
1/07/2020 13:40 3163-690	AW	5/6/2020 7:00	AW	TLD-TB	N/A

Table B.2. Second Quarter TLD and OSL Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
5/6/2020 10:06 4893-625	AW	7/15/2020 9:07	AW	TLD-1	N/A
5/6/2020 09:30 4896-626 2882	AW	7/15/2020 8:45	AW	TLD-2	N/A
5/6/2020 08:55 4897-627 2883	AW	7/14/2020 15:11	AW	TLD-3	N/A
5/5/2020 15:35 4898-628	AW	7/15/2020 10:39	AW	TLD-4	N/A
5/5/2020 15:22 4899-629	AW	7/15/2020 10:34	AW	TLD-5	N/A
5/5/2020 15:12 4900-630	AW	7/15/2020 10:26	AW	TLD-6	N/A
5/5/2020 15:54 4901-631	AW	7/15/2020 9:43	AW	TLD-7	N/A
5/6/2020 14:24 4902-632	AW	7/15/2020 15:09	AW	TLD-9	N/A
5/6/2020 12:51 4903-633	AW	7/15/2020 15:54	AW	TLD-12	N/A
5/6/2020 12:55 4904-634	AW	7/15/2020 14:00	AW	TLD-13	N/A
5/6/2020 08:44 4905-635	AW	7/14/2020 14:58	AW	TLD-14	N/A
5/6/2020 08:33 4906-636	AW	7/14/2020 14:48	AW	TLD-15	N/A
5/6/2020 10:34 4907-637	AW	7/15/2020 14:30	AW	TLD-16	N/A
5/6/2020 14:01 4908-638	AW	7/15/2020 15:00	AW	TLD-19	N/A
5/5/2020 14:22 4909-639	AW	7/15/2020 12:52	AW	TLD-22	N/A
5/6/2020 09:19 4910-640	AW	7/14/2020 15:53	AW	TLD-25	N/A
5/6/2020 13:26 4911-641	AW	7/15/2020 14:21	AW	TLD-30	N/A
5/5/2020 15:57 4912-642	AW	7/15/2020 9:47	AW	TLD-35	N/A
5/5/2020 15:08 4913-643	AW	7/15/2020 10:22	AW	TLD-37	N/A
5/5/2020 14:22 4914-644	AW	7/15/2020 15:04	AW	TLD-38	N/A
5/6/2020 19:25 4915-645	AW	7/15/2020 8:32	AW	TLD-40	N/A
5/5/2020 15:48 4916-646	AW	7/15/2020 9:52	AW	TLD-46	N/A
5/5/2020 15:02 4917-647 2884	AW	7/15/2020 10:08	AW	TLD-50	N/A
5/6/2020 08:19 4918-648	AW	7/14/2020 14:42	AW	TLD-52	N/A
5/6/2020 09:35 4919-649	AW	7/15/2020 8:42	AW	TLD-53	N/A

Table B.2. Second Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
05/04/2020 17:15 4920-650	AW	7/15/2020 16:00	AW	TLD-54	N/A
5/6/2020 08:30 4921-651	AW	7/14/2020 14:46	AW	TLD-58	N/A
5/5/2020 13:28 4922-652	AW	7/14/2020 14:14	AW	TLD-59	N/A
5/5/2020 13:15 4923-653	AW	7/14/2020 14:25	AW	TLD-60	N/A
5/5/2020 13:13 4924-654	AW	7/14/2020 14:28	AW	TLD-61	N/A
5/5/2020 13:40 4925-655	AW	7/14/2020 14:18	AW	TLD-62	N/A
5/5/2020 13:19 4926-656	AW	7/14/2020 14:05	AW	TLD-63	N/A
5/5/2020 15:20 4927-657	AW	7/15/2020 10:55	AW	TLD-64	N/A
5/6/2020 08:59 4928-658 2885	AW	7/14/2020 15:14	AW	TLD-65	N/A
5/6/2020 08:42 4929-659	AW	7/14/2020 14:56	AW	TLD-66	N/A
5/6/2020 08:40 4930-660	AW	7/14/2020 14:54	AW	TLD-67	N/A
5/5/2020 15:05 4931-661 2886	AW	7/15/2020 10:20	AW	TLD-68	N/A
5/5/2020 14:50 4932-662	AW	7/15/2020 10:03	AW	TLD-69	N/A
5/6/2020 10:17 4933-663	AW	7/15/2020 9:26	AW	TLD-70	N/A
5/6/2020 10:15 4934-664	AW	7/15/2020 9:17	AW	TLD-71	N/A
5/6/2020 10:12 4935-665	AW	7/15/2020 9:04	AW	TLD-72	N/A
5/6/2020 14:30 4936-666	AW	7/15/2020 15:16	AW	TLD-73	N/A
5/6/2020 12:10 4937-667	AW	7/15/2020 15:15	AW	TLD-74	N/A
5/6/2020 12:15 4938-668	AW	7/15/2020 15:20	AW	TLD-75	N/A
5/6/2020 12:22 4939-669	AW	7/15/2020 15:30	AW	TLD-76	N/A
5/6/2020 12:30 4940-670	AW	7/15/2020 15:34	AW	TLD-77	N/A
5/6/2020 13:00 4941-671	AW	7/15/2020 14:02	AW	TLD-78	N/A
5/5/2020 15:18 4942-672	AW	7/15/2020 10:31	AW	TLD-79	N/A
5/5/2020 13:32 4943-673	AW	7/15/2020 14:27	AW	TLD-80	N/A

Table B.2. Second Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
5/6/2020 10:10 4944-674 2887	AW	7/15/2020 9:15	AW	TLD-81	N/A
5/6/2020 09:06 4945-675	AW	7/14/2020 15:12	AW	TLD-82	N/A
5/6/2020 09:16 4946-676 2888	AW	7/14/2020 15:25	AW	TLD-83	N/A
5/6/2020 08:37 4947-677	AW	7/14/2020 15:53	AW	TLD-84	N/A
5/4/2020 17:00 4948-678	AW	7/15/2020 9:56	SO	TLD-85	N/A
5/6/2020 12:01 4949-679	AW	7/15/2020 13:10	AW	TLD-86	N/A
5/6/2020 14:35 4950-680	AW	Lost	AW	TLD-87	Estimate will be performed based on results of other quarters.
5/6/2020 13:53 4951-681	AW	7/15/2020 14:51	AW	TLD-88	N/A
5/6/2020 13:48 4952-682	AW	7/15/2020 14:42	AW	TLD-89	N/A
5/6/2020 13:44 4953-683	AW	7/15/2020 14:38	AW	TLD-90	N/A
5/6/2020 13:19 4954-684	AW	7/15/2020 14:15	AW	TLD-91	N/A
5/6/2020 13:10 4955-685	AW	7/15/2020 14:08	AW	TLD-92	N/A
5/6/2020 12:41 4956-686	AW	7/15/2020 15:44	AW	TLD-93	N/A
5/6/2020 12:40 4957-687	AW	7/15/2020 15:51	AW	TLD-94	N/A
5/6/2020 12:34 4958-688	AW	7/15/2020 15:37	AW	TLD-95	N/A
5/6/2020 15:00 4959-689	AW	7/15/2020 16:00	AW	TLD-FB	N/A
5/6/2020 12:34 4960-690	AW	7/14/2020 14:00	AW	TLD-TB	N/A

Table B.3. Third Quarter TLD and OSL Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/15/2020 09:07 7391-625	AW	10/1/2020 13:24	AW	TLD-1	N/A
7/15/2020 08:45 7394-626 2882	AW	10/1/2020 13:07	AW	TLD-2	N/A
7/14/2020 15:11 7395-627 2883	AW	10/1/2020 10:07	AW	TLD-3	N/A
7/15/2020 10:39 7396-628	AW	10/1/2020 14:51	AW	TLD-4	N/A
7/15/2020 10:34 7397-629	AW	10/1/2020 14:46	AW	TLD-5	N/A
7/15/2020 10:26 7398-630	AW	10/1/2020 14:35	AW	TLD-6	N/A
7/15/2020 09:43 7399-631	AW	10/1/2020 13:59	AW	TLD-7	N/A
7/15/2020 15:09 7400-632	AW	10/5/2020 14:00	AW	TLD-9	N/A
7/15/2020 15:54 7401-633	AW	10/5/2020 10:34	AW	TLD-12	N/A
7/15/2020 14:00 7402-634	AW	10/5/2020 12:37	AW	TLD-13	N/A
7/14/2020 14:58 7403-635	AW	10/1/2020 9:58	AW	TLD-14	N/A
7/14/2020 14:48 7404-636	AW	10/1/2020 9:35	AW	TLD-15	N/A
7/15/2020 14:30 7405-637	AW	10/5/2020 13:25	AW	TLD-16	N/A
7/15/2020 15:00 7406-638	AW	10/5/2020 13:50	AW	TLD-19	N/A
7/15/2020 12:52 7407-639	AW	10/1/2020 9:00	AW	TLD-22	N/A
7/14/2020 15:33 7408-640	AW	10/1/2020 10:45	AW	TLD-25	N/A
7/15/2020 14:21 7409-641	AW	10/5/2020 13:00	AW	TLD-30	N/A
7/15/2020 09:47 7410-642	AW	10/1/2020 14:04	AW	TLD-35	N/A
7/15/2020 10:22 7411-643	AW	10/1/2020 14:30	AW	TLD-37	N/A
7/15/2020 15:04 7412-644	AW	10/5/2020 13:55	AW	TLD-38	N/A
7/15/2020 08:32 7413-645	AW	10/1/2020 12:57	AW	TLD-40	N/A
7/15/2020 09:52 7414-646	AW	10/1/2020 14:09	AW	TLD-46	N/A
7/15/2020 10:08 7415-647 2884	AW	10/1/2020 14:18	AW	TLD-50	N/A
7/14/2020 14:42 7416-648	AW	10/1/2020 9:23	AW	TLD-52	N/A
7/15/2020 08:40 7417-649	AW	10/1/2020 13:15	AW	TLD-53	N/A

Table B.3. Third Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/15/2020 16:00 7418-650	AW	10/1/2020 8:24	AW	TLD-54	N/A
7/14/2020 14:46 7419-651	AW	10/1/2020 9:33	AW	TLD-58	N/A
7/14/2020 14:14 7420-652	AW	10/5/2020 9:28	AW	TLD-59	N/A
7/14/2020 14:25 7421-653	AW	10/5/2020 8:50	AW	TLD-60	N/A
7/14/2020 14:28 7422-654	AW	10/5/2020 9:00	AW	TLD-61	N/A
7/14/2020 14:18 7423-655	AW	10/5/2020 9:33	AW	TLD-62	N/A
7/14/2020 14:05 7424-656	AW	10/5/2020 9:06	AW	TLD-63	N/A
7/15/2020 10:55 7425-657	AW	10/1/2020 15:04	AW	TLD-64	N/A
7/14/2020 15:14 7426-658 2885	AW	10/1/2020 10:15	AW	TLD-65	N/A
7/14/2020 14:56 7427-659	AW	10/1/2020 9:54	AW	TLD-66	N/A
7/14/2020 14:54 7428-660	AW	10/1/2020 9:51	AW	TLD-67	N/A
7/15/2020 10:20 7429-661 2886	AW	10/1/2020 14:28	AW	TLD-68	N/A
7/15/2020 10:03 7430-662	AW	10/1/2020 14:14	AW	TLD-69	N/A
7/15/2020 09:26 7434-663	AW	10/1/2020 13:39	AW	TLD-70	N/A
7/15/2020 09:17 7432-664	AW	10/1/2020 13:37	AW	TLD-71	N/A
7/15/2020 09:04 7433-665	AW	10/1/2020 13:22	AW	TLD-72	N/A
7/15/2020 15:16 7434-666	AW	10/5/2020 14:06	AW	TLD-73	N/A
7/15/2020 15:15 7435-667	AW	10/5/2020 9:56	AW	TLD-74	N/A
7/15/2020 15:20 7436-668	AW	10/5/2020 10:01	AW	TLD-75	N/A
7/15/2020 15:30 7437-669	AW	10/5/2020 10:06	AW	TLD-76	N/A
7/15/2020 15:34 7438-670	AW	10/5/2020 10:10	AW	TLD-77	N/A
7/15/2020 14:02 7439-671	AW	10/5/2020 12:40	AW	TLD-78	N/A
7/15/2020 10:31 7440-672	AW	10/1/2020 14:39	AW	TLD-79	N/A
7/15/2020 14:27 7441-673	AW	10/5/2020 13:22	AW	TLD-80	N/A

Table B.3. Third Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
7/15/2020 09:15 7442-674 2887	AW	10/1/2020 13:32	AW	TLD-81	N/A
7/14/2020 15:21 7443-675	AW	10/1/2020 10:23	AW	TLD-82	N/A
7/14/2020 15:25 7444-676 2888	AW	10/1/2020 10:30	AW	TLD-83	N/A
7/14/2020 15:53 7445-677	AW	10/1/2020 9:46	AW	TLD-84	N/A
7/15/2020 09:56 7446-678	AW	10/5/2020 17:00	SO	TLD-85	N/A
7/15/2020 13:10 7447-679	AW	10/5/2020 9:52	AW	TLD-86	N/A
7/15/2020 15:21 7448-680	AW	10/5/2020 14:10	AW	TLD-87	Dosimeter lost. Estimate will be performed based on results of other quarters.
7/15/2020 14:51 7449-681	AW	10/5/2020 13:43	AW	TLD-88	N/A
7/15/2020 14:42 7450-682	AW	10/5/2020 13:37	AW	TLD-89	N/A
7/15/2020 14:38 7451-683	AW	10/5/2020 13:30	AW	TLD-90	N/A
7/15/2020 14:15 7452-684	AW	10/5/2020 12:56	AW	TLD-91	N/A
7/15/2020 14:08 7453-685	AW	10/5/2020 12:47	AW	TLD-92	N/A
7/15/2020 15:44 7454-686	AW	10/5/2020 10:21	AW	TLD-93	N/A
7/15/2020 15:51 7455-687	AW	10/5/2020 10:28	AW	TLD-94	N/A
7/15/2020 15:37 7456-688	AW	10/5/2020 10:13	AW	TLD-95	N/A
7/15/2020 16:00 7457-689	AW	10/5/2020 14:30	AW	TLD-FB	N/A
7/14/2020 14:00 7458-690	AW	10/1/2020 8:00	AW	TLD-TB	N/A

Table B.4. Fourth Quarter TLD and OSL Issue and Collection Dates

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/01/2020 13:24 8625-625	AW	1/7/2021 9:20	AW	TLD-1	N/A
10/01/2020 1307 8628-626 2882	AW	1/6/2021 12:15	AW	TLD-2	N/A
10/01/2020 1007 8629-627 2883	AW	1/7/2021 15:23	AW	TLD-3	N/A
10/01/2020 14:51 8630-628	AW	1/7/2021 13:39	AW	TLD-4	N/A
10/01/2020 14:46 8631-629	AW	1/7/2021 13:31	AW	TLD-5	N/A
10/01/2020 14:35 8632-630	AW	1/7/2021 13:17	AW	TLD-6	N/A
10/01/2020 13:59 8633-631	AW	1/6/2021 10:51	AW	TLD-7	N/A
10/05/2020 14:00 8634-632	AW	1/6/2021 9:25	AW	TLD-9	N/A
10/05/2020 10:34 8635-633	AW	1/6/2021 8:08	AW	TLD-12	N/A
10/05/2020 12:37 8636-634	AW	1/6/2021 8:22	AW	TLD-13	N/A
10/01/2020 09:58 8637-635	AW	1/7/2021 15:11	AW	TLD-14	N/A
10/01/2020 09:35 8638-636	AW	1/7/2021 14:56	AW	TLD-15	N/A
10/05/2020 13:25 8639-637	AW	1/6/2021 8:53	AW	TLD-16	N/A
10/05/2020 13:50 8640-638	AW	1/6/2021 9:17	AW	TLD-19	N/A
10/01/2020 09:00 8641-639	AW	1/6/2021 9:56	AW	TLD-22	N/A
10/01/2020 10:45 8642-640	AW	1/6/2021 12:04	AW	TLD-25	N/A
10/05/2020 13:00 8643-641	AW	1/6/2021 8:46	AW	TLD-30	N/A
10/01/2020 14:04 8644-642	AW	1/6/2021 10:49	AW	TLD-35	N/A
10/01/2020 14:30 8645-643	AW	1/7/2021 13:13	AW	TLD-37	N/A
10/05/2020 13:55 8646-644	AW	1/6/2021 9:22	AW	TLD-38	N/A
10/01/2020 12:57 8647-645	AW	1/6/2021 12:06	AW	TLD-40	N/A
10/01/2020 14:09 8648-646	AW	1/6/2021 10:55	AW	TLD-46	N/A
10/01/2020 14:18 8649-647 2884	AW	1/7/2021 13:00	AW	TLD-50	N/A
10/01/2020 09:23 8650-648	AW	1/7/2021 14:49	AW	TLD-52	N/A
10/01/2020 13:15 8651-649	AW	1/6/2021 12:25	AW	TLD-53	N/A

Table B.4. Fourth Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/01/2020 08:24 8652-650	AW	1/6/2021 10:18	AW	TLD-54	N/A
10/01/2020 09:33 8653-651	AW	1/7/2021 14:55	AW	TLD-58	N/A
10/05/2020 09:28 8654-652	AW	1/5/2021 13:30	AW	TLD-59	N/A
10/05/2020 08:50 8655-653	AW	1/7/2021 8:55	AW	TLD-60	N/A
10/05/2020 09:00 8656-654	AW	1/7/2021 8:37	AW	TLD-61	N/A
10/05/2020 09:33 8657-655	AW	1/5/2021 15:45	AW	TLD-62	N/A
10/05/2020 09:06 8658-656	AW	1/7/2021 9:07	AW	TLD-63	N/A
10/01/2020 15:04 8659-657	AW	1/7/2021 14:30	AW	TLD-64	N/A
10/01/2020 10:15 8660-658 2885	AW	1/7/2021 15:20	AW	TLD-65	N/A
10/01/2020 09:54 8661-659	AW	1/7/2021 15:08	AW	TLD-66	N/A
10/01/2020 09:51 8662-660	AW	1/7/2021 15:05	AW	TLD-67	N/A
10/01/2020 14:28 8663-661 2886	AW	1/7/2021 13:08	AW	TLD-68	N/A
10/01/2020 14:14 8664-662	AW	1/7/2021 12:53	AW	TLD-69	N/A
10/01/2020 13:39 8665-663	AW	1/7/2021 10:36	AW	TLD-70	N/A
10/01/2020 13:37 8666-664	AW	1/7/2021 9:54	AW	TLD-71	N/A
10/01/2020 13:22 8667-665	AW	1/6/2021 10:46	AW	TLD-72	N/A
10/05/2020 14:06 8668-666	AW	1/6/2021 9:31	AW	TLD-73	N/A
10/05/2020 09:56 8669-667	AW	1/6/2021 7:50	AW	TLD-74	N/A
10/05/2020 10:01 8670-668	AW	1/6/2021 7:52	AW	TLD-75	N/A
10/05/2020 10:06 8671-669	AW	1/6/2021 7:57	AW	TLD-76	N/A
10/05/2020 10:10 8672-670	AW	1/6/2021 8:02	AW	TLD-77	N/A
10/05/2020 12:40 8673-671	AW	1/6/2021 8:25	AW	TLD-78	N/A
10/01/2020 14:39 8674-672	AW	1/7/2021 13:24	AW	TLD-79	N/A
10/05/2020 13:22 8675-673	AW	1/6/2021 8:50	AW	TLD-80	N/A
10/01/2020 13:32 8676-674 2887	AW	1/7/2021 10:54	AW	TLD-81	N/A

Table B.4. Fourth Quarter TLD and OSL Issue and Collection Dates (Continued)

Date/Time Issued/Badge ID	Issued By	Date/Time Collected	Collected By	Location Name	Comments
10/01/2020 10:23 8677-675	AW	1/6/2021 11:51	AW	TLD-82	N/A
10/01/2020 10:30 8678-676 2888	AW	1/6/2021 12:01	AW	TLD-83	N/A
10/01/2020 09:46 8679-677	AW	1/7/2021 15:00	AW	TLD-84	N/A
10/05/2020 17:00 8680-678	AW	1/5/2021 17:00	SO	TLD-85	N/A
10/05/2020 09:52 8681-679	AW	1/6/2021 7:44	AW	TLD-86	N/A
10/05/2020 14:10 8682-680	AW	1/6/2021 9:37	AW	TLD-87	N/A
10/05/2020 13:43 8683-681	AW	1/6/2021 9:11	AW	TLD-88	N/A
10/05/2020 13:37 8684-682	AW	1/6/2021 9:06	AW	TLD-89	N/A
10/05/2020 13:30 8685-683	AW	1/6/2021 13:50	AW	TLD-90	N/A
10/05/2020 12:56 8686-684	AW	1/6/2021 8:41	AW	TLD-91	N/A
10/05/2020 12:47 8687-685	AW	1/6/2021 8:32	AW	TLD-92	N/A
10/05/2020 10:21 8688-686	AW	1/6/2021 8:12	AW	TLD-93	N/A
10/05/2020 10:28 8689-687	AW	1/6/2021 8:16	AW	TLD-94	N/A
10/05/2020 10:13 8690-688	AW	1/6/2021 8:06	AW	TLD-95	N/A
10/01/2020 13:53 8691-689	AW	1/7/2021 10:40	AW	TLD-96	New TLD location to monitor food vendor location
10/05/2020 14:30 8692-690	AW	10/6/2020 6:00	AW	TLD-FB	N/A
10/01/2020 08:00 8693-691	AW	1/6/2021 8:00	AW	TLD-TB	N/A

APPENDIX C

TLD ANALYTICAL DATA

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Global Dosimetry Solutions Environmental Report

Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	1/1/2020
Process	0245817

Badge Number	Name	Exposure mR*
	CONTROL	13
	CONTROL	13
622	ENVIRONMENTAL	12
623	ENVIRONMENTAL	12
624	ENVIRONMENTAL	13
625	ENVIRONMENTAL	261
626	ENVIRONMENTAL	321
627	ENVIRONMENTAL	24
628	ENVIRONMENTAL	25
629	ENVIRONMENTAL	27
630	ENVIRONMENTAL	23
631	ENVIRONMENTAL	35
632	ENVIRONMENTAL	23
633	ENVIRONMENTAL	20
634	ENVIRONMENTAL	28
635	ENVIRONMENTAL	23
636	ENVIRONMENTAL	19
637	ENVIRONMENTAL	27
638	ENVIRONMENTAL	23
639	ENVIRONMENTAL	26
640	ENVIRONMENTAL	43
641	ENVIRONMENTAL	26
642	ENVIRONMENTAL	32

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. D - Element damaged and cannot be evaluated.

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	1/1/2020
Process	0245817

Badge Number	Name	Exposure mR*
643	ENVIRONMENTAL	23
645	ENVIRONMENTAL	31
646	ENVIRONMENTAL	23
647	ENVIRONMENTAL	50
648	ENVIRONMENTAL	25
649	ENVIRONMENTAL	134
650	ENVIRONMENTAL	28
651	ENVIRONMENTAL	17
652	ENVIRONMENTAL	18
653	ENVIRONMENTAL	469
654	ENVIRONMENTAL	551
655	ENVIRONMENTAL	20
656	ENVIRONMENTAL	17
657	ENVIRONMENTAL	18
658	ENVIRONMENTAL	21
659	ENVIRONMENTAL	24
660	ENVIRONMENTAL	23
661	ENVIRONMENTAL	27
662	ENVIRONMENTAL	22
663	ENVIRONMENTAL	51
664	ENVIRONMENTAL	44
665	ENVIRONMENTAL	22
666	ENVIRONMENTAL	21

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. D - Element damaged and cannot be evaluated.

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	1/1/2020
Process	0245817

Badge Number	Name	Exposure mR*
667	ENVIRONMENTAL	29
668	ENVIRONMENTAL	27
669	ENVIRONMENTAL	39
670	ENVIRONMENTAL	26
671	ENVIRONMENTAL	27
672	ENVIRONMENTAL	19
673	ENVIRONMENTAL	24
674	ENVIRONMENTAL	130
675	ENVIRONMENTAL	34
676	ENVIRONMENTAL	77
677	ENVIRONMENTAL	20
678	ENVIRONMENTAL	24
679	ENVIRONMENTAL	22
680	ENVIRONMENTAL	24
681	ENVIRONMENTAL	22
682	ENVIRONMENTAL	24
683	ENVIRONMENTAL	19
684	ENVIRONMENTAL	25
685	ENVIRONMENTAL	22
686	ENVIRONMENTAL	21
687	ENVIRONMENTAL	23
688	ENVIRONMENTAL	27
689	ENVIRONMENTAL	13

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. D - Element damaged and cannot be evaluated.

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	1/1/2020
Process	0245817

Badge Number	Name	Exposure mR*
690	ENVIRONMENTAL	14
691	ENVIRONMENTAL	13
692	ENVIRONMENTAL	13
693	ENVIRONMENTAL	13
694	ENVIRONMENTAL	13
695	ENVIRONMENTAL	13
696	ENVIRONMENTAL	12

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. D - Element damaged and cannot be evaluated.

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Account	98365
Location	00000LAT
Monitoring Period	4/1/2020
Process	246391

WEARER_NO	NAME	Exposue mR*
	CONTROL	15
	CONTROL	15
622	ENVIRONMENTAL	13
623	ENVIRONMENTAL	20
624	ENVIRONMENTAL	18
625	ENVIRONMENTAL	131
626	ENVIRONMENTAL	174
627	ENVIRONMENTAL	16
628	ENVIRONMENTAL	18
629	ENVIRONMENTAL	21
630	ENVIRONMENTAL	16
631	ENVIRONMENTAL	24
632	ENVIRONMENTAL	15
633	ENVIRONMENTAL	18
634	ENVIRONMENTAL	19
635	ENVIRONMENTAL	14
636	ENVIRONMENTAL	17
637	ENVIRONMENTAL	21
638	ENVIRONMENTAL	668
639	ENVIRONMENTAL	18
640	ENVIRONMENTAL	27
641	ENVIRONMENTAL	20
642	ENVIRONMENTAL	21
643	ENVIRONMENTAL	20
644	ENVIRONMENTAL	+
645	ENVIRONMENTAL	22
646	ENVIRONMENTAL	15
647	ENVIRONMENTAL	41
648	ENVIRONMENTAL	17
649	ENVIRONMENTAL	70
650	ENVIRONMENTAL	20
651	ENVIRONMENTAL	14
652	ENVIRONMENTAL	15

Note: *No control exposures have been subtracted, and only element, reader and fade correction have been made.
+- unusual element result observed. D-Element damaged and cannot be evaluated. C7- Missing

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653	ENVIRONMENTAL	282
654	ENVIRONMENTAL	353
655	ENVIRONMENTAL	18
656	ENVIRONMENTAL	16
657	ENVIRONMENTAL	17
658	ENVIRONMENTAL	15
659	ENVIRONMENTAL	19
660	ENVIRONMENTAL	21
661	ENVIRONMENTAL	20
662	ENVIRONMENTAL	15
663	ENVIRONMENTAL	34
664	ENVIRONMENTAL	37
665	ENVIRONMENTAL	17
666	ENVIRONMENTAL	19
667	ENVIRONMENTAL	22
668	ENVIRONMENTAL	21
669	ENVIRONMENTAL	C7
670	ENVIRONMENTAL	17
671	ENVIRONMENTAL	20
672	ENVIRONMENTAL	16
673	ENVIRONMENTAL	25
674	ENVIRONMENTAL	74
675	ENVIRONMENTAL	24
676	ENVIRONMENTAL	48
677	ENVIRONMENTAL	15
678	ENVIRONMENTAL	19
679	ENVIRONMENTAL	18
681	ENVIRONMENTAL	17
682	ENVIRONMENTAL	19
683	ENVIRONMENTAL	17
684	ENVIRONMENTAL	18
685	ENVIRONMENTAL	17
686	ENVIRONMENTAL	17
687	ENVIRONMENTAL	34
688	ENVIRONMENTAL	19
689	ENVIRONMENTAL	13
690	ENVIRONMENTAL	13
691	ENVIRONMENTAL	13
692	ENVIRONMENTAL	12
693	ENVIRONMENTAL	13
694	ENVIRONMENTAL	12
695	ENVIRONMENTAL	14

Note: *No control exposures have been subtracted, and only element, reader and fade correction have been made.
+- unusual element result observed. D-Element damaged and cannot be evaluated. C7- Missing

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696	ENVIRONMENTAL	13

Note: *No control exposures have been subtracted, and only element, reader and fade correction have been made.
+- unusual element result observed. D-Element damaged and cannot be evaluated. C7- Missing

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	7/1/2020
Process	0247115

Badge Number	Name	Exposure mR*
	CONTROL	9
	CONTROL	9
622	ENVIRONMENTAL	9
623	ENVIRONMENTAL	9
624	ENVIRONMENTAL	10
625	ENVIRONMENTAL	147
626	ENVIRONMENTAL	193
627	ENVIRONMENTAL	11
628	ENVIRONMENTAL	15
629	ENVIRONMENTAL	16
630	ENVIRONMENTAL	13
631	ENVIRONMENTAL	19
632	ENVIRONMENTAL	13
633	ENVIRONMENTAL	13
634	ENVIRONMENTAL	18
635	ENVIRONMENTAL	13
636	ENVIRONMENTAL	13
637	ENVIRONMENTAL	17
638	ENVIRONMENTAL	14
639	ENVIRONMENTAL	16
640	ENVIRONMENTAL	22
641	ENVIRONMENTAL	18

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

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MIRION TECHNOLOGIES

Dosimetry Services Division
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Fax. (949) 296-1144
www.mirion.com

Global Dosimetry Solutions Environmental Report

Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	7/1/2020
Process	0247115

Badge Number	Name	Exposure mR*
642	ENVIRONMENTAL	18
643	ENVIRONMENTAL	14
644	ENVIRONMENTAL	14
645	ENVIRONMENTAL	20
646	ENVIRONMENTAL	14
647	ENVIRONMENTAL	34
648	ENVIRONMENTAL	14
649	ENVIRONMENTAL	78
650	ENVIRONMENTAL	16
651	ENVIRONMENTAL	10
652	ENVIRONMENTAL	11
653	ENVIRONMENTAL	245
654	ENVIRONMENTAL	408
655	ENVIRONMENTAL	13
656	ENVIRONMENTAL	11
657	ENVIRONMENTAL	13
658	ENVIRONMENTAL	13
659	ENVIRONMENTAL	16
660	ENVIRONMENTAL	16
661	ENVIRONMENTAL	15
662	ENVIRONMENTAL	13
663	ENVIRONMENTAL	31

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Global Dosimetry Solutions Environmental Report

Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	7/1/2020
Process	0247115

Badge Number	Name	Exposure mR*
664	ENVIRONMENTAL	22
665	ENVIRONMENTAL	16
666	ENVIRONMENTAL	14
667	ENVIRONMENTAL	17
668	ENVIRONMENTAL	16
669	ENVIRONMENTAL	17
670	ENVIRONMENTAL	14
671	ENVIRONMENTAL	18
672	ENVIRONMENTAL	14
673	ENVIRONMENTAL	16
674	ENVIRONMENTAL	75
675	ENVIRONMENTAL	21
676	ENVIRONMENTAL	50
677	ENVIRONMENTAL	13
678	ENVIRONMENTAL	15
679	ENVIRONMENTAL	13
680	ENVIRONMENTAL	16
681	ENVIRONMENTAL	15
682	ENVIRONMENTAL	16
683	ENVIRONMENTAL	15
684	ENVIRONMENTAL	16
685	ENVIRONMENTAL	14

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	7/1/2020
Process	0247115

Badge Number	Name	Exposure mR*
686	ENVIRONMENTAL	16
687	ENVIRONMENTAL	16
688	ENVIRONMENTAL	16
689	ENVIRONMENTAL	9
690	ENVIRONMENTAL	10
691	ENVIRONMENTAL	9
692	ENVIRONMENTAL	9
693	ENVIRONMENTAL	9
694	ENVIRONMENTAL	9
695	ENVIRONMENTAL	8
696	ENVIRONMENTAL	9

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	10/1/2020
Process	0247903

Badge Number	Name	Exposure mR*
	CONTROL	13
	CONTROL	13
622	ENVIRONMENTAL	13
623	ENVIRONMENTAL	12
624	ENVIRONMENTAL	13
625	ENVIRONMENTAL	232
626	ENVIRONMENTAL	304
627	ENVIRONMENTAL	25
628	ENVIRONMENTAL	24
629	ENVIRONMENTAL	27
630	ENVIRONMENTAL	24
631	ENVIRONMENTAL	31
632	ENVIRONMENTAL	23
633	ENVIRONMENTAL	21
634	ENVIRONMENTAL	25
635	ENVIRONMENTAL	23
636	ENVIRONMENTAL	20
637	ENVIRONMENTAL	27
638	ENVIRONMENTAL	21
639	ENVIRONMENTAL	26
640	ENVIRONMENTAL	34
641	ENVIRONMENTAL	23

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

+ - Unusual element result observed. D - Element damaged and cannot be evaluated.

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Global Dosimetry Solutions Environmental Report

Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	10/1/2020
Process	0247903

Badge Number	Name	Exposure mR*
642	ENVIRONMENTAL	26
643	ENVIRONMENTAL	23
644	ENVIRONMENTAL	25
645	ENVIRONMENTAL	26
646	ENVIRONMENTAL	23
647	ENVIRONMENTAL	52
648	ENVIRONMENTAL	22
649	ENVIRONMENTAL	111
650	ENVIRONMENTAL	27
651	ENVIRONMENTAL	20
652	ENVIRONMENTAL	19
653	ENVIRONMENTAL	413
654	ENVIRONMENTAL	574
655	ENVIRONMENTAL	22
656	ENVIRONMENTAL	19
657	ENVIRONMENTAL	17
658	ENVIRONMENTAL	20
659	ENVIRONMENTAL	23
660	ENVIRONMENTAL	27
661	ENVIRONMENTAL	22
662	ENVIRONMENTAL	21
663	ENVIRONMENTAL	47

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	10/1/2020
Process	0247903

Badge Number	Name	Exposure mR*
664	ENVIRONMENTAL	31
665	ENVIRONMENTAL	25
666	ENVIRONMENTAL	22
667	ENVIRONMENTAL	27
668	ENVIRONMENTAL	25
669	ENVIRONMENTAL	24
670	ENVIRONMENTAL	24
671	ENVIRONMENTAL	28
672	ENVIRONMENTAL	22
673	ENVIRONMENTAL	24
674	ENVIRONMENTAL	109
675	ENVIRONMENTAL	32
676	ENVIRONMENTAL	73
677	ENVIRONMENTAL	23
678	ENVIRONMENTAL	24
679	ENVIRONMENTAL	25
680	ENVIRONMENTAL	24
681	ENVIRONMENTAL	24
682	ENVIRONMENTAL	25
683	ENVIRONMENTAL	30
684	ENVIRONMENTAL	24
685	ENVIRONMENTAL	20

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	10/1/2020
Process	0247903

Badge Number	Name	Exposure mR*
686	ENVIRONMENTAL	24
687	ENVIRONMENTAL	24
688	ENVIRONMENTAL	25
689	ENVIRONMENTAL	25
691	ENVIRONMENTAL	13
692	ENVIRONMENTAL	13
693	ENVIRONMENTAL	13
694	ENVIRONMENTAL	13
695	ENVIRONMENTAL	13
696	ENVIRONMENTAL	12

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Account	98365 Four Rivers Nuclear Partnership, LLC
Location	00000LAT
Monitoring Period	10/1/2020
Process	0247115

Badge Number	Name	Exposure mR*
690	ENVIRONMENTAL	6

*- No control exposures have been subtracted, and only element, reader and fade corrections have been made.

APPENDIX D

OSL ANALYTICAL DATA

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KEVIL, KY 42053

Received Date / Reported Date	2020-07-27 / 2020-08-17
Page	1 of 3
Analytical Work Order / QC Release	2020400364 / CHA
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The following dose calculation algorithms were used for assessing the reported doses

Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Customer Service: (800) 323-8830
Technical: (800) 438-3241

Radiation Dosimetry Report

Account : 711723 Subaccount: 8018823 Series: DAR

Participant Number	Name: ID Number	Name: Birth Date	Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below: Period Shown Below: Whole Body	Period Shown Below: Lens	Period Shown Below: Skin	Quarter to Date: Whole Body	Quarter to Date: Lens	Quarter to Date: Skin	Year to Date: Whole Body	Year to Date: Lens	Year to Date: Skin	Lifetime to Date: Whole Body	Lifetime to Date: Lens	Lifetime to Date: Skin	Inception Date	Serial Number
For Monitoring Period:							2020-01-01 to 2020-03-31			QUARTER 1			2020			LIFETIME				
00DAR	CONTROL		L02TN	CNTRL																
	Control Dose Used		L02TN				22	22	22											XA01883252D
02882	AREA		L02TN	AREA	P		307	307	307										2018/01	XA02205562O
					P	H	307	307	307											
					N	T	M	M	M											
					N	F	M	M	M											
02883	AREA		L02TN	AREA	P		11	11	11										2018/01	XA003694665
					P		11	11	11											
					N	T	M	M	M											
					N	F	M	M	M											
02884	AREA		L02TN	AREA	P		41	41	41										2018/01	XA00767122L
					P		41	41	41											
					N	T	M	M	M											
					N	F	M	M	M											
02885	AREA		L02TN	AREA	P		5	M	M										2018/01	XA028943146
					P		5	M	M											
					N	T	M	M	M											
					N	F	M	M	M											
02886	AREA		L02TN	AREA	P		14	14	14										2018/01	XA00634661J
					P		14	14	14											
					N	T	M	M	M											
					N	F	M	M	M											
02887	AREA		L02TN	AREA	P		89	89	82										2018/01	XA02892679M
					P	M	89	89	82											
					N	T	M	M	M											
					N	F	M	M	M											

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Page	2 of 3
Analytical Work Order / QC Release	2020400364 / CHA
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The following dose calculation algorithms were used for assessing the reported doses

Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

Account : 711723 Subaccount: 8018823 Series: DAR

Participant Number	Name: ID Number	Name: Birth Date	Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below: Period Shown Below: Whole Body	Period Shown Below: Lens	Period Shown Below: Skin	Quarter to Date: Whole Body	Quarter to Date: Lens	Quarter to Date: Skin	Year to Date: Whole Body	Year to Date: Lens	Year to Date: Skin	Lifetime to Date: Whole Body	Lifetime to Date: Lens	Lifetime to Date: Skin	Inception Date	Serial Number
For Monitoring Period:							2020-01-01 to 2020-03-31			QUARTER 1			2020			LIFETIME				
02888	AREA		L02TN	AREA	P		66	66	65										2018/01	XA01829096B
					P	M	66	66	65											
					N	T	M	M	M											
					N	F	M	M	M											
For Monitoring Period:							2020-04-01 to 2020-06-30			QUARTER 2			2020			LIFETIME				
00DAR	CONTROL		L02TN	CNTRL																XA02015143W
	Control Dose Used		L02TN				18	18	18											
02882	AREA		L02TN	AREA	P		197	197	194										2018/01	XA00906322S
					P	H	197	197	194											
					N	T	M	M	M											
					N	F	M	M	M											
02883	AREA		L02TN	AREA			M	M	M										2018/01	XA022557927
02884	AREA		L02TN	AREA	P		22	22	22										2018/01	XA018166873
					P		22	22	22											
					N	T	M	M	M											
					N	F	M	M	M											
02885	AREA		L02TN	AREA			M	M	M										2018/01	XA02390023M
02886	AREA		L02TN	AREA	P		6	6	6										2018/01	XA017357176
					P		6	6	6											
					N	T	M	M	M											
					N	F	M	M	M											
02887	AREA		L02TN	AREA	P		68	68	68										2018/01	XA023809723
					P	H	68	68	68											
					N	T	M	M	M											
					N	F	M	M	M											

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Received Date / Reported Date	2020-07-27 / 2020-08-17
Page	3 of 3
Analytical Work Order / QC Release	2020400364 / CHA
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The following dose calculation algorithms were used for assessing the reported doses

Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

Account : 711723 Subaccount: 8018823 Series: DAR

Participant Number	Name		Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below												Inception Date	Serial Number
							Period Shown Below			Quarter to Date			Year to Date			Lifetime to Date				
	ID Number	Birth Date					Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin		
For Monitoring Period:							2020-04-01 to 2020-06-30			QUARTER 2			2020			LIFETIME				
02888	AREA		L02TN	AREA	P		28	28	28										2018/01	XA02452047H
					P		28	28	28											
					N	T	M	M	M											
					N	F	M	M	M											

D-5

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Page	1 of 2
Analytical Work Order / QC Release	2029000583 / CHA
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Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

Account : 711723 Subaccount: 8018823 Series: DAR

Participant Number	Name		Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below												Inception Date	Serial Number
							Period Shown Below			Quarter to Date			Year to Date			Lifetime to Date				
	ID Number	Birth Date					Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin		
For Monitoring Period:							2020-07-01 to 2020-09-30			QUARTER 3			2020			LIFETIME				
00DAR	CONTROL		L02TN	CNTRL																XA00734349A
	Control Dose Used		L02TN				17	17	17											
02882	AREA		L02TN	AREA	P		225	225	222										2018/01	XA00883542A
					P	H	225	225	222											
					N	T	M	M	M											
					N	F	M	M	M											
02883	AREA		L02TN	AREA			M	M	M										2018/01	XA00928599X
02884	AREA		L02TN	AREA	P		28	28	28										2018/01	XA00849992Z
					P		28	28	28											
					N	T	M	M	M											
					N	F	M	M	M											
02885	AREA		L02TN	AREA	P		5	M	M										2018/01	XA00825971B
					P		5	M	M											
					N	T	M	M	M											
					N	F	M	M	M											
02886	AREA		L02TN	AREA	P		6	6	6										2018/01	XA00868649T
					P		6	6	6											
					N	T	M	M	M											
					N	F	M	M	M											
02887	AREA		L02TN	AREA	P		78	78	76										2018/01	XA008902691
					P	H	78	78	76											
					N	T	M	M	M											
					N	F	M	M	M											

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Page	2 of 2
Analytical Work Order / QC Release	2029000583 / CHA
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Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

Account : 711723 **Subaccount:** 8018823 **Series:** DAR

Participant Number	Name		Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below												Inception Date	Serial Number
	ID Number	Birth Date					Period Shown Below			Quarter to Date			Year to Date			Lifetime to Date				
							Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin		
For Monitoring Period:							2020-07-01 to 2020-09-30			QUARTER 3			2020			LIFETIME				
02888	AREA		L02TN	AREA	P		34	34	34										2018/01	XA010100253
					P		34	34	34											
					N	T	M	M	M											
					N	F	M	M	M											

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Analytical Work Order / QC Release	2101501342 / CHA
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The following dose calculation algorithms were used for assessing the reported doses

Dosimeter Model	Dosimeter Type	Algorithm Version
InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

Account : 711723 Subaccount: 8018823 Series: DAR

Participant Number	Name		Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below												Inception Date	Serial Number
							Period Shown Below			Quarter to Date			Year to Date			Lifetime to Date				
	ID Number	Birth Date					Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin		
For Monitoring Period:							2020-10-01 to 2020-12-31			QUARTER 4			2020			LIFETIME				
00DAR	CONTROL		L02TN	CNTRL																XA020753197
	Control Dose Used		L02TN				17	17	17											
02882	AREA		L02TN	AREA	P		256	256	251										2018/01	XA025836047
					P	M	256	256	251											
					N	T	M	M	M											
					N	F	M	M	M											
02883	AREA		L02TN	AREA	P		9	9	9										2018/01	XA011547278
					P		9	9	9											
					N	T	M	M	M											
					N	F	M	M	M											
02884	AREA		L02TN	AREA	P		24	24	24										2018/01	XA02538072L
					P		24	24	24											
					N	T	M	M	M											
					N	F	M	M	M											
02885	AREA		L02TN	AREA			M	M	M										2018/01	XA008971935
02886	AREA		L02TN	AREA	P		8	8	8										2018/01	XA00790910B
					P		8	8	8											
					N	T	M	M	M											
					N	F	M	M	M											
02887	AREA		L02TN	AREA	P		83	83	78										2018/01	XA02703646D
					P	M	83	83	78											
					N	T	M	M	M											
					N	F	M	M	M											

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Analytical Work Order / QC Release	2101501342 / CHA
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InLight	Whole Body	00101
CR-39--Thermal	Whole Body	03001

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Radiation Dosimetry Report

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Participant Number	Name		Dosimeter	Use	Rad. Type	Rad. Quality	Equivalent Dose (mrem) for Periods Shown Below												Inception Date	Serial Number
							Period Shown Below			Quarter to Date			Year to Date			Lifetime to Date				
	ID Number	Birth Date					Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin	Whole Body	Lens	Skin		
For Monitoring Period:							2020-10-01 to 2020-12-31			QUARTER 4			2020			LIFETIME				
02888	AREA		L02TN	AREA	P		40	40	39										2018/01	XA021769531
					P		40	40	39											
					N	T	M	M	M											
					N	F	M	M	M											

Radiation Dosimetry Report

Annual Radiation Exposure Limits (mrem) :

Whole body, blood forming organs, gonads	5,000
Lens of Eye	15,000
Extremities and Skin	50,000
Fetal (Gestation period)	500
General Public	100

Based on the US NRC Regulations, Title 10, Part 20, Code of Federal Regulations and adopted by many states. Certain state and other regulatory agencies may adhere to different limits.

Control Dosimeter: A control dosimeter is included with each shipment of dosimeters for monitoring radiation exposure received during transit. At the customer's facility, store the control in a radiation free area during the wear period.

Minimal Dose Equivalent Reported: Dose equivalents below the minimum measurable quantity for the current monitoring period are recorded as "M." The minimal reporting levels vary by the dosimeter type and radiation quality. "SL" is an elective option for the minimal dose equivalent reported where exposures less than 10 mrem report as "SL" (excludes fetal dosimeters), and/or exposures at or more than 10 mrem begin reporting at 10 mrem and report in increments of 10 mrem.

Dosimeter Type	M (DDE,LDE,SDE)	M (SDE Only)	SL
Luxel+®	1	-	10
InLight®	5	-	10
Whole Body Beta	-	10	10
U Ring	-	30	-
Neutrak® Neutron Fast	20	-	-
Neutrak® Neutron Thermal/Fast	10	-	-
Saturn Ring	-	10	10

Special Calculations: Special dose calculations can be applied to radiation workers who wear lead aprons.
EDE 1 - two dosimeters: one worn at the waist level under lead apron and one worn at the collar level outside lead apron. 1.5 (Waist DDE) + 0.04 (Collar DDE) = Assigned Deep Dose Equivalent.
EDE 2 - one dosimeter: one worn at the collar level outside lead apron. 0.3 (Collar DDE) = Assigned Deep Dose Equivalent.
EDE 122 - one dosimeter: one worn at the collar level outside lead apron. Collar DDE / 5.6 = Assigned Deep Dose Equivalent.
Calc3 - Lens of Eye dosimeter. 0.5 (Lens of Eye LDE) = Assigned Lens of Eye Dose Equivalent.
Lens.175 - Lens of Eye dosimeter. 0.175 (Lens of Eye LDE) = Assigned Lens of Eye Dose Equivalent.
EDE1-NTC EDE1 without Thyroid Collar assigned deep dose equivalent = 0.06 × (collar dose - waist dose) + waist dose
EDE1-TC EDE1 with Thyroid Collar assigned deep dose equivalent = 0.02 × (collar dose - waist dose) + waist dose
The "ASSIGNED" line follows all of the original whole body dosimeter doses with the EDE 1 or EDE 2 calculation results or LANDAUER's standard Dose Assessment Protocol (deep and shallow whole body dose from the highest reading whole body dosimeter, lens dose from dosimeter closest to the eye).

Ring Dosimeter Reading: Ring dosimeter readings report as a shallow dose.

Fetal Dosimeter: A declared pregnant worker will possess a fetal exposure on an extra page of the report based upon the whole body dosimeter worn closest to the fetus. The fetal dose is reported for the current wear period, plus the estimated dose from conception to declaration (if provided by customer), and the total dose from declaration to present.

Use	Description	Use	Description
AREA	Area Monitor	OEXTRM	Other Extremity
CHEST	Chest	OWHBDY	Other Whole Body
CNTRL	Control	RANKLE	Right Ankle
COLLAR	Collar	RFINGR	Right Hand Ring
EYE	Eye	RUARM	Right Upper Arm
FETAL	Fetal	RULEG	Right Upper Leg
LANKLE	Left Ankle	RWRIST	Right Wrist
LFINGR	Left Hand Ring	SPCPUR	Special Purpose
LUARM	Left Upper Arm	UPBACK	Upper Back
LULEG	Left Upper Leg	WAIST	Waist
LWBACK	Lower Back	WHBODY	Whole Body
LWRIST	Left Wrist		

Code	Radiation Quality Description (Type and/or Energy)
B	beta
BH	beta high energy, e.g. Strontium, Phosphorus
BL	beta low energy e.g. Thallium, Krypton
BS	Strontium beta
BT	Thallium beta
BU	Uranium beta
BN	beta, neutron mixture
NF	neutron fast
NT	neutron thermal
P	photon (x or gamma ray)
PB	photon, beta mixture
PBN	photon, beta, neutron mixture
PH	photon high energy greater than 200 keV
PL	photon low energy less than 40 keV
PM	photon medium energy 40 keV to 200 keV
PN	photon, neutron mixture

First Line Explanation
Participant Number: Unique number assigned by LANDAUER.
Name: Participant to whom the dosimeter is assigned.
Dosimeter: Badge type according to radiation monitoring needs.

Dosimeter	Code	Type of Radiation Monitored				
		Photons			Neutrons	
		X	Gamma	Beta	Fast	Thermal
InLight Model 2	L02NN	Yes	Yes	Yes		
InLight Model 2J	L02JN	Yes	Yes	Yes	Yes	
InLight Model 2T	L02TN	Yes	Yes	Yes	Yes	Yes
Luxel+	Pa	Yes	Yes	Yes		
Luxel+	Ja	Yes	Yes	Yes	Yes	
Luxel+	Ta	Yes	Yes	Yes	Yes	Yes
Luxel+ Escort	Pa	Yes	Yes			
Neutrak	N				Yes	
Neutrak	E				Yes	Yes
Ring, Single TLD	U or S	Yes	Yes	Yes		

Deep, Eye and Shallow Dose Equivalents: Deep dose equivalent (DDE) applies to external whole body exposure at a tissue depth of 1 cm (1000 mg/cm^2).
Eye dose equivalent (LDE) applies to external exposure of the lens at a tissue depth of 0.3 cm (300 mg/cm^2).
Shallow dose equivalent (SDE) applies to the external exposure of the skin or extremity at a tissue depth of 0.007 cm (7 mg/cm^2) averaged over an area 1 cm^2.

Deep, eye and shallow dose equivalents report for the time frame indicated by "For Monitoring Period." These doses represent the dose received only for the account/subaccount specified. Individual radiation component results and combined totals report in separate lines.

Quarterly accumulated results reflect total dose received within a calendar 3-months time frame and the customer defined start day. (Note: Quarterly accumulated columns are eliminated for bimonthly service or display "Not applicable.") Year to date accumulation totals dose received from the beginning of the current year to report date. Lifetime accumulation totals all dose received from inception date of dosimeter service to report date, and could include earlier dose history if supplied by customer. Reported quarterly, annual and lifetime dose accumulations represent the doses totaling from all account/subaccount dosimeters to be reported at the customer level.

Inception Date: The date LANDAUER began keeping dosimeter records for a given dosimeter for a badging participant on the current customer.

Serial Number: Dosimeter serial number.

Second Line Explanation
Participant's personal information consisting of ID number and birth date. This information can be suppressed on "Duplicate and Original Reports" for privacy and/or posting needs.

Notes: Text messages explaining any abnormalities or comments. The notes with message appears on a separate line below all dosimeter exposure information.

U.S. Patents
6,316,702; 6,127,685; 5,892,234

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