

DEPARTMENT OF THE ARMY US ARMY INSTALLATION MANAGEMENT COMMAND 2405 GUN SHED ROAD

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April 26, 2019

ATTN: Document Control Desk
Deputy Director, Division of Decommissioning, Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards
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US Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Deputy Director:

Reference US Nuclear Regulatory Commission (NRC) license number SUB-1435 (docket 040-08838) issued to the US Army Garrison-Rock Island Arsenal, Illinois for possession for decommissioning of residual depleted uranium at Jefferson Proving Ground, Indiana.

License condition 12 requires us to perform periodic environmental radiation monitoring. I enclose a summary report of the results of our calendar year 2018 environmental radiation monitoring program for your information and to make it available to the public on your web-based ADAMS.

You may reach me at (210) 466-0368 or robert.n.cherry.civ@mail.mil.

Sincerely,

Robert N. Cherry

Koberton Cherry

License Radiation Safety Officer

Enclosure

NMSSDI

FOR LICENSE SUB-1435 JEFFERSON PROVING GROUND

Summary of Results for the April/May and October 2018 Sampling Events

FINAL

Submitted by:

U.S. Department of Army
U.S. Army Garrison, Rock Island Arsenal
Rock Island, Illinois

Submitted to:

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and Environmental Management Programs
Division of Waste Management and Environmental Protection
Decommissioning and Uranium Recovery Licensing Directorate
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Washington, DC

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LIST OF ACRONYMS AND ABBREVIATIONS

°C Degrees Celsius

 $\mu R/hr$ Microroentgens per Hour $\mu g/L$ Micrograms per Liter CFR Code of Federal Regulations

CHPPM (U.S. Army) Center for Health Promotion and Preventive Medicine

DQO Data Quality Objective
DU Depleted Uranium

ERM Environmental Radiation Monitoring

ERMP Environmental Radiation Monitoring Program

I.D. Identification

ICP-MS Inductively Coupled Plasma-Mass Spectrometry

JPG Jefferson Proving Ground LCL Lower Control Limit

MDC Minimum Detectable Concentration

MDL Method Detection Limit mg/kg Milligrams per Kilogram mg/L Milligrams per Liter

mS/cm MilliSiemens per Centimeter

NRC (U.S.) Nuclear Regulatory Commission

pCi/g Picocuries per Gram pCi/L Picocuries per Liter QA Quality Assurance

QAPP Quality Assurance Project Plan

OC Quality Control

R² Coefficient of Correlation SOP Standard Operating Procedure TPU Total Propagated Uncertainty

U-234 Uranium-234 U-235 Uranium-235 U-238 Uranium-238

UCL Upper Control Limit

USEPA U.S. Environmental Protection Agency

1. INTRODUCTION

Environmental radiation monitoring (ERM) activities are being conducted at Jefferson Proving Ground (JPG), Madison, Indiana, to ensure that depleted uranium (DU), present within the DU Impact Area as a result of the Army's past DU testing program, does not pose a threat to human health and the environment through inadvertent or unanticipated release or migration. The Environmental Radiation Monitoring Program (ERMP) is described in the standard operating procedure (SOP) developed and issued by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM), predecessor organization to the U.S. Army Public Health Center. This SOP, which is in Appendix A, is designed to meet the requirements of applicable Federal and state regulations, including Nuclear Regulatory Commission (NRC) regulations and requirements under Radioactive Materials License SUB-1435 (NRC 1985).

The overall goals of JPG's ERMP are to provide:

- A historical and current perspective of DU levels in various media
- A timely indication of the magnitude and extent of any DU release or migration from past operations.

This report summarizes the methodology, results, and conclusions of the April/May and October 2018 sampling events, which were the two planned sampling events in 2018 for this biannual program. The sampling requirements and approach are presented in Section 2. The results from the multimedia sampling events are presented and discussed in Section 3. Historical data and trend analyses from the ERMP are discussed in Section 4. Conclusions and recommendations are summarized in Section 5. References cited are identified in Section 6. The appendices of this report include the SOP (Appendix A), field logbooks and sampling forms (Appendix B), data validation summaries (Appendix C), and graph of the "Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium" (Appendix D). Tables and figures are generally presented at the end of their respective sections.

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2. SAMPLING REQUIREMENTS AND APPROACH

The ERMP SOP (CHPPM 2000) specifies the U.S. Army Public Health Center's (formerly CHPPM's) protocol for the collection and analysis of 11 groundwater, 8 surface water, 8 sediment, and 4 soil samples (with appropriate duplicates) in and near the DU Impact Area. The plan has been approved by NRC and is described in an SOP, which is provided in Appendix A. The Army has executed the plan and reports the findings in an effort to fulfill the responsibilities for monitoring under NRC Radioactive Materials License SUB-1435.

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3. RESULTS

A field crew of contractor personnel prepared for and conducted sampling at JPG during the periods of 30 April 2018 to 01 May 2018 and 22 to 23 October 2018. Appendix B contains a copy of the field logbook pages and sampling forms, which document environmental monitoring report field activities during the sampling efforts. No unusual or abnormal conditions (e.g., soil or water discoloration, odd odors, and elevated radiation levels) were observed during the two sampling events.

The locations for the groundwater, surface water, sediment, and soil samples are depicted on Figure 3-1. Sections 3.1 and 3.2 summarize the sampling results for the spring and fall 2018 sampling events, respectively. Data uncertainties are reported with two standard deviations (95 percent confidence level). The results of the data validation are presented in Appendix C. All data were determined to meet data quality objectives (DQOs) and criteria presented in the SOP (as provided in Appendix A).

The radiological and chemical analysis results for uranium are used to distinguish natural uranium from DU. Natural uranium is defined by NRC as "...uranium containing the relative concentrations of isotopes found in nature (0.7 percent uranium-235 [U-235], 99.3 percent uranium-238 [U-238], and a trace amount of uranium-234 [U-234] by mass). In terms of radioactivity, however, natural uranium contains approximately 2.2 percent U-235, 48.6 percent U-238, and 49.2 percent U-234..." (NRC 2012a). U-234 and U-238 in natural uranium exhibit secular equilibrium such that they are present at approximately the same activity concentration. Secular equilibrium is disturbed by the extraction of most U-234 together with the U-235 such that the activity exhibited by DU is about 60 percent of that from natural uranium. Hence, DU is defined by NRC as "...uranium with a percentage of U-235 lower than the 0.7 percent (by mass) contained in natural uranium. (The normal residual U-235 content in depleted uranium is 0.2-0.3 percent, with U-238 comprising the remaining 98.7-98.8 percent.)..." (NRC 2012b).

Samples are initially analyzed using alpha spectrometry to determine the activity concentrations for U-234, U-235, and U-238, which are summed for total uranium. As discussed in Section 4, the action levels for total uranium established for the ERM for JPG are 150 picocuries per liter (pCi/L) for surface water and groundwater, and 35 picocuries per gram (pCi/g) for soil and sediment outside the perimeter of the DU Impact Area. For comparison, a liquid effluent concentration limit for uranium of 300 pCi/L is specified in 10 Code of Federal Regulations (CFR) 20, Appendix B. The following sample results are well below these action levels.

Even though no action is required, additional evaluation is performed in an effort to determine whether certain sample results are suggestive of DU, natural uranium, or some combination of the two. The selection criterion is whether the U-238/U-234 ratio plus the value of total propagated uncertainty (TPU) exceeds 3.0. Information relative to U-238/U-234 activity ratios for mixtures of depleted and natural uranium is provided in Appendix D. Adding the TPU to the ratios for comparison to this selection criterion is a conservative measure, resulting in more samples being selected for additional evaluation.

Selected samples are sent for a confirmatory laboratory analysis, this time using inductively coupled plasma-mass spectrometry (ICP-MS) to reduce detection and uncertainty values from those achieved with alpha spectroscopy. If the ICP-MS results for U-235 and total uranium exceed their method detection limits (MDLs), the U-235 weight percentage can be calculated. If the weight percent of U-235 exceeds 0.49¹, then the sample result is suggestive of natural uranium, otherwise DU is suggested.

If ICP-MS results for U-235 are non-detect, then the total uranium result is evaluated against a lower comparison value and, if needed, an upper comparison value. A total uranium sample result less than the

 $^{^{1}}$ 0.49 = 0.56 × 0.72 + 0.44 × 0.20, where 0.56 and 0.44 are the natural uranium and DU fractions when the U-238/U-234 activity ratio is 3.0 (Appendix D), and 0.72 and 0.20 are the U-235 mass percentages for natural uranium and DU.

lower comparison value is suggestive of natural uranium. A total uranium sample result exceeding the upper comparison value is suggestive of DU. A total uranium result between the lower and upper comparison values is suggestive of a mixture of both natural uranium and DU.

The lower comparison value, against which total uranium is compared, is based on considering whether the result is consistent with background sample results for total uranium. The lower comparison values for the three types of environmental media are provided in Table 3-1.

The upper comparison value, against which total uranium is compared, is based on considering whether enough DU is present to cause the amount of U-235 to be too small to be detected (i.e., if natural uranium were the cause of the result, then the U-235 result would exceed the MDL). The upper comparison value is calculated as follows:

$$Upper\ Comprarison\ Value = \frac{Sample\ MDL\ for\ U - 235}{(0.56 \times 0.0072) + (0.44 \times 0.002)}$$

where:

0.56 = The natural uranium fraction when the U-238/U-234 ratio is 3 (Appendix D)

0.0072 = The U-235 mass fraction for natural uranium

0.44 = The DU fraction when the U-238/U-234 ratio is 3.0 (Appendix D)

0.002 = The U-235 mass fraction for DU.

3.1 SPRING 2018 SAMPLING RESULTS

Sections 3.1.1 through 3.1.4 summarize the spring 2018 sampling results for each environmental medium and are reported with a maximum of two significant digits.

3.1.1 Groundwater

The concentrations of dissolved total and isotopic uranium in groundwater at the 11 monitoring wells plus 1 duplicate sample are presented in Table 3-2. Groundwater quality parameter measurements are presented in Table 3-3. Groundwater samples were collected at the locations shown on Figure 3-1.

Total uranium concentrations in the April/May 2018 groundwater samples ranged from 0.43 ± 0.14 pCi/L for MW-DU-001 to 3.4 ± 0.3 pCi/L for MW-DU-006. The average total uranium concentration, computed using the average value for duplicates, was 1.4 ± 0.8 pCi/L.

In addition to the individual isotopic concentrations, Table 3-2 presents the U-238/U-234 activity ratios for each sample. These ratios ranged from 0.22 ± 0.10 for MW-DU-009 to 1.2 ± 0.8 for MW-DU-001. A U-238/U-234 ratio of 3.0 or less is generally representative of natural uranium, whereas higher ratios are potentially indicative of DU (U.S. Army 2002). For the purposes of this report, samples with U-238/U-234 ratios in excess of 3.0 are investigated further to validate if the sample is representative of DU or natural uranium. Given that the maximum U-238/U-234 ratio was 1.2 ± 0.8 , groundwater samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

3.1.2 Surface Water

The concentrations of dissolved total and isotopic uranium in surface water at eight sampling locations plus one duplicate sample are presented in Table 3-4. Surface water quality parameter measurements are presented in Table 3-5. Surface water samples were collected at the locations shown on Figure 3-1. Total uranium concentrations in surface water ranged from 0.32 ± 0.12 pCi/L for SW-DU-003 to 2.0 ± 0.3 pCi/L for SW-DU-001 with an average concentration of 0.82 ± 0.55 pCi/L, computed using the average value for duplicates.

3-2

In addition to the individual isotopic concentrations, Table 3-4 presents the U-238/U-234 activity ratios for each sample. The U-238/U-234 ratios ranged from non-detect for SW-DU-003 to 0.68 ± 0.37 for SW-DU-005. Given that the maximum U-238/U-234 ratio was 0.68 ± 0.37 , surface water samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

3.1.3 Sediment

The concentrations of total and isotopic uranium in sediment at eight sampling locations plus one duplicate sample are presented in Table 3-6. Sediment samples were collected at the same locations as surface water samples, as shown on Figure 3-1. Total uranium concentrations ranged from 0.30 ± 0.08 pCi/g for SD-DU-008 to 1.4 ± 0.2 pCi/g for SD-DU-003 with an average concentration of 0.7 ± 0.4 pCi/g, computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-6 presents the U-238/U-234 activity ratios for each sample. The U-238/U-234 ratios ranged from 0.69 ± 0.31 for SD-DU-004 to 1.9 ± 0.8 for SD-DU-005. Given that the maximum U-238/U-234 ratio was 1.9 ± 0.8 , sediment samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

3.1.4 Soils

The concentrations of total and isotopic uranium in surface soils at four sample locations plus one duplicate sample are presented in Table 3-7. Soil samples were collected at the locations shown on Figure 3-1. Total uranium concentrations ranged from 1.0 ± 0.2 pCi/g for SS-DU-004 to 1.7 ± 0.2 pCi/g for SS-DU-001, SS-DU-002, and SS-DU-002D. The average total uranium concentration of 1.4 ± 0.3 pCi/g was computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-7 presents the U-238/U-234 activity ratios for each sample. The U-238/U-234 ratio ranged from 0.92 ± 0.27 for SS-DU-003 to 1.2 ± 0.3 for SS-DU-001 and SS-DU-002D. Given that all surface soil samples exhibited U-238/U-234 ratios less than the investigation level of 3.0, confirmatory analysis by ICP-MS was not needed.

3.2 FALL 2018 SAMPLING RESULTS

Sections 3.2.1 through 3.2.4 summarize the fall 2018 sampling results for each environmental medium and are reported with a maximum of two significant digits.

3.2.1 Groundwater

The concentrations of dissolved total and isotopic uranium in groundwater at the 11 monitoring wells plus 1 duplicate sample are presented in Table 3-8. Groundwater quality parameter measurements are presented in Table 3-9. Groundwater samples were collected at the locations shown on Figure 3-1.

Total uranium concentrations in the October 2018 groundwater samples ranged from 0.54 \pm 0.13 pCi/L for MW-DU-011 to 3.7 \pm 0.4 pCi/L for MW-DU-006. The average total uranium concentration, computed using the average value for duplicates, was 1.4 \pm 0.7 pCi/L.

In addition to the individual isotopic concentrations, Table 3-8 presents the U-238/U-234 ratios for each sample. These ratios ranged from 0.18 ± 0.08 for MW-DU-009 to 0.82 ± 0.16 for MW-DU-006. Given that the maximum U-238/U-234 ratio was 0.82 ± 0.16 , groundwater samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

3.2.2 Surface Water

The concentrations of dissolved total and isotopic uranium in surface water at eight sampling locations plus one duplicate sample are presented in Table 3-10. Surface water quality parameter measurements are presented in Table 3-11. Surface water samples were collected at the locations shown on Figure 3-1. Total uranium concentrations in surface water ranged from 0.26 ± 0.08 pCi/L for SW-DU-003 to 1.0 ± 0.2 pCi/L for SW-DU-008 with an average concentration of 0.57 ± 0.35 pCi/L, computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-10 presents the U-238/U-234 ratios for each sample. As noted above, for the purposes of this report, when U-238/U-234 plus TPU for U-238/U-234 exceeds 3.0, that sample is selected for laboratory analysis by ICP-MS. Only SW-DU-008 exceeded this selection criterion. ICP-MS results for SW-DU-008 equated to 1.9, non-detect, non-detect, and 1.9 micrograms per liter (μ g/L) for total uranium, U-234, U-235, and U-238, respectively. Given that U-235 was not detected by ICP-MS, the total uranium result is compared to the lower comparison value from Table 3-1. The total uranium result for SW-DU-008 of 1.9 μ g/L is greater than the lower comparison value of 1.2 μ g/L for surface water, so the upper comparison value had to be derived. The upper comparison value was calculated to be 4.1 μ g/L based on a U-235 MDL of 0.2 μ g/L. Since the total uranium result of 1.9 μ g/L for SW-DU-008 is less than the upper comparison value of 4.1 μ g/L, it is suggestive of a mixture of both natural uranium and DU.

3.2.3 Sediment

The concentrations of total and isotopic uranium in sediment at eight sampling locations plus one duplicate sample are presented in Table 3-12. Sediment samples were collected at the same locations as surface water samples, as shown on Figure 3-1. Total uranium concentrations ranged from 0.40 ± 0.09 pCi/g for SD-DU-004 to 1.7 ± 0.2 pCi/g for SD-DU-003 with an average concentration of 0.96 ± 0.43 pCi/g, computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-12 presents the U-238/U-234 ratios for each sample. The U-238/U-234 ratio for the samples ranged from 0.82 ± 0.20 for SD-DU-007 to 1.3 ± 0.6 for SD-DU-005. As noted above, for the purposes of this report, samples with U-238/U-234 ratios in excess of 3.0 are subjected to additional investigation. Given a maximum U-238/U-234 ratio of 1.3 ± 0.6 , sediment samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

3.2.4 Soils

The concentrations of total and isotopic uranium in surface soils at four sample locations plus one duplicate sample are presented in Table 3-13. Soil samples were collected at the locations shown on Figure 3-1. Total uranium concentrations ranged from 1.1 ± 0.2 pCi/g for SS-DU-004 to 1.8 ± 0.2 pCi/g for SS-DU-002. The average total uranium concentration of 1.4 ± 0.4 pCi/g was computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-13 presents the U-238/U-234 ratios for each sample. The U-238/U-234 ratio ranged from 0.99 ± 0.29 for SS-DU-004 to 1.2 ± 0.3 for SS-DU-002. Given a maximum U-238/U-234 ratio of 1.2 ± 0.3 , soil samples did not exhibit the potential for the U-238/U-234 ratios to equal or exceed 3.0 at the upper end of its statistical range. As such, confirmatory analysis by ICP-MS was not needed.

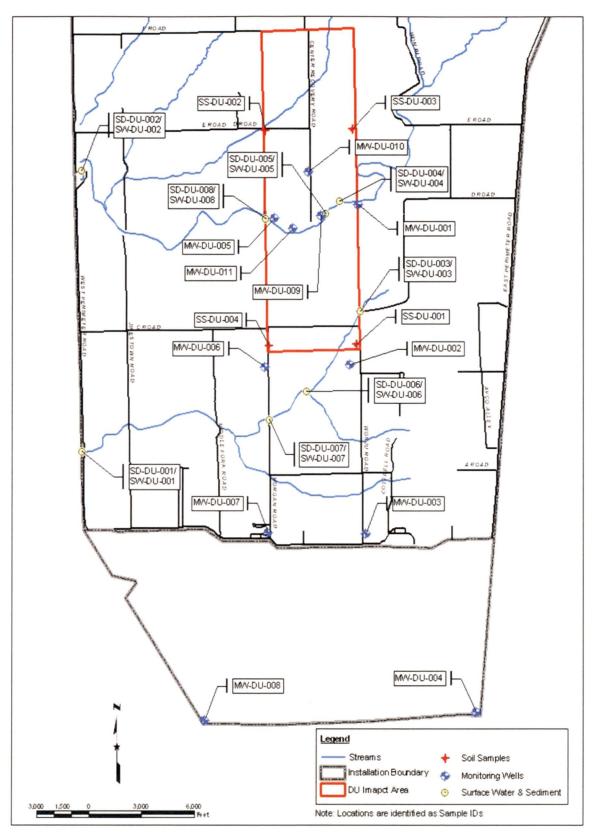


Figure 3-1. Sampling Locations

Table 3-1. Lower Comparison Values Jefferson Proving Ground, Madison, Indiana

Environmental Medium	Background Activity Concentration for Total Uranium ^a				nd Mass Cond Total Uraniu	Lower Comparison Value		
weatum	Average	Maximum	Unitsd	Average	Maximum	Unitsd	Value	Unitsd
Soil/Sediment	1.5	3.8	pCi/g	2.22	5.61	mg/kg	4.0	mg/kg
Surface Water	0.44	2.83	pCi/L	0.65	4.18	µg/L	1.2	µg/L
Groundwater	1.2	6.42	pCi/L	1.77	9.48	µg/L	3.2	µg/L

- From pages 4-2, 4-3, 6-14, and 6-45 of the Army's Environmental Report for NRC Materials License SUB-1435 (U.S. Army 2013).
- Calculated using the specific activity of 677,000 pCi/g for natural uranium from Appendix B to 10 CFR 20.
- c Calculated by the equation R=0.56Ŕ+0.44R, where 0.56R is the portion of the overall result (R) attributed to natural uranium, 0.44R is the portion of R attributed to DU, the average background mass concentration is substituted for 0.56R, and solving for R. The values 0.56 and 0.44 are the percentages when the U-238/U-234 ratio is 3.0 (Appendix D).
- d Units are picocuries per gram (pCi/g), picocuries per liter (pCi/L), milligrams per kilogram (mg/kg), and micrograms per liter (µg/L).

Table 3-2. Uranium in Groundwater (Spring 2018)
Jefferson Proving Ground, Madison, Indiana

Sample I D a		. Ratio			
Sample I.D.ª	U-234	U-235	U-238	Total Uraniumd	U-238/U-234 ^{c, d} .
MW-DU-001	0.18 ± 0.09	0.04 ± 0.05	0.21 ± 0.10	0.43 ± 0.14	1.2 ± 0.8
MW-DU-002	0.65 ± 0.16	0.02 ± 0.03 U	0.38 ± 0.12	1.1 ± 0.2	0.59 ± 0.24
MW-DU-003d	0.83 ± 0.20	0.04 ± 0.06 U	0.35 ± 0.13	1.2 ± 0.2	0.41 ± 0.18
MW-DU-003Dd	1.1 ± 0.2	0.05 ± 0.05	0.43 ± 0.14	1.6 ± 0.3	0.39 ± 0.15
MW-DU-004	0.78 ± 0.19	0.05 ± 0.06 U	0.28 ± 0.11	1.1 ± 0.2	0.36 ± 0.16
MW-DU-005	0.67 ± 0.17	0.02 ± 0.03 U	0.23 ± 0.10	0.93 ± 0.20	0.34 ± 0.17
MW-DU-006	1.9 ± 0.3	0.02 ± 0.04 U	1.5 ± 0.2	3.4 ± 0.3	0.77 ± 0.15
MW-DU-007	1.4 ± 0.3	0.09 ± 0.07	0.87 ± 0.21	2.3 ± 0.4	0.63 ± 0.20
MW-DU-008	0.74 ± 0.14	0.06 ± 0.04	0.19 ± 0.07	0.99 ± 0.16	0.26 ± 0.10
MW-DU-009	0.71 ± 0.13	0.06 ± 0.04	0.16 ± 0.06	0.92 ± 0.15	0.22 ± 0.10
MW-DU-010	1.7 ± 0.3	0.11 ± 0.08	0.75 ± 0.19	2.6 ± 0.4	0.44 ± 0.13
MW-DU-011	0.45 ± 0.15	0.05 ± 0.05	0.18 ± 0.09	0.69 ± 0.18	0.40 ± 0.23

aldentification.

b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

^c Unitless

 $^{^{\}text{d}}$ Merged total uranium and U-238/U-234 ratio for MW-DU-003 and its duplicate are 1.4 \pm 0.4 pCi/L and 0.40 \pm 0.24, respectively.

U – Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit. ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not performed.

Table 3-3. Groundwater Water Quality Parameters and Exposure Readings (Spring 2018)

Jefferson Proving Ground, Madison, Indiana

JPG Location Designation ^a	Sample I.D.	рН	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate ^b (μR/hr)
MW01	MW-DU-001	7.59	13.41	0.340	14.24	5
MW02	MW-DU-002	7.56	11.64	0.438	18.42	5
MW03	MW-DU-003	7.72	11.90	0.434	14.69	5
MW04	MW-DU-004	7.18	15.17	0.483	4.38	5
MW05	MW-DU-005	7.84	15.91	0.465	8.42	5
MW06	MW-DU-006	7.27	18.63	0.339	9.01	4
MW07	MW-DU-007	7.10	16.12	0.405	8.74	5
MW08	MW-DU-008	6.91	16.30	0.404	10.56	5
MW09	MW-DU-009	7.73	16.77	5.52	10.91	5
MW10	MW-DU-0010	7.03	16.97	0.394	9.82	5
MW11	MW-DU-0011	7.70	15.99	0.197	11.0	5

^a Represents sample designation developed in previous sampling programs.

Table 3-4. Uranium in Surface Water (Spring 2018) Jefferson Proving Ground, Madison, Indiana

Sample I D a		Ratio			
Sample I.D. ^a	U-234	U-235	U-238	Total Uranium ^d	U-238/U-234c, d
SW-DU-001	1.7 ± 0.3	0.09 ± 0.06	0.20 ± 0.09	2.0 ± 0.3	0.12 ± 0.06
SW-DU-002	0.84 ± 0.20	0.07 ± 0.06	0.32 ± 0.12	1.2 ± 0.2	0.38 ± 0.17
SW-DU-003	0.28 ± 0.11	0.01 ± 0.03 U	0.03 ± 0.04 U	0.32 ± 0.12	ND
SW-DU-004	0.37 ± 0.13	$0.0 \pm 0.01 \mathrm{U}$	0.18 ± 0.09	0.55 ± 0.15	0.50 ± 0.29
SW-DU-005	0.36 ± 0.13	0.04 ± 0.04	0.25 ± 0.10	0.65 ± 0.17	0.68 ± 0.37
SW-DU-006d	0.26 ± 0.10	0.007 ± 0.025 U	0.10 ± 0.06	0.37 ± 0.12	0.39 ± 0.28
SW-DU-006Dd	0.24 ± 0.08	0.03 ± 0.03	0.09 ± 0.05	0.35 ± 0.10	0.37 ± 0.23
SW-DU-007	0.26 ± 0.08	-0.002 ± 0.030 U	0.13 ± 0.05	0.38 ± 0.10	0.48 ± 0.25
SW-DU-008	0.67 ± 0.18	0 ± 0.01 U	0.42 ± 0.14	1.1 ± 0.2	0.63 ± 0.27

aldentification.

Dose rate data were collected using Ludlum Model 19, serial number 205706, which was calibrated on 27 December 2017.

^b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

c Unitless.

d Merged total uranium and U-238/U-234 ratio for SW-DU-006 and its duplicate were 0.36 ± 0.16 pCi/L and 0.38 ± 0.36, respectively.

U – Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit. ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not performed.

Table 3-5. Surface Water Quality Parameters and Exposure Readings (Spring 2018)

Jefferson Proving Ground, Madison, Indiana

JPG Location Designation ^a	Sample I.D.	рН	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate ^b (μR/hr)
SWS01	SW-DU-001	8.53	18.99	0.185	19.49	5
SWS02	SW-DU-002	6.90	20.56	0.113	15.53	5
SWS03	SW-DU-003	7.83	13.51	0.090	7.66	5
SWS04	SW-DU-004	8.04	14.08	0.170	23.59	5
SWS05	SW-DU-005	8.42	18.54	0.174	20.27	5
SWS06	SW-DU-006	8.19	11.83	0.156	11.14	5
SWS07	SW-DU-007	7.49	20.60	0.104	10.41	4
SWS08	SW-DU-008	8.57	20.25	0.166	10.55	5

^a Represents sample designation developed in previous sampling programs.

Table 3-6. Uranium in Sediment (Spring 2018) Jefferson Proving Ground, Madison, Indiana

Sample I D a		Ratio			
Sample I.D.ª	U-234	U-235	U-238	Total Uranium ^d	U-238/U-234 ^{c, d}
SD-DU-001	0.31 ± 0.08	0.04 ± 0.03	0.29 ± 0.08	0.64 ± 0.12	0.95 ± 0.36
SD-DU-002	0.22 ± 0.07	-0.01 ± 0.03 U	0.32 ± 0.08	0.53 ± 0.11	1.5 ± 0.6
SD-DU-003	0.62 ± 0.12	0.02 ± 0.02	0.72 ± 0.13	1.4 ± 0.2	1.2 ± 0.3
SD-DU-004	0.24 ± 0.07	0.003 ± 0.012 U	0.17 ± 0.06	0.42 ± 0.09	0.69 ± 0.31
SD-DU-005	0.21 ± 0.07	0.01 ± 0.02 U	0.40 ± 0.09	0.62 ± 0.12	1.9 ± 0.8
SD-DU-006	0.42 ± 0.10	0.04 ± 0.03	0.42 ± 0.10	0.88 ± 0.14	1.0 ± 0.3
SD-DU-007d	0.40 ± 0.10	0.03 ± 0.03	0.32 ± 0.08	0.76 ± 0.13	0.80 ± 0.28
SD-DU-007Dd	0.39 ± 0.09	0.01 ± 0.02 U	0.38 ± 0.09	0.79 ± 0.13	1.0 ± 0.3
SD-DU-008	0.13 ± 0.05	0.02 ± 0.02	0.15 ± 0.06	0.30 ± 0.08	1.2 ± 0.7

a Identification.

^b Dose rate data were collected using Ludlum Model 19, serial number 205706, which was calibrated on 27 December 2017.

^b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

Unitless

d Merged total uranium and U-238/U-234 ratio for SD-DU-007 and its duplicate are 0.77 ± 0.18 pCi/g and 0.88 ± 0.43, respectively.

U - Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

Table 3-7. Uranium in Surface Soil (Spring 2018)
Jefferson Proving Ground, Madison, Indiana

Cample I D 3		Activity Concentration (pCi/g) ^b						
Sample I.D. ^a	U-234	U-235	U-238	Total Uranium ^d	U-238/U-234c, d			
SS-DU-001	0.73 ± 0.14	0.04 ± 0.03	0.9 ± 0.2	1.7 ± 0.2	1.2 ± 0.3			
SS-DU-002d	0.83 ± 0.14	0.04 ± 0.03	0.85 ± 0.14	1.7 ± 0.2	1.0 ± 0.2			
SS-DU-002Dd	0.79 ± 0.14	0.02 ± 0.02	0.90 ± 0.15	1.7 ± 0.2	1.2 ± 0.3			
SS-DU-003	0.57 ± 0.12	0.04 ± 0.03	0.53 ± 0.11	1.1 ± 0.2	0.92 ± 0.27			
SS-DU-004	0.49 ± 0.11	0.03 ± 0.03	0.48 ± 0.10	1.0 ± 0.2	0.98 ± 0.30			

a Identification.

Table 3-8. Uranium in Groundwater (Fall 2018) Jefferson Proving Ground, Madison, Indiana

		Activity Concentration (pCi/L) ^b					
Sample I.D. ^a	U-234	U-235	U-238	Total Uranium ^d	Ratio U-238/U-234 ^{c, d}		
MW-DU-001	0.32 ± 0.09	0.01 ± 0.02 U	0.21 ± 0.07	0.55 ± 0.12	0.66 ± 0.29		
MW-DU-002	1.2 ± 0.2	0.05 ± 0.04	0.52 ± 0.11	1.8 ± 0.2	0.44 ± 0.12		
MW-DU-003	0.62 ± 0.13	$0.02 \pm 0.03 \text{U}$	0.22 ± 0.07	0.86 ± 0.15	0.36 ± 0.14		
MW-DU-004d	0.29 ± 0.08	0.01 ± 0.02 U	0.24 ± 0.07	0.54 ± 0.11	0.85 ± 0.35		
MW-DU-004Dd	0.44 ± 0.10	0.04 ± 0.03 U	0.25 ± 0.07	0.73 ± 0.13	0.57 ± 0.21		
MW-DU-005	0.74 ± 0.14	$0.03 \pm 0.03 U$	0.21 ± 0.07	0.98 ± 0.16	0.29 ± 0.11		
MW-DU-006	2.0 ± 0.3	0.11 ± 0.05	1.6 ± 0.2	3.7 ± 0.35	0.82 ± 0.16		
MW-DU-007	1.3 ± 0.2	0.04 ± 0.04 U	0.83 ± 0.14	2.2 ± 0.2	0.62 ± 0.14		
MW-DU-008	0.46 ± 0.10	0.02 ± 0.02	0.26 ± 0.08	0.73 ± 0.13	0.56 ± 0.21		
MW-DU-009	0.95 ± 0.17	0.04 ± 0.04 U	0.17 ± 0.07	1.2 ± 0.2	0.18 ± 0.08		
MW-DU-010	1.6 ± 0.3	0.06 ± 0.05	0.67 ± 0.17	2.4 ± 0.3	0.41 ± 0.13		
MW-DU-011	0.43 ± 0.11	$0.02 \pm 0.02 \mathrm{U}$	0.09 ± 0.05	0.54 ± 0.13	0.21 ± 0.13		

^a Identification.

^bLaboratory uncertainties are specified with two standard deviations (95 percent confidence level).

Unitless

 $^{^{}m d}$ Merged total uranium and U-238/U-234 ratio for SS-DU-002 and its duplicate are 1.7 \pm 0.3 pCi/g and 1.1 \pm 0.4, respectively.

U - Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

^b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

Unitless

 $^{^{\}rm d}$ Merged total uranium and U-238/U-234 ratio for MW-DU-004 and its duplicate are 0.64 \pm 0.17 pCi/L and 0.71 \pm 0.41, respectively.

U – Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not performed.

Table 3-9. Groundwater Water Quality Parameters and Exposure Readings (Fall 2018)

Jefferson Proving Ground, Madison, Indiana

JPG Location Designation ^a	Sample I.D.	рН	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate ^b (μR/hr)
MW01	MW-DU-001	7.81	13.65	0.646	8.67	6
MW02	MW-DU-002	8.15	11.05	0.548	8.95	5
MW03	MW-DU-003	7.79	13.37	0.596	6.29	5
MW04	MW-DU-004	7.66	16.05	0.647	12.96	5
MW05	MW-DU-005	8.10	14.56	1.36	13.69	5
MW06	MW-DU-006	8.00	14.75	0.686	30.70	5
MW07	MW-DU-007	7.96	16.70	0.693	20.07	5
MW08	MW-DU-008	6.77	13.47	0.605	13.74	5
MW09	MW-DU-009	7.46	13.14	8.87	20.75	7
MW10	MW-DU-0010	8.16	15.53	0.664	8.87	6
MW11	MW-DU-0011	8.34	14.33	0.503	12.58	7

^a Represents sample designation developed in previous sampling programs.

Table 3-10. Uranium in Surface Water (Fall 2018)
Jefferson Proving Ground, Madison, Indiana

Cample I D a		Ratio			
Sample I.D.ª	U-234	U-235	U-238	Total Uranium ^d	U-238/U-234c, d
SW-DU-001	0.27 ± 0.08	0.004 ± 0.013 U	0.21 ± 0.07	0.49 ± 0.10	0.78 ± 0.33
SW-DU-002	0.31 ± 0.09	0.008 ± 0.020 U	0.33 ± 0.09	0.65 ± 0.13	1.1 ± 0.4
SW-DU-003	0.18 ± 0.06	0.001 ± 0.014 U	0.08 ± 0.04	0.26 ± 0.08	0.47 ± 0.30
SW-DU-004	0.25 ± 0.08	0.01 ± 0.02 U	0.16 ± 0.06	0.42 ± 0.10	0.64 ± 0.31
SW-DU-005	0.29 ± 0.09	-0.002 ± 0.017 U	0.55 ± 0.12	0.83 ± 0.15	1.9 ± 0.7
SW-DU-006	0.32 ± 0.09	0.009 ± 0.023 U	0.14 ± 0.06	0.47 ± 0.11	0.44 ± 0.23
SW-DU-007d	0.22 ± 0.07	0.01 ± 0.02 U	0.16 ± 0.06	0.39 ± 0.10	0.73 ± 0.38
SW-DU-007Dd	0.22 ± 0.07	0.03 ± 0.03	0.19 ± 0.06	0.44 ± 0.10	0.87 ± 0.40
SW-DU-008	0.28 ± 0.08	0.04 ± 0.03 U	0.71 ± 0.14	1.0 ± 0.2	2.5 ± 0.9

a Identification.

3-10

Dose rate data were collected using Ludlum Model 19, serial number 209723, which was calibrated on 10 May 2018.

^bLaboratory uncertainties are specified with two standard deviations (95 percent confidence level).

^c Unitless

 $^{^{}d}$ Merged total uranium and U-238/U-234 ratio for SW-DU-007 and its duplicate were 0.42 \pm 0.14 pCi/L and 0.80 \pm 0.55, respectively.

U – Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit. ND – Indicates that one or more isotopes were not detected; therefore, the calculation was not performed.

Table 3-11. Surface Water Quality Parameters and Exposure Readings (Fall 2018)

Jefferson Proving Ground, Madison, Indiana

JPG Location Designation ^a	Sample I.D.	рН	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate ^b (μR/hr)
SWS01	SW-DU-001	8.71	11.25	0.368	22.06	4
SWS02	SW-DU-002	8.74	12.95	0.346	21.18	4
SWS03	SW-DU-003	8.05	8.68	0.216	35.96	5
SWS04	SW-DU-004	8.41	8.79	0.330	12.12	6
SWS05	SW-DU-005	8.67	11.09	0.409	14.42	7
SWS06	SW-DU-006	8.55	6.79	0.314	11.59	5
SWS07	SW-DU-007	8.68	14.33	0.317	33.73	5
SWS08	SW-DU-008	8.61	12.64	0.325	12.01	5

^a Represents sample designation developed in previous sampling programs.

Table 3-12. Uranium in Sediment (Fall 2018) Jefferson Proving Ground, Madison, Indiana

Comple I D a		Ratio			
Sample I.D.ª	U-234	U-235	U-238	Total Uraniumd	U-238/U-234c, d
SD-DU-001 ^d	0.29 ± 0.07	0.02 ± 0.02 U	0.25 ± 0.07	0.55 ± 0.10	0.85 ± 0.32
SD-DU-001Dd	0.34 ± 0.09	0.01 ± 0.02 U	0.30 ± 0.08	0.66 ± 0.12	0.89 ± 0.32
SD-DU-002	0.38 ± 0.09	0.03 ± 0.03 U	0.33 ± 0.08	0.74 ± 0.13	0.86 ± 0.30
SD-DU-003	0.73 ± 0.13	0.04 ± 0.03	0.90 ± 0.15	1.7 ± 0.2	1.2 ± 0.3
SD-DU-004	0.21 ± 0.07	-0.004 ± 0.015 U	0.20 ± 0.06	0.40 ± 0.09	0.92 ± 0.41
SD-DU-005	0.22 ± 0.07	0.02 ± 0.02	0.30 ± 0.08	0.54 ± 0.11	1.3 ± 0.6
SD-DU-006	0.82 ± 0.14	0.03 ± 0.03 U	0.74 ± 0.13	1.6 ± 0.2	0.90 ± 0.23
SD-DU-007	0.89 ± 0.15	0.02 ± 0.02	0.73 ± 0.13	1.6 ± 0.2	0.82± 0.20
SD-DU-008	0.22 ± 0.07	0.03 ± 0.03 U	0.22 ± 0.07	0.47 ± 0.10	1.0 ± 0.4

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Table 3-13. Uranium in Surface Soil (Fall 2018) Jefferson Proving Ground, Madison, Indiana

Comple I D a		Activity Co	Ratio		
Sample I.D. ^a	U-234	U-235	U-238	Total Uranium ^d	U-238/U-234 ^{c, d}
SS-DU-001	0.74 ± 0.13	0.01 ± 0.02 U	0.76 ± 0.13	1.5 ± 0.2	1.0 ± 0.3
SS-DU-002	0.80 ± 0.14	0.06 ± 0.04	0.94 ± 0.16	1.8 ± 0.2	1.2 ± 0.3
SS-DU-003d	0.64 ± 0.12	0.04 ± 0.03	0.65 ± 0.13	1.3 ± 0.2	1.0 ± 0.3
SS-DU-003Dd	0.57 ± 0.12	$0.03 \pm 0.03 \text{U}$	0.62 ± 0.12	1.2 ± 0.2	1.1 ± 0.3
SS-DU-004	0.55 ± 0.12	$0.02 \pm 0.03 \text{ U}$	0.54 ± 0.11	1.1 ± 0.2	0.99± 0.29

a Identification.

Dose rate data were collected using Ludlum Model 19, serial number 209723, which was calibrated on 10 May 2018.

^b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

[©] Unitless

d Merged total uranium and U-238/U-234 ratio for SD-DU-001 and its duplicate are 0.60 ± 0.16 pCi/g and 0.87 ± 0.46, respectively.

U - Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

b Laboratory uncertainties are specified with two standard deviations (95 percent confidence level).

c Unitless.

d Merged total uranium and U-238/U-234 ratio for SS-DU-003 and its duplicate are 1.3 ± 0.3 pCi/g and 1.1 ± 0.4 , respectively.

U - Indicates that the data met all QA/QC requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

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4. HISTORICAL DATA ASSESSMENT AND TREND ANALYSIS

Historical data from the ERMP are reviewed and discussed in this section in the context of existing action levels and corrective actions for environmental media documented in the SOP for the ERM. The SOP action levels and associated corrective actions are provided in Table 4-1.

Table 4-1. Action Levels and Corrective Actions for Total Uranium in Environmental Media

Jefferson Proving Ground, Madison, Indiana

Medium	Total Uranium Action Level	Corrective Action
Groundwater and Surface Water	≥ 150 pCi/L*	Resample. If activity verified, notify NRC and assess results. The findings and recommended corrective actions will be documented for the Army's Radiation Control Committee. The Committee will provide recommendations to the JPG License Holder based on its evaluation.
	Less than 150 pCi/L	No action.
Soil and Sediment:		
Perimeter and Background Samples	≥ 35 pCi/g	Collect five additional samples in a 1-meter grid. If average activity exceeds 35 pCi/g, decontaminate to 35 pCi/g.
	Less than 35 pCi/g	No corrective action.

^{*}Effluent concentration limit for uranium is 300 pCi/L, as specified in 10 CFR 20, Appendix B, Table 2, Column 2. Source: U.S. Army 1999 and CHPPM 2000 (see Appendix A, pages A-6 and A-7).

An assessment of historical trends for ERMP data was first provided in the April 2006 Radiation Monitoring Report (SAIC 2006). That assessment focused on available sampling data for groundwater, surface water, sediment, and soil since 1998. Quality assurance/quality control (QA/QC) records for data collected prior to 1998 were not available to support the trend analyses. In addition, changes to analytical methods were made that were implemented beginning in December 2004. Therefore, although historical data are reported beginning in 1998, trend analyses included in this ERM report addresses the time period from December 2004 to the present. In addition, surface water and groundwater results for the April 2004 sampling event were not trended, given that the results were provided in units of μ g/L rather than pCi/L.

As noted above, the April 2006 Radiation Monitoring Report (SAIC 2006) provided detailed information about the trending methods employed and why certain data were or were not included in the initial trend analysis. To avoid confusion, that information is not repeated in this report. This report section re-examines the ERMP data for historical trends following the addition of the ERMP data collected during the spring and fall 2018 sampling events. Stated numbers of samples and summary statistics are based on data generated since December 2004 (when laboratory analytical methods were revised and standardized).

4.1 GROUNDWATER

For 346 discrete samples (inclusive of duplicates) available from 11 monitoring wells (MW-DU-001 to MW-DU-011) during the period from 2004 through the October 2018 sampling event, the average total uranium activity-concentration is 1.4 pCi/L, the standard deviation is 1.1 pCi/L, and the maximum detected activity-concentration is 5.7 ± 0.6 pCi/L. The activity-concentrations at each monitoring location are well below the 150 pCi/L action level for groundwater.

Data for each monitoring well are summarized in run charts, as shown on Figures 4-1 through 4-11. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. The associated coefficient of correlation (\mathbb{R}^2) and trend lines are also provided and are listed on each figure. An \mathbb{R}^2 value

that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. Most monitoring wells exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. The exceptions are MW-DU-005, MW-DU-007, MW-DU-008, and MW-DU-011, which exhibited a very limited, but statistically insignificant, increasing trend. Although the figures for all 11 individual monitoring wells indicate no significant trends, the trend line for MW-DU-009 reflected an R² value of 0.58 (i.e., somewhat significant) with a declining slope.

In addition to the aforementioned run charts (Figures 4-1 through 4-11), individual variable control charts were created in April 2006 for each monitoring well with the upper control limit (UCL) and the lower control limit (LCL) defined at three standard deviations above or below the mean. The control charts were created to determine if any single sample result warranted further examination. These control charts were updated with new groundwater data and re-examined in this report. All total uranium results at each groundwater sampling location for the April/May and October 2018 sampling efforts were within the cited control limits. An example individual control chart for MW-DU-001 is provided on Figure 4-12.

The 11 monitoring wells also were examined in aggregate to determine if some wells or particular sampling events were distinctive. A simple individual control chart was created using the pooled data for all monitoring wells and all data collected after December 2004 (Figure 4-13).

Figure 4-13 indicates that three points lie on or above the UCL of 4.65 pCi/L applicable to the full data set. All three of these data points were from MW-DU-006. MW-DU-006 samples exceeding the UCL were for the December 2004, May 2005, and October 2010 sampling events and exhibited individual concentration values of 4.8, 5.3, and 5.7 pCi/L, respectively. The mean and standard deviation for MW-DU-006 is 3.3 ± 1.2 pCi/L, whereas the overall mean and standard deviation for the groundwater wells is 1.4 ± 1.1 pCi/L. Clearly, MW-DU-006 has exhibited, and continues to exhibit, total uranium results exceeding that of the other wells. Review of total uranium concentrations in MW-DU-006, as depicted on Figure 4-6, suggests a generally decreasing, but statistically insignificant, trend. The Army will continue to closely monitor results from MW-DU-006. As reflected on Figure 4-13, individual sample results vary about the mean, as expected. The maximum groundwater total uranium concentration for the April/May and October 2018 sampling event was 3.7 ± 0.4 pCi/L.

Notably, U-238/U-234 activity ratios for April/May and October 2018 groundwater sampling range from 0.18 ± 0.08 pCi/L (MW-DU-009) to 1.2 ± 0.8 pCi/L (MW-DU-001), suggesting that significant concentrations of DU were not encountered (see graph of the "Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium" in Appendix D).

4.2 SURFACE WATER

For 254 discrete samples (inclusive of duplicates) available from 8 surface water sampling locations (SW-DU-001 to SW-DU-008) during the period from 2004 through the October 2018 sampling event, the average total uranium activity-concentration is $0.69 \, \text{pCi/L}$, the standard deviation is $1.90 \, \text{pCi/L}$, and the maximum detected activity-concentration is $19 \pm 2 \, \text{pCi/L}$. The activity-concentrations at each surface water sampling location are well below the $150 \, \text{pCi/L}$ action level for surface water.

Data for each surface water sampling location are summarized in run charts, as shown on Figures 4-14 through 4-21. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. Where trend lines are provided, the associated coefficient of correlation also is provided (the R² value listed on each figure). As noted in Section 4.1, an R² value that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. The results at most surface water sampling locations exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. Exceptions are SW-DU-001, SW-DU-002, and SW-DU-008, which exhibit a very limited, but

statistically insignificant, increasing trend. None of the samples exhibited trend lines with R^2 values greater than 0.5 (i.e., somewhat significant).

Individual variable control charts were created to determine if any single surface water sample result warranted further examination. The control charts were updated with new surface water data and reexamined in this report. All total uranium results at each surface water sampling location for the April/May and October 2018 sampling efforts were within the cited control limits with the exception of SW-DU-001, which was 1.97 as compared to the UCL of 1.64. The eight surface water sampling locations also were examined in aggregate to determine if some locations or particular sampling events were distinctive. A simple individual control chart was created using the pooled data for all surface water sampling locations and data collected beginning in December 2004 (Figure 4-22). Figure 4-22 indicates that four data points have exceeded the UCL of 6.34 pCi/L for total uranium. The total uranium concentrations in SW-DU-005 of 6.9 and 19 pCi/L exceeded the UCL in October 2008 and October 2010, respectively. Analytical results for SW-DU-004 reflected concentrations of 14 and 16 pCi/L for the sample and its duplicate, respectively, for the October 2010 sampling event. The maximum surface water total uranium concentration for the April/May and October 2018 sampling event was 2.0 ± 0.2 pCi/L.

Results for SW-DU-008 from the October 2018 sampling event represent the only surface water sample location with the potential to exceed the threshold of 3.0 with a U-238/U-234 activity ratio of 2.5 \pm 0.9. During further investigation through reanalysis by ICP-MS of this sample and given that the mass of U-235 was not detected, lower and upper comparison values were derived to determine if the results are suggestive of the possible presence of DU in surface water at SW-DU-008. Since the total uranium result at SW-DU-008 was greater than the lower comparison value but lower than the upper comparison value, the results are suggestive of a mixture of both natural uranium and DU in surface water at SW-DU-008.

With regard to the surface water samples, it is notable that the maximum surface water concentration of 2.0 pCi/L is approximately equal to 10 percent of the U.S. Environmental Protection Agency's (USEPA's) uranium primary drinking water standard of 30 μ g/L (which converts to approximately 20 pCi/L) and less than 1 percent of the effluent water limit prescribed in Title 10, CFR, Part 20, Appendix B (CFR 2014). In addition, it is notable that all results are well below the action levels/corrective actions listed in Table 4-1 of the ERMP. Nonetheless, surface water results for each sampling locations will continue to be closely monitored with samples exceeding a U-238/U-234 ratio of 3.0 being subjected to confirmatory analysis by ICP-MS.

4.3 SEDIMENT

For 259 discrete samples (inclusive of duplicates) available from 8 sediment sampling locations (SD-DU-001 to SD-DU-008) during the period from December 2004 through the October 2018 sampling event, the average total uranium activity-concentration is 0.94 pCi/g, the standard deviation is 0.48 pCi/g, and the maximum detected activity-concentration is 2.5 ± 0.3 pCi/g. The activity-concentrations at each location are well below the 35 pCi/g action level.

Data for each sediment sampling location are summarized in run charts, as shown on Figures 4-23 through 4-30. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. Where trend lines are provided, the associated coefficient of correlation also is provided (the R² value listed on each figure). As noted in Section 4.1, an R² value that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. The results at all sediment sampling locations exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. None of the samples exhibited trend lines with R² values greater than 0.5 (i.e., somewhat significant).

4-3

Individual variable control charts were created to determine if any single sediment sample result warranted further examination. The control charts were updated with new sediment data and re-examined in this report. All total uranium results at each sediment sampling location for the April/May and October 2018 sampling efforts were within the cited control limits. The eight sediment sampling locations also were examined in aggregate to determine if some locations or particular sampling events were distinctive. A simple individual control chart was created using the pooled data for all sediment sampling locations and all data collected after December 2004 (Figure 4-31). Figure 4-31 indicates that two data points have equaled or exceeded the UCL of 2.37 pCi/g for total uranium. The total uranium concentrations of 2.4 pCi/g in SD-DU-004 and 2.5 pCi/g in SD-DU-007 equaled or exceeded the UCL in April 2007 and November 2016, respectively. The maximum sediment total uranium concentration for the April/May and October 2018 sampling event was 1.7 ± 0.20 pCi/g.

U-238/U-234 activity ratios for April/May and October 2018 sediment sampling range from 0.69 ± 0.31 pCi/g (SD-DU-004) to 1.9 ± 0.8 pCi/g (SD-DU-005), suggesting that significant concentrations of DU were not encountered.

4.4 SOILS

For 151 discrete samples (inclusive of duplicates) available from 4 surface soil sampling locations (SS-DU-001 to SS-DU-004) during the period from 2004 through the October 2018 sampling event, the average total uranium activity-concentration is 1.4 pCi/g, the standard deviation is 0.3 pCi/g, and the maximum detected activity-concentration is 2.2 ± 0.5 pCi/g. The activity-concentration at each location is well below the action level of 35 pCi/g.

Data for each surface soil sampling location are summarized in run charts, as shown on Figures 4-32 through 4-35. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. Where trend lines are provided, the associated coefficient of correlation also is provided (the R² value listed on each figure). As noted in Section 4.1, an R² value that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. The figures for all four individual surface soil sampling locations indicate no significant trends. The overall slope of the trend line for SS-DU-001 continues to be negative with the activity concentrations decreasing from approximately 2.0 pCi/g to approximately 1.6 pCi/g over the period 2004 to the present, with only two samples collected since 2004 exhibiting concentrations equaling or exceeding 2.0 pCi/g. The results at two soil sampling locations exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. The exceptions are SS-DU-002 and SS-DU-003, which exhibit a very limited, but statistically insignificant, increasing trend.

Individual variable control charts were created to determine if any single surface soil sample result warranted further examination. The control charts were updated with new surface soil data and reexamined in this report. All total uranium results at each surface soil sampling location for the April/May and October 2018 sampling efforts were within the cited control limits. The four surface soil sampling locations also were examined in aggregate to determine if some locations or particular sampling events were distinctive. A simple individual control chart was created using the pooled data for all surface soil sampling locations and all data collected beginning in December 2004 (Figure 4-36). As data are added to the control chart, the UCL, mean, and LCL are automatically recalculated. Figure 4-36 reflects that data from SS-DU-002 from the October 2008 sampling event that exhibited a total uranium concentration of 0.36 ± 0.09 . This concentration is below the LCL of 0.56 pCi/g. All other surface soil data were within the range of the control limits.

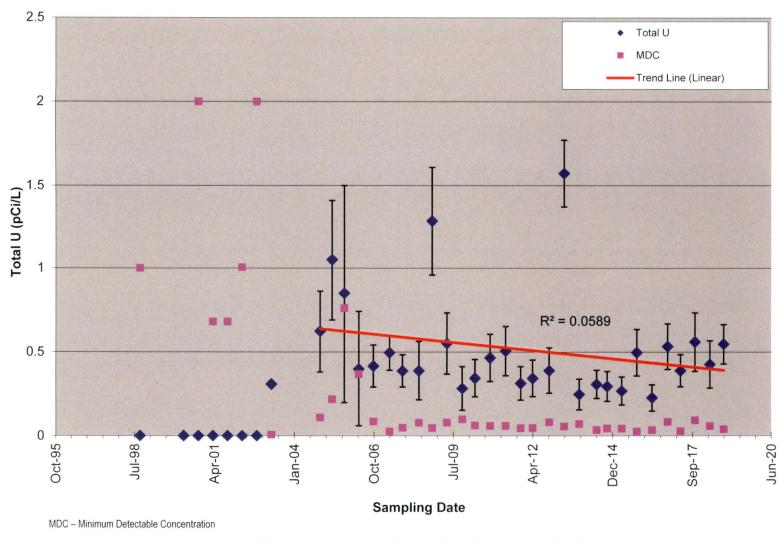


Figure 4-1. Total Uranium in MW-DU-001 (1998-2018)

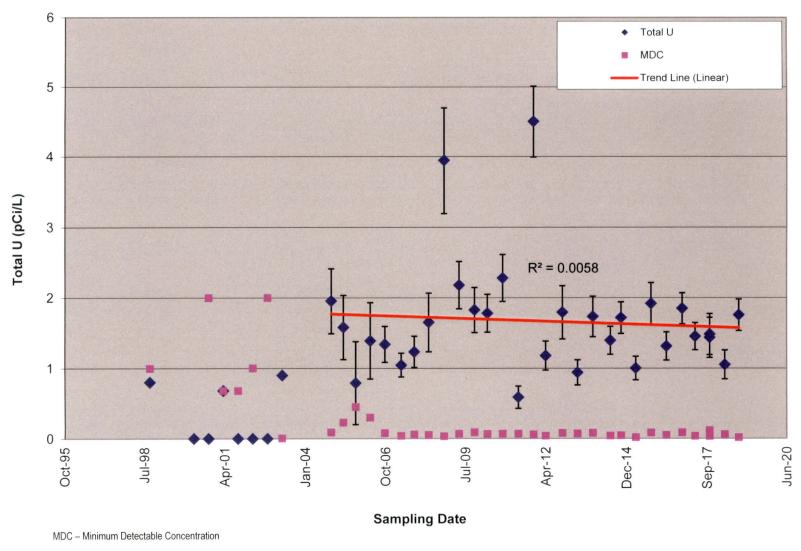


Figure 4-2. Total Uranium in MW-DU-002 (1998-2018)

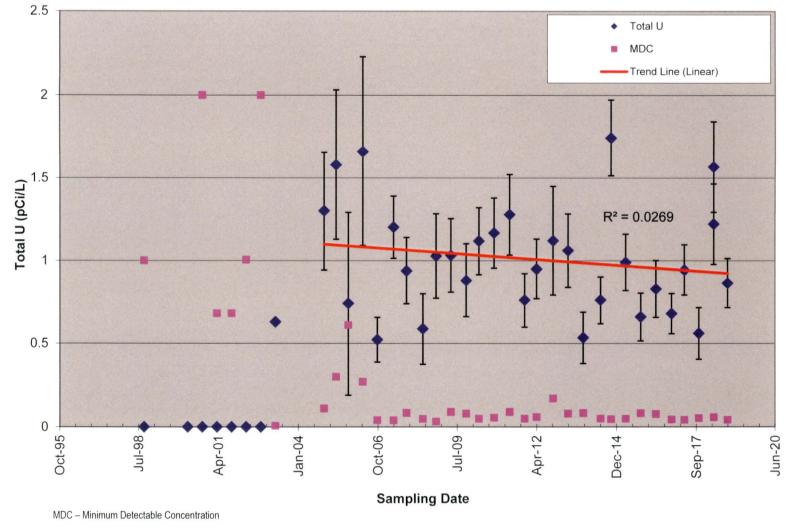


Figure 4-3. Total Uranium in MW-DU-003 (1998-2018)

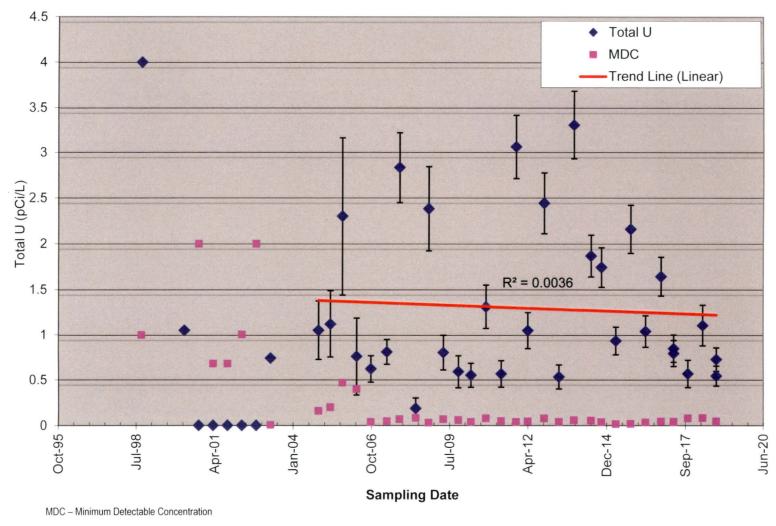
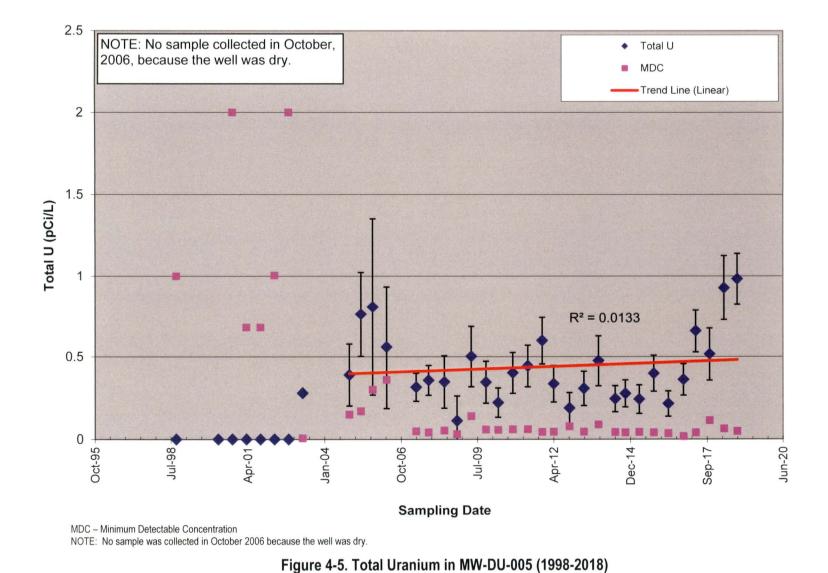


Figure 4-4. Total Uranium in MW-DU-004 (1998-2018)



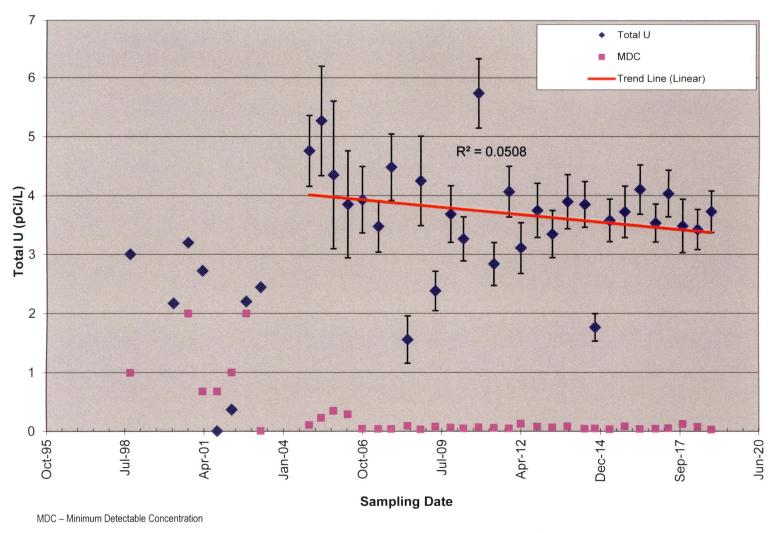


Figure 4-6. Total Uranium in MW-DU-006 (1998-2018)

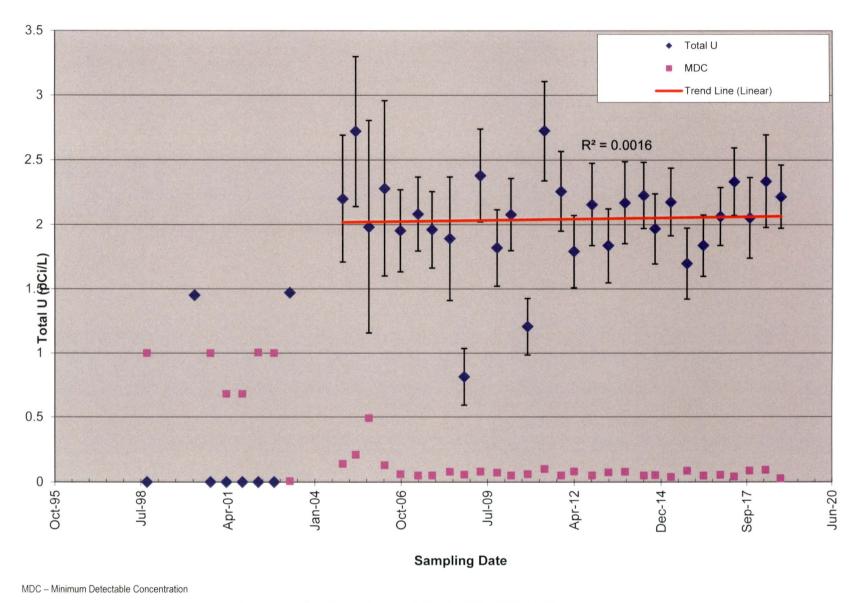


Figure 4-7. Total Uranium in MW-DU-007 (1998-2018)

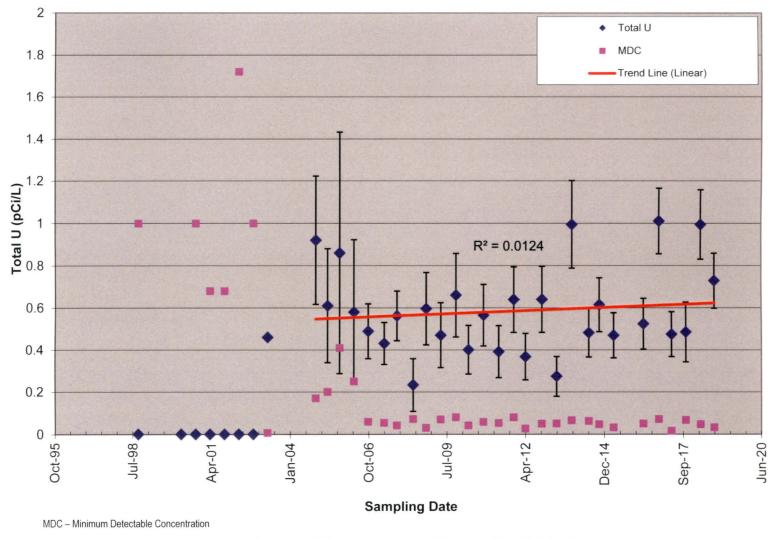


Figure 4-8. Total Uranium in MW-DU-008 (1998-2018)

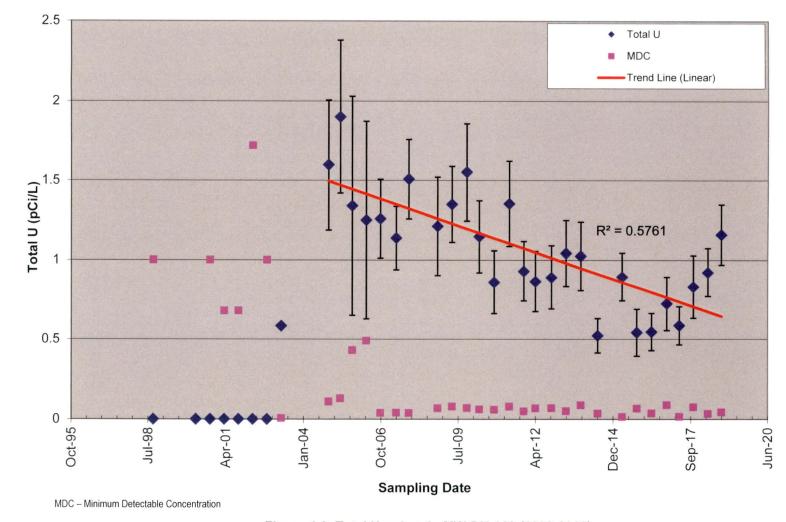


Figure 4-9. Total Uranium in MW-DU-009 (1998-2018)

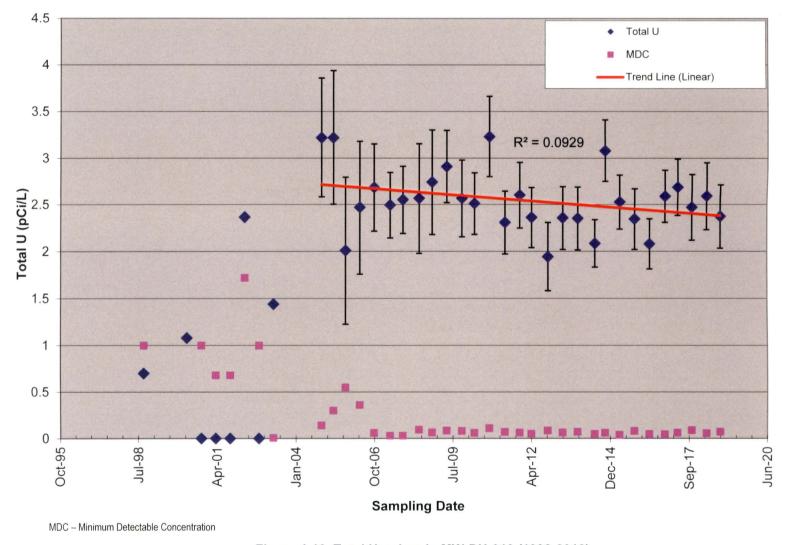


Figure 4-10. Total Uranium in MW-DU-010 (1998-2018)

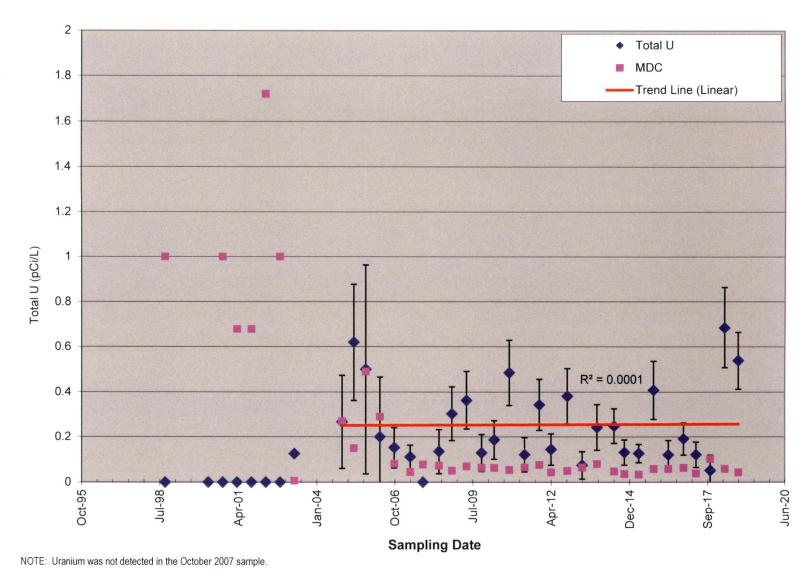
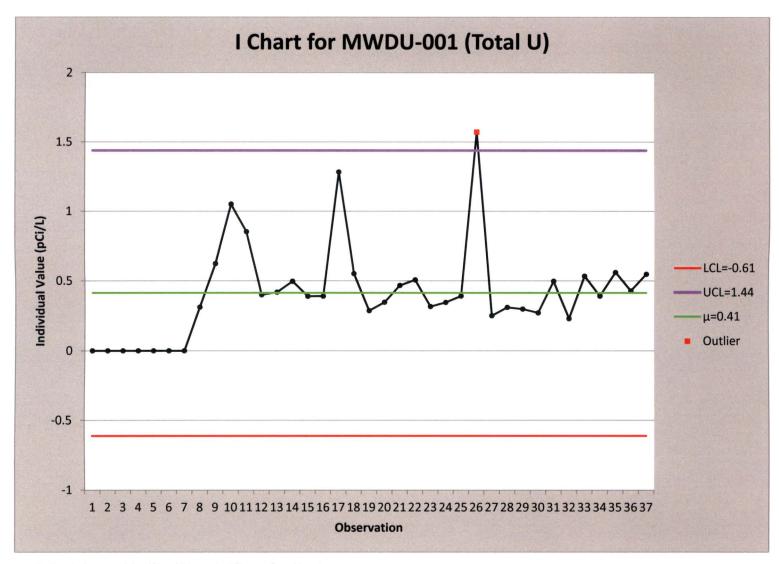
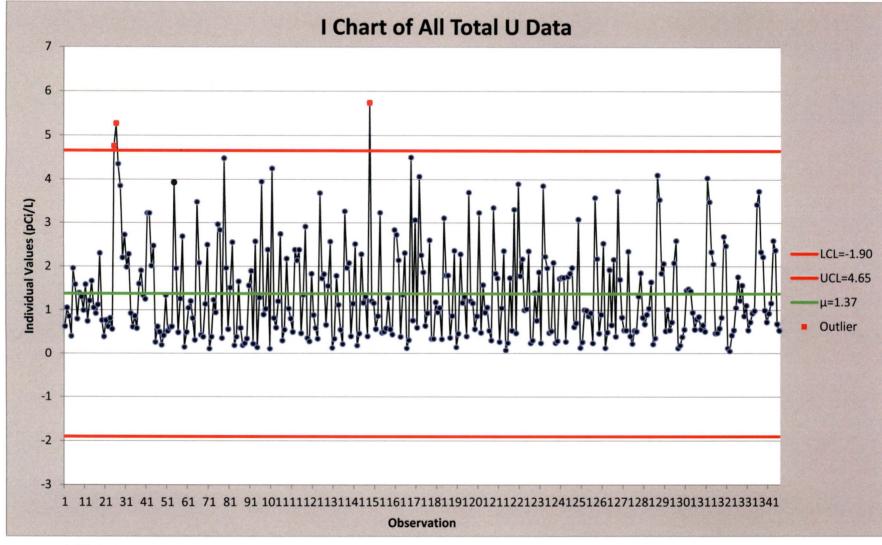


Figure 4-11. Total Uranium in MW-DU-011 (1998-2018)



NOTE: Results that exceed the UCL or fall below the LCL are reflected in red squares.

Figure 4-12. Variable Control Chart for Total Uranium in MW-DU-001 (2004-2018)



NOTE: Results that exceed the UCL or fall below the LCL are reflected in red squares.

Figure 4-13. Control Chart for All Monitoring Well Data (2004-2018)

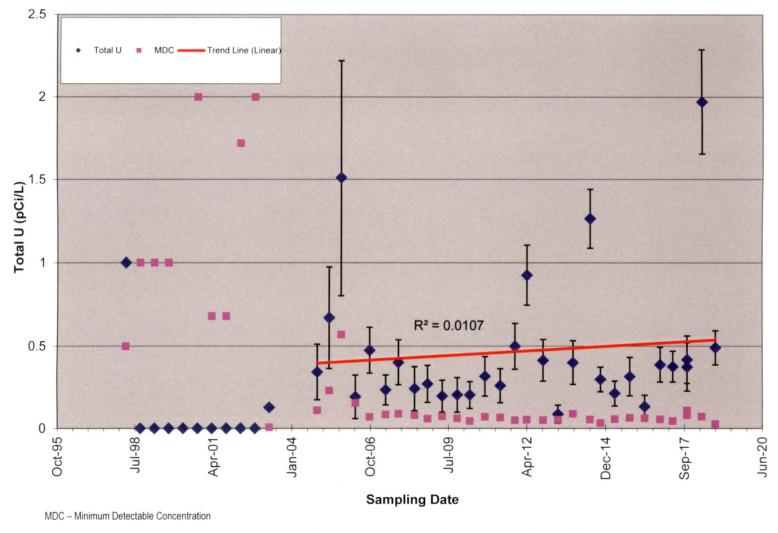


Figure 4-14. Total Uranium in SW-DU-001 (1998-2018)

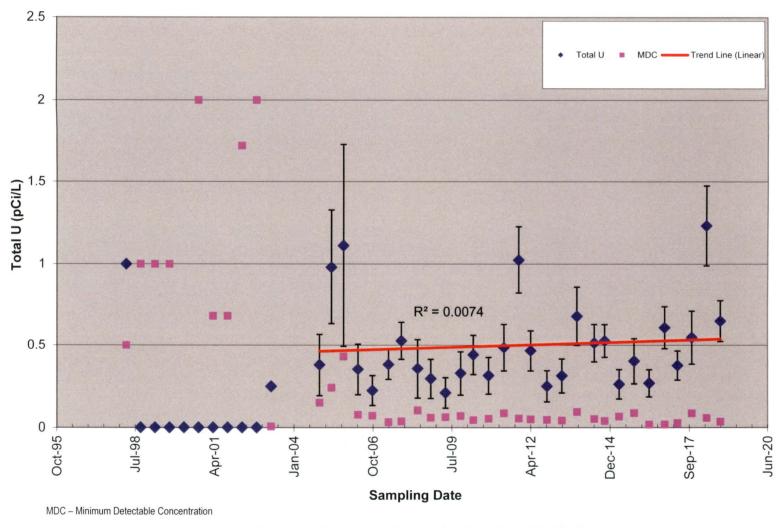
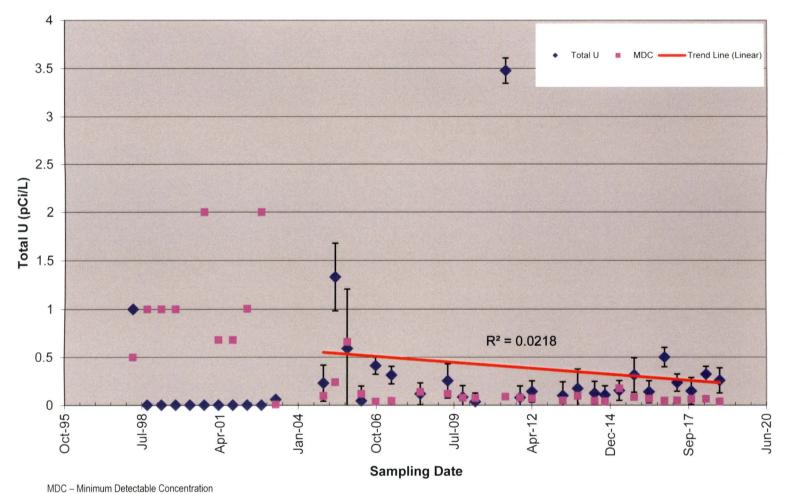


Figure 4-15. Total Uranium in SW-DU-002 (1998-2018)



NOTE: No sample was collected in October 2007, October 2008, October 2010, or October 2012 as the creek was dry during each of these sampling events.

Figure 4-16. Total Uranium in SW-DU-003 (1998-2018)

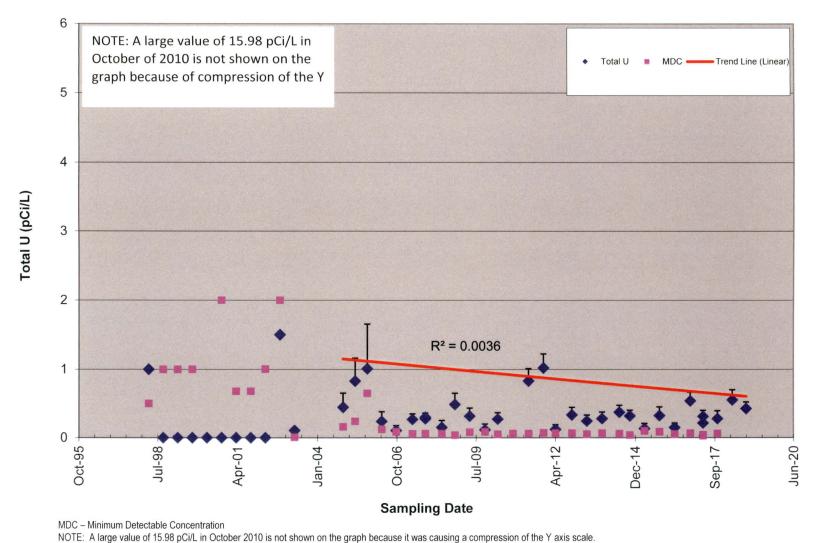


Figure 4-17. Total Uranium in SW-DU-004 (1998-2018)

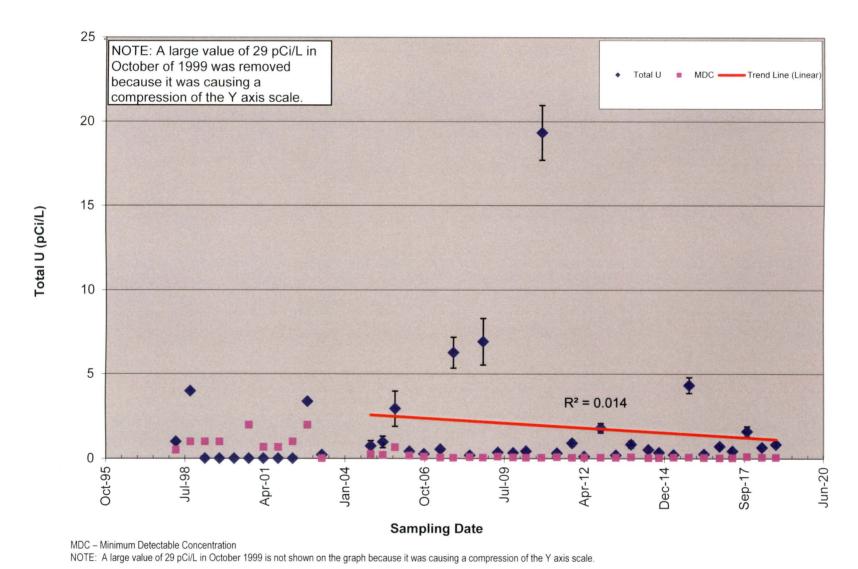
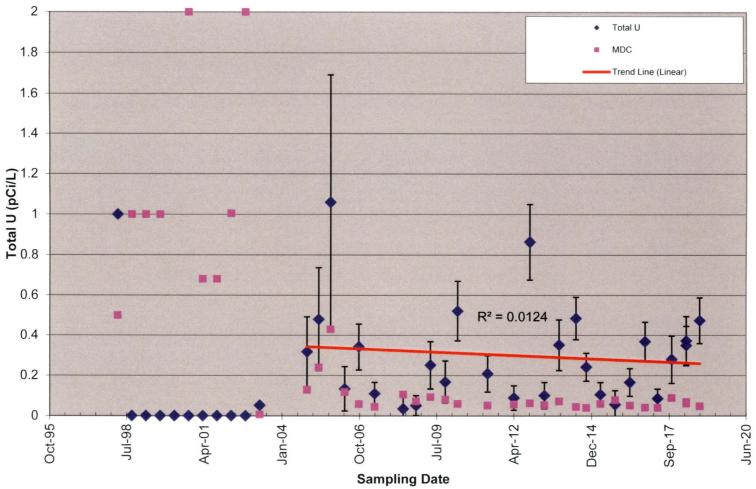
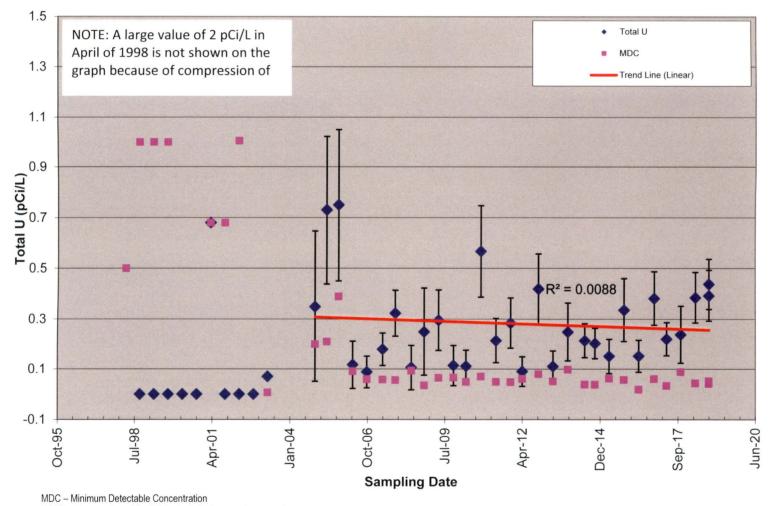


Figure 4-18. Total Uranium in SW-DU-005 (1998-2018)



MDC – Minimum Detectable Concentration NOTE: No sample was collected in October 2007 or October 2010 as the creek was dry.

Figure 4-19. Total Uranium in SW-DU-006 (1998-2018)



NOTE: A large value of 2 pCi/L in April 1998 is not shown on the graph because it was causing a compression of the Y axis scale.

Figure 4-20. Total Uranium in SW-DU-007 (1998-2018)

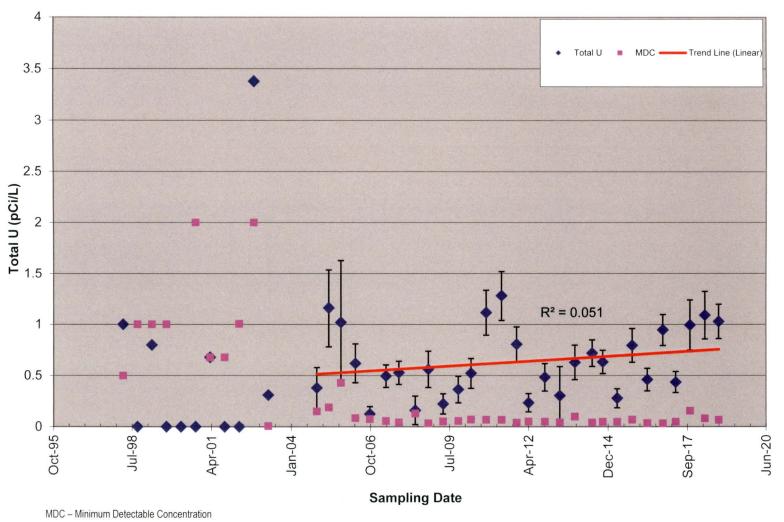
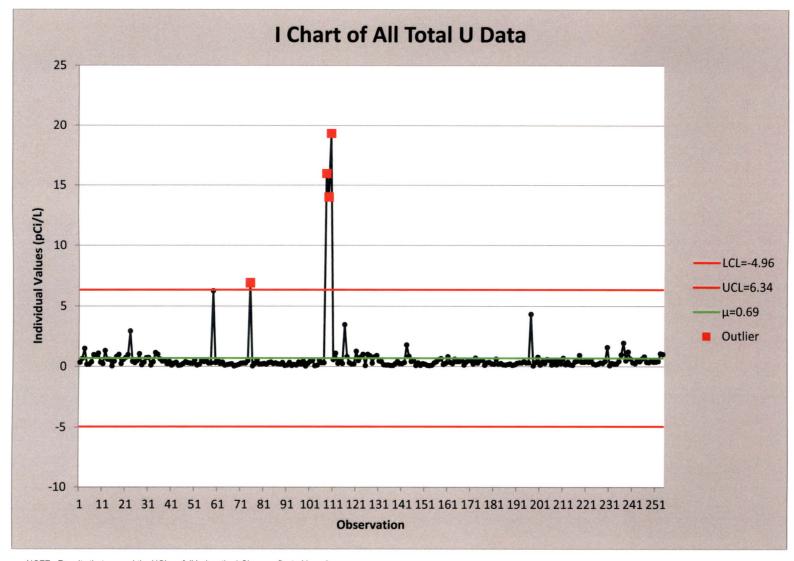


Figure 4-21. Total Uranium in SW-DU-008 (1998-2018)



NOTE: Results that exceed the UCL or fall below the LCL are reflected in red squares

Figure 4-22. Control Chart for All Surface Water Data (2004-2018)

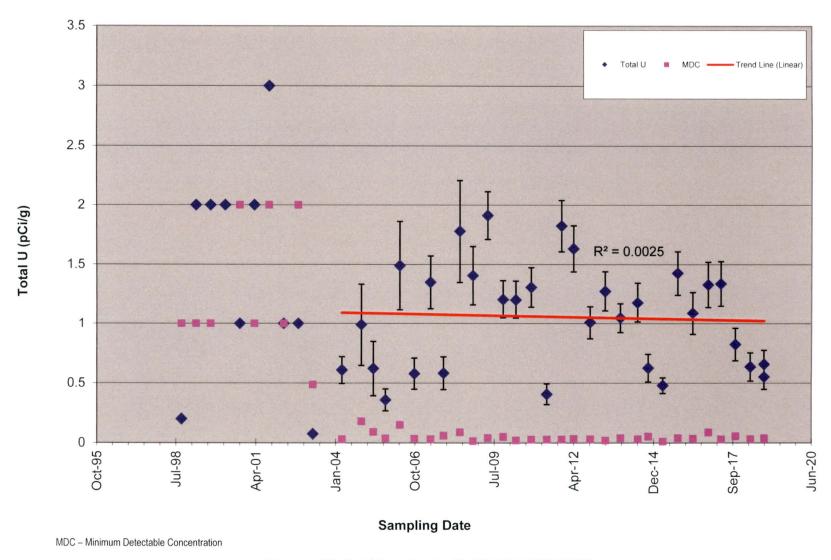


Figure 4-23. Total Uranium in SD-DU-001 (1998-2018)

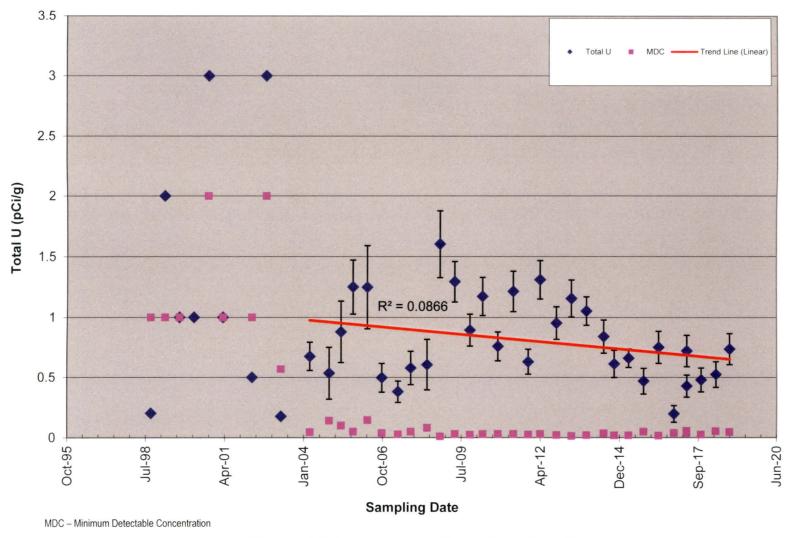


Figure 4-24. Total Uranium in SD-DU-002 (1998-2018)

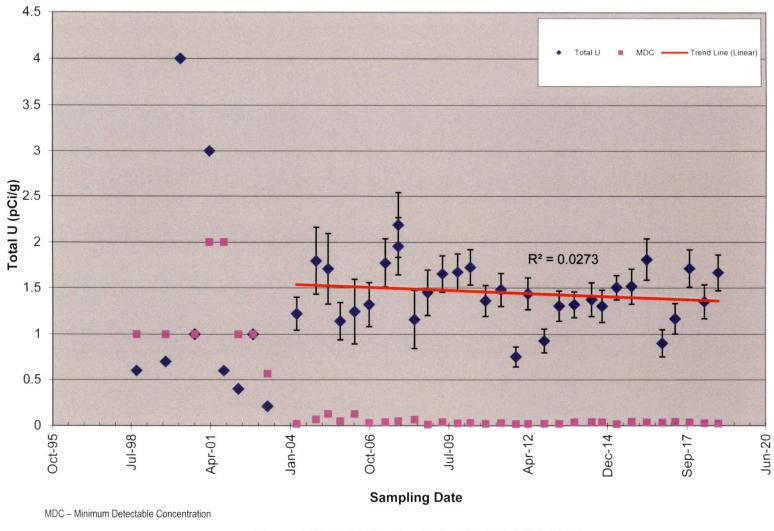


Figure 4-25. Total Uranium in SD-DU-003 (1998-2018)

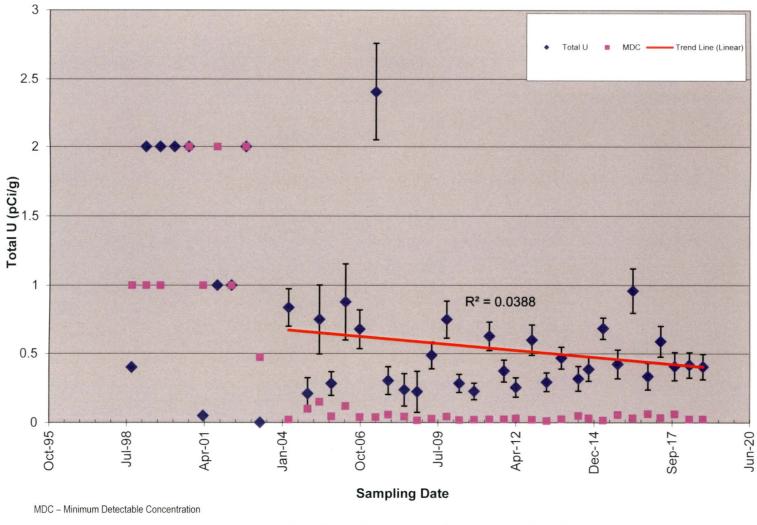


Figure 4-26. Total Uranium in SD-DU-004 (1998-2018)

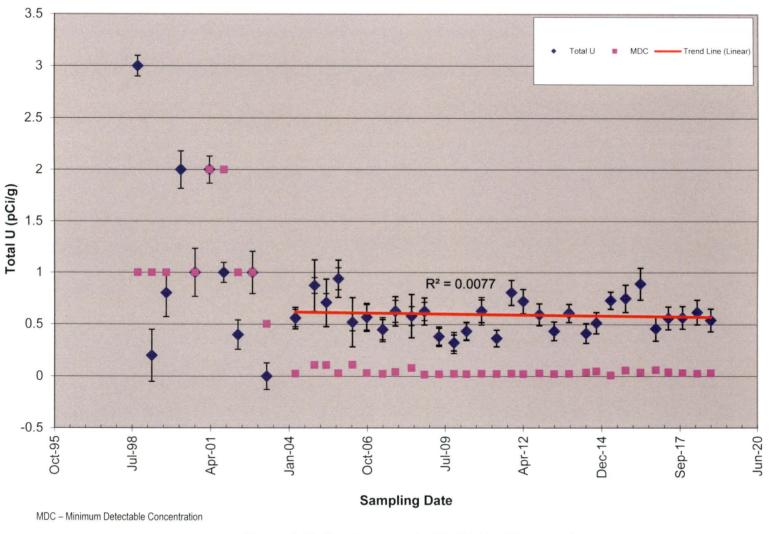


Figure 4-27. Total Uranium in SD-DU-005 (1998-2018)

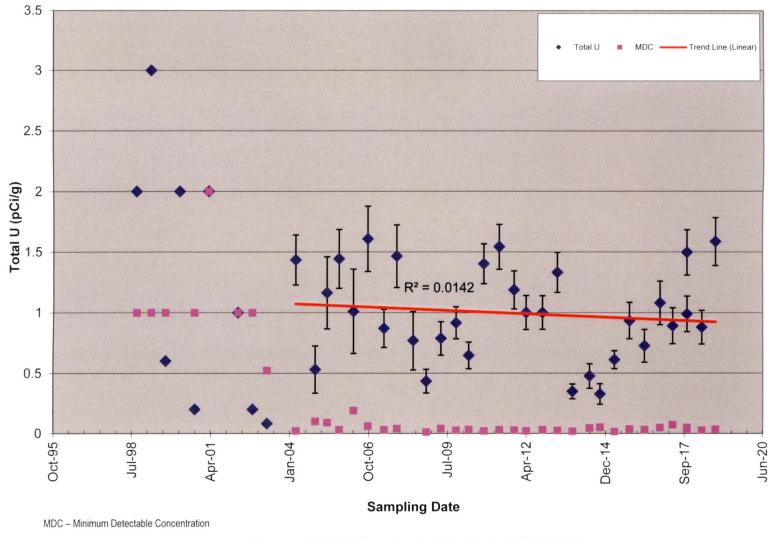


Figure 4-28. Total Uranium in SD-DU-006 (1998-2018)

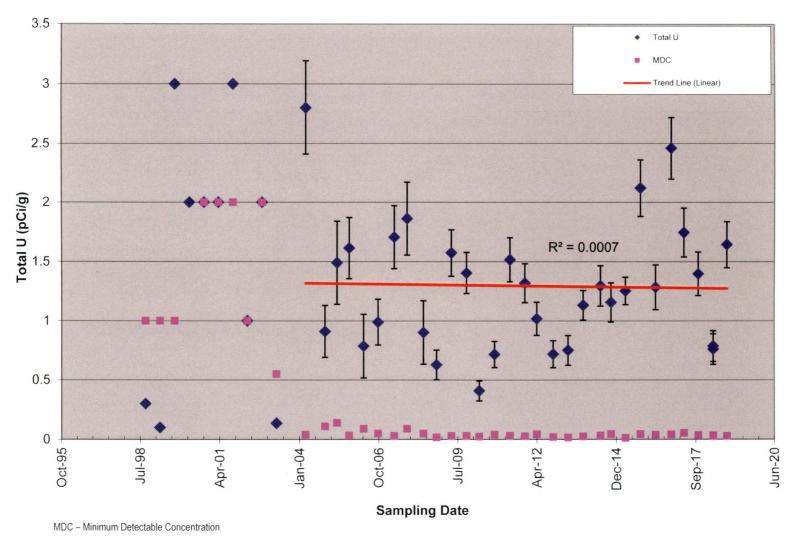


Figure 4-29. Total Uranium in SD-DU-007 (1998-2018)

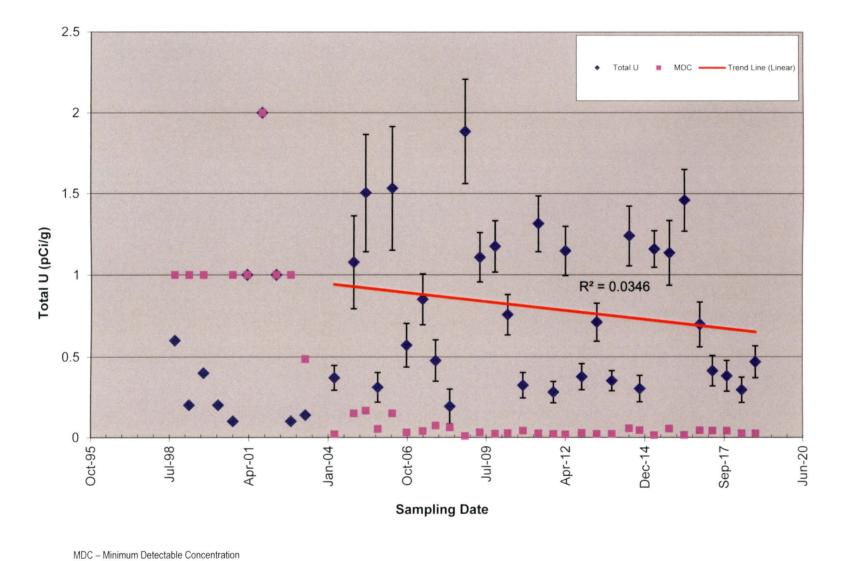
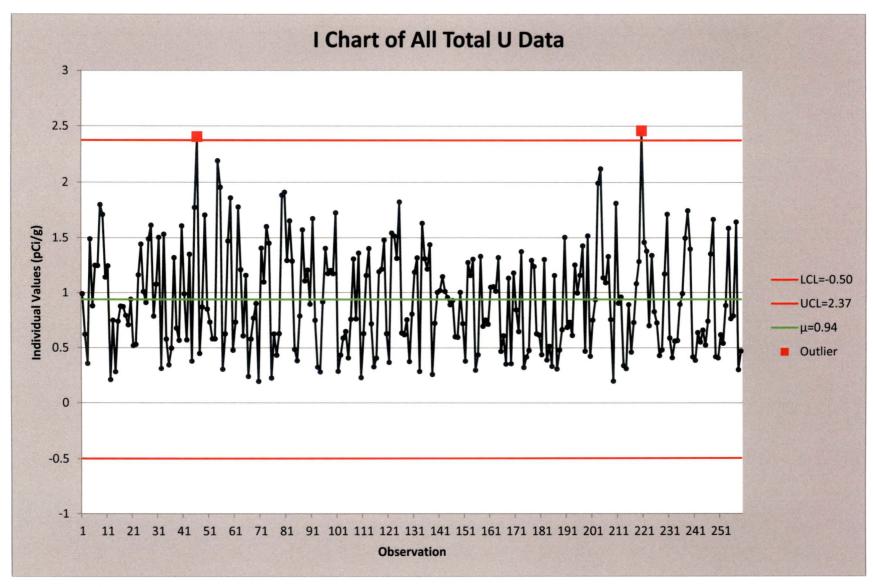


Figure 4-30. Total Uranium in SD-DU-008 (1998-2018)



NOTE: Results that exceed the UCL or fall below the LCL are reflected in the red square.

Figure 4-31. Control Chart for All Sediment Data (2004-2018)

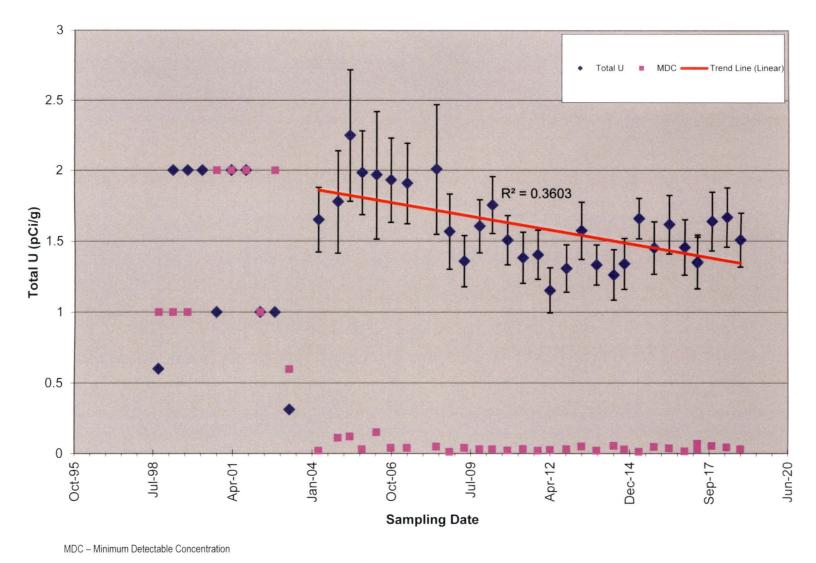


Figure 4-32. Total Uranium in SS-DU-001 (1998-2018)

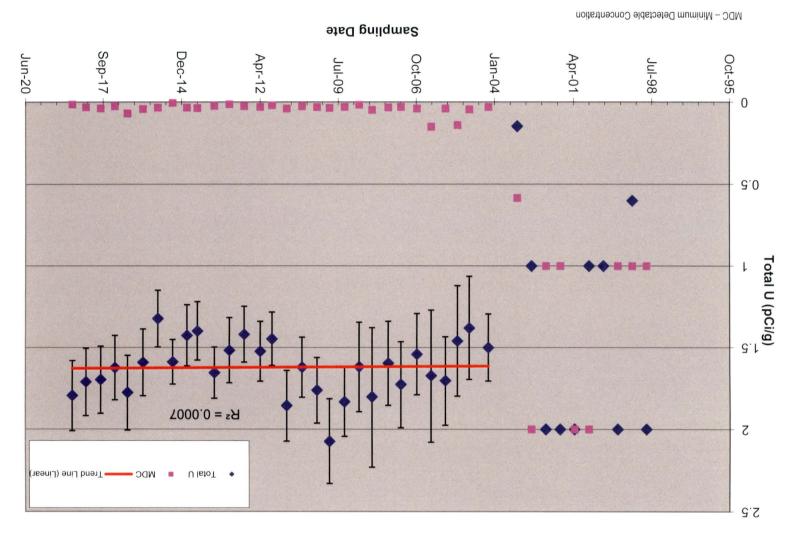


Figure 4-33. Total Uranium in SS-DU-002 (1998-2018)

April 2019

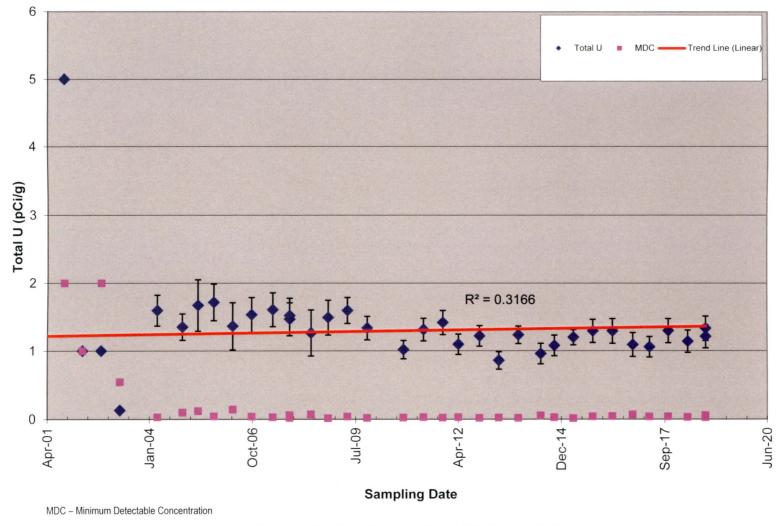
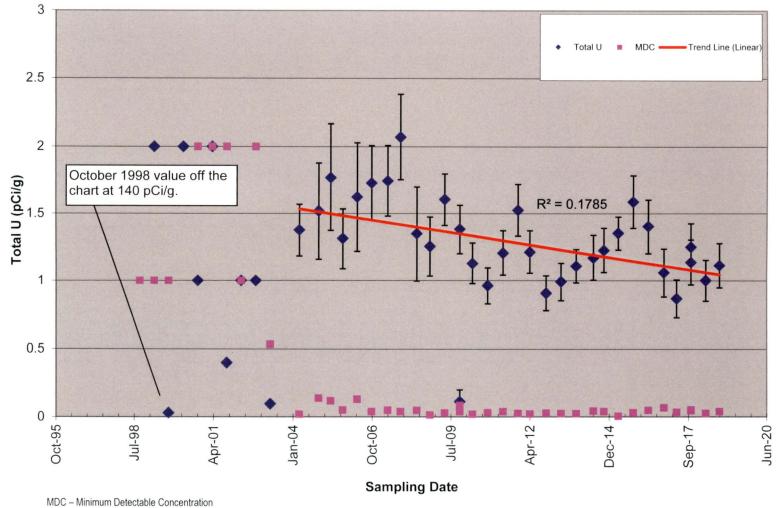
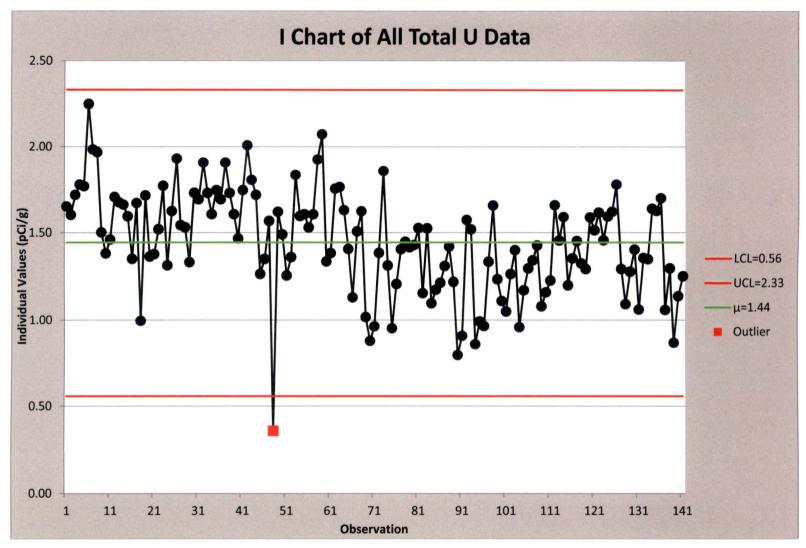


Figure 4-34. Total Uranium in SS-DU-003 (1998-2018)



NOTE: The October 1998 value of 140 pCi/g is not shown on the graph because it was causing a compression of the Y axis scale.

Figure 4-35. Total Uranium in SS-DU-004 (1998-2018)



NOTE: Results that exceed the UCL or fall below the LCL are reflected in the red square.

Figure 4-36. Control Chart for All Surface Soil Data (2004-2018)

5. CONCLUSIONS AND RECOMMENDATIONS

The April/May and October 2018 sampling events were conducted in accordance with the SOP (CHPPM 2000), and all data were determined to comply with the requirements of the Quality Assurance Project Plan (QAPP) (see Appendix A). The environmental media sample results are generally a small fraction of the action levels (see Table 4-1) established in the SOP.

For the purposes of this report, samples with U-238/U-234 ratios potentially exceeding 3.0 were investigated further to validate whether a sample result was representative of DU or natural uranium. The only sample for which the U-238/U-234 ratio could exceed 3.0 was SW-DU-008 (2.5 \pm 0.9 pCi/L) from the October 2018 sampling event.

ICP-MS results for SW-DU-008 equated to 1.9, non-detect, non-detect, and 1.9 μ g/L for total uranium, U-234, U-235, and U-238, respectively. Given that U-235 was not detected by ICP-MS, the total uranium result is compared to the lower comparison value from Table 3-1. The total uranium result for SW-DU-008 of 1.9 μ g/L is greater than the lower comparison value of 1.2 μ g/L for surface water, so the upper comparison value had to be derived. The upper comparison value was calculated to be 4.1 μ g/L based on a U-235 MDL of 0.2 μ g/L. Since the total uranium result of 1.9 μ g/L for SW-DU-008 is less than the upper comparison value of 4.1 μ g/L, it is suggestive of a mixture of both natural uranium and DU. As noted in Sections 3 and 4, these results support the conclusion that total uranium concentrations are compliant with applicable criteria, including action levels defined in Table 4-1.

Trend analysis reflected that no sample location exhibited an R² value of 1.0, which would have indicated a strong relationship between sampling results and sampling dates. The lone sample that reflected an R² value exceeding 0.50 (i.e., somewhat significant) was monitoring well sample MW-DU-009. The samples from this location reflected an R² value of 0.59. The total uranium concentrations for samples from MW-DU-009 continue to exhibit a decreasing trend.

In conclusion, no action levels defined in the Army's license were exceeded, and future environmental monitoring will continue to be completed in accordance with the SOP.

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6. REFERENCES

- CHPPM (U.S. Army Center for Health Promotion and Preventative Medicine). 2000. Standard Operating Procedure, Depleted Uranium Sampling Program, Environmental Radiation Monitoring Program. SOP No. OHP 40-2. 10 March.
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- NRC. 2012a. NRC Homepage, Glossary: http://www.nrc.gov/reading-rm/basic-ref/glossary/natural-uranium.html. Page last reviewed/updated 10 December.
- NRC. 2012b. NRC Homepage, Background Information on Depleted Uranium: http://www.nrc.gov/reading-rm/basic-ref/glossary/depleted-uranium.html. Page last reviewed/updated 10 December.
- SAIC (Science Applications International Corporation). 2006. Radiation Monitoring Report for License SUB-1435 Jefferson Proving Ground, Summary of Results for 10-13 April 2006 Sampling Event. Final. October.
- U.S. Army. 1999. U.S. Army Test and Evaluation Command, Environmental Radiation Monitoring (ERM) Plan for Jefferson Proving Ground. Memorandum to Mr. Larry W. Camper, Chief, Decommissioning Branch, Division of Waste Management, Office of Nuclear Material Safety and Safeguards, United States Nuclear Regulatory Commission, Washington, DC 20555-001 from Dal M. Nett, Chief, Safety Division, Directorate for Mission Support.
- U.S. Army. 2002. Decommissioning Plan for License SUB-1435. Jefferson Proving Ground, Madison, Indiana. Prepared for the U.S. Army SBCCOM by SAIC. June.
- U.S. Army. 2013. Army's Environmental Report for NRC Materials License SUB-1435. Depleted Uranium Impact Area. Jefferson Proving Ground, Madison, Indiana. Prepared for the U.S. Army by SAIC. August.

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APPENDIX A STANDARD OPERATING PROCEDURE

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Effective Date 10 Mar 00 Date Removed from Service

STANDING OPERATING PROCEDURE

Depleted Uranium Sampling Program Environmental Radiation Monitoring Program Jefferson Proving Ground, Madison, IN

This SOP supersedes, in its entirety, the SOP of the same name dated April 1998.

1. **Purpose**. This Standing Operating Procedure (SOP) prescribes policies, responsibilities, and procedures for administration and execution of the Health Physics Program (HPP), USACHPPM support of the Soldier and Biological Chemical Command (SBCCOM) biannual Environmental Radiation Monitoring (ERM) Program conducted at the Jefferson Proving Ground, Madison, Indiana.

2. Authority.

- a. US Nuclear Regulatory Commission License No. SUB-1435.
- b. Program Services Meeting, 14 September 1999, between SBCCOM and HPP, USACHPPM.
- 3. **Scope.** This SOP applies to Health Physics Program personnel performing the collection of environmental samples in support of the ERM.
- 4. **Definitions, Abbreviations.** A list of terms and abbreviations used in this SOP can be found in Annex A.
- 5. Forms, Labels, and Worksheets. A sample of all forms, sample labels, and sample collection worksheets can be found in Annex B.
- 6. Point(s) of Contact for Program Coordination:
 - a. Soldier and Biological Chemical Command

Ms. Joyce Kuykendall, SBCCOM Health Physicist

Comm: 410-436-7118

DSN : 584-7118

email: joyce.kuykendall@sbccom.apgea.army.mil

SOP No. OHP 40-2

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Effective Date 10 Mar 00 Date Removed from Service

b. US Army Center for Health Promotion and Preventive Medicine

Health Physics Program (Pgm 26)

Comm: 410-436-3502

DSN: 584-3502

fax: 410-436-8261/8263

Radiologic, Classic and Clinical Chemistry Division (RCCCD)

Comm: 410-436-3983/8235

DSN: 584-8235

c. Jefferson Proving Ground

Mr. Ken Knouf, Site Manager

Mr. Phil Mann

Ms. Yvette Hayes

Comm: 812-273-2551/2522/6075

7. Survey Coordination.

- a. Pre-Survey Coordination: 60 days prior to scheduled sample date.
- 1) Initial Coordination: made through the SBCCOM Health Physicist. Close coordination with the site management team at JPG will be required to ensure support will be onsite at the time of sampling.
- 2) USACHPPM HPP Program Assistant, (410) 436-1303, (if call from the Edgewood Arsenal: 5-1303) will be contacted to initiate travel orders. Due to the nature of the sampling program, a four-wheel drive vehicle is required to perform this project. The project and associated report number will be 26-MA-8260-R#-YY. The R# will be a "1" for the October and "2" for the April survey, and the YY will be the current fiscal year.
- 3) Prepare CHPPM Form 330-R-E (Request for Laboratory Services. (See Annex B) This form can be found on the USACHPPM Web Site or through intranet FormFlow program. Current DLS Test Codes being used are as follows:

Evaluations for Uranium in Soils for the soil and sediment samples, DLS Test Code: 803; STD Method: G-002.

SOP No. OHP 40-2

Evaluations for Uranium in Water for the ground and surface water samples, DLS Test Code: 586; STD Method: U-002.

Note: Sample containers for all medium except soils, are provided by SBCCOM and will be onsite however sample labels should be requested from the lab.

Ensure that sample bags, labels and coolers are shipped to the following address:

US Army Jefferson Proving Ground 1661 West J.P.G. Niblo Road (Bldg. 125) Madison, IN 47250 (812) 273-2551

4) Request for instrumentation to support the sampling program should be made no later than 30 days prior to the scheduled departure date.

Radiation detection instrumentation and soil sampling tools will be coordinated through the HPP Instrumentation Coordinator, ext. 8228. Electronic message will be used for coordination.

Water Quality Instrumentation (pH meter, temperature, and conductivity) will be coordinated through the Surface Water and Waste Water Program (Pgm 32) at extension 3310/4211.

5) Final coordination for project should be completed no later than 14 days prior to departure date.

Contact the site management personnel at JPG and schedule dates for purging of wells prior to arrival. Purging should be accomplished no later than the Friday preceding and no earlier than 14 days prior to the scheduled start date of the sampling visit.

- b. Field instrument quality control. Upon receipt of field instruments from the HPP Instrument Coordinator and the Surface Water and Waste Water Program, appropriate instrument quality control checks will be conducted to ensure proper operation prior to departure.
- 1) Radiation detection instrumentation will be checked for response against a radiation check source. This check source should also be shipped to the survey site for instrument verification on

Effective Date 10 Mar 00 Date Removed from Service

site. The radiation check source used need not be a calibrated source as instrument response is the parameter being evaluated.

- 2) Water quality instruments should also be verified using guidance provided by water program personnel. At a minimum, verify the accuracy of the pH meter using the certified pH solution packets.
- 8. Sample Collection. Four separate sample matrixes will be collected in support of the ERM. Methodologies for sampling can be found in US Army Environmental Hygiene Agency (the predecessor to USACHPPM) Technical Guide 155, Environmental Sampling Guide, February 1993.
- a. Ground Water Samples. A total of 11 monitoring wells have been established to be used for the Environmental Monitoring Program. Wells are indicated on the ground water sample map (figure 1, Anne C) using an alphanumeric code containing the letters MW and a two digit sample number (01-11).
- 1) Sample will be collected using a new hand bailer for each sample. Care will be taken when lowering the bailer into the well to prevent unnecessary aeration or contamination of the sample.
 - 2) A total quantity to be collected will be 1 US gallon.
- 3) A portion of the first bailer full of water will be placed into a clean beaker, or other suitable container, and an evaluation of radiation level, temperature, pH and conductivity will be conducted and recorded.
- 4) Sample information will be recorded on the Ground Water Sample Collection Worksheet. (Annex B)
 - 5) Samples will not be filtered or persevered in the field.
- b. Soil Samples. A total of 4 soil samples will be collected, one from each corner of the trapezoidal impact area. Sample locations are indicated on the soil sample map (figure 2, Annex C).
- 1) Sample will be collected using a new or properly cleaned scoop, trowel, or other suitable tool. Sample will be placed in a self sealing (Ziploc®) bag.
- 2) A sample quantity of approximately 1000 grams will be collected.

- 3) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Soil Sample Collection Worksheet (Annex B).
- c. Surface Water Samples. A total of 8 sample locations have been identified for the collection of water sample from the two creeks that run through the DU impact area (figure 3, Annex C).
- 1) Sample will be collected using the grab method. Sample container will be positioned pointing upstream and below the surface of the water.
 - 2) A sample quantity of 1 US gallon will be collected.
- 3) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Surface Water Sample Worksheet (Annex B).
- 4) Water sample will not be filtered or preserved in the field.
- d. Sediment Sample. A total of 8 sample locations have been identified for the collection of sediment samples from the two creeks that run through the DU impact area. Sediment samples will be collected at the sites selected for surface water collection (figure 3, Annex C).
- 1) Sample will be collected using a new or properly cleaned scoop, trowel, or other suitable tool. Sample will be placed in a glass sample jar.
- 2) Sediment sample will be collected only after the water sample has been collected.
- 3) While a sediment sample is usually considered a solid sample matrix, a certain amount of water is expected in the sample. The sample should not be drained of water that is collected as part of the sample.
- 4) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Sediment Sample Worksheet (Annex B).

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- 9. Sample Management. Since sample collected are in support of NRC License commitments, chain-of-custody procedures will be followed.
- a. Samples will be secured from unauthorized access during the period of sampling.
- b. Prior to shipment of samples to USACHPPM, a properly completed CHPPM Form 235-R-E, Chain of Custody Record (Annex B), will be placed in each shipping container. Survey personnel will maintain a copy of the Chain of Custody Record for verification of sample transport.
- c. Water samples must reach RCCCD no later than 4 days from the time of sampling. To ensure this time frame is met and that the laboratory has time to filter and preserve the sample if necessary, water samples should be collected on the first day of the sampling trip and shipped the following day. It is not necessary to ship the water, sediments, and soils together.
- 10. **Sample Analysis**. Sample analysis of all environmental samples will be performed through the USACHPPM RCCCD.
- a. Samples will be analyzed in accordance with RCCCD established protocols and procedures. All environmental samples will be coordinated with the SBCCOM RPO for disposal instructions.
- 1) Water samples will be analyzed fluorometrically for dissolved total uranium.
- 2) Soil and sediment samples will be analyzed using gamma spectroscopy, keying on the isotopic peaks of the Thorium-234. The thorium is the daughter of U-238 and is considered to be in equilibrium therefore the activity would be equal.
 - b. The QC for laboratory instruments will be performed by RCCCD.
- c. Reports of analysis will be forwarded to the USACHPPM project officer responsible for requesting the sampling. Electronic as well as hard copy reports will be requested.
- 11. **Action Levels**. Every effort will be made to maintain radiation exposures and releases of radioactive and non-radioactive toxic metals to unrestricted areas as low as is reasonable achievable (ALARA).
- a. The following criteria for the restricted area will be used to limit DU exposure. (Limits were established in the NRC Approved ERM)

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SOIL:

- Perimeter and background samples:
 - \leq 35 pCi/g no corrective action.
 - > 35 pCi/g collect 5 additional samples in a 1 meter square grid. If average > 35 pCi/g is confirmed, recommendation to decontaminate soil to \le 35 pCi/g will be made to the SBCCOM RPO.
- Sample locations along the lines of fire:
 - < 100 pCi/g no corrective action
 - 100-300 pCi/g collect 5 additional samples in a 1 meter square grid. If average > 100 pCi/g is confirmed, investigate to determine reason for the high level.
 - > 300 pCi/g collect 5 additional samples in a 1 meter square grid. If average > 300 pCi/g is confirmed, investigate to determine reason for the high level and immediately notify the SBCCOM RPO to initiate notification to the NRC.

WATER:

- Uranium limit established in 10 CFR 2, Annex B is $3.0 \times 10^{-1} \text{ pCi/ml}$
 - < 1.5 x 10^{-1} pCi/ml no corrective action.
 - $> 1.5 \times 10^{-1} \ pCi/ml resample;$ if results above $1.5 \times 10^{-1} \ pCi/ml$ is confirmed, investigate to determine reason for the high level and immediately notify the SBCCOM RPO to initiate notification to the NRC.

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b. Basis for Action. If any of the action levels are exceeded, an evaluation of cause will be performed by the SBCCOM RPO. The RPO will provide a report of findings to the RCC. Based on their determination, recommendations to the commander on corrective action will be made.

GARY J. MATCEK
MAJ, MS
Program Manager, Health Physics Program

Effective Date 10 Mar 00 Date Removed from Service

ANNEX A

DEFINITIONS AND ABBREVIATION

1. Definitions:

- a. Action Level: The numerical value that will cause the decision maker to choose one of the alternative actions. The action level may be a regulatory standard or may be a level set to ensure that corrective action is initiated before regulatory standards are met.
- b. Area: A general term referring to any portion of a site, up to and including the entire site.
- c. **Background Sample:** A sample collected from an area similar to the one being studied, but in an area thought to be free of contaminant of concern.
- d. **Calibration:** Comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.
- e. Chain-of-Custody: Documentation of the possession and handling of a sample from the time it is collected to the final disposition.
- f. **Detection Limit:** The lowest concentration at which given analytical procedures can identify.
- e. **Duplicate Samples**: Samples collected simultaneously from the same source, under identical conditions, into separate containers.
- g. Ground Water Sample: A sample of water taken from an established monitoring well.
- h. **Preservation:** Techniques which retard physical and/or chemical changes in a sample after it has been collected.

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- i. **Quality Assurance:** A monitoring program which ensures the production of quality data and identifies and quantifies all sources of error associated with each step of the sampling and analytical effort.
- j. **Sample:** A part or selection from a medium located in a survey area that represents the quality or quantity of a given parameter or nature of the whole area.
- k. **Sediment:** A sample of the mineral and/or organic matter deposited by surface waters.
- 1. **Soil Sample:** A sample of the soil taken from the first 15 centimeters (6 inches) of surface soil.
- m. **Split Sample:** A sample, which has been portioned into two or more containers from a single sample container.
- n. Surface Water: Water found above the surface of the soil, particularly water contained in creeks and streams.

2. Abbreviations:

a.	DU	Depleted Uranium
b.	ERM	Environmental Radiation Monitoring Program
С.	g	gram
d.	HPP	Health Physics Program
е.	JPG	Jefferson Proving Ground
f.	ml	milliliter
g.	NRC	Nuclear Regulatory Commission
h.	pCi	pico-Curie

i.	QC	Quality Control
j.	RCCCD	Radiologic, Classic and Clinical Chemistry Division
k.	RPO	Radiation Protection Officer
1.	SBCCOM	Soldier and Biological, Chemical Command
m.	SOP	Standing Operating Procedure
n.	USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine

ANNEX B

FORMS, LABELS AND WORKSHEETS

Effective Date $\underline{10 \text{ Mar } 00}$ Date Removed from Service

Request for Laboratory Services

	Page 1 of 2
Directorate of Laboratory Sciences REQUEST FOR LABORATORY SERVICES	For DLS Use Only
PLEASE PRINT OR TYPE ALL REQUESTED INFORMATION	Date Received
PART 1: PROJECT INFORMATION	
1. DATE OF REQUEST: 08/03/2000	
2. PROJECT #: (CHPPM only) 26 MA 8260 XO#	
3. FUND SOURCE: P84 DERA OTHER Supplemental (Specify)	
4. DIVISION/PROGRAM: Health Physics Program	
5. INSTALLATION: Jefferson Proving Ground	
6. STATE WHERE SAMPLES TO BE COLLECTED: Indiana	
7. NAME OF PROJECT OFFICER(s): Mr. David Collins	
TELEPHONE: (410) 436-3502 FAX#	(410) 436-8261
E-MAIL: david.collins@apg.amedd.army.mil	(410) 400 0201
8. NAME OF SAMPLE COLLECTOR: Mr David Collins	
9. PROJECT DESCRIPTION/OBJECTIVE (Screen, Monitoring, Regulatory or Health	Concern Sto 1:
Sampling required as part of the Environmental Radiation Monitoring Plan	Concern, Etc.).
Sumpling required as part of the Environmental Hadiates, Worldown 9 Train	
10. SAMPLE OR SITE HISTORY (High Toxicity, Etc):	
DU Firing Range	
11. PROJECT COORDINATOR/DLS TECHNICAL CONSULTANT - Was project coord	linated with DLS? X YES NO
Name of Person in DLS: Mr. Gary Wright ext. 8235	
PART 2: TURNAROUND TIME REQUESTED	
1. DATE RESULTS REQUIRED:	
2. INDICATE THE APPROPRIATE SAMPLE OR PROJECT DESIGNATION:	
STANDARD	
(Note: All samples are routinely processed as Standard Analyses Unless Arrangements Have Been Ma	de with DLS
for High-Priority or Top-Priority Analyses.)	
HIGH-PRIORITY TOP-PRIORITY	
(Note: High-Priority and Top-Priority Requests should be Coordinated with DLS and are S	Subject to Cost Surcharges.)
DART OF REPORT PICTURE TION OFFICE	
PART 3: REPORT DISTRIBUTION OPTIONS	
1. REPORT RESULTS BY: (Indicate Preference)	
X cc:MAIL/E-MAIL TO ADDRESS: david.collins@apg.amedd.army.mil	
FAX TO (Write Fax#):	
LXJ MAIL:	
REQUESTED BY: Mr. David Collins	
PRINT NAME: SIGNATURE:	Published by Hard One 1
(Note: Signature Required if S	····
CHPPM Form 330-R-E, 1 May 96, (MCHB-DC-LLI) Replaces AEHA Form 330-	R, Jul 93, which is obsolete.

Figure B-1a

					Page 2 of		
	PART	4: PROJECT C	OORDINATIO	N INFORMATIO	N		
1. DATE SA	MPLES TO ARRIVE AT DLS:	12/04/2000		101 011111			
(Note: Pri	or Arrangements Must Be Made with SA	AL for Samples That Wi	I Arrive Outside of	Routine Duty Hours w	hich are M-F 0730 -1700)		
Special	Comments: Samples will arrive	from the field with	out preservation	or filtration.	*		
2. SPECIAL							
<u> </u>	CHAIN-OF-CUSTODY (COC)						
	SAFETY CONSIDERATION/HAZ	ARDOUS MATER	IALS (Specify):	!			
	ANALYSES WITH SHORT-HOLDING TIMES (List Specific Analyses):						
[Filter water samokes and test for d	lissolved U-238, No	preservative add	in the field.	<u> </u>		
	OTHER (Specify):						
3. SAMPLE	COLLECTION KIT:						
DATE R	REQUIRED: 07/04/2000						
CHECK	PREFERENCE:				•		
Н	1. TO BE PICKED UP AT DLS						
ليا	2. SHIP TO:			il samples need to b	e shipped to site		
	(Please include Bldg # and Phone #)		ferson Proving G				
			G. Niblo Road (Bldg 126)			
		Madison, IN 4 (812) 273-255					
				NEODNATION			
		ART 5: SAMPLE			T		
DLS TEST CODE	PROCEDURE DESCRIPTION	STD METHOD	MATRIX	NUMBER OF SAMPLES	SPECIAL REQUIREMENTS/COMMENTS (REQUESTS FOR EXTRA BLANKS OR		
803	Uranium in Soil	G-002	Soil	5	Soil		
586	Uranium in Water	U-002	Water	9	Surface Water (1 gal Cubitainer)		
803	Uranium in Soil	G-002	Soil	9	Sediment		
586	Uranium in Water	U-002	Water	12	Ground Water (1 gal Cubitainer)		
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Figure B-1b

Sample Labels

Below is an example of a label to placed on each sample container.

PROJECT #:
INSTALLATION:
POC:
SAMPLE #:
DATE COLLECTED:
TIME COLLECTED:
SAMPLE PRESERVED:
ANALYSIS REQUIRED:

Figure B-2

	Effective Date	
Date	Removed from Service	

JEFFERSON PROVING GROUND

DU SAMPLING PROGRAM

PROJECT NUMBER: 26-MA-R_-8260-___

	GROUND WATER SAMPLES						
Sample ID	Sample	Exposure Reading	Sample Locations Comments		ents		
	Date	(µR/hr)		рН	Temp (°C)	Conductivity (µMHOS)	
MW01			Well @ D-Road and Wonju Road (perimeter DU impact area)				
MW02			Well between C-Road & Wonju Road (perimeter DU impact area)				
MW03			Well between A-Road & gate on Wonju Road (perimeter DU impact area)				
MW04			Well on South Perimeter Rd. (Along south border of JPG)				
MW05			Well @ D-Road & Morgan Road (across Bridge No. 13) perimeter DU impact area				
MW06			Well @ C-Road & Morgan Road (perimeter DU impact area)				

Effective Date	
Date Removed from Service	

DU SAMPLING PROGRAM

PROJECT NUMBER: 26-MA-R_-8260-__

Sample ID	Sample	Exposure Reading	Sample Locations	Comments		
ID	Date	(µR/hr)		рН	Temp (°C)	Conductivity (µMHOS)
MW07			Well @ Oakdale School House on Morgan Road (perimeter DU impact area)			
MW08			Well @ Southwest Corner of JPG (Along south border of JPG)			
MW09			Well @ D-Road and Bridge No. 22 (inside DU impact area)			
MW10			Well on Center Recovery Road (inside DU impact area)			
MW11			Well on D-Road between Morgan and C Recovery Road (inside impact area)			
MW12			Duplicate or Split Sample			

SO	Ρ	No	

THP	40.	-2
JHE	4 U	_/.

	Εf	fecti	lve Date	
Date	Removed	from	Service	

DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R -8260-___

		sc	DIL SAMPLES	
Sample ID	Sample Date	Exposure Reading (µR/hr)	Sample Locations	JPG ID Code
SOS1			Vicinity at intersection of C-Road and Wonju Road)	(S44)
SOS2			Vicinity at intersection of E-Road and Morgan Road	(S48)
sos3			0.5 miles east of intersection at C-Road & East Recovery Road	(S43)
SOS4			Corner of Morgan Road and C-Road	(S47)
SOS5			Duplicate or Split of	
SOS6			Well on south perimeter road along south border of JPG	B-1
SOS7			West Perimeter Road at Fork Creek	B-3
SOS8			South Perimeter Road of JPG	B-5
SOS9			Well on SW Corner of JPG	B-6

NOTE: Per letter from the NRC dated 7 Sep 99, soil sample locations S6 and S8 that were previously sampled will no longer require sampling. No other changes to the ERM Plan have been approved.

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	Εf	fecti	lve Date	
Date	Removed	from	Service	

DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R_-8260-___

		SURFACE	WATER SAMPLES	
Sample ID	Sample Date	Exposure Reading (µR/hr)	Sample Locations	JPG ID Code
SWS1			West Perimeter Road Middle Fork Creek (exits JPG property)	SWBS (M1)
SWS2			Big Creek (exits JPG property)	SWBN (M2)
SWS3			Wonju Road Middle Fork Creek (enters DU impact area)	SWSE (M3)
SWS4			Big Creek (enters DU impact area)	SWNE (M4)
SWS5			Bridge No. 22 Big Creek	SWM (M5)
SWS6			Line of Fire Middle Fork Creek	SWS (M6)
SWS7			Bridge No. 12 @ Morgan Road Middle Fork Creek	SWSW (M7)
SWS8	,		Bridge No. 13 @ Morgan Road Big Creek	SWNW (M8)
SWS9			Duplicate or Split of SWS_	SWNE (M4)

SOP	No.	OHE
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	Εf	fecti	ve Date	
Date	Removed	from	Service	

DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R_-8260-___

		SEDII	MENT SAMPLES	
Sample ID	Sample Date	Exposure Reading (µR/hr)	Sample Locations	JPG ID Code
SES1			West Perimeter Road Middle Fork Creek (exits JPG property)	(M1)
SES2			Big Creek (exits JPG property)	(M2)
SES3	·		Wonju Road Middle Fork Creek (enters DU impact area)	(M3)
SES4			Big Creek (enters DU impact area)	(M4)
SES5			Bridge No. 22 Big Creek	(M5)
SES6			Line of Fire Middle Fork Creek	(M6)
SES7			Bridge No. 12 @ Morgan Road Middle Fork Creek	(M7)
SES8			Bridge No. 13 @ Morgan Road Big Creek	(M8)
SES9			Duplicate or Split of SES_	(M4)

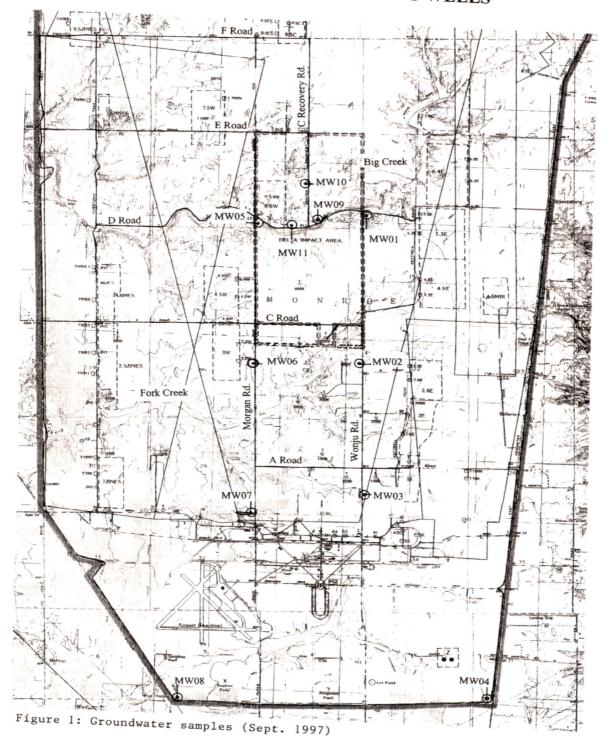
			SUP NO.	ОПР	40-2
	Εf	fecti	ve Date		
Date	Removed	from	Service		

ANNEX C

SAMPLE LOCATION MAPS

Effective Date Date Removed from Service

Jefferson Proving Ground: DU Sampling GROUNDWATER MONITORING WELLS



Effective Date
Date Removed from Service

Jefferson Proving Ground: DU Sampling SOIL SAMPLES

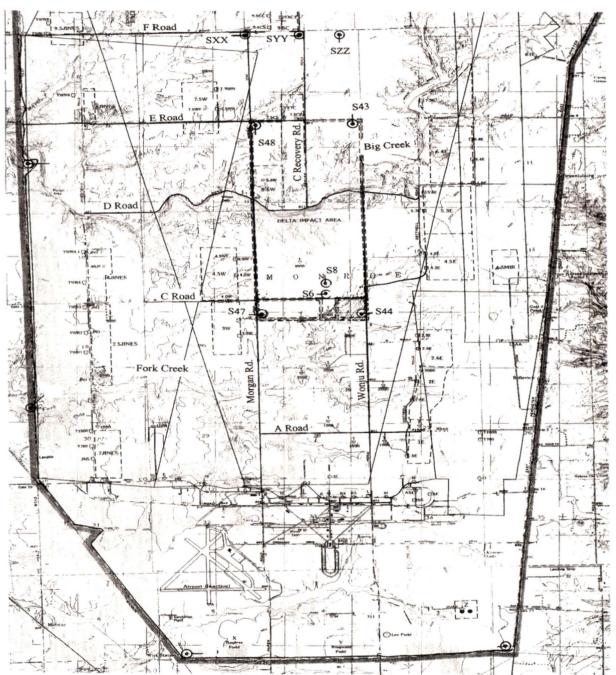


Figure 2: Soil Samples (Sept. 1997)

Effective Date Date Removed from Service

Jefferson Proving Ground: DU Sampling SURFACEWATER & SEDIMENT SAMPLES

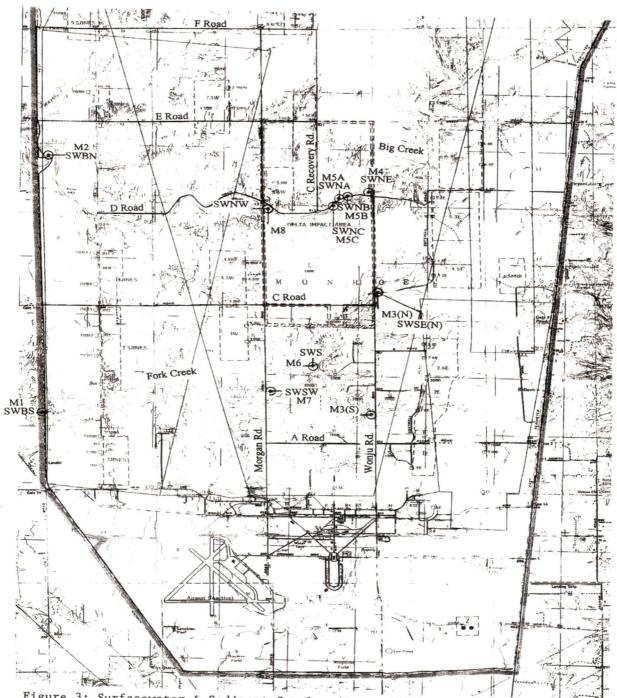


Figure 3: Surfacewater & Sediment Samples (Sept. 1997)

APPENDIX B FIELD LOGBOOK AND SAMPLING FORMS

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SPRING 2018 FIELD LOGBOOK AND SAMPLING FORMS

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Project Nar Project Nur	mber:	E	son Proving ERM Sampli	ng		Well Identif Project Loc Date:		MW-1 Madison, IN		1		
Purged by: Sampled by		Lawson		1. Sherma		•		Date: 4-18-18 Date: 05-01-18			<u>a</u>	
Checked by		D. Lawson	- & &	To Farmer		Date:			2-01-10			
0	, .		•	 								
WELL VOL	UME CAL	CULATION:										
Circle diam	eter and K	used below:	1" I.D., K=0	0.041 gai/ft		6" I.D., K=	1.469 gal/ft					
				0.163 gal/ft		.8" I.D., K=						
			4" I.D., K=0	0.653 gal/ft		10" ID, K=	4.08 gal/ft					
1 Well Volu		2 4) D4b		087 w		f	1157	11 245				
		<u>3_ft)</u> - Depth n <u>(25 .1 J</u>										
Purge Volu		n (<u>23.6)</u>	_it) x K vait	ie (<u>4.16.3</u>	gai/π) =	vveli volum	ie (<u>4.11</u>	gai)				
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		gpm) x (
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PURGE IN	FORMATIC	ON:				SAMPLING	INFORMA	rion:	<u> </u>			
Time / Date	Started:	1359	. 1	4-18-18		Time / Date	Started:	0947		5-1-18		
Time Purge	End:	1405				Sampled by	" :	D. Lawson	&	T. Farme		
Purge Meth	od: Pump	•	Bailer			Sample Met		X	Other			
Depth to Int			A	_(ft)			<u>X</u>		Composite			
Pump Type		ŇA				# of Bottles		<u>2 - 10</u>				
Purge Rate		<u>N</u>	A	(gpm)		Bottle Prese		<u>no</u>	<u> 12 </u>			
Purged Volu		Lieute e II Of		(gal)		Recovering			<u> </u>			
Water Qual How was yi	•	Horiba U-22		iA		Duplicate S Laboratory:	ampling:		?			
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				Sanj	le: 3	l com						
				/								



Project Na Project Nu			son Proving Ground Well Identification: MW-2 ERM Sampling Project Location: Madison, IN				MW-2		J	
Purged by:		Lauson		Sherm	-	Date:	anorn.		-18-18	`
Sampled b		1.Lausen	. &	T. Facmer	an	Date:			-01-18	2
Checked b			. &		_	Date:				
			•		-					
	LUME CALC									
Circle dian	neter and K u	sed below:		_		6" I.D., K≃	_			
			2" I.D., K=0	_		8" I.D., K=2	•			
			4" I.D., K=0).653 gal/ft		10" ID, K=4	4.08 gal/ft			
4 11/-11 1/-1										
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	ume (<u>2 . اه '</u>	enollen č) x 3 = 3 We	all Volumes (7.95	_gallons)				
	e (_gunons)				
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	Temp		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time	°C	pН	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate
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PURGE IN	FORMATIO	N:	MS 4-19	B-18		SAMPLING	INFORMA	TION:		
Time / Date		1346	-	2 4-18-1	አ	Time / Date		0846		05-01-18
Time Purge		1356	. '			Sampled by		O. Lawson	 &	T. Farmer
_	hod: Pump		Bailer	X	•	Sample Me	thod: Bailer	X	Other	<u> </u>
Depth to In	•	N	Α	(ft)	•	Grab	X		Composite	
Pump Type		NA				# of Bottles	Collected:	2-	1000 ml	
Purge Rate	e:	N	Α	(gpm)		Bottle Prese	ervatives:		one	
Purged Vol				(gal)		Recovering				
Water Qua	•	Horiba U-22				Duplicate S			<u> </u>	
-	ield measure			IA	•	Laboratory:			<u>4</u>	
Was well c			Yes	No		COC Form:			25	
	ainerized/An	-		(114-)	•					
Gruntos co	ntroller set	<u>@</u>	NA	(Hertz)						
ADDITIONA	NI INEODMA	TION: (i.e. w	eather cond	litione proble	ame encoun	tored mainte	nance rea	iired, unusua	l color/odor	etc \
		` .		+ 9.96/			en S-		ii Coloi/Odoi	, 610.)
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			5	ample:	33 11	/)~				
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5-1-18



Project Na Project Nu			on Proving		-	Well Identif		MW-3 Madison, IN		J
Purged by		D. Lawse		M-Shero	- ^	Date:		4-	18-18	•
Sampled b		D. Lawsen	-	T. Farme		Date: 5-01-18				
Checked b	-		. &			Date:				
WELL VO	1 1 IBAE O A L	CULATION:								
		used below:	1" I.D., K=0	0.041 gai/ft		6" I.D., K=	1.469 gal/ft			
			2" I.D., K=0	-		8" I.D., K=	_			
			4" I.D., K=0).653 gal/ft		10" ID, K=	4.08 gal/ft			
1 Well Vol								_		
Total Dept	n (<u>45.48</u>	ft) - Depth	to Water (_	5.18 ft) = Height o	f water colur	mn (40.3	ft)		
		1(4¢.3	_ft) x K valu	ie (<u>Ф. 1 % </u>	3_gal/ft) = 1	Well Volum	те (<u>ю. 57</u>	gal)		
Purge Vol		.			0.01					
		7 gallons				_gallons)				
_	•	gpm) x (5-1-18	
rurge nate	e (gpm) x () = 3 Well VC	nume				4_	
	Temp		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time	°℃	pН	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate
0741	11,90	7.72	0.434	20.1	14.69	183		†	5.56	
1	1 2 1 2	1	×		11121	-0.4				
						<u> </u>				
	<u> </u>								 	
										
							ļ			
		 								
 	 	 		<u> </u>		<u> </u>	 	 		<u> </u>
						<u> </u>		<u> </u>		<u> </u>
PURGE IN	FORMATIC	N:				SAMPLING	INFORMA	TION:		
Time / Date		1328	I	4-18-18		Time / Date		0741	ì	5-01-18
Time Purge		1340	'	, , ,	•	Sampled by		D. Lewson	. &	T. Farmer
	hod: Pump	<u></u>	Bailer	X	•	Sample Me		X	Other	1 - 1
Depth to In	•	N	Α	(ft)	•	Grab	X		Composite	
Pump Type		NA				# of Bottles	Collected:	<u> 2-11</u>	000 ml	
Purge Rate	∍:	N	Α	(gpm)	•	Bottle Prese	ervatives:	ne	16	
Purged Vol	lume:			(gal)		Recovering	WL:			
Water Qua	-	Horiba U-22				Duplicate S		Ye	5	
-	ield measur	ed?		IA	i	Laboratory:		<i>TA</i>		
Was well c			Yes	No		COC Form:		Ye	<u> </u>	
	tainerized/A		NIA.	// lost-\	i			Ouplicate	taken.	
Grunios CO	ontroller set	<u>@</u>	NA	(Hertz)				- Filance	i subori.	
ADDITIONA	AL INFORMA	ATION: (i.e. w	eather cond	itions, proble	ems encoun	tered, mainte	enance recu	ired Unusua	Leolor/oder	etc.)
M 14		H11	Water					a 05-01-12		2.0.7
112/11	M. IIM	- 1041	TVAIEN	LYCL A	, ,,,,,,	· OCOW	<u> </u>	4 VO-V(- 12	·	
			RAD:	Dose:		5 MR/h	Y			
				Backa	ground:	40cpn				
				Samp	le:	5 mR/h 40cpm 31cpm				
				ı		•				



							Well Identification Project Loc Date: Date: Date:		MW-4 Madison, IN 4-18-18 4-30-18					
	WELL VOL	.UME CALC		1" I.D., K=0.041 gal/ft 2" I.D., K=0.163 gal/ft 4" I.D., K=0.653 gal/ft			6" l.D., K= 8" l.D., K= 10" lD, K=	2.61 gal/ft						
	Total Depth Height of war Purge Volu 1 Well Volu Purge Rate	1 Well Volume: Total Depth (31.27 ft) - Depth to Water (3.68 ft) = Height of water column (27.59 ft) Height of water column (27.59 ft) x K value (6.163 gal/ft) = 1 Well Volume (4.56 gal) Purge Volume: 1 Well Volume (4.56 gallons) x 3 = 3 Well Volumes (13.49 gallons) Purge Rate (gpm) x (min) = 1 Well Volume Purge Rate (gpm) x (min) = 3 Well Volume												
	r drye Hate	\ <u></u>	9PIII) ^ (4-30-18				
	Time	Temp °C	рН	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate			
f-30-18	1413	15.17	7.18	0.483	11.9	4.38	115			4.151				
		<u> </u>					 							
	ļ	-			<u> </u>		 							
			<u> </u>				1							
				<u> </u>	-		 	 						
:			 				 				 			
'														
	PURGE INF Time / Date Time Purge Purge Meth Depth to Int Pump Type Purge Rate: Purged Volu Water Quali How was yie Was well ca Water conta Grunfos cor	Started: End: od: Pump ake: and ID: : ume: ity Meter: eld measure avitated? ainerized/An	NA Horiba U-22 ed? nount (A) TION: (i.e. w	Bailer IA P# NYes NA Peather cond 30 -16 : U	(ft) (gpm) (gal) IA No (Hertz) Itions, proble	l at	Time / Date Sampled by Sample Me Grab # of Bottles Bottle Prese Recovering Duplicate S Laboratory: COC Form:	thod: Bailer X Collected: ervatives: WL: sampling:	1413 1- Fermer X 2 - 1 Aen 7A 9e	Other Composite	4-30-18 M. Calcler			
			RA	o: 0	106e: 5	yR/hc								
				В	nose: 5 nackground ample:	: 40cp	~							
				5	مسماد:	33 ca	`							



Project Name:		on Proving		•	Well Identif		MW-5			
Project Number:	E	RM Samplin		•	Project Loc	ation:		Madison, IN		
Purged by: D. L	<u>noews</u>	& N	1. Shear	nan	Date:			8-18		
Sampled by:	Lausa		A. Beans		Date:		05	1-01-18	}	
Checked by:		&		•	Date:			207		
WELL VOLUME CALCU		1" I.D., K=0	.041 gal/ft		6" I.D., K=	1.469 gal/ft		-		
		2" I.D., K=0	-		8" I.D., K=	_				
		4" I.D., K=0	. —		10" ID, K=4	-				
1 Well Volume: Total Depth (35-85 Height of water column (ft) - Depth 1	to Water (∐ ft) x K valu	17.73 ft	e) = Height o	of water colur	nn (<u>18.)?</u> ne (2.95	2ft)			
Purge Volume:										
1 Well Volume (<u>2.95</u>			•	-	_galions)					
Purge Rate (
Purge Rate (gpm) x (min)	= 3 Well Vo	lume				5-1-18		
Temp	[Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge	
Time °C	рН	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate	
1207 15.91	7.84	0.465	0.0	8.42	205			19.02'		
 					 			<u> </u>		
								 		
 -					 					
					 					
							,			
			· ·							
					<u> </u>					
	1448 1452	 Bailer	4-18-18 X		SAMPLING Time / Date Sampled by Sample Mei	r: /	TION: 1207 3,Leven X	: & Other	<u>5-1-18</u> A. Acaset	
Depth to Intake:	N/	A	(ft)		Grab	<u>X</u> .		Composite		
Pump Type and ID: N	A			,	# of Bottles	Collected:	2-10	oo ml		
Purge Rate:	NA	4	(gpm)		Bottle Prese	ervatives:	No	ne		
Purged Volume:			(gal)		Recovering	•				
	oriba U-22				Duplicate S	ampling:	no			
How was yield measured?		N			Laboratory:		77			
Was well cavitated?		Yes	No		COC Form:	-		<u>.s</u>		
Water containerized/Amor	_	NIA	/Llown				•			
Grunfos controller set @	r	<u>NA</u>	(Hertz)							
ADDITIONAL INFORMATION AND ADDITIONAL INFORMATIO	•	. • /	tions, proble	ems encoun	tered, mainte		red, unusua o <u>n 5-1</u>		etc.)	
	R	An:	Dosc:		5 MRlh					
			Backer	and.	38 CAM					

38 gan



		E	on Proving RM Samplin	ng	• •	Well Identif		M W - 6 Madison, IN 4-1 8-1 8			
Sampled b		auson	. & M	<u>LSherm</u>		Date: Date:					
Checked b	-	Difference	& &	I. Farm	er	Date:			5-01-1	5	
Onlookou b	· y ·		-		•	Duio.					
WELL VO	LUME CALC	CULATION:									
Circle dian	neter and K ı	used below:	1" I.D., K=0	_		6" I.D., K=					
			2" I.D., K=0	-		8" I.D., K=					
			4" I.D., K=0	.653 gal/ft		10" ID, K≃	4.08 gal/ft				
4 11/-11 1/-1											
1 Well Vol		ft) - Depth	to Water (I	₹ 111 #	\ - Height	of water nelu	nn /27.3	d m			
		(27.34									
Purge Vol		(_11/ X 11 Valu	C (. P	<u>ga</u> ,,,,,	1 VVCII VOJUII	.0 <u> 47 7 0</u>	gai)			
		gallons	x 3 = 3 We	II Volumes (13.37	_gallons)					
		gpm) x (
		gpm) x (
	·			···	,		·		5-1-18		
<u> </u>	Temp	1	Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge	
Time	°C	pH	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate	
1430	18.63	7.27	0.339	20.6	9.01	347			30,36		
<u> </u>	 	 				 		<u> </u>			
<u> </u>	 	 						 			
<u> </u>	 	 				 		 	-		
 							 	 			
								 			
					- '	<u> </u>		<u> </u>			
L	<u> </u>	<u></u>						<u> </u>	L		
**************************************		.				O A MADILINIC	MEODIA	TION:			
	FORMATIO		r	11.19.19		SAMPLING Time / Date		1430	1	E 1 10	
Time / Date Time Purge		1428	I	4-18-18	•	Sampled by				5.1-18 T.5	
_	hod: Pump	1431	Bailer	Y	•	Sample Me		D.Lawson	Other	T. Fame	
Depth to In	•	N		(ft)	•	Grab	X		Composite		
Pump Type		NA		. 1. 7		# of Bottles		2-	1000 ml		
Purge Rate		N	A	(gpm)	•	Bottle Pres	ervatives:	^	ere		
Purged Vo	lume:			(gal)		Recovering	WL:				
Water Qua	ility Meter:	Horiba U-22				Duplicate S	ampling:		ne		
-	ield measure			Α	,	Laboratory:			TA		
Was well c			Yes	No		COC Form:			165		
	tainerized/Ar			// · · · ·					•		
Gruntos co	ontroller set		NA	(Hertz)							
Δηριτιονι	AL INFORMA	ATION: (i.e. w	eather cond	itions, proble	ems encour	tered mainte	enance redi	iired. Unusua	ıl color/odor	etc.)	
אטווטטא	777	•		level at			TOC		-1-18	0.0.7	
	للحبيا		WALLE	rect W	<u> </u>	- MCON	- ((/)	<u> </u>			
			RAD	Dosc	4 MR1	4					
						28 0.Am					
				Darry		28 cpm					
				Samp	le: 50	cpm					

5-1-10



Project Na Project Nu Purged by: Sampled b Checked b	mber: 5. l y:					Well Identi Project Loc Date: Date: Date:		MW-7 Madison, IN 4-18-18		
	LUME CÂLC neter and K ເ		1" I.D., K=0 2" I.D., K=0 4" I.D., K=0).163 gal/ft		6" I.D., K= 8" I.D., K= 10" ID, K=	2.61 gal/ft			
Height of w Purge Volu 1 Well Volu Purge Rate	h (<u>56.41</u> vater column ume: ume (<u>7.80</u>	(<u>4</u>	_ft) x K valu) x 3 = 3 We min		gal/ft) =	of water colui 1 Well Voluin _gallons)			5-1-18	
<u>.</u> .	Temp °C		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time 1458	16.12	PH 7.10	mS/cm	NTU 20.1	mg/l 8.74	347.	Quantity	Volume	Water 8.59'	Rate
Time / Date Time Purge Purge Meth Depth to In Pump Type Purge Rate Purged Vol Water Qua How was yi Was well cont Grunfos co	e End: nod: Pump take: e and ID: e: ume: lity Meter: ield measure avitated? ainerized/Am ntroller set	NA NOUNT NOUNT NO	Bailer IA P# N Yes NA eather cond	(ft) (gpm) (gal) IA No (Hertz)	ems encour	Time / Date Sampled by	thod: Bailer X Collected: ervatives: WL: ampling:	1458 D. Lawson X 2 - 10 no 77	Other Composite	
			-							
				RAD:	Dosc:	5 np/	<u>.</u>			
					Bample	ind; 3 : 48 q	6 cpm			



	Project Nai Project Nui Purged by: Sampled by Checked by	mber: V:					Well Identif Project Loc Date: Date: Date:		MW-8 Madison, IN 4-13-13 4-30-18			
			CULATION: used below;	1" I.D., K=0.041 gal/ft 2" I.D., K=0.163 gal/ft 4" I.D., K=0.653 gal/ft			6" I.D., K= 8" I.D., K= 10" ID, K=	2.61 gal/ft				
	Height of w Purge Volu 1 Well Volu Purge Rate	1 (3 6 . 51 ater columnume: time (1 .) 5	ft) - Depth (_ft) x K valu x 3 = 3 We min)	e (%. \\o 7 Il Volumes (= 1 Well Vo	gal/ft) = 3.40 olume	1 Well Volum			4-30-1g		
		Temp		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge	
4-30-18	Time 1345	°C	pH 6.91	mS/cm	NTU O.O	mg/l	mv 245	Quantity	Volume	Water 23.60'	Rate	
	Time / Date Time Purge	End:	N: (17)4 17)17		1-18-18		Time / Date Sampled by	r:	1345 T. Farmer		4-30-18 M Celdy	
	Purge Meth			Bailer	X (ft)	•	Sample Me		X	Other		
	Depth to Intake: Pump Type and ID: NA Purge Rate: Purged Volume: Water Quality Meter: Horiba U-2 How was yield measured?			Α	(gpm) (gai)		Grab # of Bottles Collected: Bottle Preservatives: Recovering WL: Duplicate Sampling: Laboratory:		Composite 2-1000 al plastic none 100 TA			
	Grunfos cor	ainerized/Ar htroller set L INFORMA	nount	eather condi	(Hertz) tions, proble		COC Form:		ired, unusua	Il color/odor,	etc.)	
-			RAD:	Dose: 4	5 uR/h							
-				Backgrown Sample:	1: 40 44	cpn cpn					,	



Project Name:		Jeffers	on Proving	Ground	Well Identification:			MW-9			
Project Nu	mber:	E	RM Sampl	ing	Project Location:			Madison, IN			
Purged by:	D.	Lawson	&	4. Sherw	ran	Date:		4.	-18-18		
Sampled b			&			Date:		0S-1-1B			
Checked b			&			Date:					
WELL VOI	UME CALC	·MOITA III									
	_	sed below:	1" I.D., K=	0.041 gal/ft		6" I.D., K=	1.469 gal/ft				
			2" I.D., K=	0.163 gal/ft		8" I.D., K=	2.61 gal/ft				
			4" I.D., K=	0.653 gal/ft		10" ID, K=	4.08 gal/ft			•	
1 Well Vol	ume:										
Total Depth	(38.11			24.85 ft							
		(13.26	_ft) x K val	ue (<u>6.163</u>	gal/ft) =	1 Well Volum	ne (<u>2.16</u>	gal)			
Purge Vol											
	•			ell Volumes (_gallons)					
				n) = 1 Well Vo							
Purge Hate	(gpm) x (mir	ı) = 3 Well Vo	lume				5-1-18		
	Temp		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge	
Time	°C	pН	mS/cm	NTU .	mg/l	mν	Quantity	Volume	Water	Rate	
1251	16,77	7.73	5.52	2.3	10.91	238			28.01		
	<u> </u>					 		 		 	
		ļ I		 		 					
	 	 		† 		 	 	 	<u> </u>		
			<u> </u>	 		 					
				†		 		 	 	<u> </u>	
				1							
				1		<u> </u>		<u>.</u>			
						<u></u>	<u></u>		L	<u> </u>	
PURGE IN	FORMATION	V :				SAMPLING	INFORMA	TION:			
Time / Date	Started:	1535	1	4-18-18		Time / Date	Started:	1251	1	5-1-1	
Time Purge	End:	1540				Sampled by		D. Lausen	. &	T. Face	
Purge Meth	od: Pump		Baile			Sample Me	thod: Bailer	X	Other		
Depth to In		N	4	_ (ft)		Grab	<u>X</u>		Composite		
Pump Type		NA				# of Bottles		2-10	00 ml		
Purge Rate		N	<u> </u>	_(gpm)		Bottle Prese			ne		
Purged Vol		Hariba II 00	ш	_(gal)		Recovering			-		
Water Qual	eld measure	Horiba U-22		NA		Duplicate S Laboratory:					
Mas well ca		-	Yes	No		COC Form:					
	ainerized/Am		100	140		000 / 0////		<u> 4c</u>	<u> </u>	~ = -	
	ntroller set	-	NA	(Hertz)							
	•										
ADDITIONA	L INFORMA			litions, proble						etc.)	
TH		Wate	r leve	at 28	3.01' 1	nelow T	OC on	5-1-1	3		
	· · · · · · · · · · · · · · · · · · ·	RAL):	Dose:	5 MR	be					
				Background Sample:							
						7					
				Sample:	32	cpn					
				,		7					



Project Nu Purged by: Sampled b	Project Number:					Well Identif Project Loc Date: Date: Date:		MW-18 Madison, IN 4-18-18 05-01-18		
		:ULATION: used below:	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0	.163 gal/ft		6" I.D., K= 8" I.D., K= 10" ID, K=	2.61 gai/ft			
Height of w Purge Volu 1 Well Volu Purge Rate	h (4).53 vater column ume: ume (ه.49	ft) - Depth (39.7 9 gallons _gpm) x (_gpm) x (_ft) x K value) x 3 = 3 We min)	e (<u> </u>	gal/ft) = 19.46 lume	1 Well Volun			5-1-18	
Time	Temp °C	рН	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1301	16,97	7.03	0.394	29.6	9.82	317			2.56′	
2005										
Time / Date Time Purge Purge Meth Depth to In Pump Type Purge Rate Purged Vol Water Qual How was yi Was well ca	e End: nod: Pump take: e and ID: o: ume: lity Meter: ield measure avitated? ainerized/An	NA NO Horiba U-22 nount	Bailer	(ft) (gpm) (gal)		Time / Date Sampled by	thod: Bailer X Collected: ervatives: WL: tampling:	1301 0.42 uses X		5-1-18 T. Fame
ADDITIONA	L INFORMA	TION: (i.e. w	Wa	ter leve	at 2	2.56'	enance requ			•
			Rad:		: 5 mg novnd; ple; s	16 cp- 54 cp-				

5-1-18



Project Nar			on Proving			Well Identif		MW-11 Madison, IN 4-18-18			
Project Nur			RM Sampli			Project Loc	ation:				
Purged by:		Lauson	. & .	1. Shern	nan	Date:					
Sampled by	_	D.Lauson		T. Farme	~	Date:		05	5-01-18		
Checked by	y:		. &			Date:					
WELL VOL	UME CALC	ULATION:		-							
Circle diam	eter and K u	used below:	1" I.D., K=0	0.041 gal/ft		6" I.D., K=	1.469 gal/ft				
			2" I.D., K=0	0.163 gai/ft		8" I.D., K=	2.61 gal/ft				
			4" I.D., K=0	0.653 gal/ft		10" ID, K=	4.08 gal/ft				
1 Well Volu		(4) Domah	3= 18/=a== / 1	7.61 ft	\	-6 see-4	(35.2	2 4			
				ie (6. 163							
Purge Volu		\ <u> </u>	_11/ 1/11/11/12/12	.o (<u>. </u>		T TTOIL TOIGHT	.0 \	gui/			
		5gallons) x 3 = 3 W	eli Volumes (17.26	_gallons)					
² urge Rate	(gpm) x (min) = 1 Well Vo	lume						
ourge Rate	(gpm) x (min) = 3 Well Vo	lume				۸ م		
				1 =					5-1-16		
Time	Temp °C	pН	Cond mS/cm	Turbidity	D.O.	ORP	Purged	Well Volume	Depth to	Purge Rate	
1223	15.99	7.70		NTU I	. mg/l	249	Quantity	Volume	Water 7.34'	nate	
1443	15.44	4,70	0-197	14.3	11.0	744			7.37		
		<u> </u>		 		 			 		
						 		<u> </u>	-		
	 					+			 		
				 							
								 -			
									L1		
						<u> </u>					
		<u> </u>		<u> </u>	_	<u> </u>	<u></u>				
						0.4451.015					
	FORMATIO	N: 1516	1	11 15 16			INFORMAT	_	1 .		
Γime / Date Γime Purge		1527	l	4-18-18		Time / Date Sampled by		1223		05-01	
urge Meth		1341	Bailer	· Y			r. thod: Bailer	D.Lawso. X	.1 ∝ _ Other	T. Far	
Depth to Int	•	N		(ft)		Grab	X		Composite		
Pump Type		NA		_(")		# of Bottles		2 -	1000 ml		
Purge Rate:		N		(gpm)		Bottle Prese			one		
urged Volu				(gal)		Recovering	WL:				
Vater Quali	ity Meter:	Horiba U-22	#			Duplicate S	ampling:	/	0		
low was yie	eld measure	ed?		JA		Laboratory:			4		
Vas well ca	vitated?		Yes	No		COC Form:		40	:5		
Vater conta	ainerized/An							•			
arunfos cor	ntroller set	@	NA	(Hertz)							
		TION! (!	41	liai - m.a m.a.lu i ar					11111		
ADDITIONAL	L INFORMA	.TION: (i.e. w		litions, proble							
THU!	WIL	74 111	<u>\</u>	later leve	el at	7.34'	Welow	70C	on 5.	1-18	
			Rad	: Dose	. ~	yR/h.					
	····		n L		34 4	pm	 _				
			Dack	ground: ple:	υτ (h(
			5a-	ple:	38 c	pm					
				1	,						

PROJECT NA	SA - DAC	MPLE LO	G SHEET pack Area PRO	DJECT NO:	Spring 'IB ERM
SAMPLE ID NUMBER: 51	V- DU- 001		TE COLLECTED		(): <u>05-01-</u> 4 : <u>1349</u>
SAMPLING LOCATION CO	DDE:				
SAMPLING POINT CODE: DESCRIPTION	· • .				
NORTHING:					
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO	SCRIPTION:		BLS
WEATHER:FIELD OBSERVATIONS: _			TIVITIES IN ARE 36 cp. 28 cp. 31 cp.		
	Dose: 5	n S AR/hr	: 31 ep	n (Sed)	
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAS	T CALIB.
RADIOACTIVITY:		uR/h			
TEMPERATURE:	18.99	yR/hr			
pH:	8.53	ρH			
CONDUCTIVITY:	0.185	m 5/cm			
REDOX:	255	MY			
DO:	19.49	mg/1			
ORGANIC VAPORS:					
TURBIDITY:	6.0	NTU			
OTHER:			·····	<u> </u>	
SAMPLE TYPE: NX GRAB QC TRIP OTHER (TIAL COMPOSITE RINSATE		
SAMPLE COLLECTED: XYES DI IF SAP WAS NOT FOLLOWED, Surface was	SPECIFY WHAT	T DEVIATION	S WERE NECESSAI		□ NO

QC Checked By: ____

(Signature)

Recorded By: Mr. Collection (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG - DU Impact Area PROJECT NO: ERM

	D- DU- 00	•	ATE COLLECTED) (MM/DD/YY): <u>05-01-18</u> TIME: <u>1333</u>
SAMPLING LOCATION CO	ODE:			
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:	EASTIN	G:	- ELEV	ATION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN ARE	A:
	Backgre Sample	Rad No	: 36 cp/ : 29 cp/ : 46 cp/	n n (5W)
	Dose: !	AR/hr		
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:		4R/hr		
TEMPERATURE:	20.56	000		
pH:	6.90	ρ /4	! 	
CONDUCTIVITY:	0.113	m 5/cm		
REDOX:	255	NY.		
ORGANIC VAPORS:	15.53	mg/1		
TURBIDITY:	45.5	ATTI		
OTHER:		1		
	SPECIFY)	□ QCI	TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES D IF SAP WAS NOT FOLLOWED, Surface was	SPECIFY WHA	T DEVIATION	S WERE NECESSAF	
Recorded By: 1924 Call	vell .	QC CI	necked By:	
(Signat				(Signature)

				<u>·</u>	
PROJECT NA	sa - Jac	MPLE LO	G SHEET pack Area F	PROJECT NO	Spring 18 ERM
SAMPLE ID NUMBER: SI	N-DU-00		ATE COLLECT		Y): <u>05-01-18</u> =: <u>0908</u>
SAMPLING LOCATION CO				_	
SAMPLING POINT CODE: DESCRIPTION				-	
NORTHING:	_ EASTING	G:	EI	_EVATION:	
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO DE	SCRIPTION:		BLS
WEATHER:		AC	TIVITIES IN A	REA:	
	Backaca	and Ro	d: 27	cpm	39 cpm
	Sample	Rad	: 27	ean (sw)	MC 5-1-4
	ц/	//	: 41	ean (Sea)	
	DOSE: 5	5 AR/hr		'	
					
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO	. LAS	ST CALIB.
RADIOACTIVITY:		MR/h			
RADIOACTIVITY: TEMPERATURE:		200			
pH:	7.83	p.H	· · · · · · · · · · · · · · · · · · ·		
CONDUCTIVITY: REDOX:	222	m 5/cm			
DO:	277 7.66	my //			
ORGANIC VAPORS:	F.60	mg/1			
TURBIDITY:	16.0	NTU			
OTHER:					

SAMPLE TYPE:	X	GRAB		SPATIAL COMPOSITE	TIME COMPOSITE
		QC TRIP BLANK		QC RINSATE	QC FIELD BLANK
•	D	OTHER (SPECIFY)		 .	
IF SAP WAS NO	T FQI		T DEVIA	PROCEDURE WAS FOLLO ATIONS WERE NECESSAI F SAMPLES	
Recorded By:	12	h Caldwell	Q	C Checked By:	
•	**************************************	(Signature)	_	, , , , , , , , , , , , , , , , , , , ,	 (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG - DU Impact Area PROJECT NO: ERM

SAMPLE ID NUMBER: S	D- DN- 00		ATE COLLECTED	(MM/DD/YY): <u>05-01-18</u> TIME: <u>0935</u>
SAMPLING LOCATION CO	DDE:			
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:	_ EASTIN	G:	ELEV	ATION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _	;	TO DE	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _				
FIELD OBSERVATIONS: _	Sample Sample	ound Ro Rad	: 40 cpr : 31 cpr	1 (5W)
	it	//	: 35	(5eA)
FIELD MEASUREMENTS	READING	UNITS		LAST CALIB.
RADIOACTIVITY:	5	yR/h		
TEMPERATURE:	14.08	1000		
CONDUCTIVITY:	8.04	m 5/cm		
REDOX:	278	M 3/CM		, , , , , , , , , , , , , , , , , , ,
DO:				
ORGANIC VAPORS:		~		
TURBIDITY:	4.4	NTU		
OTHER:		<u> </u>		
SAMPLE TYPE: 🏋 GRAB □ QC TRIP □ OTHER (BLANK SPECIFY)		TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES DI IF SAP WAS NOT FOLLOWED, Sochace Was	SPECIFY WHA	T DEVIATION	S WERE NECESSAR	
Recorded By: 1914 Cold		QC Cł	necked By:	(Signatura)
Recorded By: <u>//u.k_Cal/la</u> Signal)		QC C	necked By:	(Signature)

PROJECT NA	sa - Jpc	MPLE LO	og sheet pack Area PRO	JECT NO: ERM	18
SAMPLE ID NUMBER: SI	D. DU. 00	(205) 5 DA	ATE COLLECTED	(MM/DD/YY): _05-	
SAMPLING LOCATION CO DESCRIPTION:	ODE:				
SAMPLING POINT CODE: DESCRIPTION					
NORTHING:	_ EASTING	G:	ELEV	ATION:	
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO DE	SCRIPTION:	· · · · · · · · · · · · · · · · · · ·	BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN AREA	A:	
	Backgeo Sample Dose: 5	Rad Rad " " agR/bc	2): 38 cpm : 32 cpm : 46 cpm	(SW)	
FIELD MEASUREMENTS	READING			LAST CALIB.	_
RADIOACTIVITY:		mR/hr			
TEMPERATURE: 18	548.42	300			
pH: CONDUCTIVITY:	8,42	ρH		<u> </u>	
REDOX:	218	m 5/cm		 	
DO:	20.27	mg/1			
ORGANIC VAPORS:	_	`~			
TURBIDITY: OTHER:	2.4	NTU			
SAMPLE TYPE: X GRAB C QC TRIP C OTHER (SAMPLE COLLECTED: XYES COLLECTED)	SPECIFY) INO SAP SAMF SPECIFY WHAT	EI QC	S WERE NECESSAR	U TIME COMPOSITE U QC FIELD BLANK WED: OXYES U NO Y AND WHY:	
Surface va	ler of Bedi	ment s	amples		
Recorded By: 19sh Cald	ell	QC Cł	necked By:		
(Signat			J	(Signature)	

SAMPLE LOG SHEET

PROJECT NAME: JPG - DU Impact Area PROJECT NO: ERM

SAMPLE ID NUMBER: SI SI SAMPLING LOCATION CO) · DU · 00	6.		(MM/DD/YY): <u>05-01-8</u> TIME: <u>08/6</u>
DESCRIPTION:				
SAMPLING POINT CODE: DESCRIPTION			·	
NORTHING:	_ EASTIN	G:	ELEV	ATION:
SAMPLE DEPTH CODE: SAMPLE MEDIA CODE:		TO	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _	Rackson	AC	TIVITIES IN ARE	A:
	Sample	Rad	: 48 cp	(5w)
	Dose:	5 AR/hr	: 30 cm	1 (5eA)
				
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY: TEMPERATURE:	5 11.83	ur/h		
pH: CONDUCTIVITY:		ρH		
REDOX: DO:	227	MY		
ORGANIC VAPORS: TURBIDITY:	5.9	NTU		
OTHER:				
SAMPLE TYPE: 🗽 GRAB □ QC TRIP □ OTHER (S			TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES D IF SAP WAS NOT FOLLOWED, S Surface was	PECIFY WHAT	DEVIATION:	S WERE NECESSAR	
Duplicate a	wiface-wat	er søle	Collected	
Recorded By: Mak Cally	.00	OC Ch	ecked By:	

PROJECT NAME: JPG - DU Impact Area PROJECT NO: ERM

S	N. NII. AA	~		(MM/DD/YY): <u>05-01-18</u> TIME: <u>1444</u>
SAMPLING LOCATION CO	ODE:			
SAMPLING POINT CODE DESCRIPTION				
NORTHING:	EASTIN	G:	ELEV	ATION:
SAMPLE DEPTH CODE: _	;	TO	SCRIPTION:	BLS
WEATHER:				
	Sample	Rad	: 42 ep	n (SW)
	Dose: 4	+ AR/hr		n (Sea)
	·			
FIELD MEASUREMENTS	READING	1	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	4	agr/h		
TEMPERATURE:	20.60	100		
CONDUCTIVITY:	7.49	m 5/cm		
REDOX:	0.104			
DO;	322	MY		
ORGANIC VAPORS:	10.71	mg/1		
TURBIDITY:	27.8	NTU		
OTHER:	-	10,70		
SAMPLE TYPE: TY GRAB COUNTY OF THER	BLANK (SPECIFY)	☐ SPA	TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES DIES SAP WAS NOT FOLLOWED,	SPECIFY WHA	T DEVIATION	S WERE NECESSAF	
Duplicate	sediment	Sample	collected	
Recorded By: Ms. Cold			necked By:	
(Signa				(Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG - DU Impact Area PROJECT NO: ERM

SAMPLE ID NUMBER: S	D. DU. 00	8	ATE COLLECTED	(MM/DD/YY): <u>05-01-1</u> TIME: <u>1152</u>
SAMPLING LOCATION CO	ODE:			
SAMPLING POINT CODE DESCRIPTION				
NORTHING:	EASTIN	G:	ELEV	ATION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO _	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN AREA	A:
	Sample Sample	Rad R	20) : 3B cpm : 34 cpm	(5W)
••••••••••••••••••••••••••••••••••••••	<u> </u>	11	: 42 epr	(5ed)
FIELD MEASUREMENTS	READING	UNITS		LAST CALIB.
RADIOACTIVITY: TEMPERATURE:	5	mR/h		
pH: CONDUCTIVITY:	20.25 8.57 0.166	ρΗ		
REDOX:	175	MY		
DO: ORGANIC VAPORS:	10.55	mg/1		-
TURBIDITY:	1.1	NTU		
OTHER:	-		-	
SAMPLE TYPE: 🏋 GRAB	BLANK (SPECIFY)		TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES E IF SAP WAS NOT FOLLOWED, Surface wa	SPECIFY WHA	T DEVIATION	S WERE NECESSAR	
Recorded By: Mul. Cold.	æll	QC CI	necked By:	
(Signa				(Signature)

PROJECT NA	SAI ME: JPG.	MPLE LO	G SHEET part Area PROJ	Spring 18 JECT NO: ERM
SAMPLE ID NUMBER: S	5-0U-00	DA DA	TE COLLECTED (MM/DD/YY): <u>65-01-18</u> TIME: <u>0855</u>
SAMPLING LOCATION CO	DDE:			
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:	_ EASTING	6:	ELEVA	TION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:		TO DE	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN AREA	:
	Beck g	le Rad	Rad: 33 : 52	can
	•			
FIELD MEASUREMENTS	READING	UNITS		LAST CALIB.
RADIOACTIVITY:				
TEMPERATURE:		 		
CONDUCTIVITY:				
REDOX:				
DO: ORGANIC VAPORS:				
TURBIDITY:				
OTHER:				
SAMPLE TYPE: X GRAB QC TRIF O OTHER	BLANK	□ QC	TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES DIES IF SAP WAS NOT FOLLOWED,	NO SAP SAMI SPECIFY WHAT	PLING PROC DEVIATION	EDURE WAS FOLLO' S WERE NECESSAR'	WED: XYES (I) NO Y AND WHY:
5,,	Sample			
Recorded By: M. (aldwell	QC C	necked By:	
	ture)		•	(Signature)

PROJECT NA	SA!	MPLE LC	G SHEET -pact Area PRO	Spring 18 DJECT NO: ERM
SAMPLE ID NUMBER: _5	S- DU-00	<u>2</u> DA	TE COLLECTED	(MM/DD/YY): <u>05-01-18</u> TIME: <u>1316</u>
SAMPLING LOCATION CO	DDE:			
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:				
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _	:	TO DE	SCRIPTION:	BLS
WEATHER:		AC	TIVITIES IN ARE	A:
	Beckg	reund	Rad: 38 : 52	срп
, , , , , , , , , , , , , , , , , , ,	Samp	le Rad	: 52	- c'pm
	Doses	5	uR/hr	
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	-			
TEMPERATURE:	_			
pH:				
CONDUCTIVITY:		<u> </u>		
REDOX:				
ORGANIC VAPORS:				1
TURBIDITY: OTHER:	-			
TURBIDITY: OTHER : GRAB QC TRIF	(SPECIFY)	□ QC	TIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
TURBIDITY: OTHER: SAMPLE TYPE:	(SPECIFY)	QC QC	RINSATE CEDURE WAS FOLLO S WERE NECESSAF	OWED: XYES INO
TURBIDITY: OTHER: SAMPLE TYPE:	(SPECIFY)	QC QC	RINSATE CEDURE WAS FOLLO	OWED: XYES INO
TURBIDITY: OTHER: SAMPLE TYPE:	(SPECIFY)	QC QC	RINSATE CEDURE WAS FOLLO S WERE NECESSAF	OWED: XYES INO
TURBIDITY: OTHER :: SAMPLE TYPE: A GRAB Q QC TRIF Q OTHER SAMPLE COLLECTED: A YES C IF SAP WAS NOT FOLLOWED,	(SPECIFY)	PLING PROC	CEDURE WAS FOLLO S WERE NECESSAF	OWED: XYES INO
TURBIDITY: OTHER: SAMPLE TYPE:	(SPECIFY)	PLING PROC	RINSATE CEDURE WAS FOLLO S WERE NECESSAF	OWED: XYES INO

PROJECT NA			G SHEET -pact Area PRO.	Spring 18 JECT NO: ERM
SAMPLE ID NUMBER: 5	5- DU- 00	0.3 DA	TE COLLECTED (MM/DD/YY): <u>05-01-18</u> TIME: <u>1023</u>
SAMPLING LOCATION CO	DE:			
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:	_ EASTING	S:	ELEVA	TION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:				
WEATHER:FIELD OBSERVATIONS:		AC	TIVITIES IN AREA	
	Beckg	ound	Rad: 38	cpn
	Samp.	le Rad		—c;bw
	Dose:	5	4R/hr	
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:				
TEMPERATURE:				
CONDUCTIVITY:		 		
REDOX:				
DO: ORGANIC VAPORS:				
TURBIDITY;	=	 		
OTHER:	_			
SAMPLE TYPE: 🔭 GRAB			TIAL COMPOSITE	□ TIME COMPOSITE
□ QC TRIP	BLANK SPECIFY)	QC	RINSATE 	QC FIELD BLANK
QC TRIP OTHER (SPECIFY)	PLING PROC	CEDURE WAS FOLLO	WED: XYES II NO
QC TRIP O OTHER () SAMPLE COLLECTED: XYES	SPECIFY)	PLING PROC	CEDURE WAS FOLLO	WED: XYES II NO
G QC TRIP G OTHER (S SAMPLE COLLECTED: XYES G IF SAP WAS NOT FOLLOWED, S	NO SAP SAME SPECIFY WHAT	PLING PROC	CEDURE WAS FOLLO	WED: XYES II NO

PROJECT NA	SAI ME: JPG.	MPLE LO	G SHEET PRO PACT Area PRO	Spring DJECT NO: ERM	5 '18 1
SAMPLE ID NUMBER: 5	5-00-00	<u>04</u> DA	TE COLLECTED	(MM/DD/YY): 05 TIME: 140	<u>-01-4</u>
SAMPLING LOCATION CO DESCRIPTION:)DE:				
SAMPLING POINT CODE: DESCRIPTION					
NORTHING:					
SAMPLE DEPTH CODE: SAMPLE MEDIA CODE:	:_	TO DE:	SCRIPTION:	<u> </u>	_BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN ARE	A:	
	Beck g	1- 4.4	Rad: 38 : 43	cpn	
	•		. 43 4R/hr	- cp	
FIELD MEASUREMENTS	READING	UNITS		LAST CALIB	.]
RADIOACTIVITY:	-	 			
TEMPERATURE:	 	 		 	
pH:				 	
CONDUCTIVITY:				' — — — — — — — — — — — — — — — — — — —	
		<u></u>			
REDOX:					
REDOX: DO:					
REDOX: DO: ORGANIC VAPORS:					
REDOX: DO:					
REDOX: DO: ORGANIC VAPORS: TURBIDITY: OTHER:: SAMPLE TYPE: GRAB QC TRIP	BLANK SPECIFY)	□ SPAT	TIAL COMPOSITE RINSATE	☐ TIME COMPOSITI	
REDOX: DO: ORGANIC VAPORS: TURBIDITY: OTHER: SAMPLE TYPE: X GRAB QC TRIP QC TRIP OTHER () SAMPLE COLLECTED: XYES C IF SAP WAS NOT FOLLOWED, SAMPLE COLLECTED.	SPECIFY) I NO SAP SAME SPECIFY WHAT	QC F	RINSATE EDURE WAS FOLLO	□ QC FIELD BLANK	
REDOX: DO: ORGANIC VAPORS: TURBIDITY: OTHER: SAMPLE TYPE: A GRAB OCTRIP OTHER (SAMPLE COLLECTED: AYES O	SPECIFY) I NO SAP SAME SPECIFY WHAT	QC F	RINSATE EDURE WAS FOLLO	□ QC FIELD BLANK	
REDOX: DO: ORGANIC VAPORS: TURBIDITY: OTHER: SAMPLE TYPE: X GRAB QC TRIP QC TRIP OTHER (: SAMPLE COLLECTED: XYES CI IF SAP WAS NOT FOLLOWED, S	SPECIFY) I NO SAP SAME SPECIFY WHAT	D QC F	RINSATE EDURE WAS FOLLO S WERE NECESSAF	□ QC FIELD BLANK	
REDOX: DO: ORGANIC VAPORS: TURBIDITY: OTHER: SAMPLE TYPE: X GRAB QC TRIP QC TRIP OTHER () SAMPLE COLLECTED: XYES C IF SAP WAS NOT FOLLOWED, SAMPLE COLLECTED.	SPECIFY) NO SAP SAMF SPECIFY WHAT Sample	D QC F	RINSATE EDURE WAS FOLLO	□ QC FIELD BLANK	

Project / Client Spring 18 ERM / VEALE 1506: Water-level meter: Solinst Model 101, 238276. 1523: Conducting site-specific radiological training. Conducting general healths safety briefing. 1548: Rad instruments used: -> Micro R Model 19 Seriel # 205706 -> 2221/44-9 Sec. 1# 212129/197792 1602: Completed training 60 cessfully. 1634: Crew leaving site.

Location Former JPG - Madison, IN Date 4-30-18

10 1 Date 3-1-18 Project / Client String 18 ERM / USACE Juny, upper 405 - 705 0659: All even members at Blog 125. Preparing Au sampling. 0741: Collecting sample at MW-03. Duplicate Sample collected. 0816: Collecting 5W-006, 5W-006-DUP, # 0846: Collecting sample at MW-002. 0855: Collecting sample at 55-001 0908: Collecting samples 50-003 \$ 5W-003. 0935: Collecting samples 50-004 & SW-004 0947: Collecting sample MW-001. 1023: Collecting sample 55.003. 1131: Breaking For lunch at D Road & Mergan Pd 1152: Collecting SW 008 & SD-008 1207: Collecting MW-005 1223: Collecting sample MW-011. 1239: Collecting samples SW-005 & 50-005 1251: Collecting sample MW-009, 1301: Collecting sample MW-010. 1312: D. Lausen & A. Bennett are returning to Blag 125. A. Bennett is not feeling Make Coldwell

1316: Sampling 55-002 & 55-002-DUP 1333: Sampling SW-002 & SD-002 1349: Sampling SW-001 & SD-001 1407: Sampling SS 004. 1430: Sampling MW-006. 1444: Sampling SW-007, SD-007, 450-007-OUP 1458: Sampling MW-007. 1522: Clew leaving 13ldg 125.

Location Former JPG - Madison, IN Date 05-01-18

Project / Client Spring 'IB ERM / USACE

Project / Client Spring 18 ERM / USACE	Project / Client	00
21: Crew at Bby 128. Preparing samples and conducting rad		N
Samples and conducting rad Survey of equipment, supplies, coolers, d vehicles. 39: Scanning / Survey Completed, Samples are packaged. Crem leaving site.		
packagen, crem leaving site.		
	5	
6.7.18		
MC -		

1 t u = t > 13715 Rider Trail North

Chain of Custody Record

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_				-			~			

Earth City, MO 63045 Phone (314) 298-8566 Fax (314) 298-8757			JI Out													THE			NTAL TESTING
Client Information	Sampler:	er 1 C	aldwell	Lab	PM:	Iva	~ 1	Vani	٠	Car	rier Tra	cking t	Vo(s):			COC	No:		
Cilent Contact: Mr. Mark Caldwell	Phone: 865	5.481.		E-Ma	ail:							•	_			Page :	. 1	OP 4	
Company: XCEL Engineering Inc.			<u> </u>		T			Anal	lysis F	eane	sted					Job #	r:		
Address:	Due Date Reques	ted:			影	ă I	T-	1 1	T	1000					T	Pres	ervation C	odes:	
1066 Commerce Park Drive City:	TAT Requested (c	lays):			1 🔣	1		}					-			A-H B-N	ICL NaOH	M - Hexa N - None	
Oak Ridge State, Zip:	- 	tandar	1			<u> </u>	}	} }			}		j		- [:-	D-1	Zn Acetate Nitric Acid	O - AsNa P - Na2O	
TN, 37830 Phone:	PO#:					3	}	1 1	1 1				}			F-N	NaHSO4 MeOH	Q - Na2S R - Na2S	203
<u>865. 766. 8547</u>					9				1 1						- }:	H-/	Amchlor Ascorbic Acid		Dodecahydrate
Email: mcaldwell@xceleng.com	WO #:				6 5	1 a-				1	}		Ì	. }			l Water	U - Aceto V - MCA	4
Project Name:	Project #:				٤	Isotopic			1 1	}			}	- }	ş	L-E	DTA DA	W - pH 4 Z - olher	
Site: 10C - DU T A	SSOW#:				Sampl	H		1 1				}	ļ	- {		Othe	r:	•	
JPG - DU Impact Area	+	T	Commis	Matrix	Spers			[1 1	ľ	1		ł	ł		<u> </u>			
		i i	Sample Type	(Wawater,	Field Filtered	4		} }	1 1	1				- {	Maria				
Sample Identification	Sample Date	Sample Time	(C=comp, G=grab)	O=wastefoli, BY=Tissue, A=Air					11			[]	- [<u> </u>		Special	Instruction	os/Note:
		$\geq <$		ation Code:								6.			\supset				
MW-DU - 001	5-1-18	0947	G	W	MN	12													
1 002		0846									_					A	11 S	amples	are_
003		0741			Ш											C		idated	
003 - DUP	↓	0741			Ш	Ш										`I.	hice		coolers.
004	4-30-18	1413			$\parallel \parallel \parallel \parallel$				\prod						_	0	ne (i	Co	_
005	5-1-18	1207														-:[sample	
006	1	1430			$\Pi\Pi$	TTT			1-1							T		7	
007	1	1458			$\Pi\Pi$	TIT			77						$\neg \Gamma$				
008	4-30-18				Ш	TTT													
009	5-1-18	1251			$\overline{\parallel}$														
010	1	1301	V	V	111		1		11										
Possible Hazard Identification	F-7	 .	·		s	ample Di	isposa	l (A fee	may b	e asse	ssed	if sar	nple	s are	retal	ned lo	nger than	1 month)	
Non-Hazerd Flammable Skin Irritant Poil Deliverable Requested: I, II, III, IV, Other (specify)	son B Unkr	nown F	Radiologica	<u> </u>		Retu	<i>irn To</i>	Client ns/QCR		Disp		y Lab	<u> </u>		Y Arc	chive F	or(Montl	18
E		Date:			Time							od of S		ent:		160			
Refinquished by: Mark Caldwell Residual to the control of the co	Date/Time:	 -		Company		Received	d by:							Time:		<u>15</u> 0		Company	,
Relinquished by:	5-2-18 Date/Time:	108:	22	XCEL Company	-	Received	đ by:						Date/	Time:				Company	,
	Date/Time:																		
Relinquished by:	Date/Time:			Company		Received							Date/	Time;				Company	<i>'</i>
Custody Seals Intact: Custody Seal No.: Δ Yes Δ No					-	Cooler T	empera	ture(s) °C	and Othe	r Remai	ks:								

TestAmerica St. Louis

13715 Rider Trail North Earth City, MO 63045 Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record



Client Information	Sampler:	er / Co	aldwell	Lab	PM:	•	Iva	~ V	lani		Car	rier Trackin	g No(s):			COC No:	
Client Contact: Mr. Mark Caldwell	Phone:	. 481.		E-M	ail:		_	_					_			Page: 2 6	14
Company: XCEL Engineering Inc.	<u> </u>				Τ				Ana	lvsis	Reque	sted				Job#:	
Address:	Duo Date Request	ted:			17	XIII		77		. <u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>	1		TT			Preservation Code	s:
1066 Commerce Park Drive	TAT Requested (d	lays):			-		য	1 1			- 1		1				M - Hexane N - None
Oak Ridge State, Zip:	{	tandara	1			Į.	1.5	1 1									O - AsNaO2 P - Na2O4S
TN, 37830			л ————		4		Ura	1 1					11	1 1	1	F - MeOH	Q - Na2SO3 R - Na2S2O3
Phone: 865. 766. 8547	PO#:				<u></u>			1 1	ł				11		[[H - Ascorbic Acid	S - H2SO4 T - TSP Dodecahydrate
Email: mcaldwell@xceleng.com	WO#;				ě	Q.	o tapic	1 1	1		1	}		1 1	o l	J - DI Water	U - Acelone V - MCAA
Project Name:	Project #:		•		ڲۣ	50	50 t	1						}]			W - pH 4-5 Z - olher (specify)
Sile: JPG - DU Impact Area	SSOW#:			·	ample	ω	H				}	1 }			of con	Other:	
OFG DU IMPRET HIER	 	<u> </u>	Samula .	Matrix		SING					Į						
	}		Sample Type	(Wewater, Sesolid.	얦	Perform MS	ote					}			Number		İ
Sample Identification	Sample Date	Sample Time	(C≔comp, G≔grab)	O=waste/oil, BT=Tissue, A=Ali) Jugar	17								Total	Special Ins	tructions/Note:
		><	Preserva	tion Code:	\boxtimes	X									X		
MW- DU - OH	5-1-18	1223	G	W	M	N	2										
5W-DU-001		1349			Ш	1										All Sam	ples are
1 002		1333			Ш	Ш										Consolida	ted into
003		0908			Ш						_ }					three li	3) coolers.
004		0935													,	One (1)	COC For
005		1239			Ш											all sa	moles.
006		0816			Ш											. ,	
606 - DUP		0816			Ш												
007		1444			Ш	Ш						<u> </u>					
V 008	V	1152	V	V	M	¥	4										
					-	-											
Possible Hazard Identification Non-Hazard Flammable Skin Irritant Poise	on B Unkn					Sar [_			may i	_			are ret	aine	d longer than 1 n	
Non-Hazard Flammable Skin Irritant Poise Deliverable Requested: I, II, III, IV, Other (specify)	on B — Unkn	iown h	Radiological			Spe	Retu ecial Ins	rn To C truction		Require		osal By L	aD	ZNA	rcni	ve r-ort	Months
Empty Kit Relinquished by:		Date:			Tin	ne:						Malhod o	/ Shipmen	t:	1) <	5ρ	
Reilinguished by: Mark Caldwell	Date/Time:	2-18/		Company			Received	by:					Date/Tir		- -		Company
Relinquished by:	Date/Time:	10/	VOLL	Company			Received	l by:					Date/Tir	me:	_		Company
Relinquished by:	Date/Time:			Company			Received	by:					Date/Tir	ne:			Company
Custody Seals Intact: Custody Seal No.:	<u></u>			L			Cooler To	emperat	ıre(s) °C	end Oth	er Remari	s:	٠				
Δ Yes Δ No						_											

Chain of Custody Record

<u> </u>	. 🛍		i	1	Ţ
5.886 a.c. 3	W 7.	~	4	4.6.6	H 4 m/s

Farth City MO 63045 THE LEADER IN ENVIRONMENTAL TESTING Phone (314) 298-8566 Fax (314) 298-8757 Carrier Tracking No(s): COC No: Ivan Vania Caldwell Client Information Client Contact: Mr. Mark Caldwell Job # Company: Analysis Requested XCEL Engineering Inc. Due Date Requested: Preservation Codes: 1066 Commerce Park Drive TAT Requested (days): B - NaOH N - None Uraniu Oak Ridge C - Zn Acelate O - AsNaO2 Standard D - Nilric Acid P - Na2O4S State, Zio: E - NaHSO4 Q - Na2SQ3 TN. 37830 F - MeOH R - Na2S2O3 G - Amchior S - H2SO4 865, 766, 8547 H - Ascorbic Acid T - TSP Dodecahydrate Isotopic U - Acetone J - DI Water V-MCAA mcaldwell@xcelena.com K - FOTA W - pH 4-5 Project Name: L - EDA Z - other (specify) SSOW# Other: JPG - DU Impact Area **Total Number** Matrix Sample (w=water. Type Sweetld. Sample (C=comp. G=grab) BT=Tissuo, Avair) IL Sample Date Time Sample Identification Special Instructions/Note: Preservation Code: 5D - DU -1349 001 1333 002 Samples 0908 003 0935 004 1239 005 0816 1444 007-DUP 1444 1152 008 Possible Hazard Identification

Non-Hazard Flammable Skin Imitant Poison B Unknown Radiological Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

Return To Client Disposal By Lab Archive For Month Archive For Months Deliverable Requested: I. II. III. IV. Other (specify) Special Instructions/QC Requirements: Empty Kit Relinquished by: USP Date/Time: Company Received by: Date/Time: Company 0822 5-2-18 Received by: Date/Time: Relinquished by: Company Received by: Date/Time: Relinquished by: Company Custody Seals Intact: Custody Seal No.: Cooler Temperature(s) °C and Other Remarks: Δ Yes Δ No

TestAmerica St. Louis

Phone (314) 298-8566 Fax (314) 298-8757

13715 Rider Trail North Earth City, MO 63045 **Chain of Custody Record**

162144	HUHCU
180 4 4 19 15 19 19 19 19 19 19 19 19 19 19 19 19 19	with a war a disamble
THE LEADER IN ENV	IRONMENTAL TESTING

Carrier Tracking No(s): COC No: Ivan Vania Client Information Client Contact: Page: 865.481.3200 Mr. Mark Caldwell Company: XCEL Engineering Inc. **Analysis Requested** Address: Due Date Requested: Preservation Codes: 1066 Commerce Park Drive M - Hexane TAT Requested (days): B - NaOH N - None Oak Ridge C - Zn Acetate O - AsNaO2 Standard D - Nitric Acid P - Na2O4S State, Zip: E - NaHSQ4 Q - Na2SO3 TN, 37830 F-MeOH R - Na2S2O3 PO#: G - Amchlor S - H2SO4 865. 766. 8547 H - Ascorbic Acid T - TSP Dodecahydrate Iso topic U - Acetone WO#: I - ice J - DI Water V - MCAA mcaldwell@xceleng.com K-EDTA W - pH 4-5 Project Name: L - EDA Z - other (specify) SSOW#: Other: JPG - DU Impact Area ö Number Matrix Sample (W=water, Type Sesolid, Total Sample (C=comp, Sample Identification Sample Date Time G=grab) BT=Tissue, A=Al Special Instructions/Note: Preservation Code: 55- DU- 001 0855 1316 002-DUP 1316 1023 604 1407 Possible Hazard Identification Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) Non-Hazard Flammable Skin Irritant Poison B Unknown Radiological Disposal By Lab Archive For Return To Client Months Deliverable Requested: I, II, III, IV, Other (specify) Special Instructions/QC Requirements: Empty Kit Relinquished by: Relinquished by: Date/Time: Received by: Date/Time: Company XCEL Received by: Relinquished by: Date/Time: Date/Time: Company Relinquished by: Date/Time: Received by: Date/Time: Company Custody Seals Intact; Custody Seal No.: Cooler Temperature(s) °C and Other Remarks: Δ Yes Δ No

FALL 2018 FIELD LOGBOOK AND SAMPLING FORMS

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Project Nar Project Nur Purged by: Sampled by Checked by	nber: /:					Well Identif Project Loo Date: Date: Date:			Mw-1 Madison, IN 10-15-18 10-23-1	
	.UME CALC eter and Κ ι	SULATION: used below:	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0	.163 gal/ft		6" I.D., K= 8" I.D., K= 10" ID, K=	2.61 gal/ft			
Height of w Purge Volu 1 Well Volu Purge Rate	(<u>)</u> 5, <u>0</u> 3 ater column ime: me (<u></u> 4.01	(_ gallons gpm) x (_ft) x K valu) x 3 = 3 We min)	10.45 ft) e (0.165) ell Volumes (= 1 Well Vol = 3 Well Vol	gal/ft) = 1 gal/ft) = 1 	Well Volum	ne (<u> ५.७ </u>	<u>&</u> ft) gal) 		
Time	Temp °C	pН	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
0947	13.65	7.81	0.646	2.5	8.67	234		11-26	11-261	
PURGE INITIME / Date Time Purge Purge Meth Depth to Int Pump Type Purge Rate Purged Volu Water Qual How was yi Was well ca Water conta	Started: End: od: Pump ake: and ID: ume: ity Meter: eld measure avitated? ainerized/Am	NA NA Horiba U-22 d?	A }	10 -15 - 15 X		Time / Date Sampled by	thod: Bailer X Collected: ervatives: WL: eampling:	0947 0. Lawso X	Other Composite	10-23-1E T. Farme
	L INFORMA	TION: (i.e. w		evel at	11.26' 6	clow top				
			INTU .	Britigion Sample	6 MR nd: 46 ; 27	cpn cpn				· · · · · · · · · · · · · · · · · · ·



1 Well Volument Total Depth Height of w Purge Volument 1 Well Volument Rate	ume: ater column ume: ater () . 5.	D. LAWJON	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0 to Water (ft) x K value n) x 3 = 3 We	.041 gal/ft .041 gal/ft .163 gal/ft .653 gal/ft .653 gal/ft .9.40_ft) = Height o gal/ft) = 1 	Well Volum	ation: 1.469 gal/ft 2.61 gal/ft 4.08 gal/ft mn (-	MW-J Madison, IN 10/15/12 8 - 2-3 -	8
	Temp	1	Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time	.C	рН	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate
0913	11.05	9.15	0.548	15.2	8.95	241			10.0'	
				70.6	<u></u>				70.0	
		 								
		 								
			·i							
}	}	 		<u> </u>						
		 								
		 								
<u> </u>		ļ								
							<u> </u>			
	<u> </u>	<u> </u>	l				<u> </u>		لـــــــــــــــــــــــــــــــــــــ	
Time / Date Time Purge Purge Meth Depth to Int Pump Type Purge Rate Purged Voli Water Qual How was yi Was well ca Water conta Grunfos con	e End: nod: Pump take: and ID: : ume: lity Meter: eld measure avitated? ainerized/An ntroller set	NA NO	NA eather condi	(ft) (gpm) (gal) A No (Hertz) tions, proble	o' belo.	Time / Date Sampled by Sample Me Grab # of Bottles Bottle Prese Recovering Duplicate S Laboratory: COC Form:	thod: Bailer X Collected: ervatives: WL: ampling:	O913 A. Lawso X 2- no no TA yrs	Other Composite	•
		RA	<u>0: (</u>)05C:	5 mR/h	····				
			В	ackground	1: 61 c	0~1				

Background: 61 cpm Sample: 42 cpm



Project Na	ıme:	Jeffers	son Proving	Ground	_	Well Identi			mw-3	
Project Nu		E	RM Sampli		-	Project Loc	cation:		Madison, I	
Purged by		D. LAWSON		J. Padford		Date:			10/15/19	?
Sampled b	-	O. Lawson	-	T. Fame	_	Date:			10/23/	18
Checked b	y:		- &		-	Date:				
		CULATION:								
Circle dian	neter and K	used below:					1.469 gal/ft			
			2" I.D., K=0	•		8" I.D., K=	-			
			4" I.D., K=0).653 gai/ft		10" ID, K=	4.08 gai/ft			
1 Well Vol				7 24			- >0	4		
Total Dept	h (<u> </u>	ft) - Depth	to Water (_	7. 38 f	t) = Height o	of water colu	mn (•		
		1 (_38./	_ft) x K valu	le (<u>0.16)</u>	gal/ft) =	1 Well Volun	ne (<u>6.3</u> 1	gal)		
Purge Vol	ume:	gallons) O . O . N/ .	.0.1/-1	10 ()	W N				
		<u>⊁∤ g</u> alions <u> g</u> pm) x (<u> </u>				_gallons)				
-		gpm) x (
		gpiii) ^ () = 0 vveii vc						
Time	Temp °C	рН	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
0759	13.37	7.79	0.5 96	9.2	6.29	92	Guaritty	Volume	7-681	Hate
0.737	13.57	1 7 7 -	V13.16	1.2	0.7.7	176			7-681	
	1						 			
		<u> </u>								
	ļ									
	<u> </u>									
	ļ			<u> </u>		ļ				·
	<u> </u>	<u></u>					<u> </u>			
PURGE IN	FORMATIO	N:			_	SAMPLING	INFORMAT	TION:		
Time / Date	e Started:	1300	[12/15/1	ัช	Time / Date		0759	1	10-23-18
Time Purge	e End:	1315				Sampled by	/ :	D. Lawson	 k	T. Farmer
Purge Meth	nod: Pump		Bailer	Χ	•	Sample Me	thod: Bailer	X	Other	
Depth to In		N	A	(ft)		Grab	X		Composite	
Pump Type		NA			•	# of Bottles			00 ml	
Purge Rate		N		(gpm)		Bottle Pres		non	<u>e</u>	
Purged Vol			9	(gal)		Recovering			-	
Water Qua	•	Horiba U-22			•	Duplicate S				
How was y	ield measure		Yes	No		Laboratory: COC Form:		TA		
	avitateu : ainerized/Ar		165	NO		COC FOIM.	•	ye	<u> </u>	
	ntroller set		NA.	(Hertz)	•					
				, ,						
ADDITIONA	AL INFORMA	TION: (i.e. w	eather cond	itions, proble	ems encoun	tered, mainte	enance requi	red, unusua	l color/odor,	etc.)
	H M	MT IIII		ter level		, ,	low top	T .	_	10-23-18
			RAI	۸٠ /	Dose: 5	5 MR/h		.	7	
				_		•			· · · · · · ·	
				1	Sackground	1: 52c	PM			
					و ماه و	26.0				



1 Well Volu Total Depth Height of w Purge Volu	wher: y: UME CALC eter and K under (3). 37 ater column ume:	O. LAWSOL T. Farmer	& & 1" I.D., K=0 2" I.D., K=0 4" I.D., K=0 to Water (ft) x K value	.041 gal/ft .163 gal/ft .653 gal/ft) = Height o gal/ft) = 1	Well Volum	ation: 1.469 gal/ft 2.61 gal/ft 4.08 gal/ft	<i>3</i> ft)	MV-4 Madison, IN 10-15- 0-22-	18
Purge Rate		gpm) x (min)		lume					
Time	Temp "C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1428	16.05	7.66	0.647	25.2	12.96	248			7.46'	
					<u> </u>					
PURGE IN	FORMATIO	<u>. </u>		<u> </u>		SAMPLING	INFORMAT	ION.	L	
Time / Date Time Purge Purge Meth Depth to Int Pump Type	e Started: e End: eod: Pump take:	NA N	Bailer	10 -15-18 X (ft)		Time / Date Sampled by Sample Mel Grab # of Bottles	Started: r: thod: Bailer X	1428 T. Farmer X	& Other Composite	10-12-18 M. Caldwell
Purge Rate Purged Vol		N		(gpm) (gal)		Bottle Prese Recovering		<u></u>		
Was well ca	eld measure	,	#N Yes	A No		Duplicate Salaboratory: COC Form:		Ye. 74 Yes		
Grunfos coi			NA	(Hertz)						
	LINFORMA JHT //	ATION: (i.e. w	reather cond	.) _			•			, etc.) 0 - 12 - 18 .
			RAD:		: 5 4					
			13 5	ackground ample:	.: 54 6 43 9	ipm ipm				



Project Name: Project Number:		on Proving			Well Identif			MW-5	
		RM Sampli	ng	_	Project Loc	ation:		Madison, IN	
Purged by:	D. LAWSON		5. Duffer	Ī	Date:			10-15-18	
Sampled by:	D. Lause.		T. Farme		Date:			10-23-16	
Checked by:		&		_	Date:				
				-					
WELL VOLUME CAL									
Circle diameter and K	used below:	1" I.D., K=0			6" I.D., K=	-			
		2" I.D., K=0	-		8" I.D., K=				
		4" I.D., K=0).653 gai/ft		10" ID, K=	4.08 gal/ft			
1 Well Volume:									
Total Depth (35.85	ft) - Depth	to Water (16.00 fi	t) = Height o	water colur	nn (19.8	ft)		
Height of water column	19.85	ft) x K valu	ie (0.163	, gal/ft) = 1	Well Volum	ne (3.34	gal)		
Purge Volume:		- /	\			\ 			
1 Well Volume (3.)	gallons	x 3 = 3 We	ell Volumes (9.71	gallons)				
Purge Rate (gpm) x (min) = 1 Well Vo		,				
Purge Rate (gpm) x (min) = 3 Well Vo	lume					
	, , , , , , , , , , , , , , , , , , , 	F-10-18-28-31-18-18-18-18-18-18-18-18-18-18-18-18-18		14.57.1	- 272				
Time Temp	Hg	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
	8-10		1.4			Quantity	Volume		Nate
1314 14.56	8-10	1.36	1.7	13.69	249			16.07	
 	+		 	 					
 	1					-		 - 	
	+		 					 	
}			 	·				 	
			 						
	+		f						
									
	<u> </u>		<u> </u>						
	1					-			
PURGE INFORMATIO			40	,		INFORMAT			
Time / Date Started:	<u>1434</u>		10-12-18		Time / Date		1314	. ! -	<u> 10-23-18</u>
Time Purge End:	1437				Sampled by		D.Lauson		T. Farmer
Purge Method: Pump		Bailer		•		thod: Bailer	X	Other	
Depth to Intake:	N N	Α	_(ft)		Grab		_	Composite _	
Pump Type and ID:	NA	<u> </u>	<u> </u>	•	# of Bottles	-		1000 ml	
Purge Rate:	N	Α	_(gpm)		Bottle Prese		No.	re	
Purged Volume:	10	ш	_(gal)		Recovering			·	
Water Quality Meter:	Horiba U-22			•	Duplicate S		10		
How was yield measur			Na.	_	Laboratory:		<u>7A</u>		
Was well cavitated?		Yes	No		COC Form:	-	yee	<u> </u>	
Water containerized/Au Grunfos controller set	-	NA	(Hertz)						
Grunios controller sec	<u>w</u>	INA .	_(116112)						
ADDITIONAL INFORMA	ATION: (i.e. w	eather cond	ditions, probl	ems encoun	ered, maint	enance requi	red, unusua	l color/odor.	etc.)
	HT ,		er level		, ,	1 top of			- 13-18
					- VENE)	
		RAD	: Dos	se: 5	yR/h		,		

Background: 22 cpm Sample: 41 cpm



1 Well Voluments 1 Well Voluments 1 Well Voluments 1 Well Voluments	ume: ater column ume: ater column ume: ater (3.78)	EULATION: ft) - Depth (yy	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0 to Water (_ _ft) x K valu) x 3 = 3 We min)	0.041 gal/ft 0.163 gal/ft 0.653 gal/ft 0.653 gal/ft 0.653 gal/ft 0.653 gal/ft) = Height o gal/ft) = 1 		ation: 1.469 gal/ft 2.61 gal/ft 4.08 gal/ft		MW-6 Madison, IN 10-15-18 10-23-	
Purge Rate	(gpm) x (min)	= 3 Well Vo	lume					
Time	Temp °C	рН	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1431	14.75	8.00	0.686	56.0	30.70	188	_		32.38	
<u> </u>	 	<u> </u>				<u> </u>			<u> </u>	
 	 			 						
<u> </u>	ļ				-	<u> </u>				
_	 					ļ				
		 								
Time / Date Time Purge Purge Meth Depth to In Pump Type Purge Rate Purged Vol Water Qual How was yi Was well co	e End: nod: Pump take: e and ID: : ume: lity Meter: eld measure avitated? ainerized/An	NA NA Horiba U-22 ed?	Bailer A A Yes	(ft) (gpm) (gal) IA No		SAMPLING Time / Date Sampled by Sample Me Grab # of Bottles Bottle Prese Recovering Duplicate S Laboratory: COC Form:	thod: Bailer X Collected: ervatives: WL: ampling:	1431 D. Lawson X		10-23-18 To Farmer
Grunfos co	ntroller set	@	NA	(Hertz)						
ADDITIONA	-1	ATION: (i.e. w	<u></u>	nter leve 10: Do	se: 5		on top			etc.) 10-23-18

Backgrand: 42 cpm Sample: 64 cpm



Project Nar Project Nur Purged by: Sampled by Checked by	nber:					Date:			MW-7 Madison, IN 10-15- 10-23-	18
WELL VOL Circle diam	-	ULATION: sed below:	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0	.163 gal/ft		6" I.D., K= 8" I.D., K= 10" ID, K=				
Height of war	(<u>56.4/</u> ater column i me: me (<u>7.6</u>	(_ft) x K valu) x 3 = 3 We min)	e (0. 163	gal/ft) = ^ 	f water colu Well Volun _gallons)	mn (<u>47.</u> ne (<u>7.63</u>	∕ ft) <mark>Y</mark> gal)		
77 Jac	Temp °C		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time	16.70	рН 7, 96	mS/cm 0.693	NTU 16.8	mg/l 20.07	201	Quantity	Volume	Water 9.47'	Rate
Time / Date Time Purge Purge Metho Depth to Int Pump Type Purge Rate: Purged Volu Water Quali How was yic Was well ca Water conta	End: od: Pump ake: and ID: ime: ty Meter: eld measure	NA NA Horiba U-22 d?	A	(ft) (gpm) (gal)		Time / Date Sampled b	y: ethod: Bailer X s Collected: eervatives: g WL: Sampling:	145B A. Lavson X 2- 14	Other Composite OOO m (10-23-18 T. Farmer
ADDITIONA	L INFORMA	TION: (i.e. w	reather cond	itions, proble	RAD RAD	clevel a	tenance requ + 9.47' k Desc: 5 46 cp	selow top		etc.)



Project Nan		Jefferson Proving Ground			Well Identification:				MW-8				
Project Nur			RM Samplir		•	Project Loc	ation:	,	Madison, IN				
Purged by:		12 LAWSON		. Bad 61d		Date:			10-15-1				
Sampled by		T. Former		M. Caldi	well	Date:			10-22-	18			
Checked by	/;		. &		•	Date:							
WELL VOL	UME CALC	HII ATION:											
	eter and K u		1" I.D., K=0	.041 gal/ft		6" I.D., K=	1.469 gal/ft						
			2" I.D., K=0			8" I.D., K=2							
			4" I.D., K=0	_		10" ID, K=4							
				_			·						
1 Well Volu	ıme:							_					
Total Depth						f water colur							
		(6.16	_ft) x K valu	e (_ 0.163	gal/ft) = 1	Well Volum	ne (1.1d	gal)					
Purge Volu	/ 1	^			2 15			•					
1 Well Volu	\ <u></u>			II Volumes (gallons)							
Purge Rate		gpm) x (= 1 Well Vo									
Purge Rate	(_gpm) x (min)	= 3 Well Vo	iume								
AWS SALVE OF	Temp	NA SA	Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge			
Time	°C	рН	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate			
1349	13.47		0.605	7.3	13.74	257			23.69				
 	<u> </u>		V.DU.S	7.3	10.7		 	 	A.G. 67				
					·	ţ							
		<u> </u>							<u> </u>				
					 -	ļ							
 						<u> </u>	<u> </u>		ļ				
<u> </u>		<u> </u>					ļ		 				
L	l		<u></u>		<u> </u>	<u> </u>	1	MC 10.	22-18				
DUDGE IN	FORMATIO	NI.				SAMPI INC	INFORMA		22-40	,			
Time / Date		1703	ı	10-15-18	3	Time / Date		10 -2 13	49	10.22-10			
Time Purge		17/10		15 18		Sampled by		TiFamo		10-22-18 M. C. Guell			
Purge Meth		-1.08	Bailer	X	•		thod: Bailer		Other .	71. (1004			
Depth to Int	•	N		(ft)	i	Grab	X		Composite				
Pump Type	and ID:	NA				# of Bottles	Collected:	2 -	1000 m	7			
Purge Rate		N	A	(gpm)	'	Bottle Prese	ervatives:	no					
Purged Vol	ume:		1	(gal)		Recovering	WL:						
Water Qual	ity Meter:	Horiba U-22	<u>#</u>		i	Duplicate S		10					
	eld measure			Α		Laboratory:		<u>T4</u>					
Was well ca			Yes	No		COC Form:		<u> 40.5</u>	<u> </u>				
	ainerized/An			(111-)				•					
Grunfos cor	ntroller set	<u>@</u> _	NA	(Hertz)									
ADDITIONA	I INCODMA	ATION: (i.e. w	oothor conc	itions proble	ome encoun	torod maint	ananca ragu	irad unueus	al color/odor	etc)			
ADDITIONA	IL HALOKIAN	(1.e. w			(^	13.69 '	below	المال المال	1 colol/odor,	• • • • • • • • • • • • • • • • • • • •			
	-	_111	\/a·	rec levi	21 00 2	-3.61	CC IIW	- +0/1 - 81	(4.5/76]			
			RAD:	dose	5 MR	76		 -					
						···							
			Clacke	round:	54 cpm								
					6100								
			Sampl	L:	4 1 Cpm								



1 Well Vol Total Depth Height of w Purge Volt 1 Well Volt	ume: EULATION: used below: ft) - Depth (17.19	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0 to Water (2 _ft) x K value	.041 gal/ft .163 gal/ft .653 gal/ft) = Height o gal/ft) = 1	Well Identification: Project Location: Date: Date: Date: 6" I.D., K=1.469 gal/ft 8" I.D., K=2.61 gal/ft 10" ID, K=4.08 gal/ft 10" ID, Well Volume (MW-9 Madison, IN 10-15-14 (0-23-18				
	e (gpm) x (gpm) x (= 1 Well Vo = 3 Well Vo								
. digo nate	·	9P'''/ ^ \										
Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate		
1222	13.14	7.46	8.87	10,3	20.75			- voidine	30.34	- Tale		
			<u> </u>									
	<u> </u>						ļ			<u> </u>		
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}	 	 					 	 				
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		İ										
						·						
PURGE IN Time / Date Time Purge Purge Meth Depth to in	e End: nod: Pump	N: N:	Bailer	10-15-16 X (ft)	•	Time / Date Sampled by	y: thod: Bailer	1222 D. Lawson	& Other	0-23-18 T. Farmer		
Pump Type	e and ID:	NA				# of Bottles	Collected:	1-1	000 ml			
Purge Rate	e :	N		(gpm)		Bottle Pres	ervatives:	No.	ne			
Purged Vol			<u>z</u>	(gal)		Recovering			- 			
Water Qua	-	Horiba U-22				Duplicate S	_					
Was well c	ield measure		Yes	No		Laboratory: COC Form:		T/				
	avitated: :ainerized/Ar		165	NO		COC FOILI	•	<u>4e</u>				
Grunfos co			NA	(Hertz)								
		ATION: (i.e. w	eather cond	, ,			enance requ	Α .		etc.) <i> 0 - 13 -[8</i>		
		·		RAD:	Dosci	7 11	RIL					
					Book	ound; 4	 -					
					c I	1 4 ;	t cpm					



Project Nar Project Nur Purged by: Sampled by Checked by	nber: /:		on Proving (RM Samplir & & &			Well Identif Project Loc Date: Date: Date:			MW-10 Madison, IN 10-15-18 10-23-18			
	UME CALC eter and K u	ULATION: sed below:	1" I.D., K=0 2" I.D., K=0 4" I.D., K=0	.163 gal/ft		6" I.D., K= 8" I.D., K= 10" ID, K=	2.61 gal/ft					
Height of w Purge Volu 1 Well Volu Purge Rate	ater column ame: me (6.))		_ft) x K valud) x 3 = 3 We min)	e (<u>0./63</u> Il Volumes (= 1 Well Vo	gal/ft) = [·] gal/ft) = · 	of water colur 1 Well Volum _gallons)						
Time	Temp °C	pH .	Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge		
1206	15.53		mS/cm 0-664	NTU 14.5	mg/l. <i>8.8</i> 7	mv 234	Quantity —	Volume :	Water 3, 86 /	Rate		
Time / Date Time Purge Purge Meth Depth to Int Pump Type Purge Rate Purged Volu Water Qual How was yi Was well ca	End: od: Pump ake: and ID: : ume: ity Meter: eld measure avitated? ainerized/An	NA NA Horiba U-22 d?	A Î	// -/5~/8 X (ft) (gpm) (gal) A No (Hertz)		Time / Date Sampled by	thod: Bailer X Collected: ervatives: WL: ampling:	1206 D. Lawson X	Other Composite	10-23-18 T. Farmen		
ADDITIONA	L INFORMA		_	litions, proble			at 3.88			etc.)		
								1 срм : 51 ср	1			



Project Name: Project Number: Purged by:	Jefferson Proving Ground ERM Sampling D. LAWDW & D. Destroid				Well Identif Project Loc Date:			MW-11 Madison, II	V
Sampled by:	D. LAWSON	, &	T. Farm		Date:			10-23-	
Checked by:		. &		-	Date:				
WELL VOLUME CALC	CULATION:								
Circle diameter and K	used below:	1" I.D., K=0	_		6" I.D., K=	_			
		2" I.D., K=0	_		8" I.D., K=2	-			
		4" I.D., K=0	1.653 gai/π		10" ID, K=4	4.08 gai/π			
1 Well Volume:						2.10			
Total Depth (42.30	ft) - Depth	to Water (_	755 fi	:) = Height o	f water colur		<u>ft)</u>		
Height of water column	(34.75	_ft) x K valu	e (<u>0./(</u> 3	gal/ft) = 1	l Well Volum	e (3 .66	gal)		
Purge Volume:	, , ,			11.00					
1 Well Volume ().6 Purge Rate (ni volumes (i = 1 Well Vo		_gallons)				
· · · · · · · · · · · · · · · · · · ·			= 1 Well Vo						
Purge Rate (gpm) x (i = 3 Weii VC	nume					
Temp		Cond	Turbidity	D.O.	ORP	Purged	Well	Depth to	Purge
Time °C	pH	mS/cm	NTU	mg/l	mv	Quantity	Volume	Water	Rate
1252 14.33	8.34	0-503	9.9	12.58	252			14.95	
	 								
<u> </u>			 		-				
	 				 				
					-				†
	<u> </u>		<u> </u>						
	1	_							
		,							
		·							
	<u> </u>			l	<u> </u>				
PURGE INFORMATIO	M•				SAMPI INC	INFORMAT	TION:		
Time / Date Started:	1455	1	10-15-18	,	Time / Date		1252	ı	10-23-18
Time Purge End:	1506	'	10		Sampled by		D. Lawson	. , &	10-23-18 T. Famer
Purge Method: Pump		Bailer	X	•	Sample Me		X	Other	
Depth to Intake:	N		(ft)	•	Grab	X		Composite	
Pump Type and ID:	NA			_	# of Bottles	Collected:	2-	1000 m	
Purge Rate:	N		(gpm)		Bottle Prese		no	ne	
Purged Volume:	17		(gal)		Recovering			-	
Water Quality Meter:	Horiba U-22			•	Duplicate S		<u>no</u>		
How was yield measure			IA	•	Laboratory:		7/4		
Was well cavitated?		Yes	No		COC Form:		- 40	<u>.s</u>	
Water containerized/Ar Grunfos controller set		NA	(Hertz)	-					
Grunios controller set	<u>w</u>	INA	(11612)						
ADDITIONAL INFORMA	ATION: (i.e. w	eather cond	litions, probl	ems encoun	itered, maint	enance requ	ired, unusua	al color/odor	, etc.)
THE THE	JHL 11_				4.95 be				10-23-18
						· · · · · · · · · · · · · · · · · · ·	<u> </u>	J	
			RAD:	Dose:	7 MR/				
				Back scon	d: 53	. coa			

Background: 53 cp. Sample: 34 cpm

~ -				~ " "	
SA	MPL	E L	.OG	SH	EET

PROJECT NAME: JPG - DU Impact Area PROJECT NO: Fall 18
ERM SAMPLE ID NUMBER: <u>Sw-Du - 001</u> DATE COLLECTED (MM/DD/YY): <u>10-23-18</u> 50-00-001 TIME: 1350 50 - DU - 001 - DUP SAMPLING LOCATION CODE: DESCRIPTION: SAMPLING POINT CODE: _______
DESCRIPTION ______ NORTHING: _____ EASTING: ____ ELEVATION: SAMPLE DEPTH CODE: _____ TO _____ BLS SAMPLE MEDIA CODE: ____ DESCRIPTION: ____ ACTIVITIES IN AREA: WEATHER: FIELD OBSERVATIONS: Background Rad : 30 cpm Sample Rad : 42 cpm (SW) n : 31 can (Sed) DOSE: 4 AR/hr UNITS FIELD MEASUREMENTS READING SERIAL NO. LAST CALIB. MR/W 4 RADIOACTIVITY: 11.25 00 TEMPERATURE: 8.71 ρH CONDUCTIVITY: 0.368 m 5/cm REDOX: 230 MY DO: 22.06 mg/1 **ORGANIC VAPORS:** NTU TURBIDITY: 0.0 OTHER
 ★ GRAB
 □ SPATIAL COMPOSITE
 □ TIME COMPOSITE

 □ QC TRIP BLANK
 □ QC RINSATE
 □ QC FIELD BLANK
 SAMPLE TYPE: 🗽 GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE O OTHER (SPECIFY) _____ SAMPLE COLLECTED: XYES INO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES INO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Surface water & sediment samples Duplicate sediment sample Recorded By: Mak Caldwell QC Checked By:

(Signature)

(Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG- DU Inpect Area PROJECT NO: Fall IB ERM SAMPLE ID NUMBER: SW-DU-002 DATE COLLECTED (MM/DD/YY): 10-23-18 TIME: 1336 SD-DU-002 SAMPLING LOCATION CODE: DESCRIPTION: SAMPLING POINT CODE: _______
DESCRIPTION ______ NORTHING: ____ EASTING: ___ ELEVATION: ____ SAMPLE DEPTH CODE: ____ : ___ TO _____ BLS SAMPLE MEDIA CODE: ____ DESCRIPTION: ____ WEATHER: _____ ACTIVITIES IN AREA: ____ FIELD OBSERVATIONS: Background Rad : 39 cpm
Sample Rad : 50 cpm (SW)

11 : 46 cpm (Sed)

Dose: 4 9R/hr FIELD MEASUREMENTS READING UNITS SERIAL NO. LAST CALIB. 4R/h RADIOACTIVITY: TEMPERATURE: 12.95 8.74 ρH CONDUCTIVITY: 0.346 m 5/cm REDOX: 216 DO: 21.18 **ORGANIC VAPORS:** 0,9 TURBIDITY: NTU OTHER SAMPLE TYPE: X GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE ☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK O OTHER (SPECIFY) ____ SAMPLE COLLECTED: XYES INO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES INO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Surface water & sediment samples. Recorded By: Mak Coldwell QC Checked By: _____

(Signature)

(Signature)

	SAMPLE LOG SHEET
PROJECT NAME:	JPG- DU Impact Area

PROJECT NO: Fall 18 ERM

	N-DU-00:		DATE COLLECTED (MM/DD/YY): <u>10-23-18</u> TIME: <u>0934</u>					
SAMPLING LOCATION CO DESCRIPTION:								
SAMPLING POINT CODE: DESCRIPTION								
NORTHING:	_ EASTING	9:	ELEV	ATION:				
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:								
WEATHER:	Backgro Sample Dose: 5	AC und Rad Rad 11 12 13 14 16 16 17 18 18 18 18 18 18 18 18 18 18	TIVITIES IN AREA : 43 cpm : 46 cpm : 66 cpm	A:				
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.				
SAMPLE COLLECTED: XYES IN IF SAP WAS NOT FOLLOWED,	SPECIFY) NO SAP SAMI SPECIFY WHAT	O SPA O QC PLING PROC		RY AND WHY:				
Recorded By: Mr. Cold. (Signat		QC CI	necked By:	(Signature)				

SAF	VI.	P	١.	F	L	O	G	S	Н	F	F٦	Γ

PROJECT NAME: JPG-DU-Inpact Area PROJECT NO: Fall 18 ERM
SAMPLE ID NUMBER: <u>5W-DU-004</u> DATE COLLECTED (MM/DD/YY): <u>10-23-18</u> 5D - DU - 00 4 TIME: <u>1066</u>
SAMPLING LOCATION CODE: DESCRIPTION:
SAMPLING POINT CODE: DESCRIPTION
NORTHING: EASTING: ELEVATION:
SAMPLE DEPTH CODE: TOBLS SAMPLE MEDIA CODE: DESCRIPTION:
WEATHER: ACTIVITIES IN AREA:
Background Rad : 48 cpm
Sample Rad : 50 cpm (SW) " : 31 cpm (Sea) Dose: 5 gR/hr Mc
Dose: 5 & AR/he Mc
10-23-18
FIELD MEASUREMENTS READING UNITS SERIAL NO. LAST CALIB.
RADIOACTIVITY: 6 48/h TEMPERATURE: 8, 79 °C
TEMPERATURE: 8,79 °C
pH: 9.41 pH CONDUCTIVITY: 0.430 p5/cm
REDOX: 227 nv DO: 12.12 mg/l
ORGANIC VAPORS:
TURBIDITY: 3.9 NTU
OTHER: -
SAMPLE TYPE: X GRAB
SAMPLE COLLECTED: XYES ID NO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES ID NO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Surface water 4 sediment samples
Recorded By: M. Collected By: QC Checked By: (Signature)

PROJECT NA	ME: JPC	MPLE LO	G SHEET	PROJECT NO:	Fall. 18 ERM					
SAMPLE ID NUMBER: _S	W-DU-00.		TE COLLEC): <u>10-23-</u> 18 1239					
SAMPLING LOCATION CO										
SAMPLING POINT CODE: DESCRIPTION										
NORTHING:	_ EASTING	3:		ELEVATION:						
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:		TO DE	SCRIPTION	:	BLS					
FIFI D OBSERVATIONS:	WEATHER: ACTIVITIES IN AREA: FIELD OBSERVATIONS: Background Rad : 47 cpm Sample Rad : 55 cpm (Sw) " " : 59 cpm (Sed) Dose: 7 gR/hr									
	Dose: 7	AR/hr								
FIELD MEASUREMENTS	READING	UNITS	SERIAL N	IO. LAS	Γ CALIB.					
RADIOACTIVITY:	7	MR/h								
TEMPERATURE:	11.09	ngR/hr								
pH:	8.67	ρH								
CONDUCTIVITY:	0.409	m 5/cm								
REDOX:	228	MY								
DO:	14.42	mg/1								
ORGANIC VAPORS:										
TURBIDITY:	0.6	NTU								
OTHER:	_									
SAMPLE TYPE: X GRAB Q QC TRIP O OTHER (BLANK SPECIFY)	□ SPA □ QCI		SITE I TIME CO II QC FIEL						
SAMPLE COLLECTED: XYES III	NO SAP SAME SPECIFY WHAT Surbace w	DEVIATION	S WERE NEC	ESSARY AND WHY:	⊒ NO					

QC Checked By: _____

(Signature)

Recorded By: Mr. Columbia (Signature)

PROJECT NA	ME: JPG	S-DUI	pact Area PRO	JECT NO: Fall 18 ERM
SAMPLE ID NUMBER: S		DA		_
SAMPLING LOCATION CO				
SAMPLING POINT CODE: DESCRIPTION				
NORTHING:	_ EASTING	G:	ELEV	ATION:
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:		TO DE	SCRIPTION:	BLS
WEATHER:FIELD OBSERVATIONS: _		AC	TIVITIES IN AREA	4: <u>-</u>
	Backgro Sample	Rad Ra	3: 32 cpm : 69 cpm	(5W)
	Dose: 5	AR/hr	TO EAR	(Sea)
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	4R/h		
TEMPERATURE:	6.79	4R/h		
pH:	8.55	pH m5/cm		
CONDUCTIVITY: REDOX:	218			
DO;	11.59	MY		
ORGANIC VAPORS:	-11/9/	mg/1		
TURBIDITY:	3.3	NTU		
OTHER:	_			
SAMPLE TYPE: X GRAB QC TRIP O OTHER (FIAL COMPOSITE RINSATE	☐ TIME COMPOSITE ☐ QC FIELD BLANK
SAMPLE COLLECTED: XYES II IF SAP WAS NOT FOLLOWED,	SPECIFY WHAT	DEVIATION		Y AND WHY:
				
Recorded By: Mak Colle	ell	QC Cł	necked By:	
(Signat	:ure)			(Signature)

SA	ħΛ	ΡI	F	i d	O	G	S	Н	F	FT
-	IVE	г L		L-1	_		•		4	

PROJECT NA			G SHEET ct Area PRO	JECT NO: Fall 18 ERM					
5	W-DU-00	7 - DUP	TE COLLECTED	(MM/DD/YY): <u>/0-23-1</u> 8 TIME: <u>1443</u>					
SAMPLING LOCATION CO DESCRIPTION:	D-DU-00 DDE:								
SAMPLING POINT CODE: DESCRIPTION									
NORTHING:	_ EASTING	G:	ELEV	ATION:					
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE: _		TO DE	SCRIPTION:	BLS					
WEATHER: ACTIVITIES IN AREA: FIELD OBSERVATIONS: Background Rad : 46 cpm									
Background Rad: 46 cpm Sample Rad: 53 cpm (SW) 11 11 : 37 cpm (Sed) Dosk: 5 qR/hc									
	Doge: S	10 // L.	: 3+ epo	(Sed)					
	NUSK · S	4000							
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.					
RADIOACTIVITY:	5	MR/h							
TEMPERATURE:	14.33	100							
PH: CONDUCTIVITY:	8.68	m 5/cm							
REDOX:	166	MY							
DO:	33.73	ma/1	·						
ORGANIC VAPORS:		-							
TURBIDITY:	1.0	NTU							
OTHER: SAMPLE TYPE: X GRAB									
SAMPLE COLLECTED: XYES INO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES INO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Surface water and sediment samples.									
O _{V/}	alicate:	Suiface-	water sample						
Recorded By: <u>MA Colla</u> (Signat		QC Cł	necked By:	(Signature)					

PROJECT NA			G SHEET act Area PRO	DJECT NO: Fall in ERM						
SAMPLE ID NUMBER: 5	W-DU-00 D-DU-00		TE COLLECTED	(MM/DD/YY): 10-23-18 TIME: 1304						
SAMPLING LOCATION CODE: DESCRIPTION:										
SAMPLING POINT CODE: DESCRIPTION										
NORTHING:	_ EASTING	3:	ELEV	/ATION:						
SAMPLE DEPTH CODE: : TO BLS SAMPLE MEDIA CODE: DESCRIPTION:										
WEATHER: ACTIVITIES IN AREA: FIELD OBSERVATIONS:										
Background Rad : 22 cpm Sample Rad : 37 cpm (SW) "" : 41 cpm (Sed) Dose: 5 aR/hr										
	Dose: 3	aR/hr		T I SEE/						
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.						
RADIOACTIVITY:	5	MR/h								
TEMPERATURE:	12.64	MR/h								
pH:	8.61	ρH								
CONDUCTIVITY:	0.325	m 5/cm								
REDOX:	241	MY								
DO;	12.01	mg/1								
ORGANIC VAPORS:		\ <u></u>								
TURBIDITY:	0.0	NTU								
SAMPLE TYPE: CRAB DISPATIAL COMPOSITE DIME COMPOSITE DI QC TRIP BLANK DI QC RINSATE DI QC FIELD BLANK DISPATIAL COMPOSITE DI QC FIELD BLANK DISPATIAL COMPOSITE DI QC FIELD BLANK DISPATIAL COMPOSITE DI QC FIELD BLANK DI QC RINSATE DI QC										
O OTHER	(SPECIFY)	□ QC	RINSATE EDURE WAS FOLLO	☐ QC FIELD BLANK OWED: ÞXYES ☐ NO						
SAMPLE COLLECTED: XYES DIF SAP WAS NOT FOLLOWED,	(SPECIFY) INO SAP SAMI SPECIFY WHAT	D QC	RINSATE EDURE WAS FOLICE S WERE NECESSA	☐ QC FIELD BLANK						
SAMPLE COLLECTED: XYES DIF SAP WAS NOT FOLLOWED,	(SPECIFY) INO SAP SAMI SPECIFY WHAT	D QC	RINSATE EDURE WAS FOLLO	☐ QC FIELD BLANK						
SAMPLE COLLECTED: XYES DIF SAP WAS NOT FOLLOWED,	(SPECIFY)	D QC	RINSATE EDURE WAS FOLICE S WERE NECESSA	☐ QC FIELD BLANK						

PROJECT NAME: JPG-DU-Impact Area PROJECT NO: Fall 18 EAM SAMPLE ID NUMBER: SS-DU-001 DATE COLLECTED (MM/DD/YY): 10-23-18 TIME: **0**919 SAMPLING LOCATION CODE: _____ DESCRIPTION: SAMPLING POINT CODE: _______
DESCRIPTION ______ NORTHING: _____ EASTING: ____ ELEVATION: SAMPLE DEPTH CODE: ____ : ___ TO _____ BLS SAMPLE MEDIA CODE: ____ DESCRIPTION: ____ WEATHER: _____ ACTIVITIES IN AREA: ____ FIELD OBSERVATIONS: Background Rad : 78 cpm

Sample Rad : 56 cpm (5w) Soil

The same of the same o DOSE: 6 AR/hr READING UNITS LAST CALIB. FIELD MEASUREMENTS SERIAL NO. 4R/h RADIOACTIVITY: TEMPERATURE: ρH CONDUCTIVITY: m 5/cm REDOX: DO: **ORGANIC VAPORS:** TURBIDITY: NTU OTHER ____:
 ★ GRAB
 □ SPATIAL COMPOSITE
 □ TIME COMPOSITE

 □ QC TRIP BLANK
 □ QC RINSATE
 □ QC FIELD BLANK
 ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE SAMPLE TYPE: 🗽 GRAB O OTHER (SPECIFY) SAMPLE COLLECTED: XYES II NO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES II NO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Recorded By: Much Caldwell ____ QC Checked By: _____

(Signature)

(Signature)

PROJECT NAME: JPG-DU-Impact Area PROJECT NO: Fall 18 ERM SAMPLE ID NUMBER: SS-DU-002 DATE COLLECTED (MM/DD/YY): 10-23-18 TIME: 1150 SAMPLING LOCATION CODE: DESCRIPTION: SAMPLING POINT CODE: ______
DESCRIPTION _____ NORTHING: _____ EASTING: ____ ELEVATION: ____ SAMPLE DEPTH CODE: _____ TO ______BLS SAMPLE MEDIA CODE: ____ DESCRIPTION: ____ WEATHER: _____ ACTIVITIES IN AREA: ____ FIELD OBSERVATIONS: Background Rad : 30 cpm Sample Rad : 56 cpm (5w) Soil DOSE: 6 4R/hr FIELD MEASUREMENTS UNITS READING SERIAL NO. LAST CALIB. 48/h RADIOACTIVITY: TEMPERATURE: ρH CONDUCTIVITY: m 5/cm REDOX: DO: **ORGANIC VAPORS:** TURBIDITY: NTU OTHER © GRAB □ SPATIAL COMPOSITE □ QC TRIP BLANK □ QC RINSATE SAMPLE TYPE: X GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE QC FIELD BLANK O OTHER (SPECIFY) SAMPLE COLLECTED: XYES II NO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES II NO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Recorded By: Mak Collabol QC Checked By:

(Signature)

(Signature)

PROJECT NAME: JPG-DU-Impact Area PROJECT NO: Fall 18 EAM SAMPLE ID NUMBER: <u>SS- DU- 003</u> DATE COLLECTED (MM/DD/YY): <u>10-23-18</u> 55 - DU - 003 - DUP TIME: 1652 SAMPLING LOCATION CODE: _____ DESCRIPTION: SAMPLING POINT CODE: ______ NORTHING: _____ EASTING: ____ ELEVATION: ____ SAMPLE DEPTH CODE: ____ TO ____ BLS SAMPLE MEDIA CODE: ____ DESCRIPTION: ____ WEATHER: ACTIVITIES IN AREA: FIELD OBSERVATIONS: Sample Rad : 77 cm (5w) Seil UNITS FIELD MEASUREMENTS READING SERIAL NO. LAST CALIB. 4R/h RADIOACTIVITY: 06 TEMPERATURE: ρH CONDUCTIVITY: m 5/cm REDOX: **ORGANIC VAPORS:** TURBIDITY: NTU OTHER_
 ™
 GRAB
 □
 SPATIAL COMPOSITE
 □
 TIME COMPOSITE

 □
 QC TRIP BLANK
 □
 QC RINSATE
 □
 QC FIELD BLANK
 ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE SAMPLE TYPE: X GRAB O OTHER (SPECIFY) ____ SAMPLE COLLECTED: XYES □ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: XYES □ NO IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY: Soil sample Applicated sample collected Recorded By: 124 Collected By: _____ (Signature) (Signature)

SAMPLE ID NUMBER:	· · · · · · · · · · · · · · · · · · ·			OJECT NO: Fall (MM/DD/YY): <u>lo</u> TIME: <u>14</u>	-23-1
SAMPLING LOCATION CO					
SAMPLING POINT CODE: DESCRIPTION	· · · · · · · · · · · · · · · · · · ·				
NORTHING:	_ EASTIN	G:	ELEV	ATION:	
SAMPLE DEPTH CODE: _ SAMPLE MEDIA CODE:		TO	SCRIPTION:		BLS
WEATHER:FIELD OBSERVATIONS: _	Backgro	AC	TIVITIES IN ARE	A:	
	Sample	Rad	: 37 ip	1 (5w) Soil	,
	Dose :	AR/hr	<i></i>	u	-23-18
FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALI	В.
RADIOACTIVITY:	5	48/h			
TEMPERATURE:		4R/h			
pH:		04		 	
CONDUCTIVITY:		m 5/cm			
REDOX:		MY		<u> </u>	
ORGANIC VAPORS:		mg/1			
TURBIDITY:		NTU			
OTHER:					
SAMPLE TYPE: X GRAB Q CTRIP OTHER (SAMPLE COLLECTED: XYES D IF SAP WAS NOT FOLLOWED, S	SPECIFY) NO SAP SAM	D QC F		□ QC FIELD BLAN DWED: DXYES □ NO	
	specify WHA		O VVERE INECESSAL	CI WIND AND I.	
Recorded By: Mr. Color	00		a along D		
recorded by: /% (Labela	»FY	uu in	ecked By:		

Mark Caldwell

Location Former JPG - Madison, IN Date 10-24-18

Project / Client Fall 18 ERM / USACE

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restamerica St. Louis

13715 Rider Trail North

Earth City, MO 63045 Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

	Sampler:	1 0	1	Į.	ab PM:		77	1/			Carr	ier Trac	king No(s):		COC No:	
Client Information Client Contact:	Phone:	<u>, </u>	4awc11		-Mail:		Iva	· Va	ania		4		_			Page:	
Mr. Mark Caldwell	865.	481.	3200		-wan.			7								10	:4
Company: XCEL Engineering Inc.		· -				•			Analy	sis Re	gues	sted				Job #:	-
Address; 1066 Commerce Park Drive	Due Date Requeste	rd:	_		\$ 15 K				T		i –				7. 7.	Preservation Cod	es:
City:	TAT Requested (da	ys):					1						ļ			A - HCL B - NaOH	M - Hexane N - None
Oak Ridge Slate, Zip:	· .				A STATE OF											C - Zn Acetate D - Nitric Acid	O - AsNaO2 P - Na2O4S
TN, 37830		andara	*\ 		- 14 14		Ure									E - NaHSO4	Q - Na2SO3 R - Na2S2O3
Phone: 865. 766. 8547	PO#:				<u>_</u>								ļ		180 S.	G - Amchlor H - Ascorbic Acid	S - H2SO4 T - TSP Dodecahydrate
Email: mcaldwell@xceleng.com	WO #:				or N	(O)	topic									I - Ice J - DI Water	U - Acetone V - MCAA
Project Name: Fall 18 ERM	Project #:				e (Yes	JO Se	60 t									K - EDTA L - EDA Other:	W - pH 4-5 Z - other (specify)
Project Name: Fall '18 ERM Site: JPG - DU I-pact Area	SSOW#:				Sampl	y) as	T								20 C		•
			Sample	Matrix	, ered	WS!									1		
		Sample	Type (C=comp,	(W=wate S=solid,	111	Perform	ota					1			3		
Sample Identification	Sample Date	Time	G=grab)		pAir)	E E									Total	Special In	structions/Note:
		$\gg <$	effettagen and many	ation Cod	<u>። X</u>	\bowtie			To the second	. %	# PO	-3		1200	<u> </u>	Service and the service and th	eran parameteran di Santan
MW-DU-001	10-23-18	0947	G	W	_N	N	2				_		_		2		
1 002		0913	Ţ			1	1				_					All Sam	ples are
003	1	0759				Ш									3,400	Consolid	ated into
004	10-22-18	1428			$\perp \parallel$	Ш										three (3) coolers.
004-DUP	10-22-18	1428				Ш	11_		_ _		$oldsymbol{ol}}}}}}}}}}}}}}}}}$				94.38	One (1)	COC For
005	10-23-18	1314				Щ									76	all Sa	mples.
006		1431			Щ	Ш			\perp						ě H		1
007	L	1458				Ш	Ц_		1	_	<u> </u>						
008	10-22-18	1349			_	Ш	4		-		ــــــــ		_		\$ P		
009	10-23-18	1222			Щ.	Ш	1		$\perp \perp$		1_		\perp		77	2	
<u> </u>	<u> </u>	1206		<u> </u>	\\	•	<u> </u>										
Possible Hazard Identification Non-Hazard Flammable Skin Irritant Poiso	_ []	r1_				San	–									ned longer than 1 in	
Non-Hazard Flammable Skin Irritant Poisc Deliverable Requested: I, II, III, IV, Other (specify)	n B — Unkno	wn —R	adiological			Spe	<i>Returr</i> cial Instr	<i>To Cli</i>			<i>Dispo</i> ents:	sal By	Lab		₹ Arci	nive For [Months
Empty Kit Relinquished by:		Date:			Tin	ne:						Method	of Ship	ment:	1)	<u>5P</u>	
Relinquished by: Mark Caldwell Relinquished by:	Date/Time: 10-24-16 /	081	,	Company		1	Received b	oy:					Date	e/Time:		- 1	Company
Relinquished by:	Date/Time:	ישט		Company	<u> </u>	- 	Received b	oy:					Date	e/Time:		 	Company
Relinquished by:	Date/Time:			Company		-	Received b	y:					Date	e/Time:			Company
Custody Seals Intact: Custody Seal No.: Δ Yes Δ No	<u> </u>					+	Cooler Ten	nperature	(s) °C and	d Other F	Remarks	:			-		· · · · · · · · · · · · · · · · · · ·

13/15 Rider Frait North Earth City, MO 63045

Chain of Custody Record



Phone (314) 298-8566 Fax (314) 298-8757 Carrier Tracking No(s): Ivan Vagia Client Information Client Contact: Mr. Mark Caldwell Company: **Analysis Requested** XCEL Engineering Inc. Address: Due Date Requested: Preservation Codes: 1066 Commerce Park Drive M - Hexane City: TAT Requested (days): B ~ NaOH N - None Oak Ridge C - Zn Acetate Standard D - Nitric Acid P - Na2O4S State, Zip: E - NaHSO4 Q - Na2SO3 TN, 37830 F - MeOH R - Na2S2O3 G - Amchlor S - H2SO4 865. 766. 8547 T - TSP Dodecahydrate H - Ascorbic Acid Iso topic Email: 1-lce U - Acetone mcaldwell@xceleng.com J - DI Water V-MCAA of containers W - pH 4-5 K - EDTA Project #: L - EDA Z - other (specify) SSOW#: Other: **Total Number** Matrix Sample (W=water. Type S=solid, O=waste/oil, (C=comp, Sample G=grab) BT=Tissue, A=Alr Sample Identification Sample Date Time Special Instructions/Note: Preservation Code: 2 MW-DU -011 10-23-19 1252 SW-DU -001 1350 1336 002 0934 003 1006 004 1239 005 006 0841 007 1443 007 - DUP 1443 008 1304 Possible Hazard Identification Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) Disposal By Lab Non-Hazard Flammable Skin Irritant Poison B Unknown Radiological Return To Client Archive For Months Deliverable Requested: I, II, III, IV, Other (specify) Special Instructions/QC Requirements: Empty Kit Relinquished by: Method of Shipment: Time: USP Relinquished by: Company Received by: Date/Time: Company 10-24-18 XCEL Relinguished by: Received by: Date/Time: Date/Time: Company Received by: Relinquished by: Company Custody Seals Intact: Custody Seal No.: Cooler Temperature(s) °C and Other Remarks: Δ Yes Δ No

l'estAmerica St. Louis

13715 Rider Trail North Earth City, MO 63045

Phone (314) 298-8566 Fax (314) 298-8757

Chain of Custody Record



1 Halle (017) 200 0000 1 4x (014) 200 0107	, 																	
Client Information	Sampler:	1 Ca	4dwc1	Lab F	PM:	7	-va-	Va	ania	_	Ca	rrier Ti	racking	No(s):			COC No:	
Cilent Contact: Mr. Mark Caldwell	(Phone: _	.481.3		E-Ma	iil:					-	\Box			_			Page: 3	14
Company: XCEL Engineering Inc.									Analy	reie F	Seniii	aeta	d				Job#:	
Address:	Due Date Request	ed:		- ,		旅	T	ТΤ	Allais	3.3	tequi			П	\neg	Ŷ.	Preservation Cod	es:
1066 Commerce Park Drive City:	TAT Requested (d	ays):		· · · · · · · · · · · · · · · · · · ·			1						1			i i	A - HCL B - NaOH	M - Hexane N - None
Oak Ridge State, Zip:	. >	andaro	1				7								-		C - Zn Acetate D - Nitric Acid	O - AsNaO2 P - Na2O4S
TN, 37830			١		13 M	, ا	Ure									2.1	E - NaHSO4 F - MeOH	Q - Na2SO3 R - Na2S2O3
Phone: 865, 766, 8547	PO#:				ြ		1								ĺ		G - Amchlor H - Ascorbic Acid	S - H2SO4 T - TSP Dodecahydrate
Email: mcaldwell@xceleng.com	WO #:	-			O. C	ON I	topic								1	:: :4	ା I - Ice ଜ୍ୟୁ J - DI Water	U - Acetone V - MCAA
Project Name: Fall 18 ERM	Project #:				18	-	ot	1								1	K - EDTA L - EDA	W - pH 4-5 Z - other (specify)
Sile: JPG - DU Impact Area	ssow#:			·	ample) 	7									000	Other:	
7			Sample	Matrix	red (함 -	_									្នាំ		
		0	Type	(W≖water, S≖solid,	NE I	Fill -	4								- 1	2		
Sample Identification	Sample Date	Sample Time	(C≕comp, G≃grab)	O=waste/oil, BT=Tissue, A=Air)	Field		٥									1012	Special In	structions/Note:
A STATE OF THE STA		\gg	Same and	ation Code:	X		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.67		<u> </u>			1 5.3		10 10	<u> </u>	China and and	Alter and server of the server
SD-DU - 001	10-23-18	1350	<u> </u>	S	MV	Ш	_				\perp		1		_		Š.	
001-009		1350			Ш	Ш			\perp			_	<u> </u>			À	All Sa-	ples are
002		1336			Ш											#. (See 2)	Consolid	ated into
003		0934														100 M	three (3) coolers.
004		1006														2000	One (1)	COC For
005		1239														2000	all Sa	moles.
006		0841														25.	*####	7
007		1443															3023	
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Possible Hazard Identification	<u></u>			•	s					nay b	7				s are	retair	ned longer than 1 i	
Non-Hazard Flammable Skin Irritant Poiso Deliverable Requested: I, II, III, IV, Other (specify)	on B Unkno	own R	adiological		s			To Cli		quiren			By Lai	<u> </u>		₹ Arcl	hive For	Months
Empty Kit Relinquished by:		Date:			Time	·							hod of	Shipme	int:	13	SP	·
77	Date/Time:			Company			ceived b							Date/T	ime:		<u> </u>	Company
Relinquished by: Mark Callsell Relinquished by:	10-24-18 Date/Time:	108	<u> </u>	Company		Re	ceived b	 .y:				·		Date/T	ime:			Company
Relinquished by:	Date/Time:			Company		Re	ceived b	y:						Date/Time:				Company
Custody Seals Intact: Custody Seal No.:				 		Cooler Temperature(s) °C and Other Remarks:												
Δ Yes Δ No						1	5,61 TGH	.,,,,,,,,,,,,,,			AMING							

Phone (314) 298-8566 Fax (314) 298-8757

Earth City. MO 63045

Chain of Custody Record

THE LEADER IN ENVIRONMENTAL TESTING

Carrier Tracking No(s): Sampler: Ivan Vania Client Information Client Contact: Page: Mr. Mark Caldwell Company: XCEL Engineering Inc. **Analysis Requested** Due Date Requested: Preservation Codes: 1066 Commerce Park Drive M - Hexane City: TAT Requested (days): B - NaOH N - None Oak Ridge C - Zn Acetate O - AsNaO2 Standard D - Nitric Acid P - Na2O4S State, Zip: F - NaHSO4 O - Na2SO3 TN. 37830 F ~ MeOH R - Na2S2O3 PO #: Phone. G - Amchior S - H2SO4 865. 766. 8547 H - Ascorbic Acid T - TSP Dodecahydrate Isotopic WO# Email: L-Ice U - Acetone J - Di Water V - MCAA mcaldwell@xceleng.com K - FDTA W - pH 4-5 Project#: Project Name: L-FDA Z - other (specify) 950W# Other: Matrix Sample Type (W=water, Suspild, O=waste/oil, G=grab) BT=Tiesue, A=Air) (wewater. Sample Sample Date Time Sample Identification Special Instructions/Note: Preservation Code: SS- DU - 001 0919 1150 002 003 1052 003 - DUP 1052 004 1419 Possible Hazard Identification Sample Disposal (A fee may be assessed if samples are retained longer than 1 month) Disposal By Lab Archive For Skin Irritant Poison B Unknown Radiological Return To Client Non-Hazard Flammable Months Special Instructions/QC Requirements: Deliverable Requested: I, II, III, IV, Other (specify) Method of Shipment: Empty Kit Relinguished by: Time: USP Date/Time: 10-24-18 / Received by: Date/Time: Company Company Company Received by: Date/Time: Company Relinquished by: Relinquished by: Date/Time: Company Received by: Date/Time: Company Custody Seals Intact: Custody Seal No.: Cooler Temperature(s) °C and Other Remarks: Δ Yes Δ No

APPENDIX C DATA VALIDATION SUMMARY

SPRING 2018 DATA VALIDATION

C. DATA VALIDATION SUMMARY

C.1 TESTAMERICA SDG 160-28187

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) Environmental Radiation Monitoring (ERM) April 2018 samples and analyses that are associated with the above-referenced laboratory and sample delivery group (SDG) number. These data points have been selected for data validation, and the sample data summary sheets on the following pages specifically identify the samples and analyses associated with this validation review.

The JPG validation technical review was conducted in accordance with the U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (July 2002) and Leidos Quality Assurance Technical Procedure (QATP) Environmental Science and Engineering (ESE) DM-05, Data Verification and Validation (Revision 0, 1/2015). The validation technical review was based on the information and documentation supplied by the associated laboratory. The analyses were evaluated against criteria established in the related analytical procedures and the JPG data quality requirements.

The attachment to this report provides the sample data summary sheets for the samples associated with the above-referenced SDG. These summary sheets identify the analytical values and the qualifiers for each sample and parameter. The attachment also outlines the validation qualifiers and reason codes used in the validation of the data.

Report Summary									
Total Number of Samples	35								
Total Number of Data Points*	140								
Total Number of Rejected Data Points	0								
Percent Completeness (approval to rejection ratio)	100%								

^{*}Includes 140 alpha spectrometry results.

C.1.1 Analytical Category: Radiochemical and ICP-MS

- Uranium-234 (U-234), uranium-235 (U-235), and uranium-238 (U-238) were determined by alpha spectrometry (U.S. Department of Energy Health and Safety Laboratory [DOE HASL]-300 Methods Compendium A-01-R) with SDG 160-28187-1. Total uranium was calculated using a published specific activity value for U-238 and assuming all the mass originates from U-238.
- All total/isotopic uranium samples were analyzed by DOE A-01-R-MOD with SDG 160-28187.
- No samples were reanalyzed for total uranium via inductively coupled plasma-mass spectrometry (ICP-MS).
- 1. The following items (as applicable) have been addressed during the validation review:
 - Sample custody, integrity, and preservation
 - Sample handling and preparation
 - Holding times
 - Instrument calibration and performance
 - Dilution factors
 - Detection limits
 - Laboratory background and carry-over
 - Overall assessment of the data

- Alpha spectrometry quality control (QC)
 - Calibration checks and background
 - Preparation blanks
 - Uncertainty/detected value comparison
 - Laboratory control samples
 - Field blanks (if available)
 - Chemical yield (tracer recovery)
 - Laboratory duplicates
 - Sample holding times
- 2. The above items were found to be acceptable, except as follows:
 - Overall Assessment of Data—U-234, U-235, and U-238 radiochemical sample data with results greater than the minimum detectable concentration (MDC) were qualified as estimated, J, reason code 37 in instances where the associated error was greater than 50 percent of the sample result.
 - **Method Blank Uncertainty**—U-234 results were qualified as estimated, *J*, with reason code 6 where the sediment sample result is less than 10 times the concentration found in the associated method blank.
 - Sample Duplicate RPD Precision—U-238 result was qualified as estimated, J, with reason code 19 for which the RPD was affected by the elevated parent result.

The attached sample data summary for soil and water samples provides the qualifiers and the appropriate validation code for all samples.

SAMPLE INDEX	
Laboratory:	SDG #s:
Test America Laboratories, Inc.	160-28187-1

Client I.D.	Sample I.D.*	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-001	LDOS29E	160-28187-01	4/29/2018	Total and Isotopic Uranium
MW-DU-002	LDOS29E	160-28187-02	4/29/2018	Total and Isotopic Uranium
MW-DU-003	LDOS29E	160-28187-03	4/29/2018	Total and Isotopic Uranium
MW-DU-003	LDOS29DE	160-28187-04	4/29/2018	Total and Isotopic Uranium
MW-DU-004	LDOS29E	160-28187-05	4/28/2018	Total and Isotopic Uranium
MW-DU-005	LDOS29E	160-28187-06	4/29/2018	Total and Isotopic Uranium
MW-DU-006	LDOS29E	160-28187-07	4/29/2018	Total and Isotopic Uranium
MW-DU-007	LDOS29E	160-28187-08	4/29/2018	Total and Isotopic Uranium
MW-DU-008	LDOS29E	160-28187-09	4/28/2018	Total and Isotopic Uranium
MW-DU-009	LDOS29E	160-28187-10	4/29/2018	Total and Isotopic Uranium
MW-DU-010	LDOS29E	160-28187-11	4/29/2018	Total and Isotopic Uranium
MW-DU-011	LDOS29E	160-28187-12	4/29/2018	Total and Isotopic Uranium
SD-DU-001	LDOS29E	160-28187-22	4/29/2018	Total and Isotopic Uranium
SD-DU-002	LDOS29E	160-28187-23	4/29/2018	Total and Isotopic Uranium
SD-DU-003	LDOS29E	160-28187-24	4/29/2018	Total and Isotopic Uranium
SD-DU-004	LDOS29E	160-28187-25	4/29/2018	Total and Isotopic Uranium
SD-DU-005	LDOS29E	160-28187-26	4/29/2018	Total and Isotopic Uranium
SD-DU-006	LDOS29E	160-28187-27	4/29/2018	Total and Isotopic Uranium
SD-DU-007	LDOS29E	160-28187-28	4/29/2018	Total and Isotopic Uranium
SD-DU-007	LDOS29DE	160-28187-29	4/29/2018	Total and Isotopic Uranium
SD-DU-008	LDOS29E	160-28187-30	4/29/2018	Total and Isotopic Uranium
SW-DU-001	LDOS29E	160-28187-13	4/29/2018	Total and Isotopic Uranium
SW-DU-002	LDOS29E	160-28187-14	4/29/2018	Total and Isotopic Uranium
SW-DU-003	LDOS26E	160-28187-15	4/29/2018	Total and Isotopic Uranium
SW-DU-004	LDOS29E	160-28187-16	4/29/2018	Total and Isotopic Uranium
SW-DU-005	LDOS29E	160-28187-17	4/29/2018	Total and Isotopic Uranium
SW-DU-006	LDOS28E	160-28187-18	4/29/2018	Total and Isotopic Uranium
SW-DU-006	LDOS28DE	160-28187-19	4/29/2018	Total and Isotopic Uranium
SW-DU-007	LDOS29E	160-28187-20	4/29/2018	Total and Isotopic Uranium
SW-DU-008	LDOS29E	160-28187-21	4/29/2018	Total and Isotopic Uranium
SS-DU-001	LDOS29E	160-28187-31	4/29/2018	Total and Isotopic Uranium
SS-DU-002	LDOS29E	160-28187-32	4/29/2018	Total and Isotopic Uranium
SS-DU-002	LDOS29DE	160-28187-33	4/29/2018	Total and Isotopic Uranium
SS-DU-003	LDOS29E	160-28187-34	4/29/2018	Total and Isotopic Uranium
SS-DU-004	LDOS29E	160-28187-35	4/29/2018	Total and Isotopic Uranium

^{*} The Leidos sample I.D. (LDOS29E) is a unique designation that provides a tracking procedure in the electronic database for data retrieval.

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ATTACHMENT JEFFERSON PROVING GROUND SAMPLE DATA SUMMARY

			Water Sample Summ	ary				
Site I.D.	Cample I D	Mathad	Anglyta	Value	Error	MDC	Final	Reason
Site I.D. MW-DU-001	Sample I.D. LDOS29E	Method DOE A-01-R MOD	Analyte Total Uranium	0.65	0.144	MIDC 0	Qual	Code
MW-DU-001	LDOS29E LDOS29E	DOE A-01-R MOD	Uranium 234	0.05	0.0894	0.0588	J	37
MW-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0397	0.0094	0.0397	J	37
MW-DU-001	LDOS29E LDOS29E	DOE A-01-R MOD	Uranium 238	0.0397	0.046	0.0397	J	31
MW-DU-002	LDOS29E	DOE A-01-R MOD	Total Uranium	1.15	0.0907	0.0319		
MW-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 234	0.648	0.162	0.059		
MW-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0223	0.103	0.0335	U	
MW-DU-002	LDOS29E LDOS29E	DOE A-01-R MOD	Uranium 238	0.0223	0.122	0.0335	U	
MW-DU-002	LDOS29E LDOS29DE	DOE A-01-R MOD	Total Uranium	1.29	0.122	0.0495		-
MW-DU-003	LDOS29DE	DOE A-01-R MOD	Uranium 234	1.09	0.232	0.0572		
MW-DU-003	LDOS29DE LDOS29DE	DOE A-01-R MOD				0.0372	-	37
	_		Uranium 235	0.0515	0.0517		J	31
MW-DU-003	LDOS29DE	DOE A-01-R MOD	Uranium 238	0.425	0.139	0.0679		
MW-DU-003	LDOS29E	DOE A-01-R MOD	Total Uranium	1.05	0.187	0		
MW-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 234	0.834	0.201	0.0587		<u> </u>
MW-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0418	0.0552	0.0868	U	<u> </u>
MW-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 238	0.345	0.125	0.0585		
MW-DU-004	LDOS29E	DOE A-01-R MOD	Total Uranium	0.855	0.162	0		
MW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 234	0.779	0.188	0.0833		
MW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 235	0.045	0.0565	0.0884	U	
MW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 238	0.28	0.109	0.0632		
MW-DU-005	LDOS29E	DOE A-01-R MOD	Total Uranium	0.696	0.143	0		
MW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 234	0.674	0.172	0.0632		
MW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0239	0.0339	0.0359	U	
MW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 238	0.23	0.0959	0.0288		ļ
MW-DU-006	LDOS29E	DOE A-01-R MOD	Total Uranium	4.42	0.324	0		
MW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 234	1.92	0.261	0.0773		
MW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0243	0.0415	0.0738	U	
MW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 238	1.48	0.218	0.0466		
MW-DU-007	LDOS29E	DOE A-01-R MOD	Total Uranium	2.63	0.317	0		
MW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 234	1.38	0.279	0.0918		
MW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0851	0.0698	0.0425	J	37
MW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 238	0.871	0.213	0.0629	J	19
MW-DU-008	LDOS29E	DOE A-01-R MOD	Total Uranium	0.606	0.102	0		
MW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 234	0.739	0.142	0.0471		
MW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0613	0.0441	0.0473	J	37
MW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 238	0.194	0.0679	0.0379		
MW-DU-009	LDOS29E	DOE A-01-R MOD	Total Uranium	0.499	0.0913	0	_	
MW-DU-009	LDOS29E	DOE A-01-R MOD	Uranium 234	0.708	0.133	0.0347		
MW-DU-009	LDOS29E	DOE A-01-R MOD	Uranium 235	0.055	0.0369	0.0183	J	37
MW-DU-009	LDOS29E	DOE A-01-R MOD	Uranium 238	0.159	0.0611	0.0492		
MW-DU-010	LDOS29E	DOE A-01-R MOD	Total Uranium	2.29	0.276	0		
MW-DU-010	LDOS29E	DOE A-01-R MOD	Uranium 234	1.73	0.3	0.0553		
MW-DU-010	LDOS29E	DOE A-01-R MOD	Uranium 235	0.107	0.0759	0.0688	J	37
MW-DU-010	LDOS29E	DOE A-01-R MOD	Uranium 238	0.754	0.185	0.0551		
MW-DU-011	LDOS29E	DOE A-01-R MOD	Total Uranium	0.561	0.133	0		
MW-DU-011	LDOS29E	DOE A-01-R MOD	Uranium 234	0.453	0.145	0.0588		
MW-DU-011	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0529	0.0531	0.0397	J	37
MW-DU-011	LDOS29E	DOE A-01-R MOD	Uranium 238	0.18	0.0888	0.0318		
SW-DU-001	LDOS29E	DOE A-01-R MOD	Total Uranium	0.62	0.133	0		
SW-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 234	1.69	0.295	0.0721		
SW-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0851	0.0647	0.0365	J	37

			Water Sample Summa	ary				
0:: 1.0	2						Final	Reason
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Qual	Code
SW-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 238	0.195	0.0888	0.0293		
SW-DU-002	LDOS29E	DOE A-01-R MOD	Total Uranium	0.992	0.181	0		
SW-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 234	0.843	0.202	0.0585		
SW-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0659	0.0592	0.0395	J	37_
SW-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 238	0.323	0.121	0.0584		
SW-DU-003	LDOS26E	DOE A-01-R MOD	Total Uranium	0.0829	0.0536	0		
SW-DU-003	LDOS26E	DOE A-01-R MOD	Uranium 234	0.283	0.111	0.0661	J	37
SW-DU-003	LDOS26E	DOE A-01-R MOD	Uranium 235	0.0125	0.025	0.0375	U	
SW-DU-003	LDOS26E	DOE A-01-R MOD	Uranium 238	0.0259	0.0358	0.0554	U	
SW-DU-004	LDOS29E	DOE A-01-R MOD	Total Uranium	0.545	0.127	0		
SW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 234	0.368	0.125	0.0635		
SW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 235	0	0.01	0.036	U	
SW-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 238	0.183	0.0854	0.0289		
SW-DU-005	LDOS29E	DOE A-01-R MOD	Total Uranium	0.754	0.154	0		
SW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 234	0.363	0.128	0.0679		
SW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0386	0.0447	0.0386	J	37
SW-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 238	0.248	0.103	0.0309		
SW-DU-006	LDOS28DE	DOE A-01-R MOD	Total Uranium	0.269	0.068	0		
SW-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 234	0.236	0.0806	0.0694		
SW-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 235	0.0267	0.0268	0.02	J	37
SW-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 238	0.0864	0.0455	0.0378	J	37
SW-DU-006	LDOS28E	DOE A-01-R MOD	Total Uranium	0.308	0.0929	0		
SW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 234	0.263	0.103	0.0613		
SW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 235	0.00677	0.0252	0.0641	Ū	
SW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 238	0.102	0.0623	0.0279	j	37
SW-DU-007	LDOS29E	DOE A-01-R MOD	Total Uranium	0.375	0.0809	0		
SW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 234	0.261	0.0775	0.0437		
SW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 235	-0.00207	0.0299	0.0692	U	
SW-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 238	0.126	0.0542	0.0436		
SW-DU-008	LDOS29E	DOE A-01-R MOD	Total Uranium	1.25	0.212	0		
SW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 234	0.67	0.182	0.0801		
SW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 235	0	0.0113	0.0405	U	
SW-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 238	0.42	0.142	0.0799		

^{*}The sample specific detection limit value is shown in the MDC column for SW-846 6020A results.

		Soil/S	Sediment Sample Su	mmary				
					_		Final	Reason
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Qual	Code
SD-DU-001	LDOS29E	DOE A-01-R MOD	Total Uranium	0.886	0.118	0 0047		
SD-DU-001 SD-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 234	0.305	0.0815	0.0317	J	6
SD-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0395	0.0323	0.0332	J	37
SD-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 238	0.291	0.0791	0.0266		
SD-DU-002	LDOS29E LDOS29E	DOE A-01-R MOD DOE A-01-R MOD	Total Uranium Uranium 234	0.956 0.216	0.118 0.0676	0.0526		6
SD-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 235	-0.014	0.0076	0.0528	J	6
SD-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 238	0.323	0.0274	0.0009	0	
SD-DU-002	LDOS29E	DOE A-01-R MOD	Total Uranium	2.14	0.0793	0.0311		-
SD-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 234	0.617	0.122	0.0272		
SD-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0183	0.122	0.0272	J	37
SD-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 238	0.0103	0.0212	0.0103	J	
SD-DU-003	LDOS29E	DOE A-01-R MOD	Total Uranium	0.504	0.0863	0.0322		
SD-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 234	0.244	0.0003	0.0251	J	6
SD-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0033	0.0123	0.0231	U	
SD-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 238	0.0033	0.0123	0.0299	0	
SD-DU-005	LDOS29E	DOE A-01-R MOD	Total Uranium	1.19	0.141	0.0299		
SD-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 234	0.207	0.0668	0.0275	J	6
SD-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 235	0.207	0.0006	0.0275	U	
SD-DU-005	LDOS29E	DOE A-01-R MOD	Uranium 238	0.397	0.0173	0.0149		
SD-DU-006	LDOS29E	DOE A-01-R MOD	Total Uranium	1.28	0.0347	0.0149		
SD-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 234	0.422	0.0967	0.0263		
SD-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0356	0.0307	0.0203	J	37
SD-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 238	0.423	0.0292	0.0178	J	- 31
SD-DU-007	LDOS29DE	DOE A-01-R MOD	Total Uranium	1.14	0.134	0.0140		
SD-DU-007	LDOS29DE	DOE A-01-R MOD	Uranium 234	0.393	0.0924	0.0342		
SD-DU-007	LDOS29DE	DOE A-01-R MOD	Uranium 235	0.0125	0.0324	0.038	U	
SD-DU-007	LDOS29DE	DOE A-01-R MOD	Uranium 238	0.38	0.0897	0.0139		
SD-DU-007	LDOS29E	DOE A-01-R MOD	Total Uranium	0.975	0.124	0.0100		
SD-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 234	0.404	0.0946	0.0264		
SD-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0332	0.0297	0.0329	J	37
SD-DU-007	LDOS29E	DOE A-01-R MOD	Uranium 238	0.323	0.0833	0.0264	-	
SD-DU-008	LDOS29E	DOE A-01-R MOD	Total Uranium	0.462	0.0838	0		
SD-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 234	0.126	0.0507	0.0263	J	6
SD-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0177	0.0205	0.0177	J	37
SD-DU-008	LDOS29E	DOE A-01-R MOD	Uranium 238	0.153	0.0562	0.0312		
SS-DU-001	LDOS29E	DOE A-01-R MOD	Total Uranium	2.69	0.229	0		·
SS-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 234	0.731	0.136	0.0431		
SS-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0356	0.0341	0.0457	U	
SS-DU-001	LDOS29E	DOE A-01-R MOD	Uranium 238	0.9	0.154	0.0326		
SS-DU-002	LDOS29DE	DOE A-01-R MOD	Total Uranium	2.7	0.224	0		
SS-DU-002	LDOS29DE	DOE A-01-R MOD	Uranium 234	0.785	0.139	0.0309		
SS-DU-002	LDOS29DE	DOE A-01-R MOD	Uranium 235	0.0234	0.0235	0.0175	J	37
SS-DU-002	LDOS29DE	DOE A-01-R MOD	Uranium 238	0.904	0.151	0.0141		
SS-DU-002	LDOS29E	DOE A-01-R MOD	Total Uranium	2.54	0.213	0		
SS-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 234	0.827	0.141	0.03		
SS-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0397	0.0302	0.017	J	37
SS-DU-002	LDOS29E	DOE A-01-R MOD	Uranium 238	0.847	0.143	0.0137		
SS-DU-003	LDOS29E	DOE A-01-R MOD	Total Uranium	1.58	0.163	0.		
SS-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 234	0.572	0.116	0.0315		

	Soil/Sediment Sample Summary									
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code		
SS-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0418	0.0318	0.0179	J	37		
SS-DU-003	LDOS29E	DOE A-01-R MOD	Uranium 238	0.525	0.11	0.0265				
SS-DU-004	LDOS29E	DOE A-01-R MOD	Total Uranium	1.44	0.155	0				
SS-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 234	0.491	0.106	0.0265				
SS-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 235	0.0308	0.0301	0.0392	U			
SS-DU-004	LDOS29E	DOE A-01-R MOD	Uranium 238	0.48	0.104	0.0264				

Data Validation Reason Code

- Associated error was greater than 50 percent of the sample result. Method blank contamination.

 Inorganic laboratory duplicate or MS/MSD RPD outside QC limits. 37
- 6
- 19

FALL 2018 DATA VALIDATION

C. DATA VALIDATION SUMMARY

C.1 TESTAMERICA SDG 160-31536

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) Environmental Radiation Monitoring (ERM) October 2018 samples and analyses that are associated with the above-referenced laboratory and sample delivery group (SDG) number. These data points have been selected for data validation, and the sample data summary sheets on the following pages specifically identify the samples and analyses associated with this validation review.

The JPG validation technical review was conducted in accordance with the U.S. Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review (July 2002) and Leidos Quality Assurance Technical Procedure (QATP) Environmental Science and Engineering (ESE) DM-05, Data Verification and Validation (Revision 0, 1/2015). The validation technical review was based on the information and documentation supplied by the associated laboratory. The analyses were evaluated against criteria established in the related analytical procedures and the JPG data quality requirements.

The attachment to this report provides the sample data summary sheets for the samples associated with the above-referenced SDG. These summary sheets identify the analytical values and the qualifiers for each sample and parameter. The attachment also outlines the validation qualifiers and reason codes used in the validation of the data.

Report Summary	
Total Number of Samples	35
Total Number of Data Points*	144
Total Number of Rejected Data Points	0
Percent Completeness (approval to rejection ratio)	100%

^{*}Includes 140 alpha spectrometry results and 4 ICP-MS results.

C.1.1 Analytical Category: Radiochemical and ICP-MS

- Uranium-234 (U-234), uranium-235 (U-235), and uranium-238 (U-238) were determined by alpha spectrometry (U.S. Department of Energy Health and Safety Laboratory [DOE HASL]-300 Methods Compendium A-01-R) with SDG 160-31536-1. Total uranium was calculated using a published specific activity value for U-238 and assuming all the mass originates from U-238.
- Uranium-233 (U-233), U-234, U-235, uranium-236 (U-236), and U-238 were reanalyzed on one surface water sample by inductively coupled plasma-mass spectrometry (ICP-MS) (SW846 6020A) per client request with SDG 160-31536-2. All results were reported.
- All total/isotopic uranium samples were analyzed by DOE A-01-R-MOD with SDG 160-31536-1.
- One surface water sample was reanalyzed for total uranium by Method SW846 6020A with SDG 160-31536-2. All data quality objectives were met for the SW846 Method 6020A analysis.
- 1. The following items (as applicable) have been addressed during the validation review:
 - Sample custody, integrity, and preservation
 - Sample handling and preparation
 - Holding times
 - Instrument calibration and performance
 - Dilution factors
 - Detection limits

- Laboratory background and carry-over
- Overall assessment of the data
- Alpha spectrometry quality control (QC)
 - Calibration checks and background
 - Preparation blanks
 - Uncertainty/detected value comparison
 - Laboratory control samples
 - Field blanks (if available)
 - Chemical yield (tracer recovery)
 - Laboratory duplicates
 - Sample holding times

ICP/MS QC

- Initial and continuing calibration verification
- Reporting limit check standard
- Preparation blanks
- Initial and continuing calibration blanks
- Laboratory control samples
- Interference check standard
- Serial dilution
- Internal standard performance
- Sample holding times.
- 2. The above items were found to be acceptable, except as follows:
 - Overall Assessment of Data—U-234, U-235, and U-238 radiochemical sample data with results greater than the minimum detectable concentration (MDC) were qualified as estimated, J, reason code 37 in instances where the associated error was greater than 50 percent of the sample result.

The attached sample data summary for soil and water samples provides the qualifiers and the appropriate validation code for all samples.

SAMPLE INDEX	
Laboratory:	SDG #s:
Test America Laboratories, Inc.	160-531536-1, 160-531536-2

Client I.D.	Sample I.D.*	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-001	LDOS30E	160-531536-01	10/23/2018	Total and Isotopic Uranium
MW-DU-002	LDOS30E	160-531536-02	10/23/2018	Total and Isotopic Uranium
MW-DU-003	LDOS30E	160-531536-03	10/23/2018	Total and Isotopic Uranium
MW-DU-004	LDOS30E	160-531536-04	10/23/2018	Total and Isotopic Uranium
MW-DU-004	LDOS30DE	160-531536-05	10/23/2018	Total and Isotopic Uranium
MW-DU-005	LDOS30E	160-531536-06	10/23/2018	Total and Isotopic Uranium
MW-DU-006	LDOS30E	160-531536-07	10/23/2018	Total and Isotopic Uranium
MW-DU-007	LDOS30E	160-531536-08	10/23/2018	Total and Isotopic Uranium
MW-DU-008	LDOS30E	160-531536-09	10/23/2018	Total and Isotopic Uranium
MW-DU-009	LDOS30E	160-531536-10	10/23/2018	Total and Isotopic Uranium
MW-DU-010	LDOS30E	160-531536-11	10/23/2018	Total and Isotopic Uranium
MW-DU-011	LDOS30E	160-531536-12	. 10/23/2018	Total and Isotopic Uranium
SW-DU-001	LDOS30E	160-531536-13	10/23/2018	Total and Isotopic Uranium
SW-DU-002	LDOS30E	160-531536-14	10/23/2018	Total and Isotopic Uranium
SW-DU-003	LDOS27E	160-531536-15	10/23/2018	Total and Isotopic Uranium
SW-DU-004	LDOS30E	160-531536-16	10/23/2018	Total and Isotopic Uranium
SW-DU-005	LDOS30E	160-531536-17	10/23/2018	Total and Isotopic Uranium
SW-DU-006	LDOS29E	160-531536-18	10/23/2018	Total and Isotopic Uranium
SW-DU-007	LDOS30E	160-531536-19	10/23/2018	Total and Isotopic Uranium
SW-DU-007	LDOS30DE	160-531536-20	10/23/2018	Total and Isotopic Uranium
SW-DU-008	LDOS30E	160-531536-21	10/23/2018	Total and Isotopic Uranium
SD-DU-001	LDOS30E	160-531536-22	10/23/2018	Total and Isotopic Uranium
SD-DU-001	LDOS30DE	160-531536-23	10/23/2018	Total and Isotopic Uranium
SD-DU-002	LDOS30E	160-531536-24	10/23/2018	Total and Isotopic Uranium
SD-DU-003	LDOS30E	160-531536-25	10/23/2018	Total and Isotopic Uranium
SD-DU-004	LDOS30E	160-531536-26	10/23/2018	Total and Isotopic Uranium
SD-DU-005	LDOS30E	160-531536-27	10/23/2018	Total and Isotopic Uranium
SD-DU-006	LDOS30E	160-531536-28	10/23/2018	Total and Isotopic Uranium
SD-DU-007	LDOS30E	160-531536-29	10/23/2018	Total and Isotopic Uranium
SD-DU-008	LDOS30E	160-531536-30	10/23/2018	Total and Isotopic Uranium
SS-DU-001	LDOS30E	160-531536-31	10/23/2018	Total and Isotopic Uranium
SS-DU-002	LDOS30E	160-531536-32	10/23/2018	Total and Isotopic Uranium
SS-DU-003	LDOS30E	160-531536-33	10/23/2018	Total and Isotopic Uranium
SS-DU-003	LDOS30DE	160-531536-34	10/23/2018	Total and Isotopic Uranium
SS-DU-004	LDOS30E	160-531536-35	10/23/2018	Total and Isotopic Uranium

^{*} The Leidos sample I.D. (LDOS30E) is a unique designation that provides a tracking procedure in the electronic database for data retrieval.

ATTACHMENT JEFFERSON PROVING GROUND SAMPLE DATA SUMMARY

			Nater Sample Summa	ary				
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SW-DU-001	LDOS30E	DOE A-01-R MOD	Total Uranium	0.64	0.0999	0	Quai	Code
SW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 234	0.273	0.0764	0.0266		
SW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0035	0.013	0.0331	υ	
SW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 238	0.214	0.0671	0.0266		
SW-DU-002	LDOS30E	DOE A-01-R MOD	Total Uranium	0.983	0.132	0		
SW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 234	0.312	0.0866	0.0352		
SW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 235	0.00778	0.0204	0.0438	U	
SW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 238	0.329	0.0887	0.0296	-	
SW-DU-003	LDOS27E	DOE A-01-R MOD	Total Uranium	0.243	0.0648	0		
SW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 234	0.175	0.0619	0.0389		
SW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 235	0.001	0.014	0.0395	U	
SW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 238	0.0815	0.0435	0.0417	J	37
SW-DU-004	LDOS30E	DOE A-01-R MOD	Total Uranium	0.484	0.0897	0		
SW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 234	0.25	0.076	0.0291		
SW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0131	0.0186	0.0197	U	
SW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 238	0.161	0.0602	0.029		
SW-DU-005	LDOS30E	DOE A-01-R MOD	Total Uranium	1.62	0.176	0.020		
SW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 234	0.288	0.0876	0.0651		
SW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 235	-0.00167	0.0165	0.0494	U	
SW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 238	0.546	0.118	0.0396		
SW-DU-006	LDOS29E	DOE A-01-R MOD	Total Uranium	0.426	0.0932	0		
SW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 234	0.323	0.0934	0.0478		
SW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 235	0.00862	0.0226	0.0486	U	
SW-DU-006	LDOS29E	DOE A-01-R MOD	Uranium 238	0.142	0.0626	0.0513		
SW-DU-007	LDOS30DE	DOE A-01-R MOD	Total Uranium	0.575	0.0941	0		
SW-DU-007	LDOS30DE	DOE A-01-R MOD	Uranium 234	0.216	0.0691	0.0417		
SW-DU-007	LDOS30DE	DOE A-01-R MOD	Uranium 235	0.0335	0.0299	0.0331	J	37
SW-DU-007	LDOS30DE	DOE A-01-R MOD	Uranium 238	0.188	0.0631	0.0316	_	
SW-DU-007	LDOS30E	DOE A-01-R MOD	Total Uranium	0.483	0.0938	0		
SW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 234	0.221	0.0747	0.0521	-	
SW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0106	0.0197	0.037	υ	
SW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 238	0.161	0.063	0.0464	_	
SW-DU-008	LDOS30E	DOE A-01-R MOD	Total Uranium	2.13	0.207	0		
SW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 234	0.282	0.0843	0.0663		
SW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0369	0.0349	0.0471	Ū	
SW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 238	0.71	0.139	0.0837	-	
SW-DU-008	LDOS30E	SW846 6020A	Total Uranium	1.9	0	0.025		
SW-DU-008	LDOS30E	SW846 6020A	Uranium 234	0.02	0	0.05	U	
SW-DU-008	LDOS30E	SW846 6020A	Uranium 235	0.02	0	0.05	U	
SW-DU-008	LDOS30E	SW846 6020A	Uranium 238	1.9	0	0.05	D	
MW-DU-001	LDOS30E	DOE A-01-R MOD	Total Uranium	0.641	0.111	0		
MW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 234	0.322	0.0854	0.0396		
MW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0107	0.023	0.0452	U	
MW-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 238	0.214	0.0745	0.0674		
MW-DU-002	LDOS30E	DOE A-01-R MOD	Total Uranium	1.57	0.17	0		

		V	Vater Sample Summa	ary				
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
MW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 234	1.19	0.189	0.0161		
MW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0467	0.0355	0.02	J	37
MW-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 238	0.519	0.114	0.0161		
MW-DU-003	LDOS30E	DOE A-01-R MOD	Total Uranium	0.674	0.109	0		
MW-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 234	0.62	0.127	0.0426		
MW-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0208	0.0275	0.0432	Ū	
MW-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 238	0.223	0.0729	0.0425		
MW-DU-004	LDOS30DE	DOE A-01-R MOD	Total Uranium	0.757	0.111	0		
MW-DU-004	LDOS30DE	DOE A-01-R MOD	Uranium 234	0.44	0.102	0.0428		
MW-DU-004	LDOS30DE	DOE A-01-R MOD	Uranium 235	0.038	0.0335	0.0405	U	
MW-DU-004	LDOS30DE	DOE A-01-R MOD	Uranium 238	0.249	0.0747	0.0398	_	
MW-DU-004	LDOS30E	DOE A-01-R MOD	Total Uranium	0.731	0.109	0		
MW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 234	0.287	0.0808	0.047		
MW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0121	0.0171	0.0181	U	
MW-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 238	0.244	0.0732	0.039		
MW-DU-005	LDOS30E	DOE A-01-R MOD	Total Uranium	0.648	0.103	0	-	
MW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 234	0.738	0.138	0.0483		
MW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0321	0.0314	0.0408	U	
MW-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 238	0.213	0.0688	0.0367		
MW-DU-006	LDOS30E	DOE A-01-R MOD	Total Uranium	4.9	0.339	0		
MW-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 234	1.99	0.262	0.0282	i	
MW-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 235	0.108	0.0531	0.019		
MW-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 238	1.63	0.228	0.0335		
MW-DU-007	LDOS30E	DOE A-01-R MOD	Total Uranium	2.5	0.215	0		
MW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 234	1.34	0.195	0.0262		
MW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0433	0.0369	0.0475	U	
MW-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 238	0.834	0.144	0.0311		
MW-DU-008	LDOS30E	DOE A-01-R MOD	Total Uranium	0.766	0.115	0		
MW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 234	0.455	0.103	0.0328		
MW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0186	0.0216	0.0186	J	37
MW-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 238	0.255	0.0771	0.0483		
MW-DU-009	LDOS30E	DOE A-01-R MOD	Total Uranium	0.522	0.101	0		
MW-DU-009	LDOS30E	DOE A-01-R MOD	Uranium 234	0.947	0.171	0.044		
MW-DU-009	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0427	0.0409	0.0548	U	
MW-DU-009	LDOS30E	DOE A-01-R MOD	Uranium 238	0.169	0.0675	0.048		
MW-DU-010	LDOS30E	DOE A-01-R MOD	Total Uranium	2.03	0.257	0		<u> </u>
MW-DU-010	LDOS30E	DOE A-01-R MOD	Uranium 234	1.64	0.287	0.0707		
MW-DU-010	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0596	0.0536	0.0358	J	37
MW-DU-010	LDOS30E	DOE A-01-R MOD	Uranium 238	0.673	0.173	0.077		
MW-DU-011	LDOS30E	DOE A-01-R MOD	Uranium 234	0.433	0.113	0.043		
MW-DU-011	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0163	0.0231	0.0244	U	
MW-DU-011	LDOS30E	DOE A-01-R MOD	Uranium 238	0.0898	0.052	0.0482	J	37

^{*}The sample specific detection limit value is shown in the MDC column for SW-846 6020A results.

		Soil/S	ediment Sample Su	mmary				
Site I.D.	Sample I D	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SD-DU-001	Sample I.D.	DOE A-01-R MOD	Total Uranium	0.907	0.118	WDC 0	Quai	Code
SD-DU-001	LDOS30DE	DOE A-01-R MOD	Uranium 234	0.342	0.0851	0.039		
SD-DU-001	LDOS30DE	DOE A-01-R MOD	Uranium 235	0.0122	0.0205	0.0369	U	
SD-DU-001	LDOS30DE	DOE A-01-R MOD	Uranium 238	0.303	0.0793	0.0362		
SD-DU-001	LDOS30E	DOE A-01-R MOD	Total Uranium	0.742	0.102	0		
SD-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 234	0.289	0.0747	0.0336		
SD-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0164	0.0217	0.0341	U	
SD-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 238	0.247	0.0686	0.0335		
SD-DU-002	LDOS30E	DOE A-01-R MOD	Total Uranium	0.985	0.126	0		
SD-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 234	0.381	0.093	0.0461		
SD-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0306	0.0299	0.0389	U	
SD-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 238	0.326	0.0843	0.035		
SD-DU-003	LDOS30E	DOE A-01-R MOD	Total Uranium	2.69	0.217	0		
SD-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 234	0.732	0.129	0.024		
SD-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0378	0.0288	0.0162	J	37
SD-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 238	0.898	0.146	0.0285		
SD-DU-004	LDOS30E	DOE A-01-R MOD	Total Uranium	0.581	0.0933	0		
SD-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 234	0.212	0.065	0.0251		
SD-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 235	-0.00377	0.0147	0.0456	U	
SD-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 238	0.196	0.0627	0.0299		
SD-DU-005	LDOS30E	DOE A-01-R MOD	Total Uranium	0.892	0.121	0		
SD-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 234	0.221	0.0683	0.0314		
SD-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0238	0.0239	0.0178	J	37
SD-DU-005	LDOS30E	DOE A-01-R MOD	Uranium 238	0.296	0.0815	0.0462		
SD-DU-006	LDOS30E	DOE A-01-R MOD	Total Uranium	2.21	0.2	0		
SD-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 234	0.821	0.143	0.0349		
SD-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0279	0.0301	0.0434	U	
SD-DU-006	LDOS30E	DOE A-01-R MOD	Uranium 238	0.738	0.134	0.038		
SD-DU-007	LDOS30E	DOE A-01-R MOD	Total Uranium	2.19	0.19	0		
SD-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 234	0.894	0.145	0.028		
SD-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0159	0.0184	0.0159	J	37
SD-DU-007	LDOS30E	DOE A-01-R MOD	Uranium 238	0.734	0.128	0.0313		
SD-DU-008	LDOS30E	DOE A-01-R MOD	Total Uranium	0.67	0.099	0		
SD-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 234	0.222	0.0666	0.0252		
SD-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 235	0.026	0.0259	0.0314	U	
SD-DU-008	LDOS30E	DOE A-01-R MOD	Uranium 238	0.221	0.0665	0.0252	,	
SS-DU-001	LDOS30E	DOE A-01-R MOD	Total Uranium	2.26	0.2	0		
SS-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 234	0.738	0.132	0.0303		
SS-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0124	0.021	0.0377	U	
SS-DU-001	LDOS30E	DOE A-01-R MOD	Uranium 238	0.757	0.134	0.0254		
SS-DU-002	LDOS30E	DOE A-01-R MOD	Total Uranium	2.83	0.233	0		
SS-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 234	0.797	0.141	0.0146	<u></u>	
SS-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0579	0.0389	0.0334	J	37
SS-DU-002	LDOS30E	DOE A-01-R MOD	Uranium 238	0.941	0.157	0.0145		

		Soil/S	Sediment Sample Su	mmary				
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC ·	Final Qual	Reason Code
SS-DU-003	LDOS30DE	DOE A-01-R MOD	Total Uranium	1.85	0.179	0		
SS-DU-003	LDOS30DE	DOE A-01-R MOD	Uranium 234	0.566	0.116	0.0569		
SS-DU-003	LDOS30DE	DOE A-01-R MOD	Uranium 235	0.0277	0.0299	0.0431	U	
SS-DU-003	LDOS30DE	DOE A-01-R MOD	Uranium 238	0.617	0.12	0.0346		
SS-DU-003	LDOS30E	DOE A-01-R MOD	Total Uranium	1.95	0.187	0		
SS-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 234	0.637	0.124	0.0272		
SS-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0428	0.0325	0.0183	J	37
SS-DU-003	LDOS30E	DOE A-01-R MOD	Uranium 238	0.65	0.126	0.0271		
SS-DU-004	LDOS30E	DOE A-01-R MOD	Total Uranium	1.62	0.17	0		
SS-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 234	0.551	0.115	0.0395		
SS-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 235	0.0193	0.0255	0.0401	U	
SS-DU-004	LDOS30E	DOE A-01-R MOD	Uranium 238	0.543	0.114	0.0424		

Data Validation Reason Code

³⁷ Associated error was greater than 50 percent of the sample result.

APPENDIX D

RELATIVE URANIUM-238/URANIUM-234 ACTIVITY RATIOS FOR MIXTURES OF DEPLETED AND NATURAL URANIUM

