RADIATION MONITORING REPORT
FOR LICENSE SUB-1435
JEFFERSON PROVING GROUND

Summary of Results for the April and October 2017 Sampling Events

FINAL

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
µR/hr	Microroentgens per Hour
µg/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
QC	Quality Control
R^2	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 and October 2017 sampling events, which were the two planned sampling events in 2017 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. Leidos has executed the plan and reports the findings in an effort to fulfill the Army's responsibilities for monitoring under NRC Radioactive Materials License SUB-1435.

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3. RESULTS

A Leidos field crew prepared for and conducted sampling at JPG during the periods of 24 to 25 April 2017 and 23 to 25 October 2017. 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 in Figure 3-1. Sections 3.1 and 3.2 summarize the sampling results for the spring and fall 2017 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 discussion 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 or natural uranium. 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 second 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 0.49[1], 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] $0.49 = 0.56 \times 0.72 + 0.44 \times 0.20$, 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 not suggestive of one or the other.

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)
0.2 = The U-235 mass fraction for DU.

3.1 SPRING 2017 SAMPLING RESULTS

Sections 3.1.1 through 3.1.4 summarize the spring 2017 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 in Figure 3-1.

Total uranium concentrations in the April 2017 groundwater samples ranged from 0.12 ± 0.06 pCi/L for MW-DU-011 to a maximum of 4.0 ± 0.4 pCi/L for MW-DU-006. The average total uranium concentration, computed using the average value for duplicates, was 1.3 ± 0.7 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 non-detects for MW-DU-011 to 1.6 ± 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 1.6 ± 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 in Figure 3-1. Total uranium concentrations in surface water ranged from 0.086 ± 0.047 pCi/L for SW-DU-006 to 0.44 ± 0.10 pCi/L for SW-DU-008 with an average concentration of 0.30 ± 0.24 pCi/L, computed using the average value for duplicates.

The U-238/U-234 ratios ranged from non-detects for SW-DU-003 and SW-DU-006 to 1.3 ± 0.6 for SW-DU-002. Given that the maximum U-238/U-234 ratio was 1.3 ± 0.6, 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 in Figure 3-1. Total uranium concentrations ranged from 0.41 ± 0.09 pCi/g for SD-DU-008 to 1.7 ± 0.2 pCi/g for SD-DU-007 with an average concentration of 0.9 ± 0.4 pCi/g, computed using the average value for duplicates.

As noted above, for the purposes of this report, when U-238/U-234 ratios plus TPU exceed 3.0, that sample is selected for laboratory analysis by ICP-MS. Only SD-DU-005 exceeded this selection criterion.

ICP-MS results for SD-DU-005 equated to 0.64, non-detect, non-detect, and 0.64 milligrams per kilogram (mg/kg) 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 SD-DU-005 of 0.64 mg/kg is less than the lower comparison value of 4.0 mg/kg for soil/sediment, so SD-DU-005 is suggestive of natural uranium.

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 in Figure 3-1. Total uranium concentrations ranged from 0.87 ± 0.14 for SS-DU-004 to 1.6 ± 0.2 pCi/g for SS-DU-002. The average total uranium concentration of 1.2 ± 0.4 pCi/g was computed using the average value for duplicates.

The U-238/U-234 ratio ranged from a minimum of 1.1 ± 0.3 for SS-DU-001, SS-DU-002, and SS-DU-004 to a maximum of 1.3 ± 0.4 for SS-DU-003. 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 2017 SAMPLING RESULTS

Sections 3.2.1 through 3.2.4 summarize the fall 2017 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 in Figure 3-1.

Total uranium concentrations in the October 2017 groundwater samples ranged from 0.05 ± 0.07 for MW-DU-011 to a maximum of 3.5 ± 0.5 pCi/L for MW-DU-006. The average total uranium concentration, computed using the average value for duplicates, was 1.2 ± 0.9 pCi/L.

In addition to the individual isotopic concentrations, Table 8 presents the U-238/U-234 ratios for each sample. These ratios ranged from non-detect for MW-DU-011 to 0.84 ± 0.22 for MW-DU-006. 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. With a maximum U-238/U-234 ratio of 0.84 ± 0.22, 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 in Figure 3-1. Total uranium concentrations in surface water ranged from 0.15 ± 0.09 for SW-DU-003 to 1.6 ± 0.3 pCi/L for SW-DU-005 with an average concentration of 0.56 ± 0.51 pCi/L, computed using the average value for duplicates.

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-004 and SW-DU-005 exceeded this selection criterion. ICP-MS results for SW-DU-004 equated to 0.65, non-detect, non-detect, and 0.65 micrograms per liter (µg/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-004 of 0.65 µg/L is less than the lower comparison value of 1.2 µg/L for surface water, so SW-DU-004 is suggestive of natural uranium.

ICP-MS results for SW-DU-005 equated to 3.9, non-detect, non-detect, and 3.9 µg/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-005 exceeds the lower comparison value of 1.2 µg/L for surface water. The total uranium result for SW-DU-005 is less than the upper comparison value of 4.1 µg/L calculated using the equation in Section 3. Thus, SW-DU-005 is not suggestive of either natural uranium or DU. For perspective on how small this upper comparison value is, the upper comparison value of 4.1 µg/L is less than the maximum natural value for total uranium in Table 3-1 of 4.18 µg/L for surface water. Since the location of this sample is within the DU Impact Area, some DU contribution to a sample result is not unexpected.

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 in Figure 3-1. Total uranium concentrations ranged from 0.38 ± 0.09 pCi/g for SD-DU-008 to 1.7 ± 0.2 pCi/g for SD-DU-003 with an average concentration of 0.88 ± 0.44 pCi/g, computed using the average value for duplicates.

The U-238/U-234 ratio for the samples ranged from 0.75 ± 0.25 for SD-DU-001 to 1.4 ± 0.6 for SD-DU-008. 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 1.4 ± 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 in Figure 3-1. Total uranium concentrations ranged from 1.1 ± 0.2 for SS-DU-004 to 1.7 ± 0.2 pCi/g for SS-DU-002. The average total uranium concentration of 1.5 ± 0.4 pCi/g was computed using the average value for duplicates.

The U-238/U-234 ratio ranged from a minimum of 0.94 ± 0.27 for SS-DU-004D to a maximum of 1.3 ± 0.4 for SS-DU-003. Given a maximum U-238/U-234 ratio of 1.3 ± 0.4, 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.

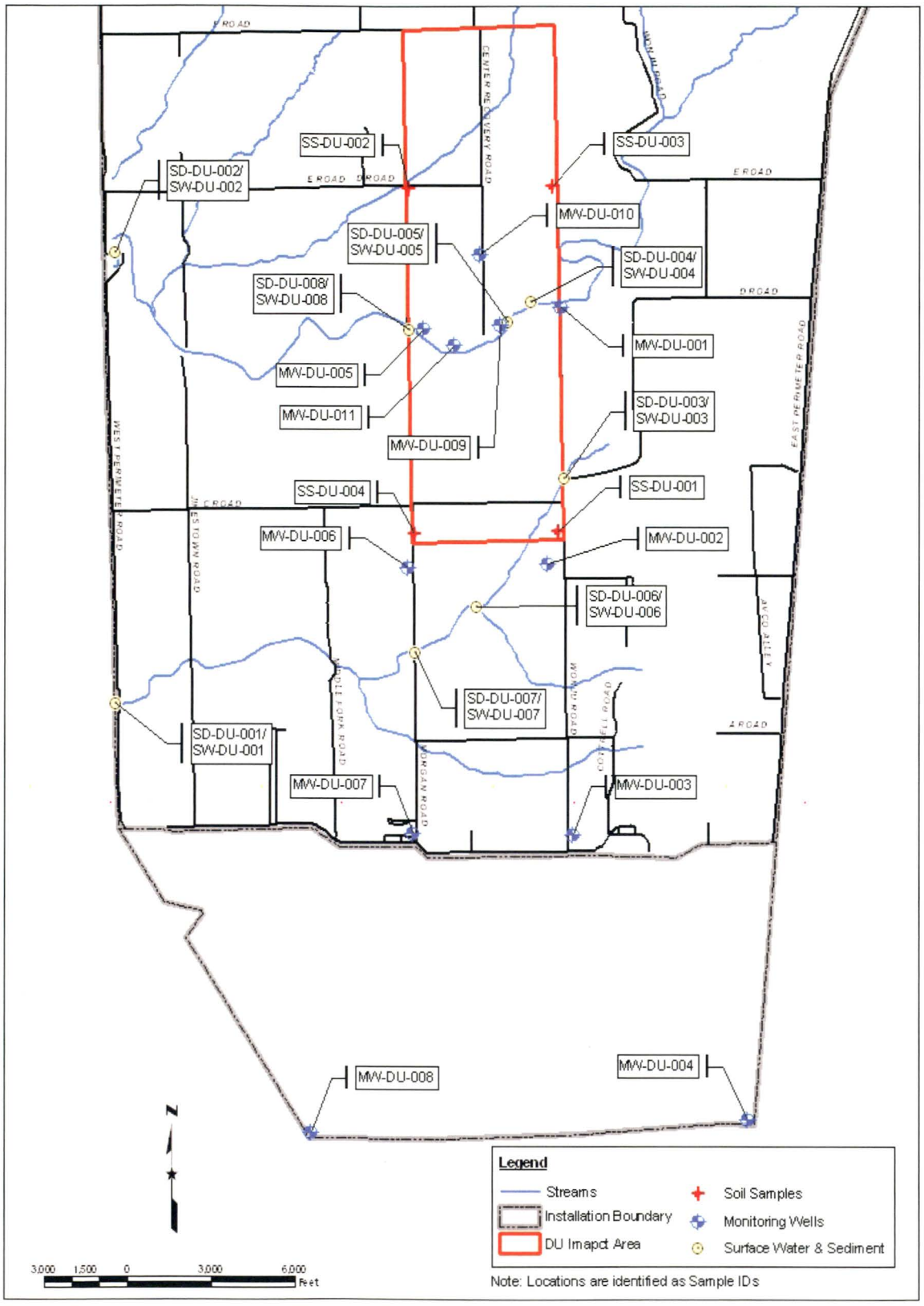


Figure 3-1. Sampling Locations

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

Environmental Medium	Background Activity Concentration for Total Uranium[a]			Background Mass Concentration for Total Uranium[b]			Lower Comparison Value[c] (mg/kg)	
	Average	Maximum	Units[d]	Average	Maximum	Units[d]	Value	Units[d]
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

[a] 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).
[b] 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=0.56R+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 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
MW-DU-001	0.15 ± 0.06	0.008 ± 0.024 U	0.23 ± 0.07	0.39 ± 0.09	1.6 ± 0.8
MW-DU-002	0.97 ± 0.16	0.052 ± 0.037	0.43 ± 0.10	1.5 ± 0.2	0.44 ± 0.12
MW-DU-003	0.68 ± 0.13	-0.003 ± 0.005 U	0.27 ± 0.08	0.94 ± 0.15	0.40 ± 0.14
MW-DU-004[d]	0.42 ± 0.11	-0.003 ± 0.006 U	0.38 ± 0.10	0.79 ± 0.15	0.90 ± 0.33
MW-DU-004D[d]	0.49 ± 0.12	0.012 ± 0.022 U	0.35 ± 0.10	0.85 ± 0.15	0.71 ± 0.26
MW-DU-005	0.58 ± 0.12	0.004 ± 0.015 U	0.079 ± 0.043	0.66 ± 0.13	0.14 ± 0.08
MW-DU-006	2.1 ± 0.3	0.12 ± 0.06	1.8 ± 0.3	4.0 ± 0.4	0.86 ± 0.17
MW-DU-007	1.4 ± 0.2	0.077 ± 0.045	0.89 ± 0.16	2.3 ± 0.3	0.65 ± 0.15
MW-DU-008	0.27 ± 0.08	0.021 ± 0.028 U	0.19 ± 0.07	0.48 ± 0.11	0.70 ± 0.32
MW-DU-009	0.44 ± 0.11	0.018 ± 0.024 U	0.13 ± 0.05	0.59 ± 0.12	0.29 ± 0.14
MW-DU-010	1.8 ± 0.3	0.077 ± 0.049	0.77 ± 0.15	2.7 ± 0.3	0.42 ± 0.10
MW-DU-011	0.072 ± 0.042	0.013 ± 0.018 U	0.036 ± 0.033 U	0.12 ± 0.06	ND

[a] Identification.
[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 MW-DU-004 and its duplicate are 0.82 ± 0.21 pCi/L and 0.80 ± 0.42, 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 2017)
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation[a]	Sample I.D.	pH	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate[b] (µR/hr)
MW01	MW-DU-001	7.4	14.67	0.417	20.0	5
MW02	MW-DU-002	7.59	14.27	0.517	37.40	5
MW03	MW-DU-003	6.48	14.66	0.604	39.32	4
MW04	MW-DU-004	8.03	19.02	0.643	43.82	6
MW05	MW-DU-005	6.95	24.24	0.928	6.19	5
MW06	MW-DU-006	7.14	21.17	0.335	9.03	5
MW07	MW-DU-007	7.14	17.98	0.424	28.38	5
MW08	MW-DU-008	8.33	19.21	0.555	16.23	6
MW09	MW-DU-009	7.28	18.62	5.05	25.53	5
MW10	MW-DU-0010	7.50	18.84	0.570	28.11	6
MW11	MW-DU-0011	8.52	16.21	0.303	41.95	4

[a] Represents sample designation developed in previous sampling programs.
[b] Dose rate data were collected using Ludlum Model 19, serial number 207483, which was calibrated on 30 March 2017.

Table 3-4. Uranium in Surface Water (Spring 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SW-DU-001	0.20 ± 0.07	0.019 ± 0.025 U	0.16 ± 0.06	0.38 ± 0.09	0.77 ± 0.39
SW-DU-002	0.16 ± 0.06	0.006 ± 0.012 U	0.21 ± 0.07	0.38 ± 0.09	1.3 ± 0.6
SW-DU-003	0.18 ± 0.06	0.024 ± 0.034 U	0.032 ± 0.028 U	0.23 ± 0.08	ND
SW-DU-004[d]	0.10 ± 0.04	0.018 ± 0.021	0.10 ± 0.05	0.21 ± 0.07	1.0 ± 0.7
SW-DU-004D[d]	0.13 ± 0.06	0.008 ± 0.021 U	0.18 ± 0.07	0.31 ± 0.09	1.4 ± 0.8
SW-DU-005	0.19 ± 0.06	0.029 ± 0.029 U	0.22 ± 0.07	0.43 ± 0.10	1.2 ± 0.6
SW-DU-006	0.059 ± 0.039	0.014 ± 0.019 U	0.014 ± 0.019 U	0.086 ± 0.047	ND
SW-DU-007	0.15 ± 0.05	0.023 ± 0.023	0.050 ± 0.030	0.22 ± 0.07	0.34 ± 0.24
SW-DU-008	0.19 ± 0.07	0.007 ± 0.014 U	0.24 ± 0.08	0.44 ± 0.10	1.2 ± 0.6

[a] Identification.
[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-004 and its duplicate were 0.26 ± 0.11 pCi/L and 1.2 ± 1.0, 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 2017)
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation[a]	Sample I.D.	pH	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate[b] (µR/hr)
SWS01	SW-DU-001	8.07	20.18	0.195	20.51	5
SWS02	SW-DU-002	8.13	21.06	0.182	9.30	5
SWS03	SW-DU-003	7.53	16.91	0.123	10.88	5
SWS04	SW-DU-004	7.69	18.21	0.204	7.81	7
SWS05	SW-DU-005	8.99	20.55	0.282	24.71	5
SWS06	SW-DU-006	5.72	15.58	0.123	11.27	5
SWS07	SW-DU-007	7.58	21.85	0.109	20.71	4
SWS08	SW-DU-008	8.14	19.57	0.196	15.16	4

[a] Represents sample designation developed in previous sampling programs.
[b] Dose rate data were collected using Ludlum Model 19, serial number 207483, which was calibrated on 30 March 2017.

Table 3-6. Uranium in Sediment (Spring 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/g)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SD-DU-001	0.77 ± 0.14	0.027 ± 0.027	0.54 ± 0.12	1.3 ± 0.2	0.71 ± 0.20
SD-DU-002[d]	0.37 ± 0.09	0.044 ± 0.039 U	0.31 ± 0.08	0.72 ± 0.13	0.82 ± 0.30
SD-DU-002D[d]	0.24 ± 0.07	-0.005 ± 0.006 U	0.20 ± 0.06	0.43 ± 0.09	0.84 ± 0.36
SD-DU-003	0.55 ± 0.11	0.024 ± 0.026 U	0.60 ± 0.12	1.2 ± 0.2	1.1 ± 0.3
SD-DU-004	0.27 ± 0.08	0.012 ± 0.017 U	0.31 ± 0.08	0.59 ± 0.11	1.1 ± 0.44
SD-DU-005	0.10 ± 0.05	0.028 ± 0.025	0.44 ± 0.10	0.56 ± 0.11	4.6 ± 2.4
SD-DU-006	0.46 ± 0.11	0.006 ± 0.024 U	0.43 ± 0.10	0.89 ± 0.15	0.93 ± 0.31
SD-DU-007	0.93 ± 0.15	0.042 ± 0.032	0.78 ± 0.14	1.7 ± 0.2	0.84 ± 0.20
SD-DU-008	0.19 ± 0.06	0.003 ± 0.012 U	0.22 ± 0.07	0.41 ± 0.09	1.2 ± 0.5

[a] Identification.
[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 SD-DU-002 and its duplicate are 0.57 ± 0.16 pCi/g and 0.83 ± 0.47, 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 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/g)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SS-DU-001[d]	0.66 ± 0.13	0.011 ± 0.024 U	0.69 ± 0.13	1.4 ± 0.2	1.1 ± 0.3
SS-DU-001D[d]	0.63 ± 0.12	0.028 ± 0.030 U	0.69 ± 0.13	1.3 ± 0.2	1.1 ± 0.3
SS-DU-002	0.73 ± 0.13	0.055 ± 0.037	0.84 ± 0.14	1.6 ± 0.2	1.1 ± 0.3
SS-DU-003	0.45 ± 0.10	0.015 ± 0.023 U	0.59 ± 0.11	1.1 ± 0.2	1.3 ± 0.4
SS-DU-004	0.41 ± 0.09	0.024 ± 0.027 U	0.43 ± 0.10	0.87 ± 0.14	1.1 ± 0.3

[a] Identification.
[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-001 and its duplicate are 1.4 ± 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.

Table 3-8. Uranium in Groundwater (Fall 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
MW-DU-001	0.34 ± 0.13	-0.00 ± 0.03 U	0.23 ± 0.11	0.56 ± 0.17	0.68 ± 0.42
MW-DU-002[d]	1.1 ± 0.2	0.05 ± 0.06 U	0.36 ± 0.14	1.5 ± 0.3	0.33 ± 0.15
MW-DU-002D[d]	0.96 ± 0.23	-0.01 ± 0.06 U	0.49 ± 0.16	1.4 ± 0.3	0.51 ± 0.21
MW-DU-003	0.32 ± 0.12	0.01 ± 0.03 U	0.23 ± 0.10	0.56 ± 0.15	0.71 ± 0.40
MW-DU-004	0.33 ± 0.12	0.01 ± 0.02 U	0.23 ± 0.09	0.57 ± 0.15	0.69 ± 0.37
MW-DU-005	0.30 ± 0.13	0.01 ± 0.03 U	0.20 ± 0.09	0.52 ± 0.16	0.68 ± 0.42
MW-DU-006	1.8 ± 0.3	0.10 ± 0.09 U	1.5 ± 0.3	3.5 ± 0.5	0.84 ± 0.22
MW-DU-007	1.2 ± 0.2	0.06 ± 0.06	0.82 ± 0.19	2.1 ± 0.3	0.70 ± 0.22
MW-DU-008	0.27 ± 0.11	0.01 ± 0.03 U	0.20 ± 0.09	0.49 ± 0.14	0.74 ± 0.44
MW-DU-009	0.54 ± 0.16	0.01 ± 0.03 U	0.29 ± 0.12	0.83 ± 0.20	0.54 ± 0.27
MW-DU-010	1.6 ± 0.3	0.04 ± 0.04	0.82 ± 0.20	2.5 ± 0.4	0.51 ± 0.15
MW-DU-011	0.01 ± 0.05 U	0.01 ± 0.02 U	0.03 ± 0.04 U	0.05 ± 0.07	ND

[a] Identification.
[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 MW-DU-002 and its duplicate are 1.5 ± 0.4 pCi/L and 0.42 ± 0.25, 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 2017)
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation[a]	Sample I.D.	pH	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate[b] (µR/hr)
MW01	MW-DU-001	6.47	14.21	0.647	12.78	5
MW02	MW-DU-002	6.56	14.05	0.629	11.32	5
MW03	MW-DU-003	6.76	16.07	0.623	3.01	5
MW04	MW-DU-004	5.46	18.30	0.728	2.81	6
MW05	MW-DU-005	6.59	14.16	1.17	11.47	5
MW06	MW-DU-006	7.07	12.63	0.771	11.42	5
MW07	MW-DU-007	6.76	15.83	0.767	8.55	4
MW08	MW-DU-008	5.70	17.66	0.659	1.76	5
MW09	MW-DU-009	6.14	13.24	0.749	10.82	6
MW10	MW-DU-0010	6.06	14.81	0.745	12.09	5
MW11	MW-DU-0011	7.29	14.24	0.333	13.01	5

[a] Represents sample designation developed in previous sampling programs.
[b] Dose rate data were collected using Ludlum Model 19, serial number 207483, which was calibrated on 30 March 2017.

Table 3-10. Uranium in Surface Water (Fall 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SW-DU-001[d]	0.18 ± 0.10	0.02 ± 0.05 U	0.17 ± 0.09	0.37 ± 0.15	0.94 ± 0.74
SW-DU-001D[d]	0.25 ± 0.11	-0.01 ± 0.01 U	0.18 ± 0.09	0.42 ± 0.14	0.71 ± 0.49
SW-DU-002	0.22 ± 0.10	0.02 ± 0.04 U	0.31 ± 0.12	0.55 ± 0.16	1.4 ± 0.9
SW-DU-003	0.05 ± 0.05 U	-0.01 ± 0.01 U	0.1 ± 0.0713	0.15 ± 0.09	ND
SW-DU-004	0.10 ± 0.07	-0.01 ± 0.01 U	0.18 ± 0.09	0.28 ± 0.12	1.8 ± 1.5
SW-DU-005	0.27 ± 0.12	0.03 ± 0.04 U	1.3 ± 0.3	1.6 ± 0.3	4.9 ± 2.5
SW-DU-006	0.12 ± 0.08	0.00 ± 0.01 U	0.16 ± 0.08	0.28 ± 0.12	1.3 ± 1.1
SW-DU-007	0.14 ± 0.08	-0.00 ± 0.03 U	0.10 ± 0.07	0.24 ± 0.11	0.70 ± 0.64
SW-DU-008	0.14 ± 0.11 U	0.029 ± 0.041 U	0.81 ± 0.21	0.99 ± 0.24	ND

[a] Identification.
[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-001 and its duplicate were 0.40 ± 0.21 pCi/L and 0.83 ± 0.88, 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 2017)
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation[a]	Sample I.D.	pH	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate[b] (µR/hr)
SWS01	SW-DU-001	7.31	12.98	0.355	6.49	5
SWS02	SW-DU-002	7.38	13.08	0.334	20.35	5
SWS03	SW-DU-003	6.93	12.26	0.209	7.01	6
SWS04	SW-DU-004	6.97	12.12	0.337	20.07	5
SWS05	SW-DU-005	7.16	12.48	0.392	42.31	6
SWS06	SW-DU-006	6.78	12.21	0.258	14.10	4
SWS07	SW-DU-007	7.36	12.66	0.304	13.40	4
SWS08	SW-DU-008	7.25	13.06	0.234	16.89	5

[a] Represents sample designation developed in previous sampling programs.
[b] Dose rate data were collected using Ludlum Model 19, serial number 207483, which was calibrated on 30 March 2017.

Table 3-12. Uranium in Sediment (Fall 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/g)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SD-DU-001	0.46 ± 0.10	0.02 ± 0.02 U	0.35 ± 0.09	0.82 ± 0.14	0.75 ± 0.25
SD-DU-002	0.24 ± 0.07	0.02 ± 0.02 U	0.23 ± 0.07	0.48 ± 0.10	0.96 ± 0.40
SD-DU-003	0.89 ± 0.15	0.06 ± 0.04	0.77 ± 0.14	1.7 ± 0.2	0.86 ± 0.21
SD-DU-004	0.20 ± 0.07	0.03 ± 0.03 U	0.18 ± 0.06	0.41 ± 0.10	0.88 ± 0.45
SD-DU-005	0.23 ± 0.07	0.01 ± 0.02 U	0.33 ± 0.08	0.57 ± 0.11	1.4 ± 0.6
SD-DU-006[d]	0.50 ± 0.11	0.01 ± 0.02 U	0.48 ± 0.10	0.99 ± 0.15	0.94 ± 0.28
SD-DU-006D[d]	0.86 ± 0.14	0.02 ± 0.02 U	0.62 ± 0.12	1.5 ± 0.2	0.73 ± 0.18
SD-DU-007	0.73 ± 0.13	0.04 ± 0.03	0.63 ± 0.12	1.4 ± 0.2	0.85 ± 0.23
SD-DU-008	0.15 ± 0.06	0.01 ± 0.02 U	0.22 ± 0.07	0.38 ± 0.09	1.4 ± 0.7

[a] Identification.
[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 SD-DU-006 and its duplicate are 1.2 ± 0.2 pCi/g and 0.83 ± 0.34, 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 3-13. Uranium in Surface Soil (Fall 2017)
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/g)[b]				Ratio U-238/U-234[c, d]
	U-234	U-235	U-238	Total Uranium	
SS-DU-001	0.78 ± 0.14	0.04 ± 0.04 U	0.82 ± 0.15	1.6 ± 0.2	1.0 ± 0.3
SS-DU-002	0.83 ± 0.15	0.04 ± 0.03	0.83 ± 0.14	1.7 ± 0.2	1.0 ± 0.2
SS-DU-003	0.54 ± 0.11	0.04 ± 0.03	0.71 ± 0.13	1.3 ± 0.2	1.3 ± 0.4
SS-DU-004[d]	0.56 ± 0.12	0.01 ± 0.03 U	0.57 ± 0.12	1.1 ± 0.2	1.0 ± 0.3
SS-DU-004D[d]	0.62 ± 0.12	0.04 ± 0.03 U	0.59 ± 0.12	1.3 ± 0.2	0.94 ± 0.27

[a] Identification.
[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-004 and its duplicate are 1.2 ± 0.2 pCi/g and 1.0 ± 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.

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, there were changes to analytical methods 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 µg/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 2017 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 322 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 2017 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 in 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 (R^2) and trend lines are also provided and are listed in each figure. An 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. An exception is MW-DU-004, which exhibits 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 R^2 value of 0.71 (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 data and re-examined in this report. All total uranium results at each sampling location for the April and October 2017 sampling efforts were within the cited control limits. An example individual control chart for MW-DU-001 is provided in 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 4.69 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, April 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 in 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 in Figure 4-13, individual sample results vary about the mean, as expected. The maximum groundwater total uranium concentration for the April and October 2017 sampling event was 4.0 ± 0.4 pCi/L.

Notably, U-238/U-234 activity ratios for April and October 2017 groundwater sampling range from a non-detect (MW-DU-011) to a maximum of 1.6 ± 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 236 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 2017 sampling event, the average total uranium activity-concentration is 0.69 pCi/L, the standard deviation is 2.0 pCi/L, and the maximum detected activity-concentration is 19 ± 2 pCi/L. The activity-concentrations at each surface water sampling location are well below the 150 pCi/L action level for surface water.

Data for each surface water sampling location are summarized in run charts, as shown in 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 R^2 value listed in each figure). As noted in Section 4.1, an R^2 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. An exception is SW-DU-008, which exhibits 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).

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 6.55 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 and October 2017 sampling event was 1.6 ± 0.3 pCi/L.

Results for SW-DU-004 and SW-DU-005 from the October 2017 sampling event represent the only surface water sample locations with the potential to exceed the threshold of 3.0 with the following U-238/U-234 activity ratios: 1.8 ± 1.5 and 4.9 ± 2.5, respectively. During further investigation through reanalysis by ICP-MS of these samples and given that the mass of U-235 was not detected from either sample, the evaluation of weight percent U-235 could not be performed to determine if the results are suggestive of the possible presence of DU in surface water at SW-DU-004 and SW-DU-005.

With regard to the surface water samples, it is notable that the maximum surface water concentration of 1.6 pCi/L is less than 10 percent of the U.S. Environmental Protection Agency's (USEPA's) uranium primary drinking water standard of 30 µg/L (which converts to approximately 20 pCi/L) and < 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 241 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 2017 sampling event, the average total uranium activity-concentration is 0.95 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 in 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 R^2 value listed in each figure). As noted in Section 4.1, an R^2 value that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. The results at most sediment sampling locations exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. Exceptions are SW-DU-001 and SW-DU-007, 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).

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 2.40 pCi/g for total uranium.

Results for SD-DU-005 from the April 2017 sampling event represents the only sediment sample location with the potential to exceed the threshold of 3.0 with a U-238/U-234 activity ratio of 4.6 ± 2.4. During further investigation through reanalysis by ICP-MS of this sample and given that the mass of U-235 was not detected, the evaluation of weight percent U-235 could not be performed to determine if the results are suggestive of the possible presence of DU in surface water at SD-DU-005.

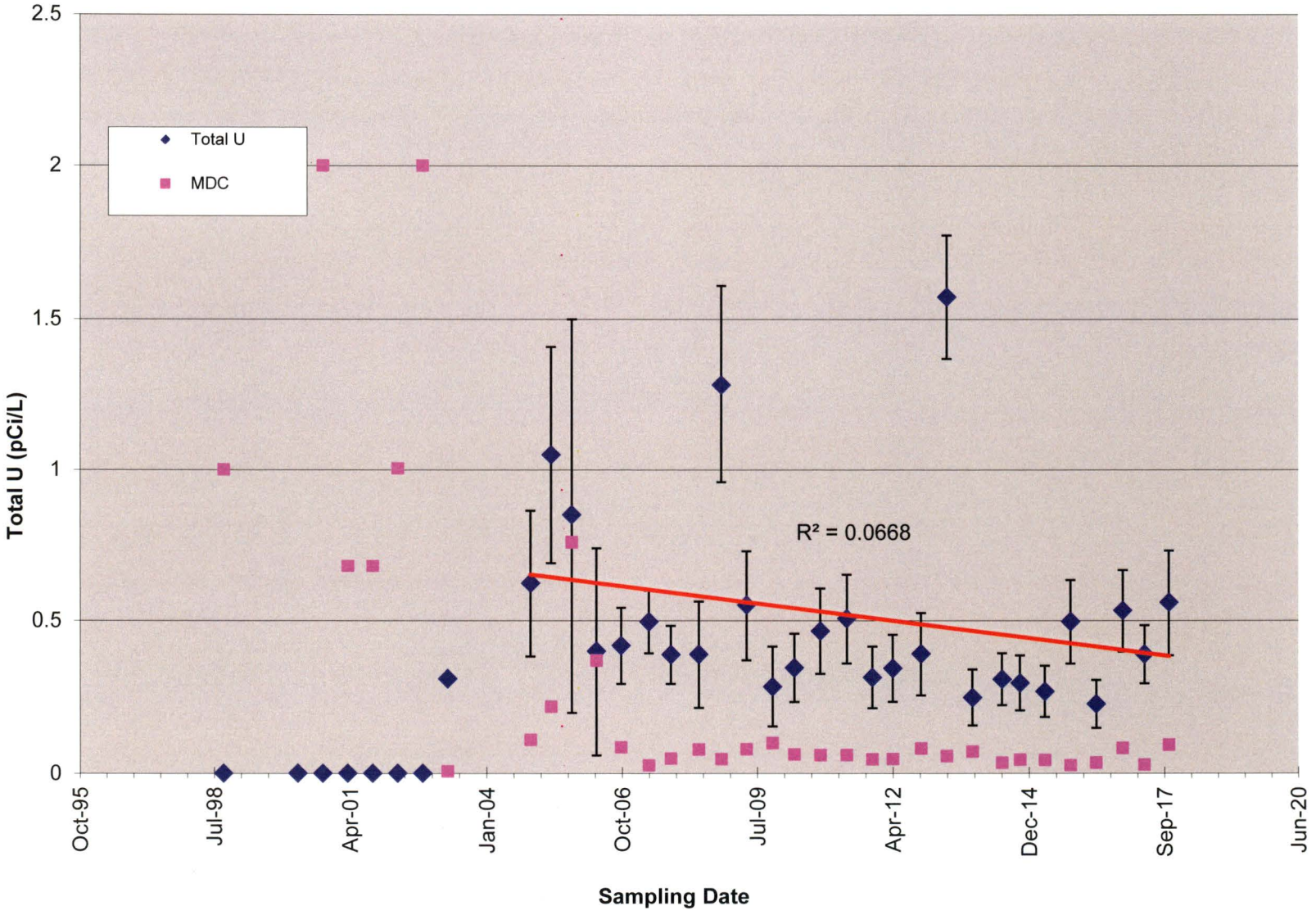
The total uranium concentrations in SD-DU-004 of 2.4 and in SD-DU-007 of 2.5 pCi/g equaled or exceeded the UCL in April 2007 and November 2016, respectively. The maximum sediment total uranium concentration for the April and October 2017 sampling event was 1.8 ± 0.2 pCi/g.

4.4 SOILS

For 141 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 2017 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.

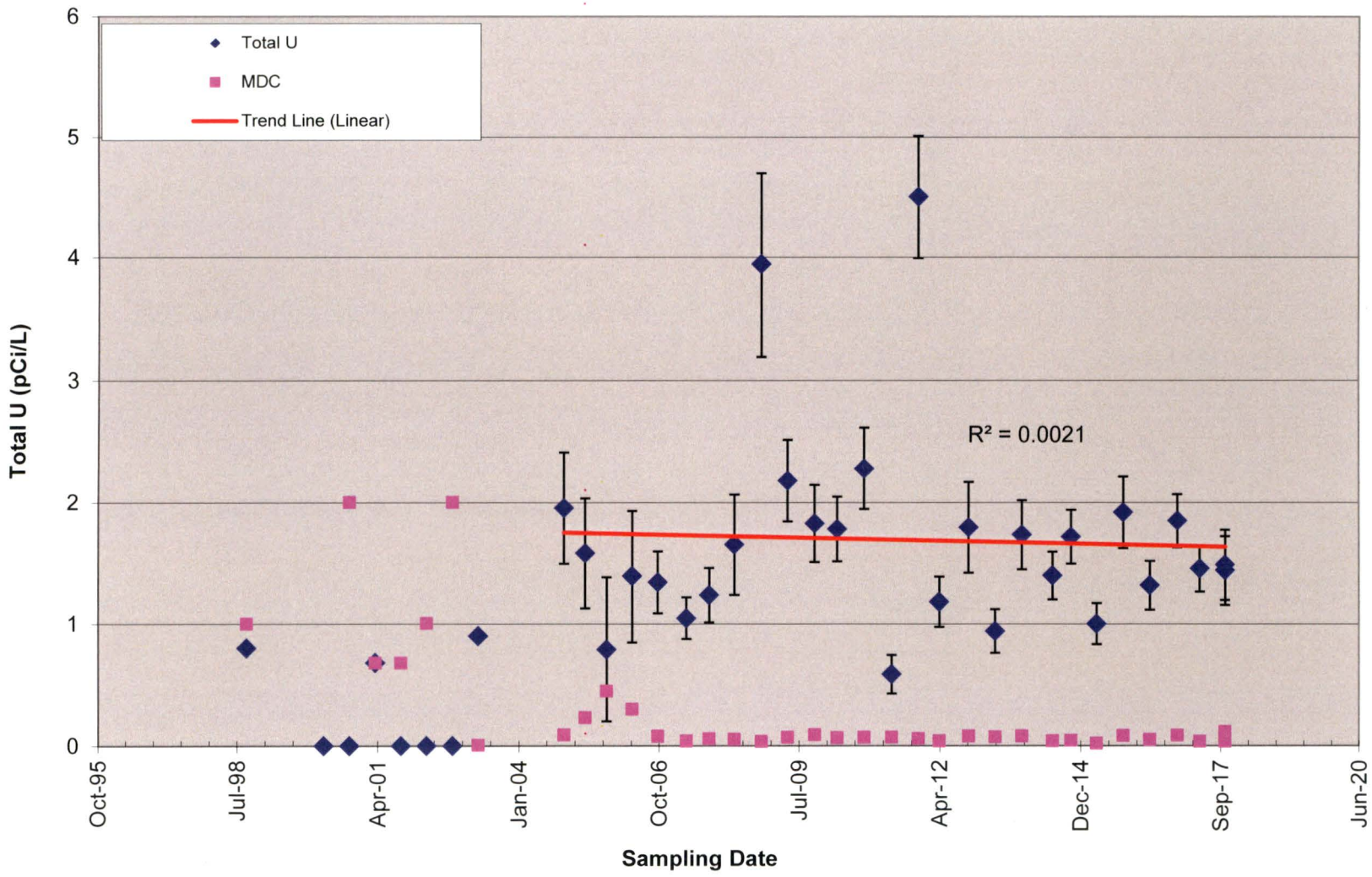
Data for each surface soil sampling location are summarized in run charts, as shown in Figures 4-32 through 4-35. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. Where trend lines are provided, the associated coefficient of correlation also is provided (the R^2 value listed in each figure). As noted in Section 4.1, an R^2 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 about 2.0 pCi/g to about 1.4 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 most soil sampling locations exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. An exception is SW-DU-003, which exhibits a very limited, but statistically insignificant, increasing trend.

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 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.



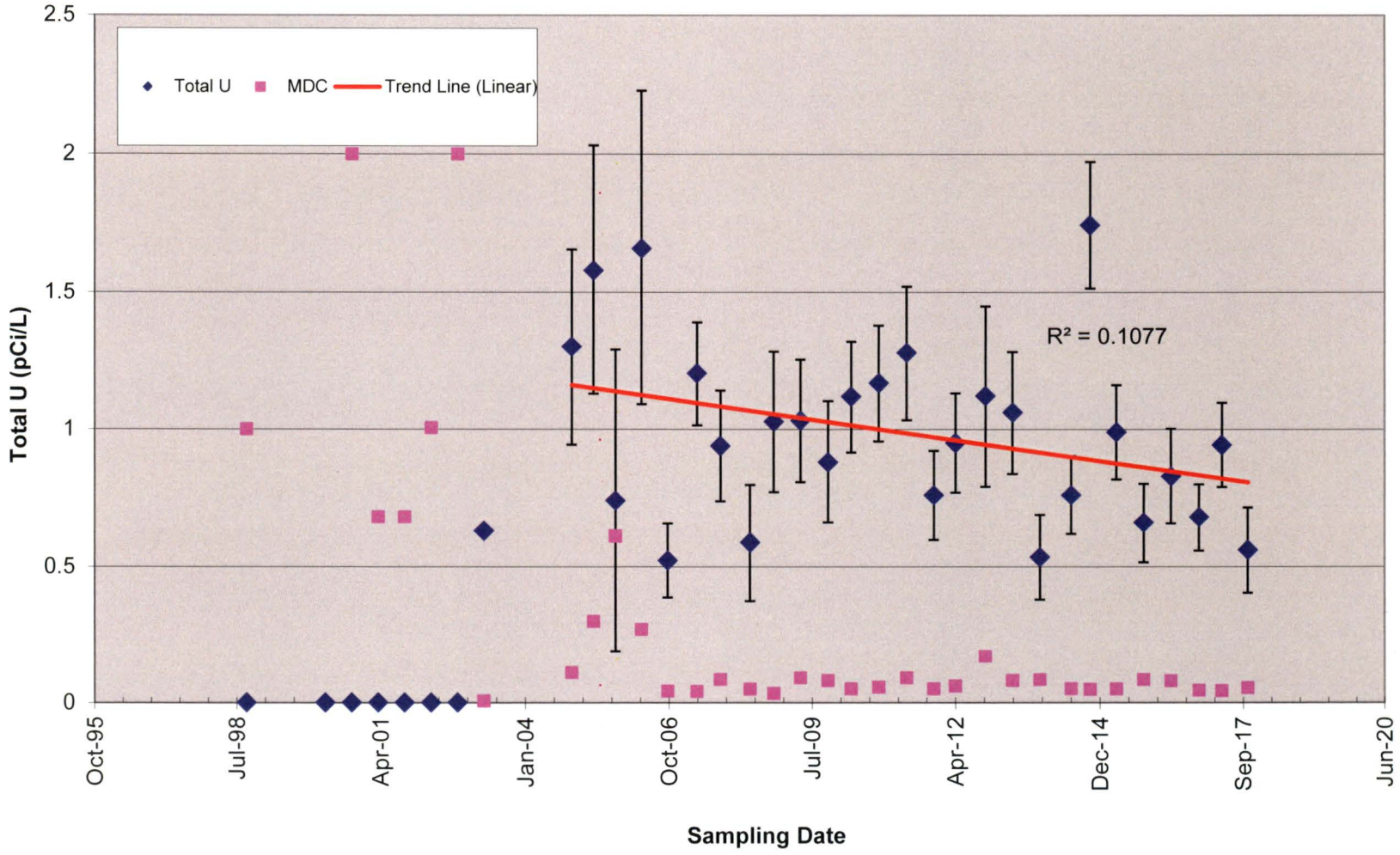
MDC – Minimum Detectable Concentration

Figure 4-1. Total Uranium in MW-DU-001 (1998-2017)



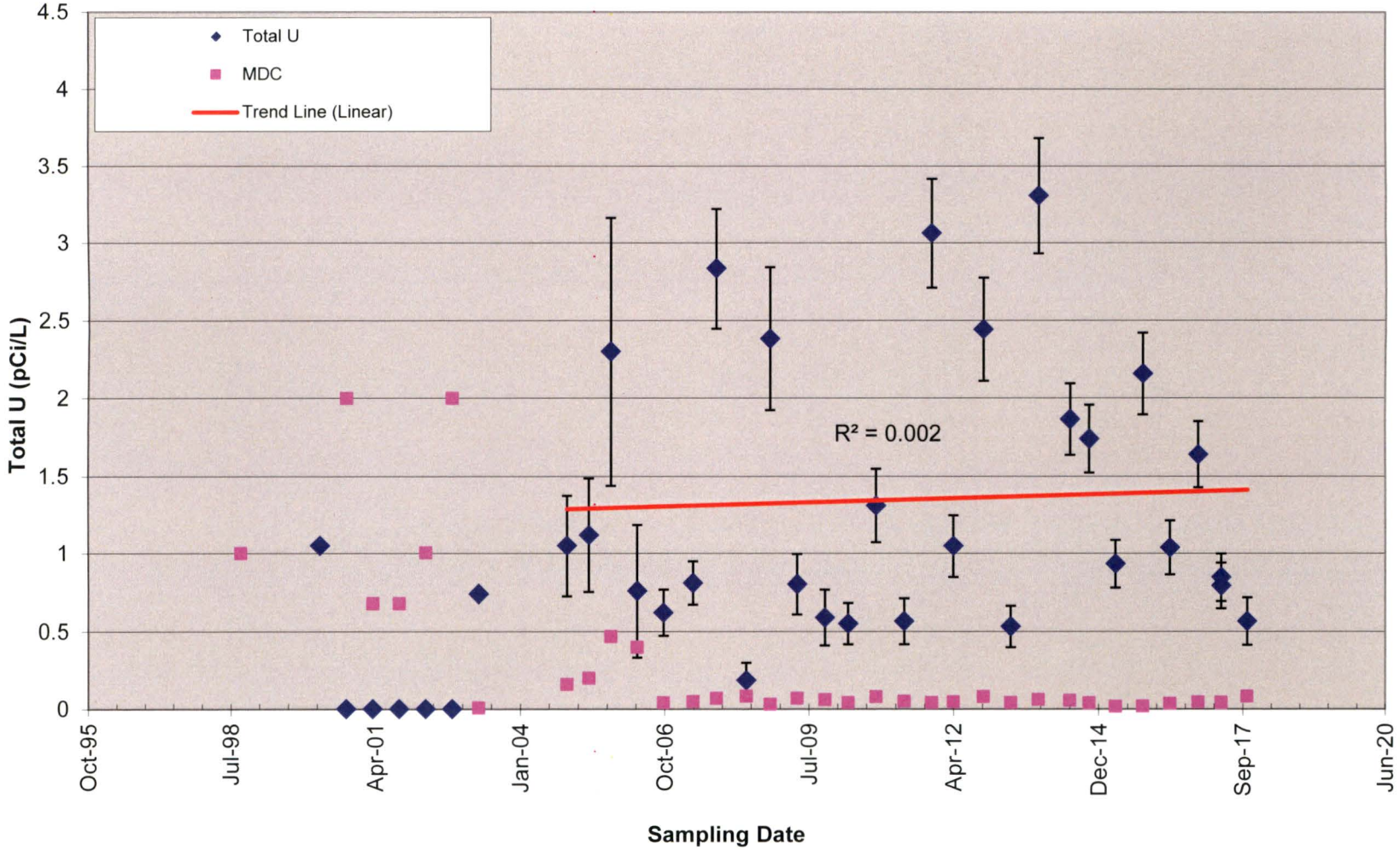
MDC – Minimum Detectable Concentration

Figure 4-2. Total Uranium in MW-DU-002 (1998-2017)



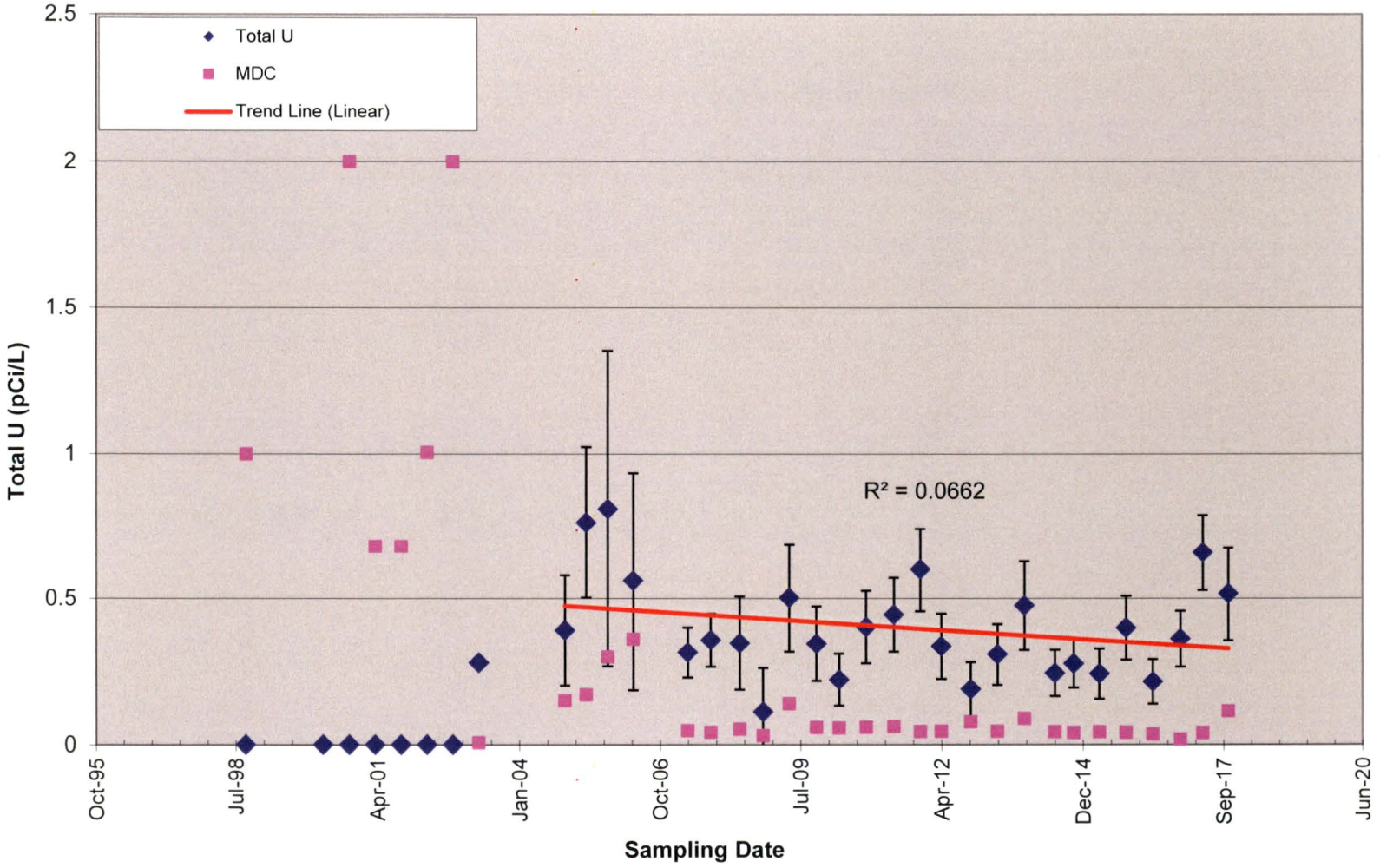
MDC – Minimum Detectable Concentration

Figure 4-3. Total Uranium in MW-DU-003 (1998-2017)



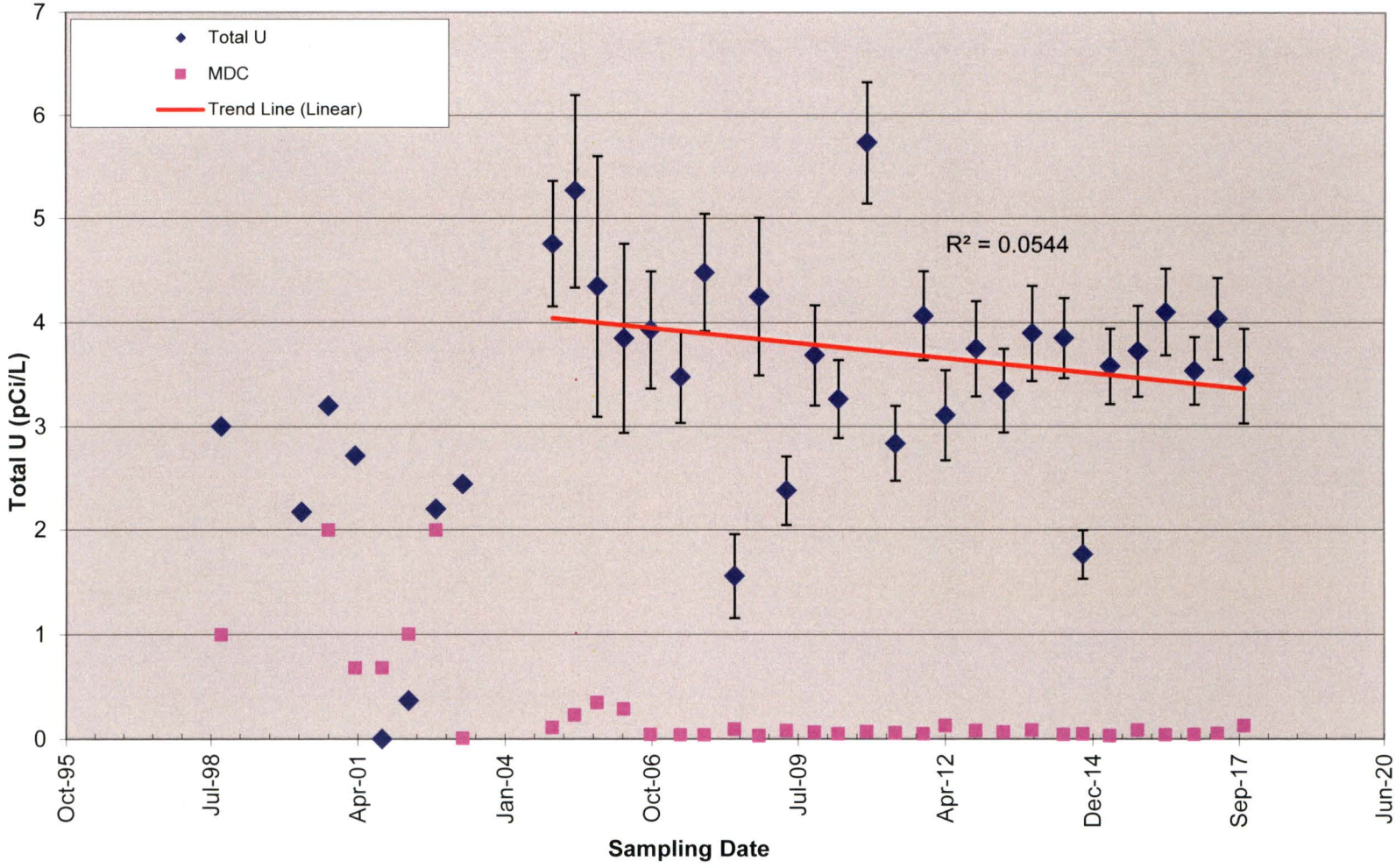
MDC – Minimum Detectable Concentration

Figure 4-4. Total Uranium in MW-DU-004 (1998-2017)



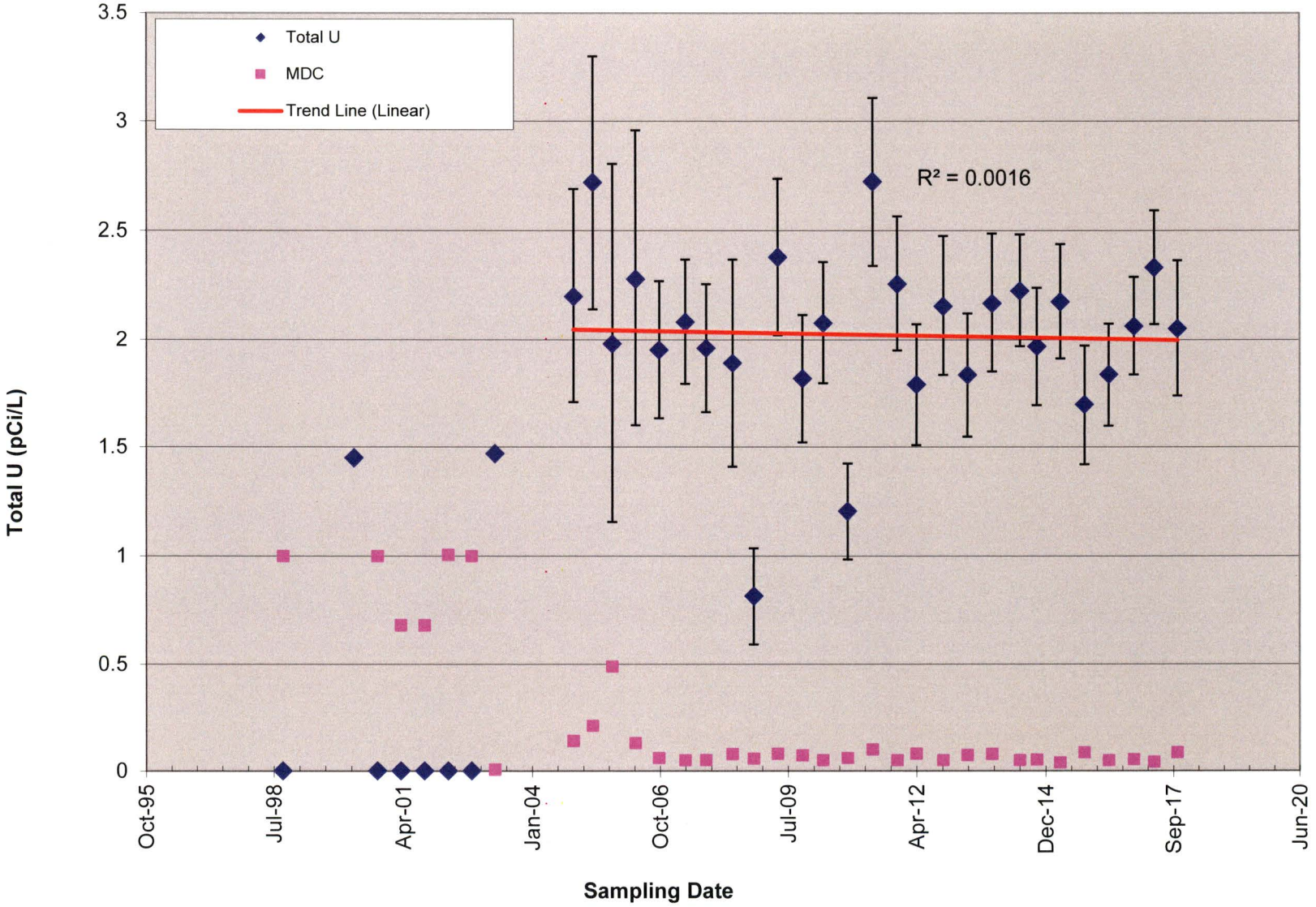
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2006 because the well was dry.

Figure 4-5. Total Uranium in MW-DU-005 (1998-2017)



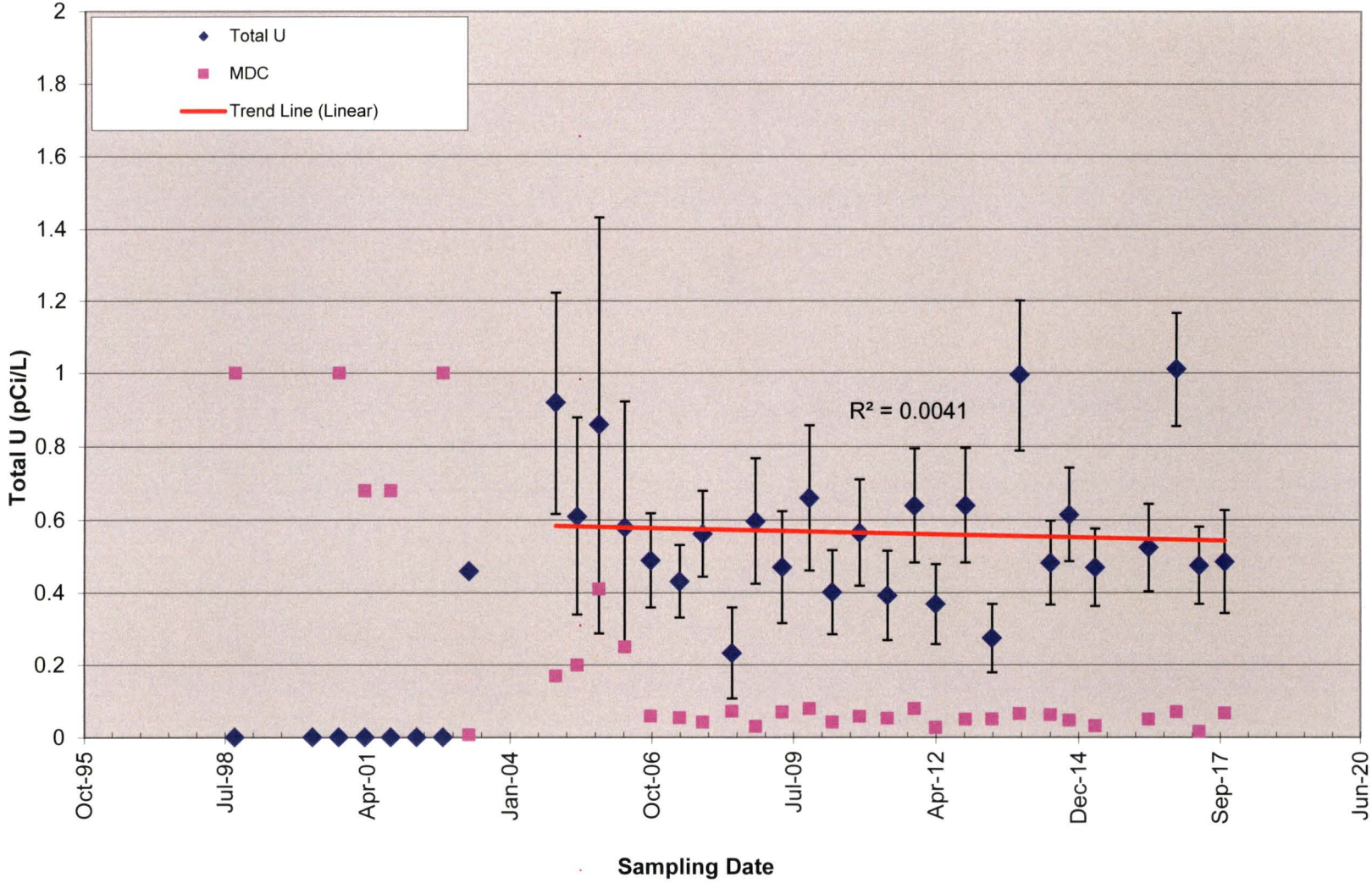
MDC – Minimum Detectable Concentration

Figure 4-6. Total Uranium in MW-DU-006 (1998-2017)



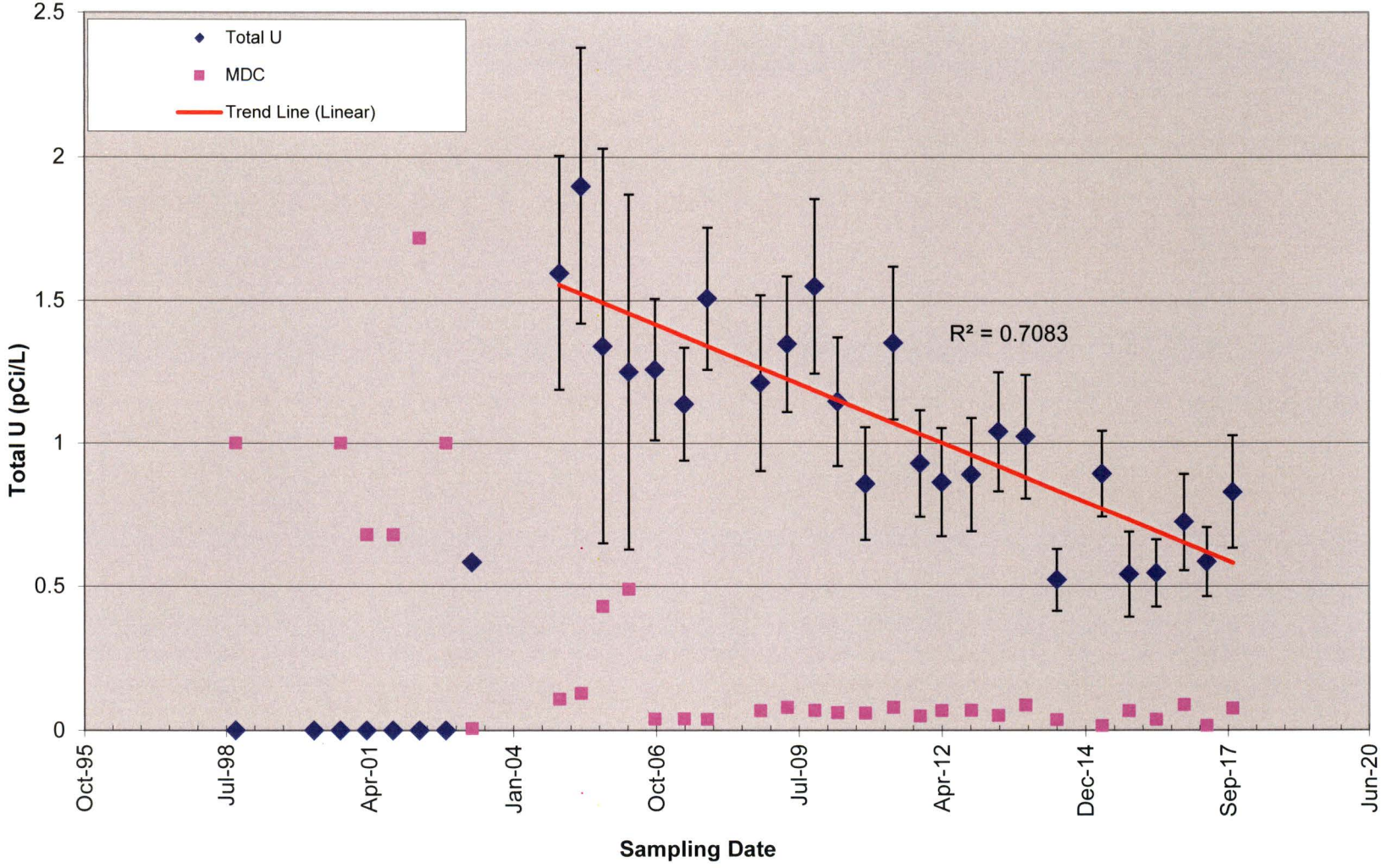
MDC – Minimum Detectable Concentration

Figure 4-7. Total Uranium in MW-DU-007 (1998-2017)



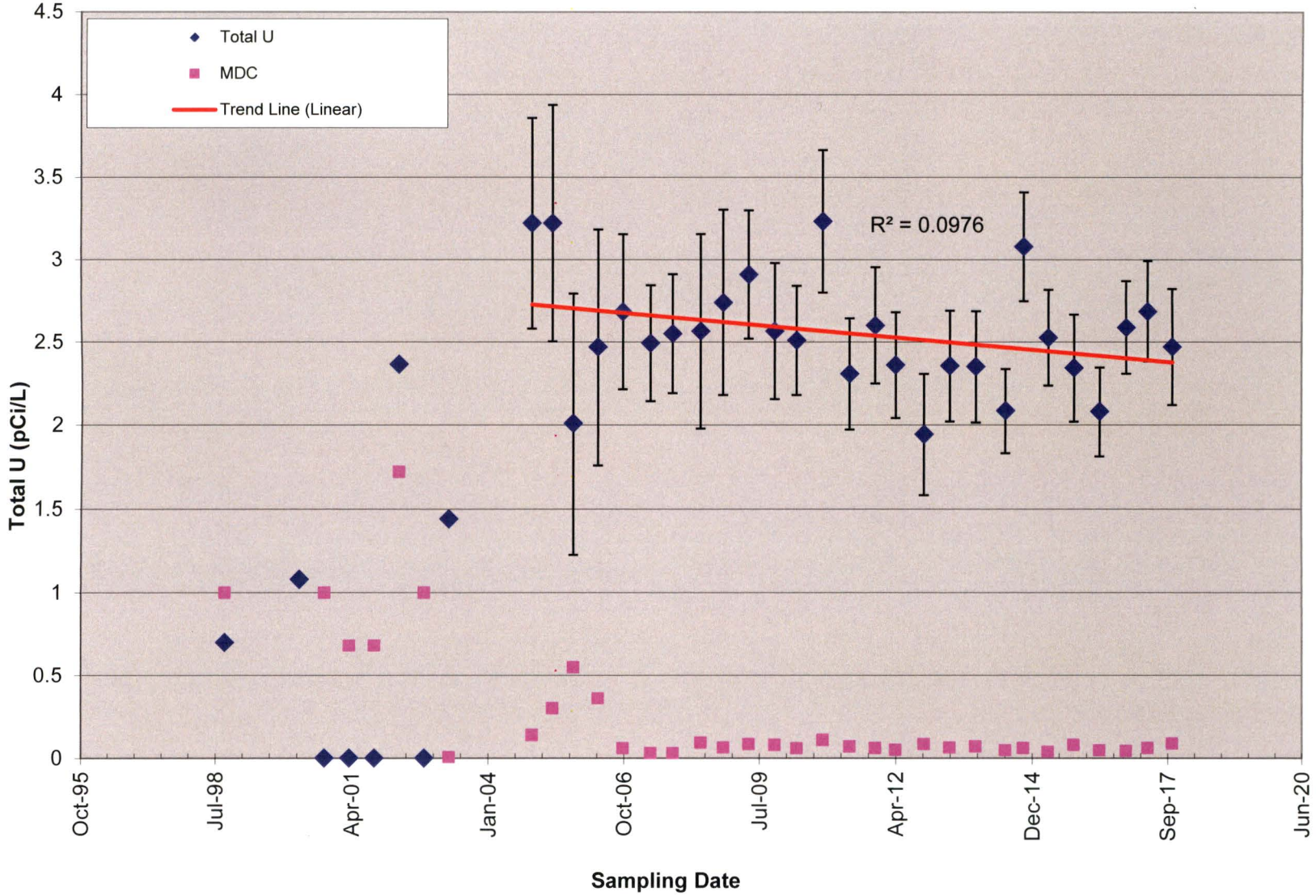
MDC – Minimum Detectable Concentration

Figure 4-8. Total Uranium in MW-DU-008 (1998-2017)



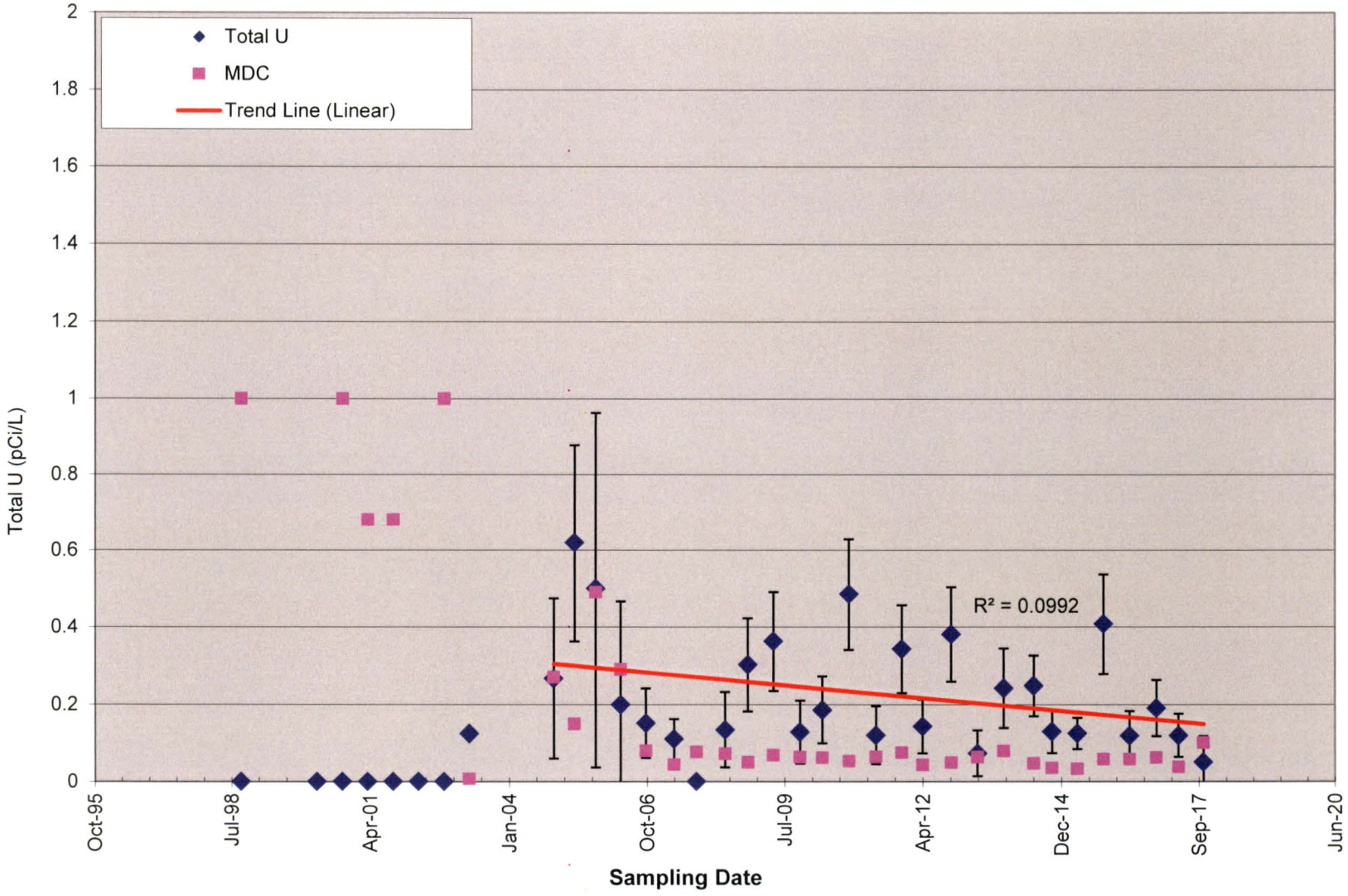
MDC – Minimum Detectable Concentration

Figure 4-9. Total Uranium in MW-DU-009 (1998-2017)



MDC – Minimum Detectable Concentration

Figure 4-10. Total Uranium in MW-DU-010 (1998-2017)



MDC – Minimum Detectable Concentration
NOTE: Uranium was not detected in the October 2007 sample.

Figure 4-11. Total Uranium in MW-DU-011 (1998-2017)

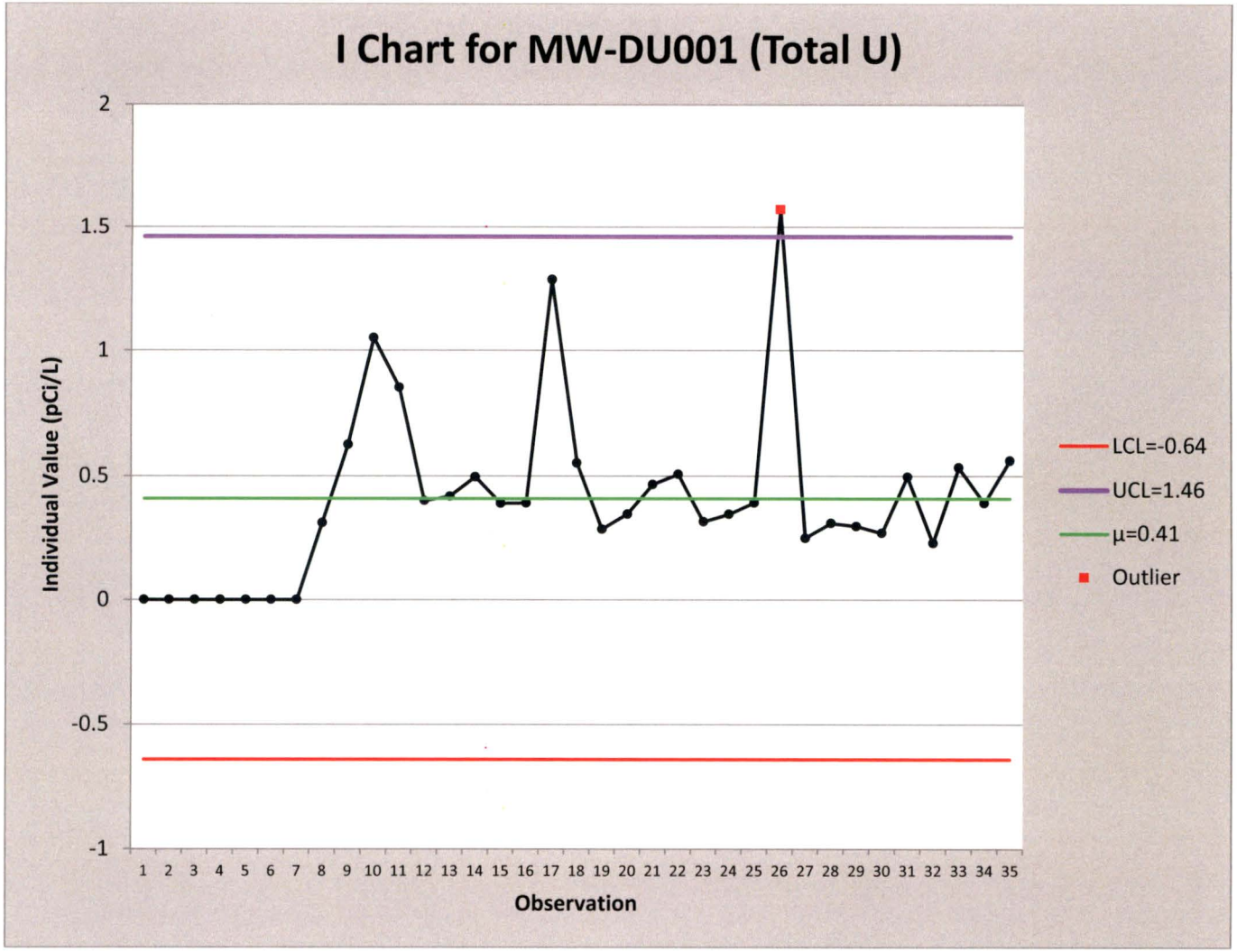


Figure 4-12. Variable Control Chart for Total Uranium in MW-DU-001 (2004-2017)

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

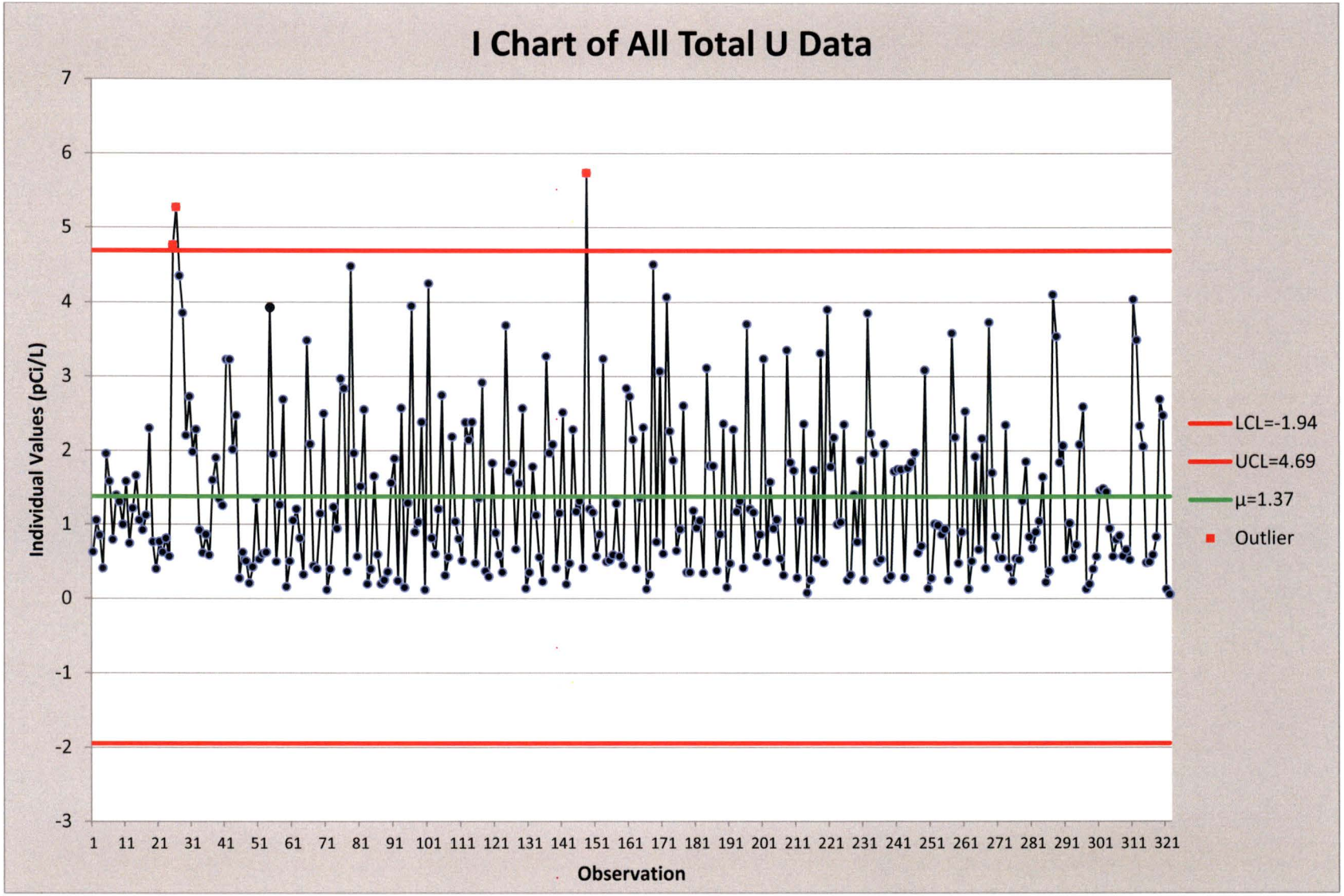
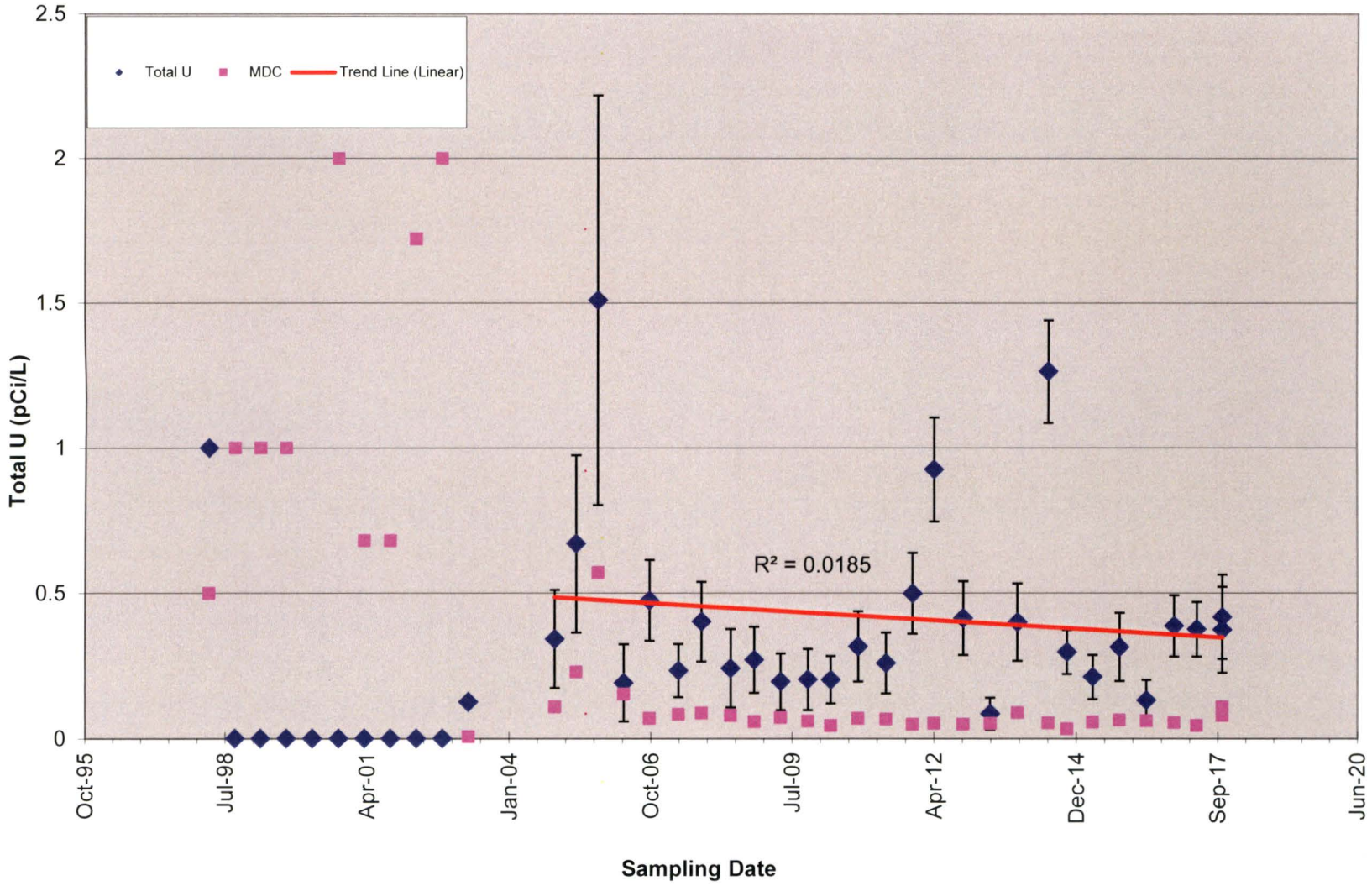


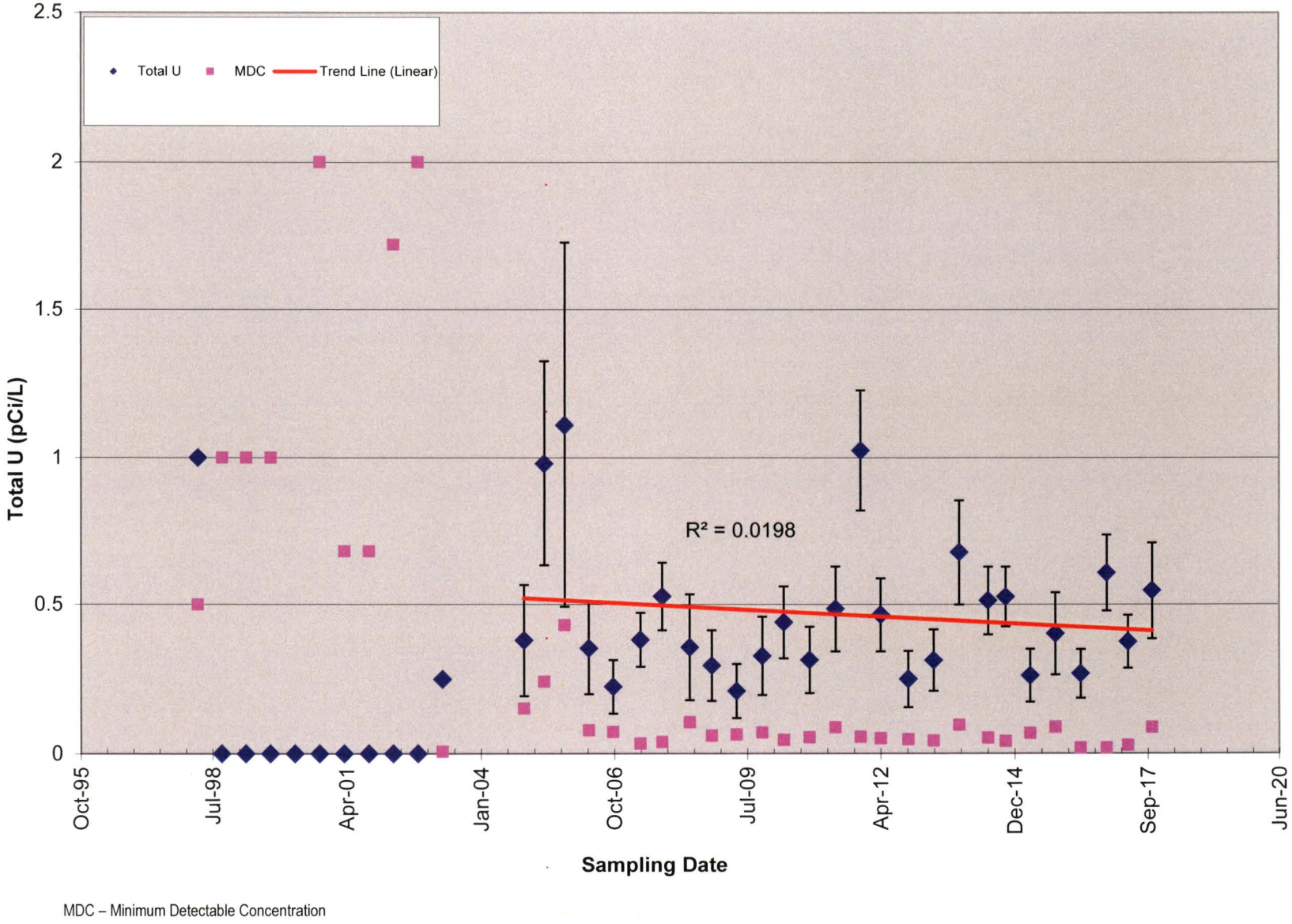
Figure 4-13. Control Chart for All Monitoring Well Data (2004-2017)

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



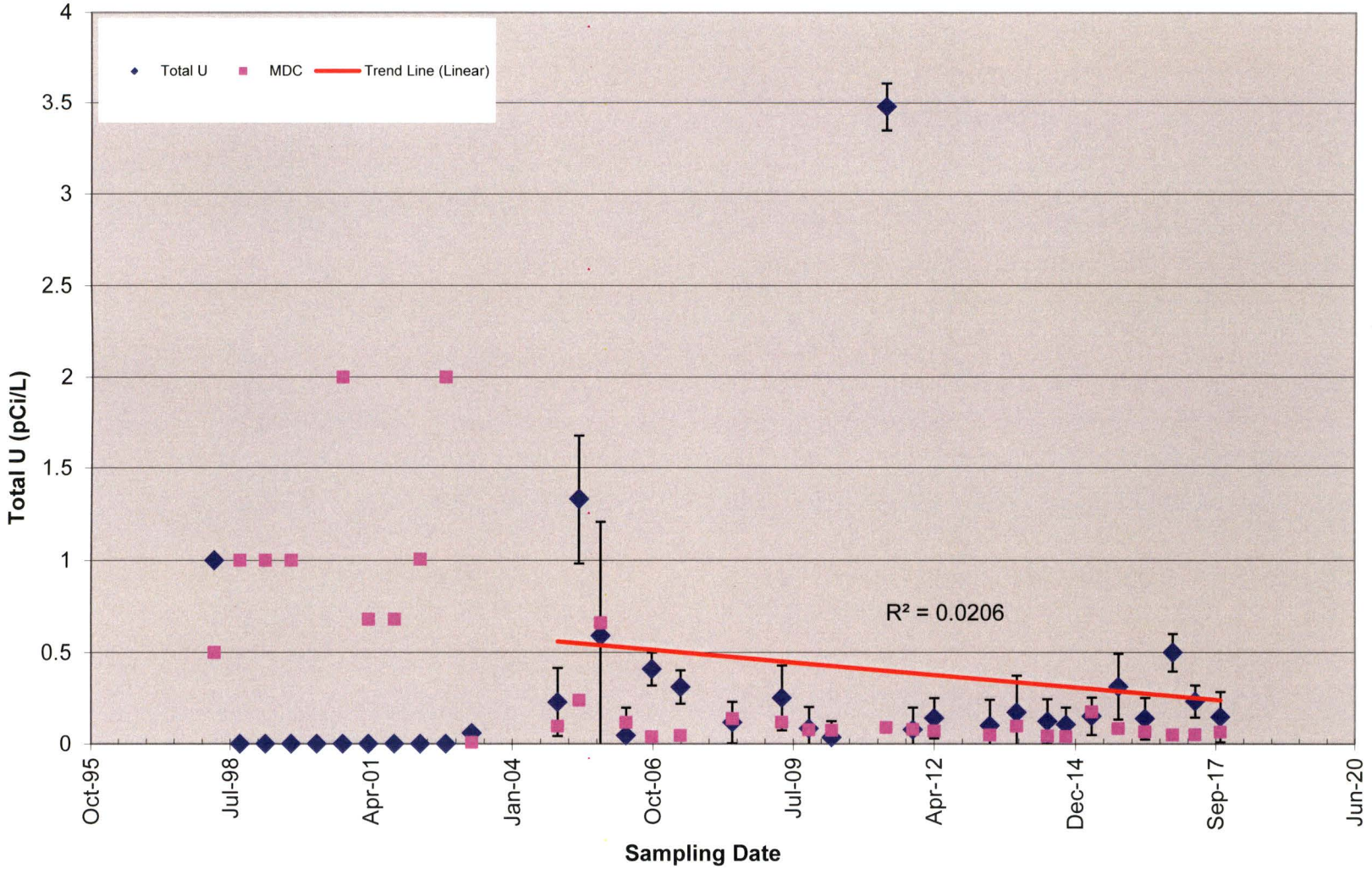
MDC – Minimum Detectable Concentration

Figure 4-14. Total Uranium in SW-DU-001 (1998-2017)



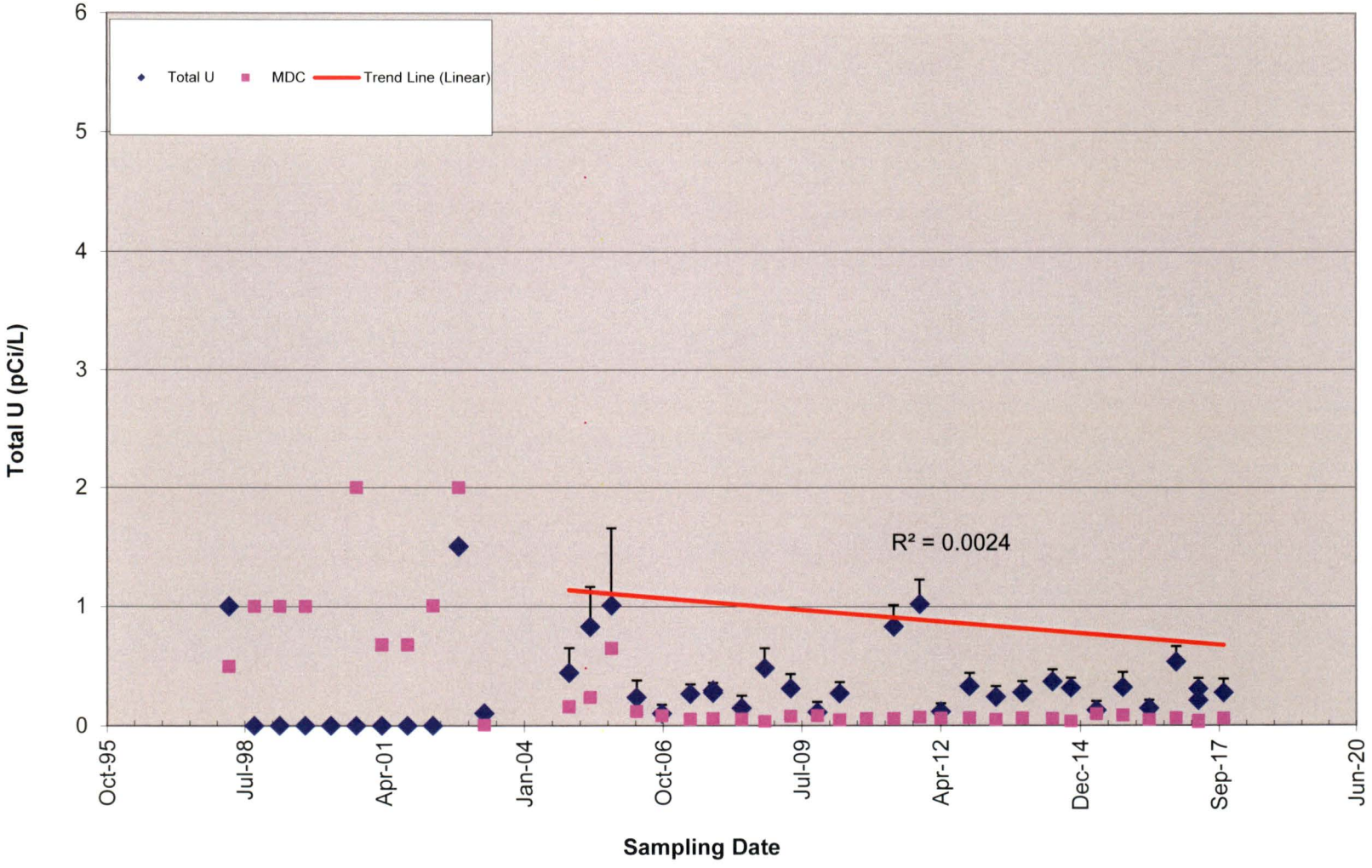
MDC – Minimum Detectable Concentration

Figure 4-15. Total Uranium in SW-DU-002 (1998-2017)



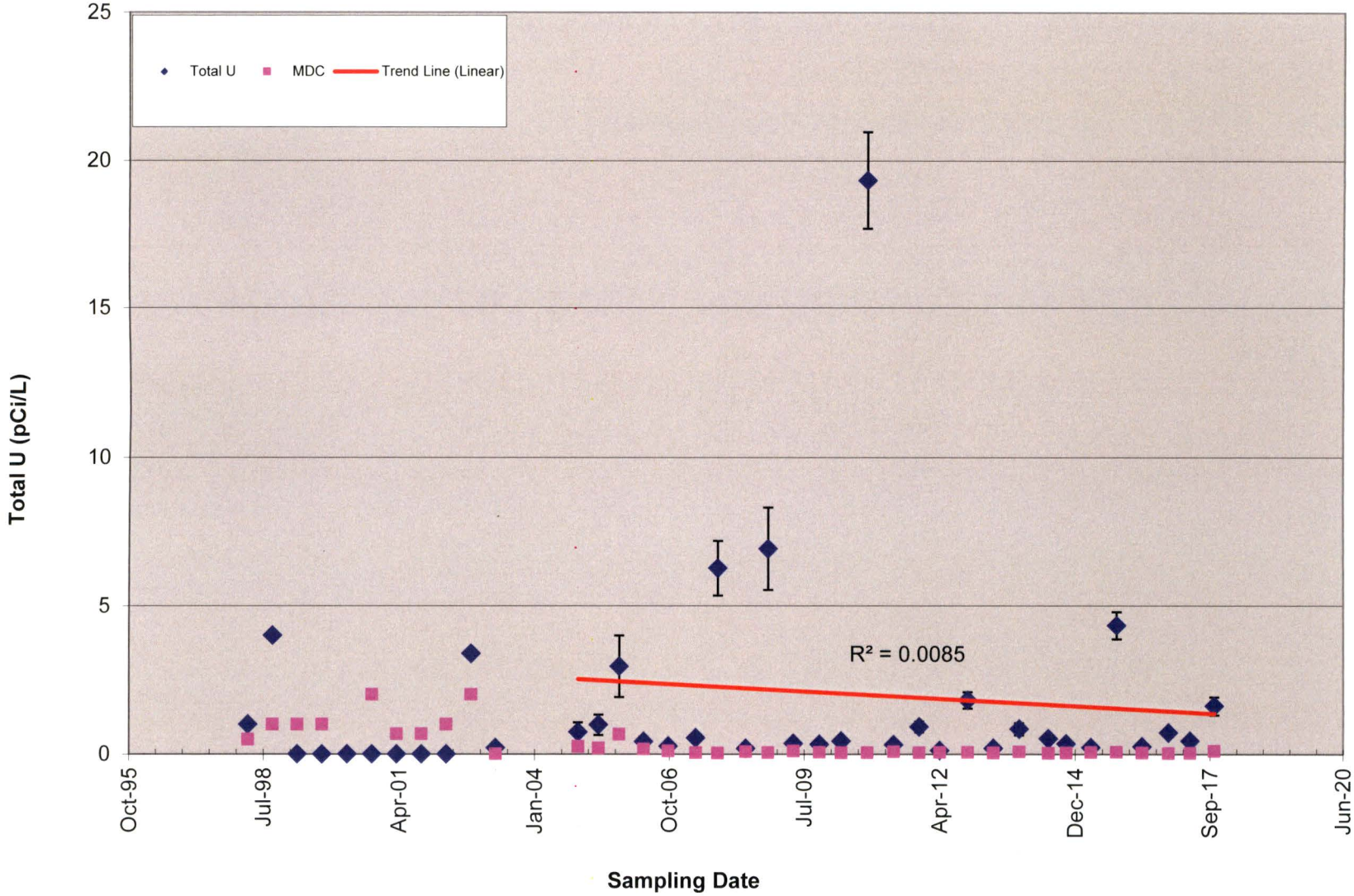
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2007, October 2008, October 2010, or October 2012 as the creek was dry during each of these sampling events.

Figure 4-16. Total Uranium in SW-DU-003 (1998-2017)



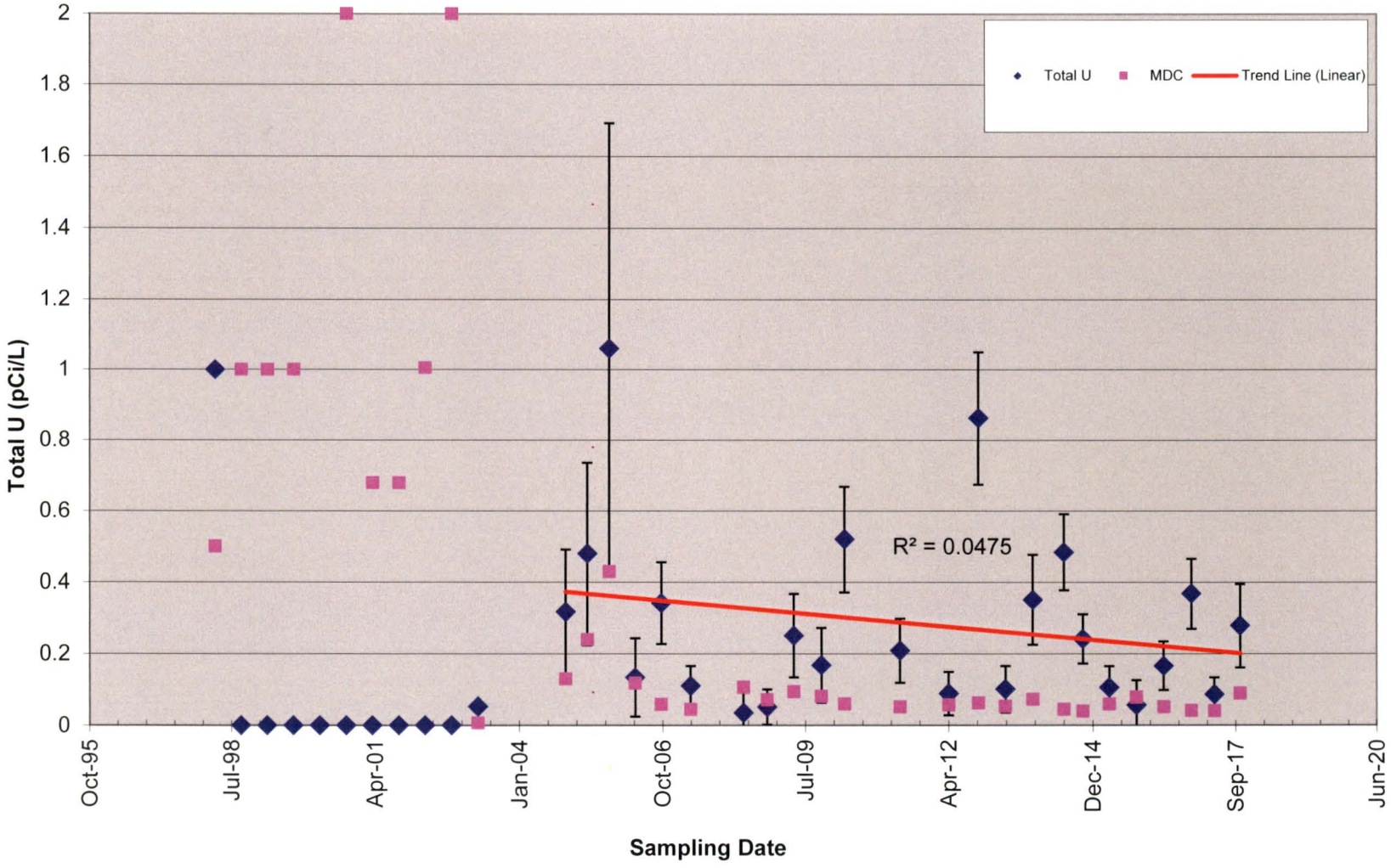
MDC – Minimum Detectable Concentration
NOTE: A large value of 15.98 pCi/g in October 2010 is not shown on the graph because it was causing a compression of the Y axis scale.

Figure 4-17. Total Uranium in SW-DU-004 (1998-2017)



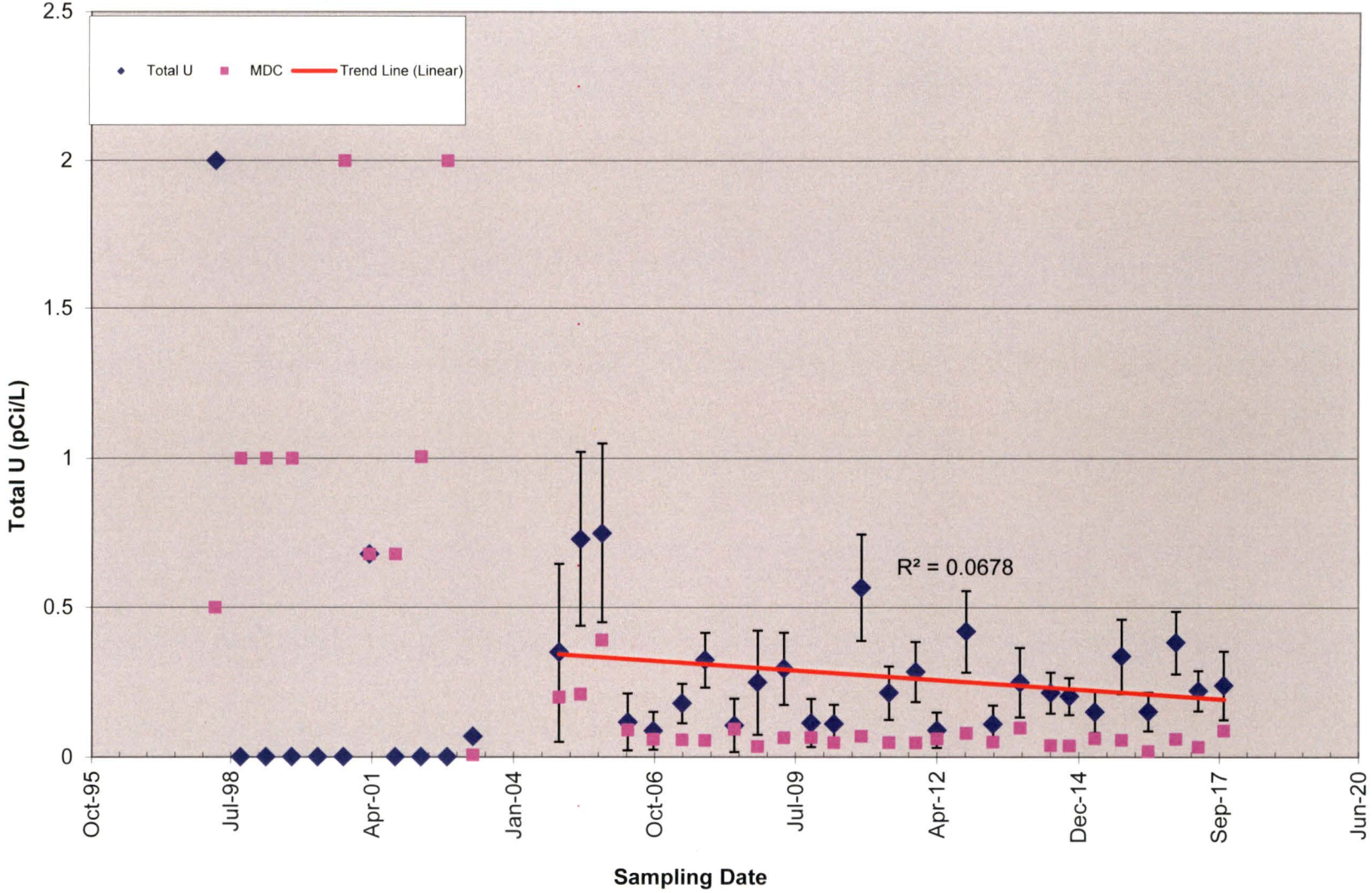
MDC – Minimum Detectable Concentration
NOTE: A large value of 29 pCi/g in October 1999 is not shown on the graph because it was causing a compression of the Y axis scale.

Figure 4-18. Total Uranium in SW-DU-005 (1998-2017)



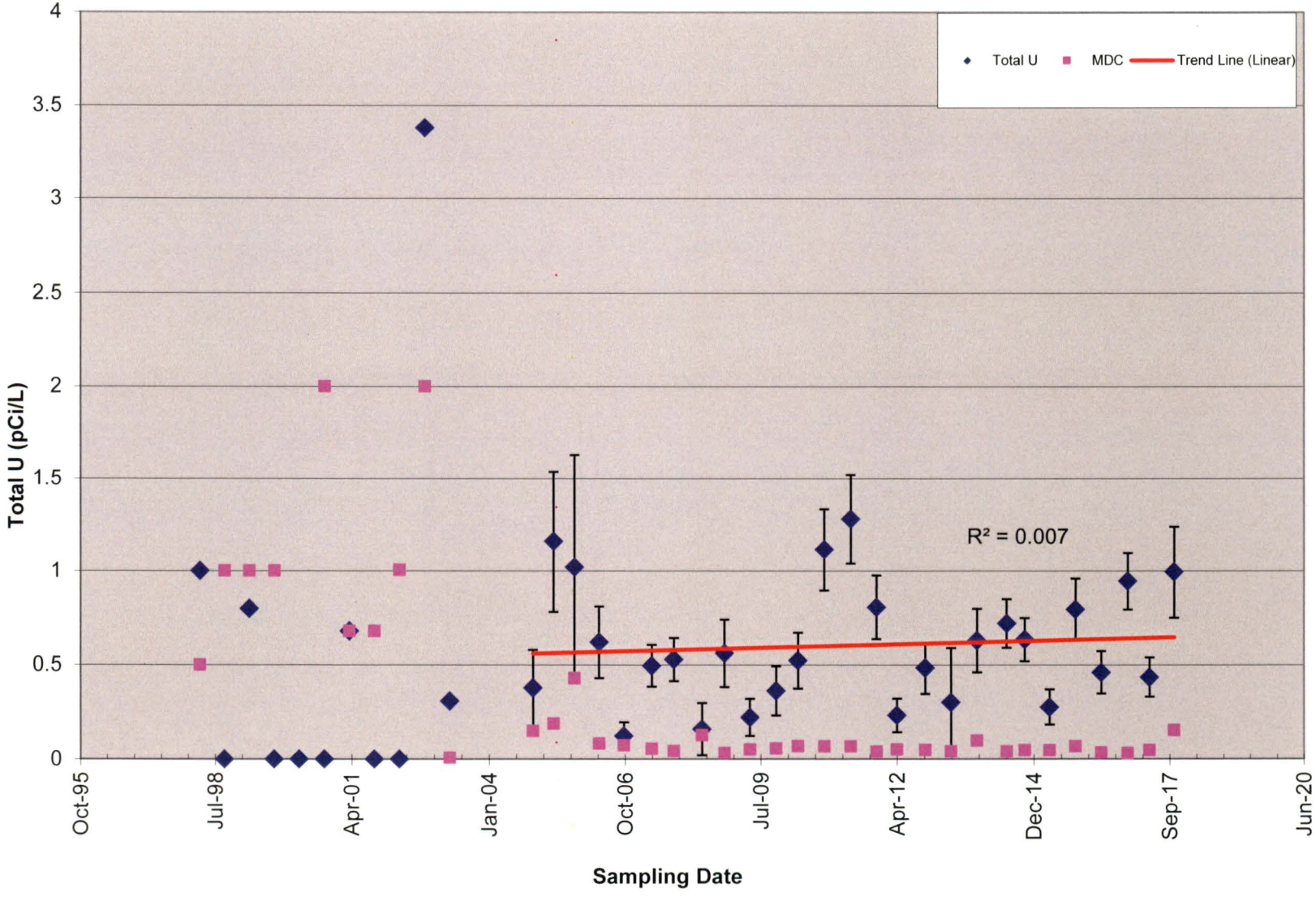
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2007 or October 2010 as the creek was dry.

Figure 4-19. Total Uranium in SW-DU-006 (1998-2017)



MDC – Minimum Detectable Concentration
NOTE: A large value of 2 pCi/g 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 (1998-2017)



MDC – Minimum Detectable Concentration

Figure 4-21. Total Uranium in SW-DU-008 (1998-2017)

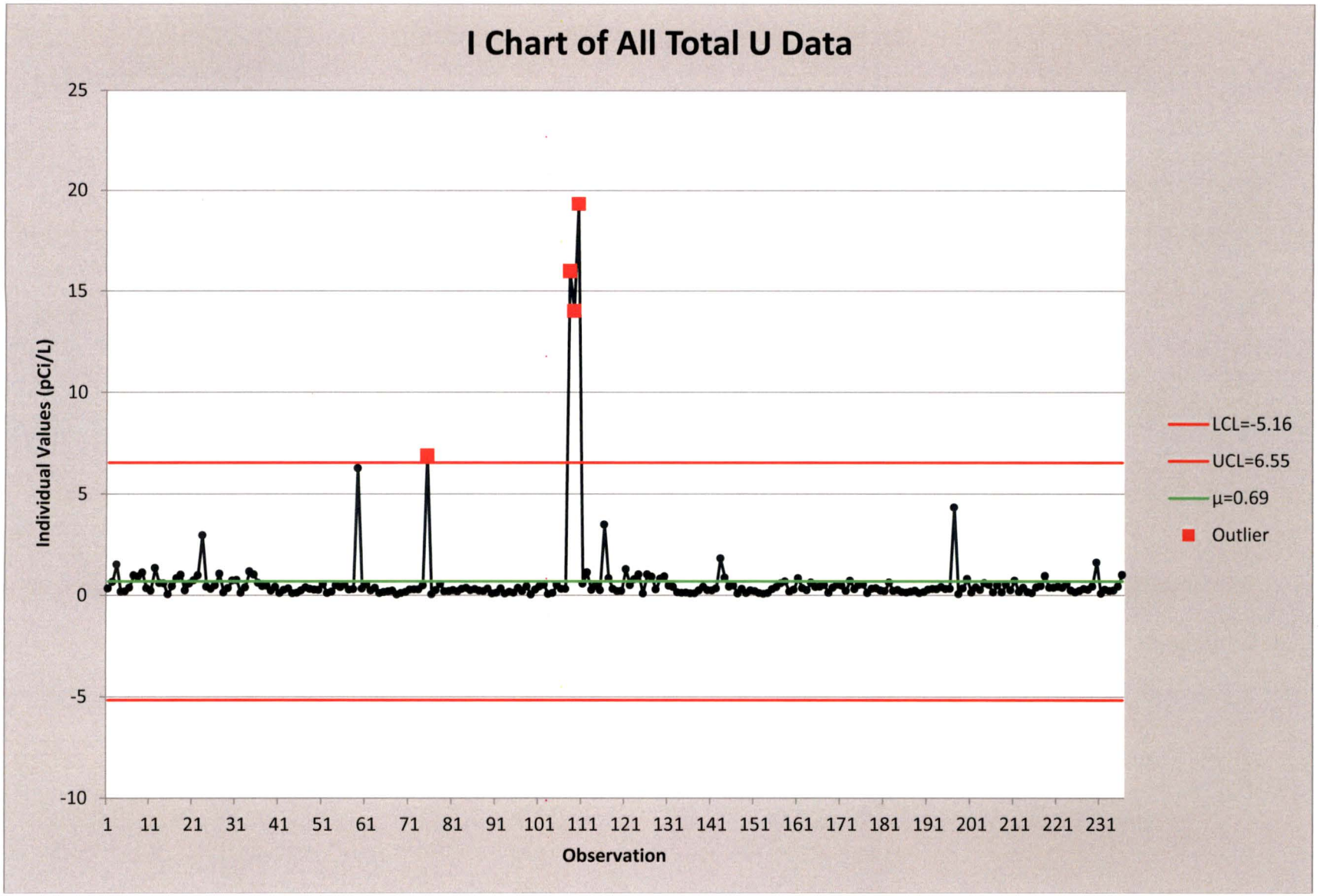
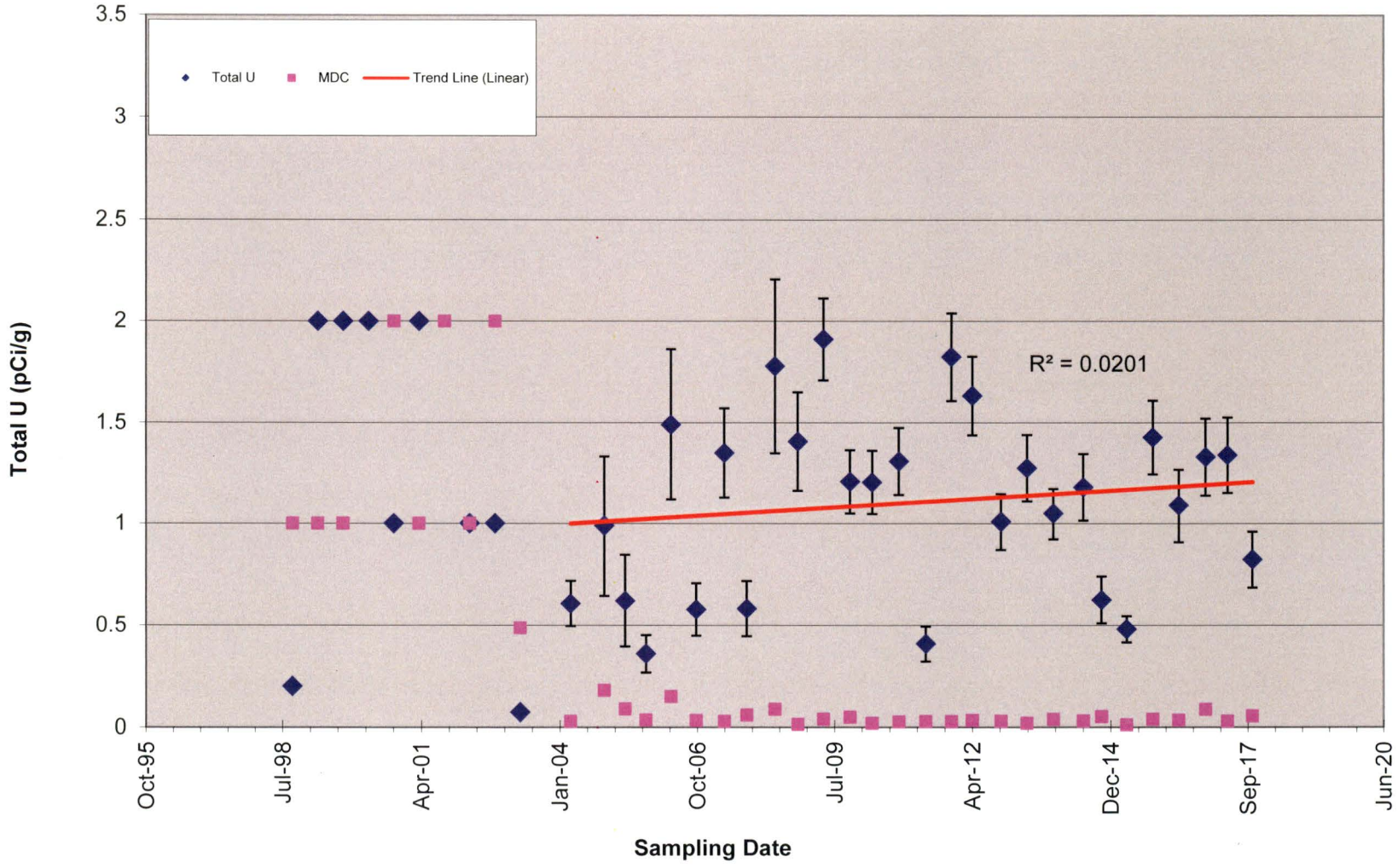


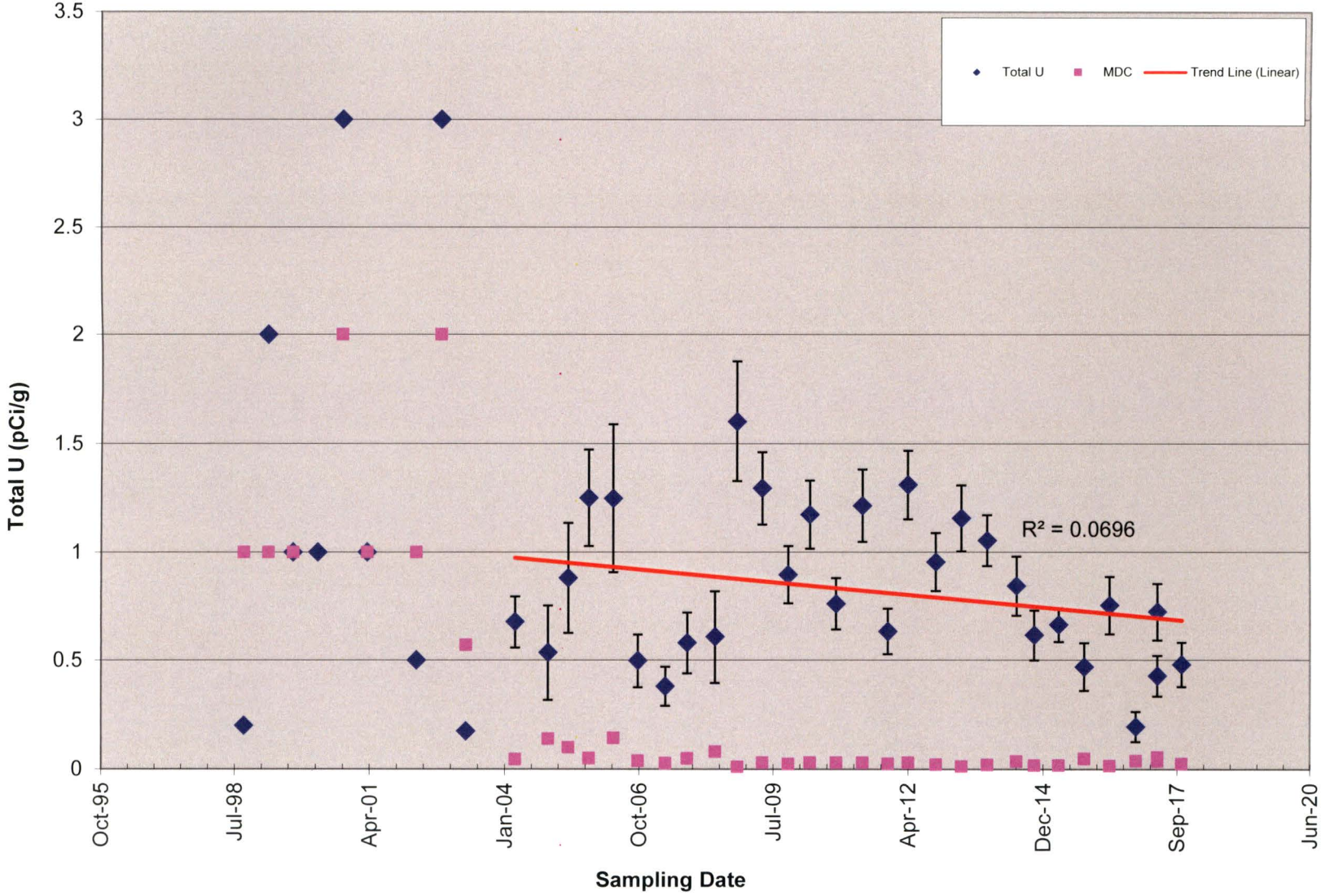
Figure 4-22. Control Chart for All Surface Water Data (2004-2017)

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



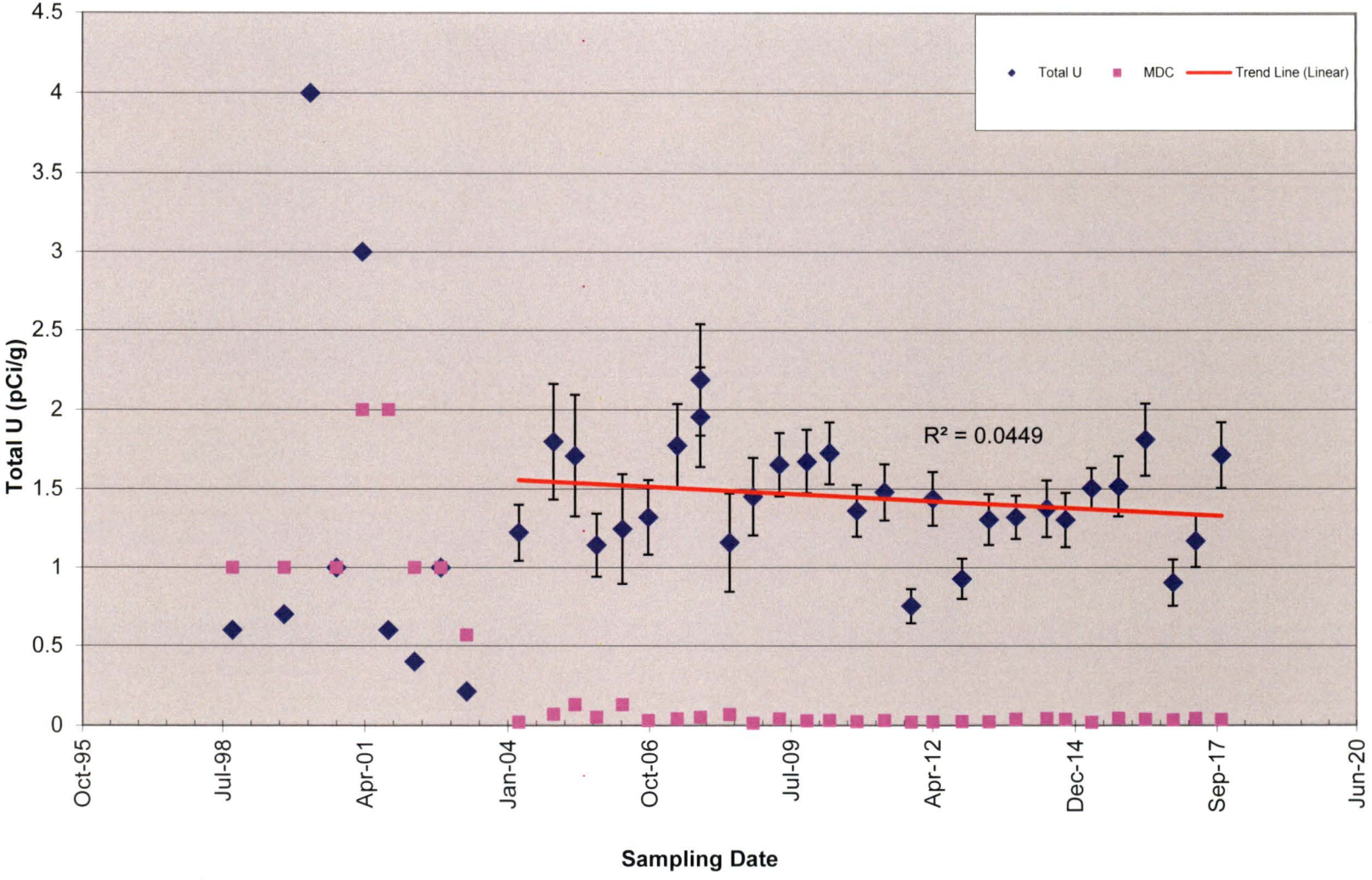
MDC – Minimum Detectable Concentration

Figure 4-23. Total Uranium in SD-DU-001 (1998-2017)



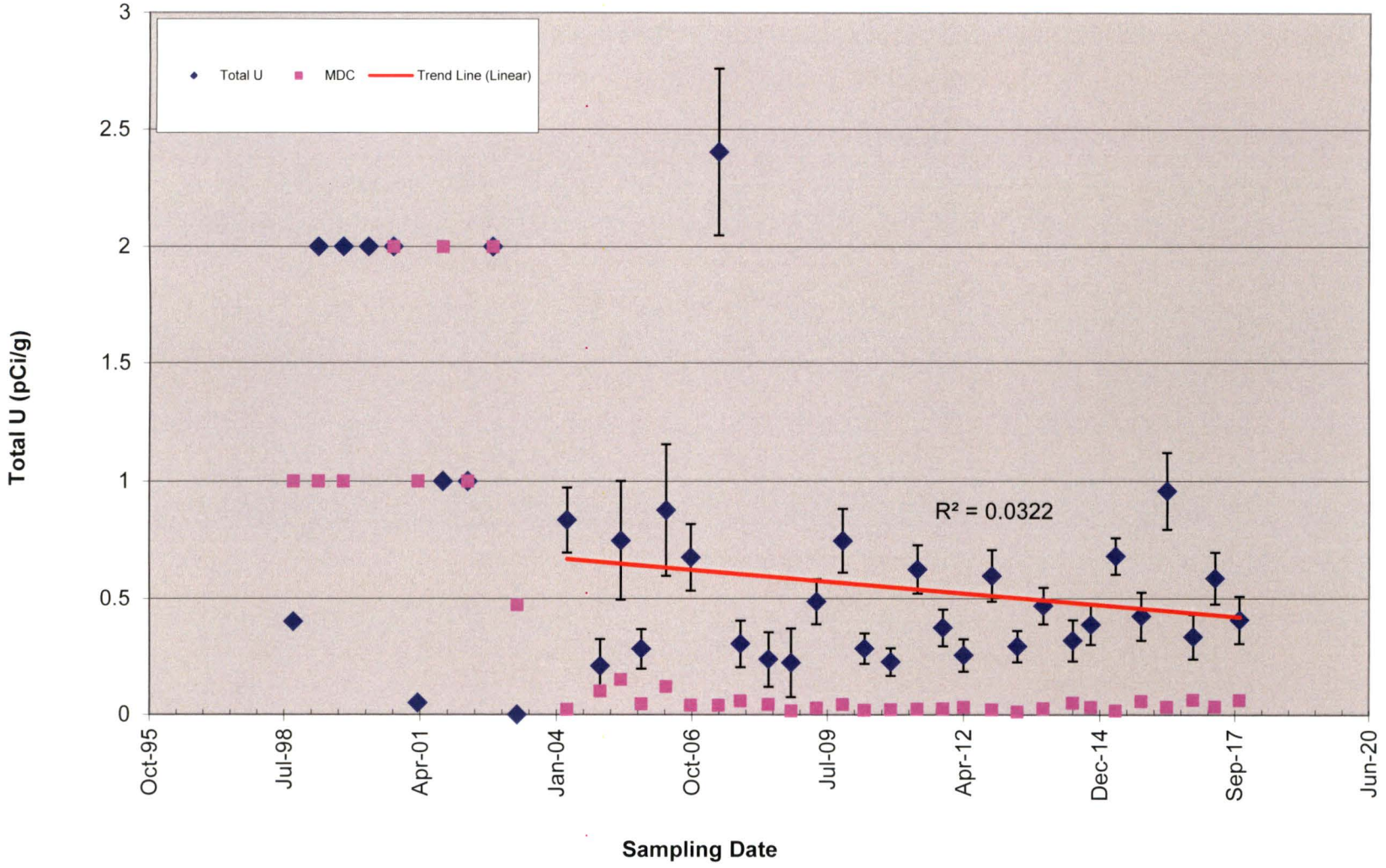
MDC – Minimum Detectable Concentration

Figure 4-24. Total Uranium in SD-DU-002 (1998-2017)



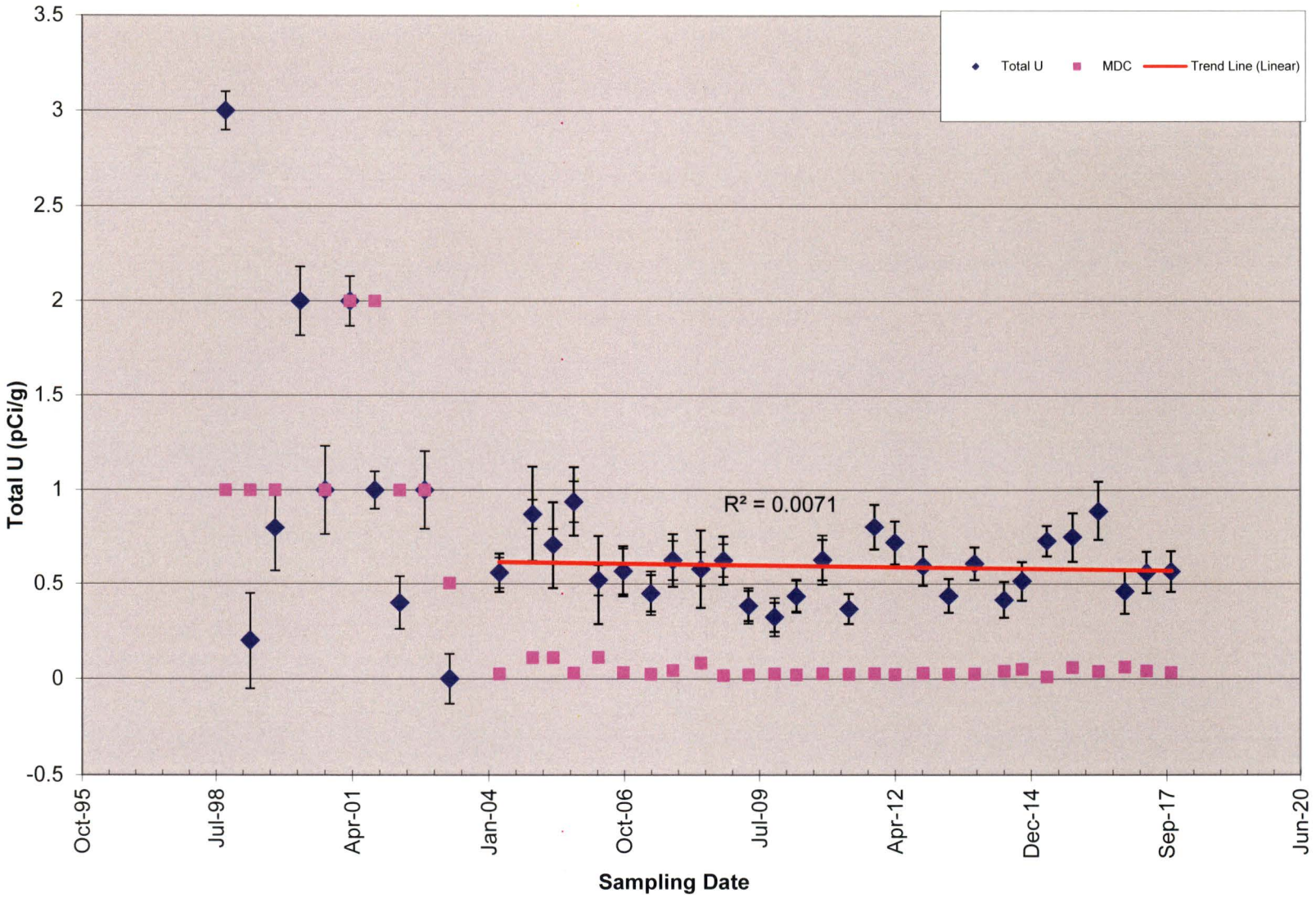
MDC – Minimum Detectable Concentration

Figure 4-25. Total Uranium in SD-DU-003 (1998-2017)



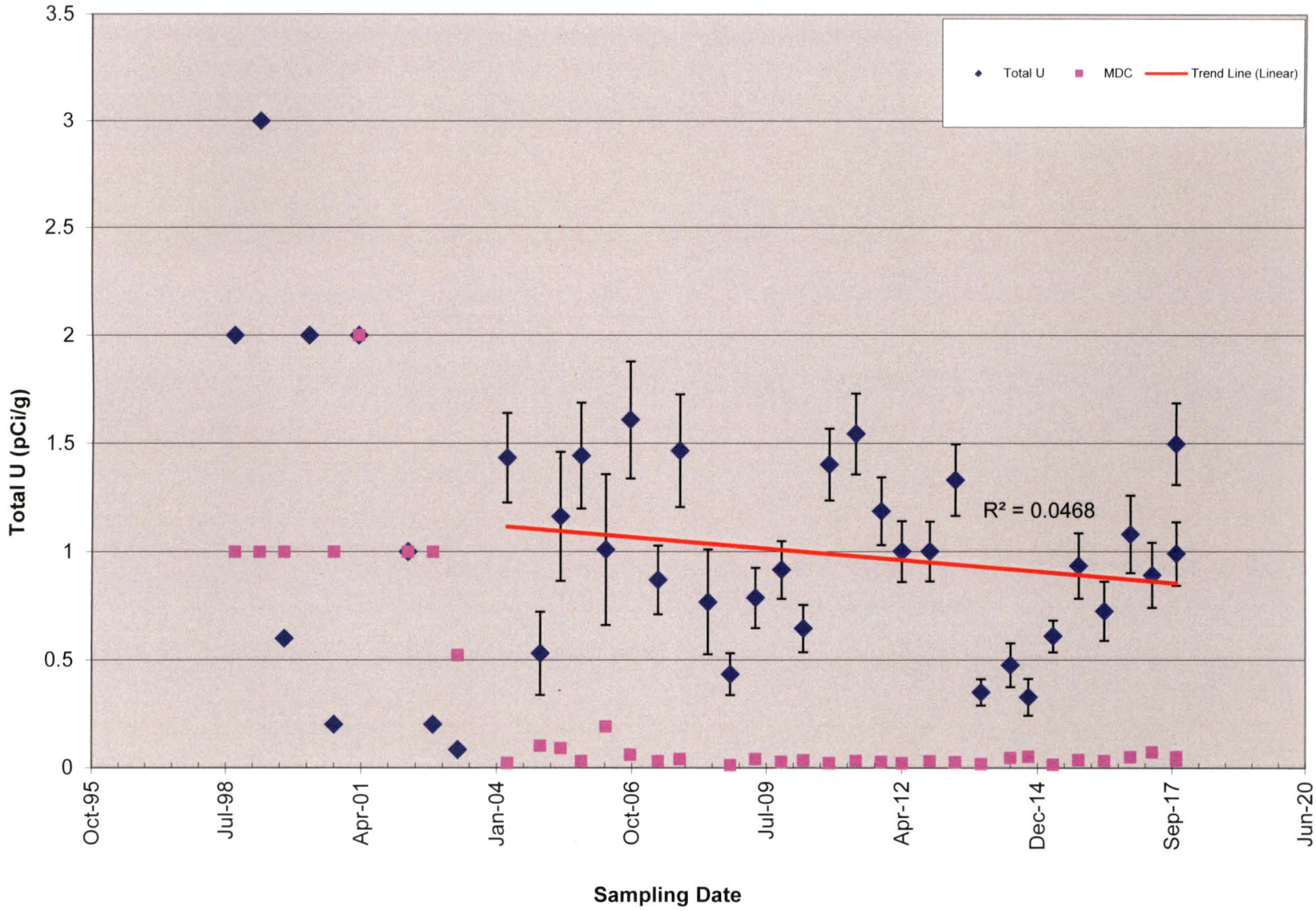
MDC – Minimum Detectable Concentration

Figure 4-26. Total Uranium in SD-DU-004 (1998-2017)



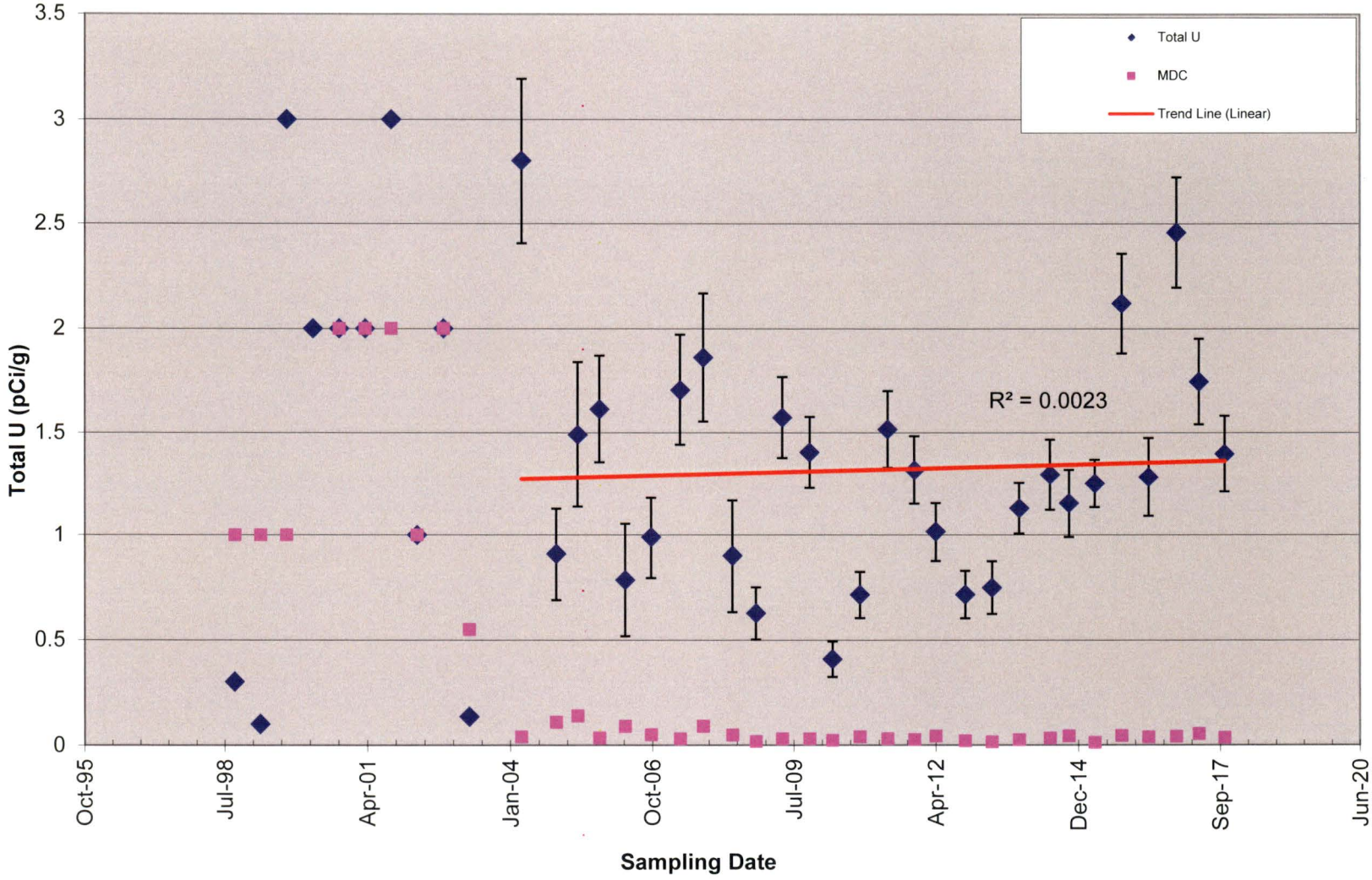
MDC – Minimum Detectable Concentration

Figure 4-27. Total Uranium in SD-DU-005 (1998-2017)



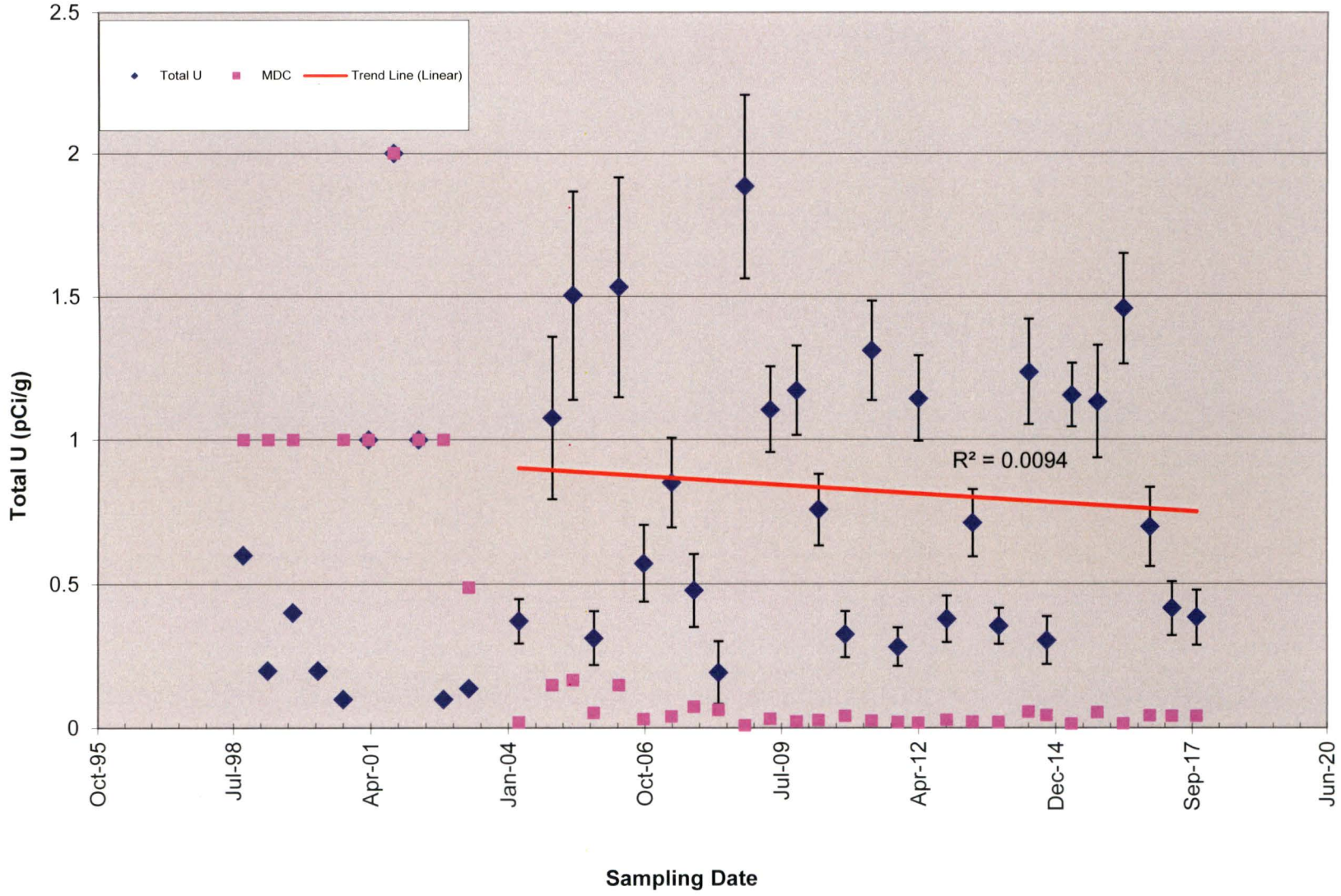
MDC – Minimum Detectable Concentration

Figure 4-28. Total Uranium in SD-DU-006 (1998-2017)



MDC – Minimum Detectable Concentration

Figure 4-29. Total Uranium in SD-DU-007 (1998-2017)



MDC – Minimum Detectable Concentration

Figure 4-30. Total Uranium in SD-DU-008 (1998-2017)

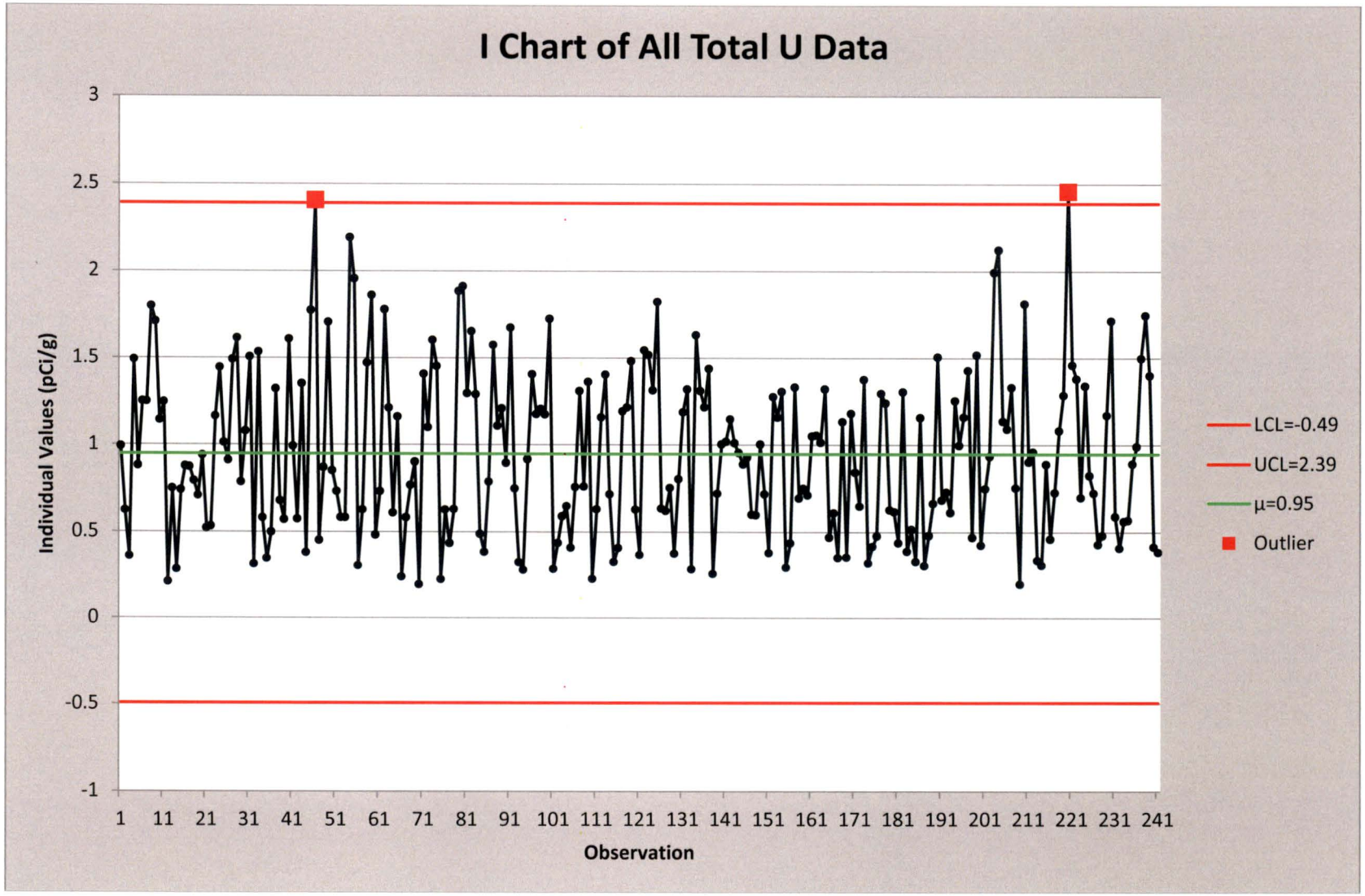
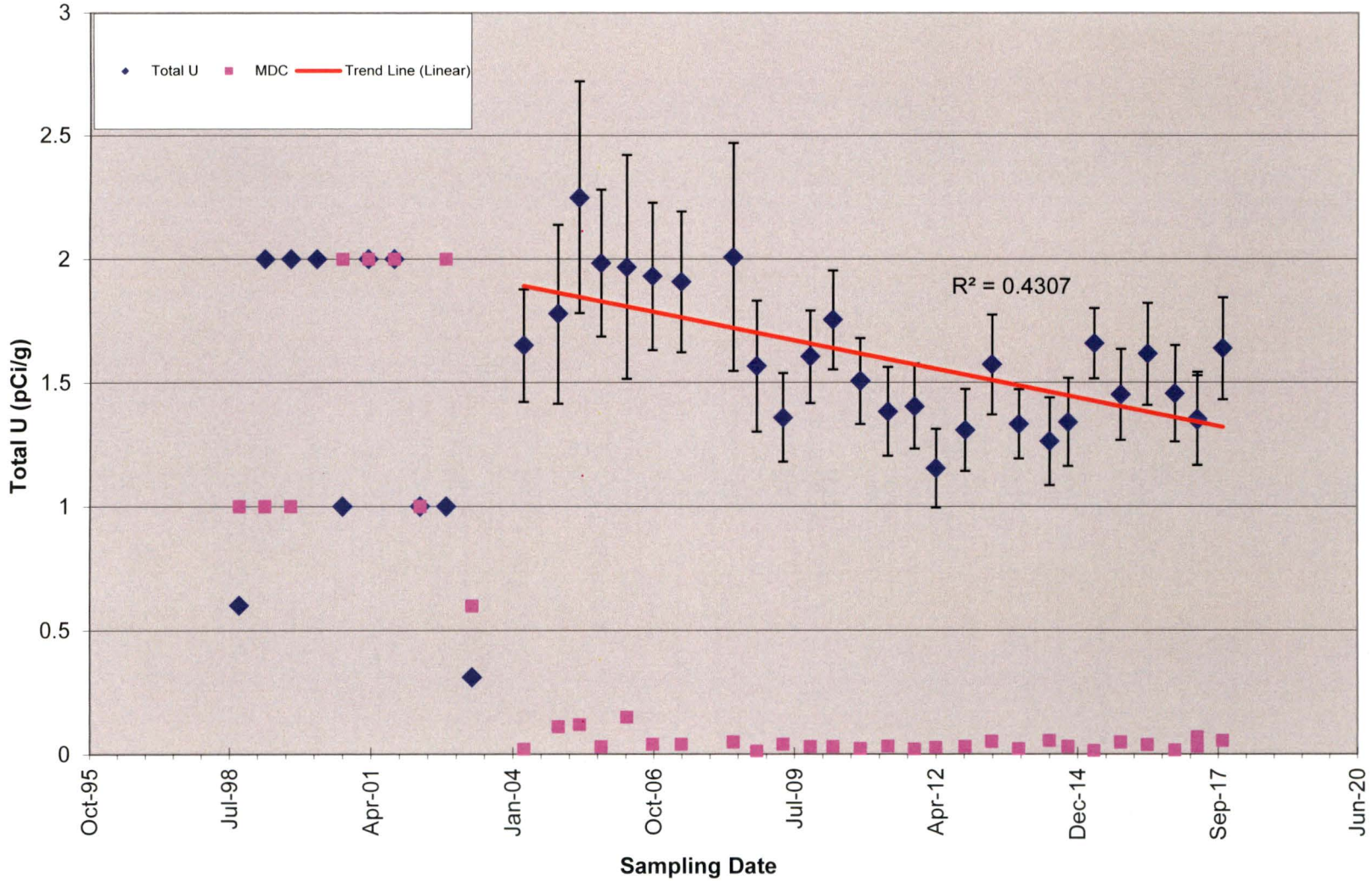
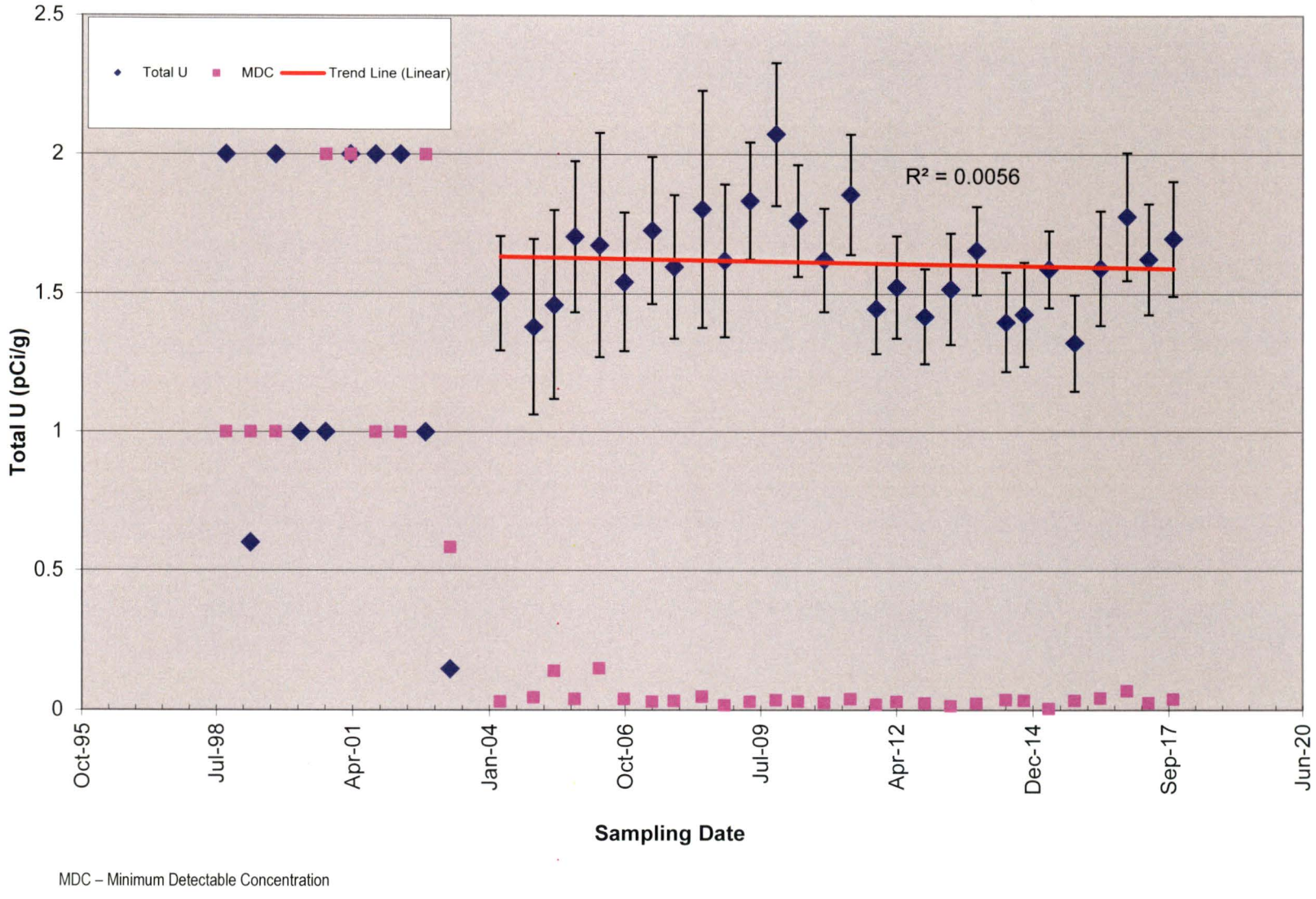


Figure 4-31. Control Chart for All Sediment Data (2004-2017)
NOTE: Results that exceed the UCL or fall below the LCL are reflected in the red square.



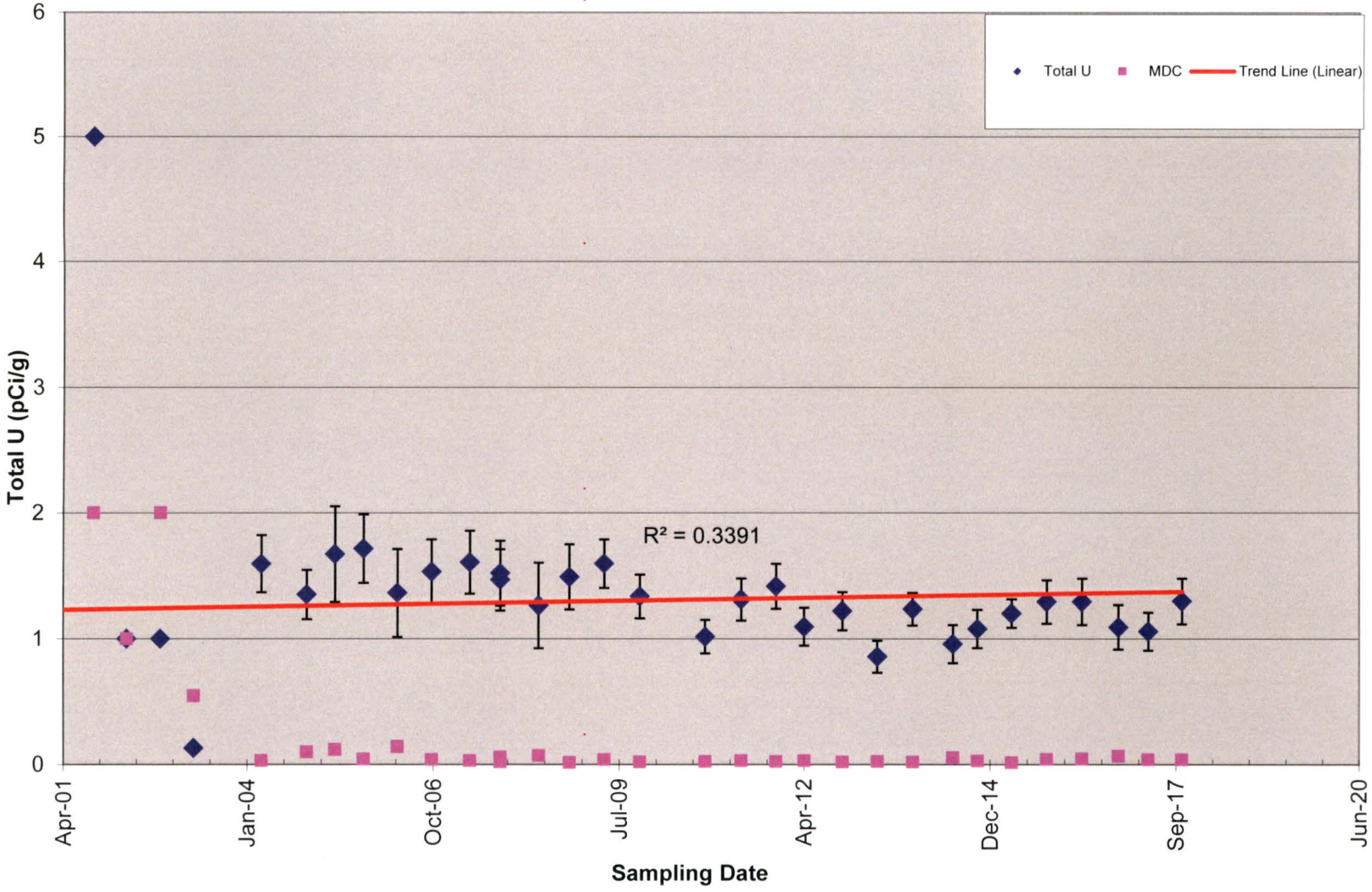
MDC – Minimum Detectable Concentration

Figure 4-32. Total Uranium in SS-DU-001 (1998-2017)



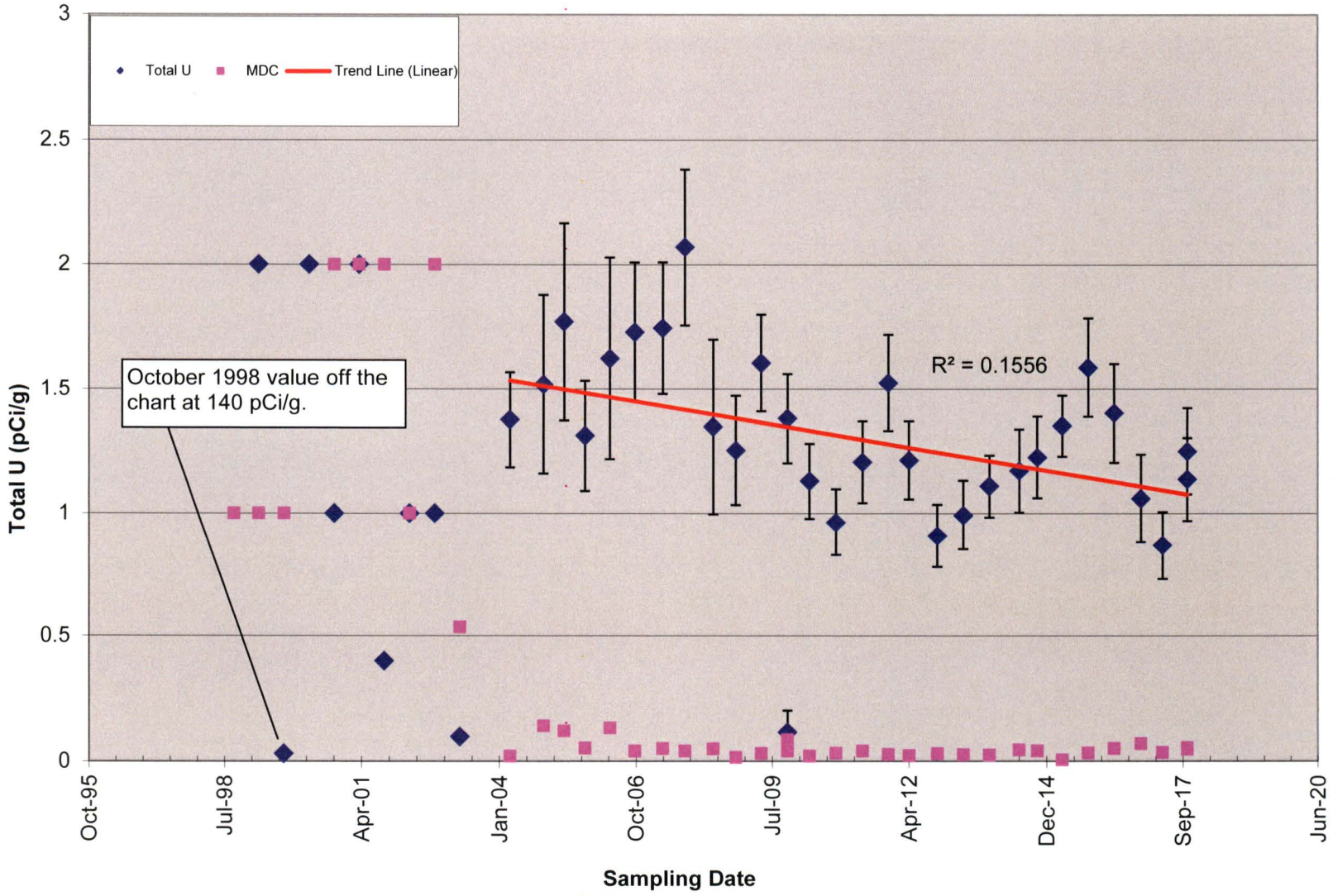
MDC – Minimum Detectable Concentration

Figure 4-33. Total Uranium in SS-DU-002 (1998-2017)



MDC – Minimum Detectable Concentration

Figure 4-34. Total Uranium in SS-DU-003 (1998-2017)



MDC – Minimum Detectable Concentration
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 (1998-2017)

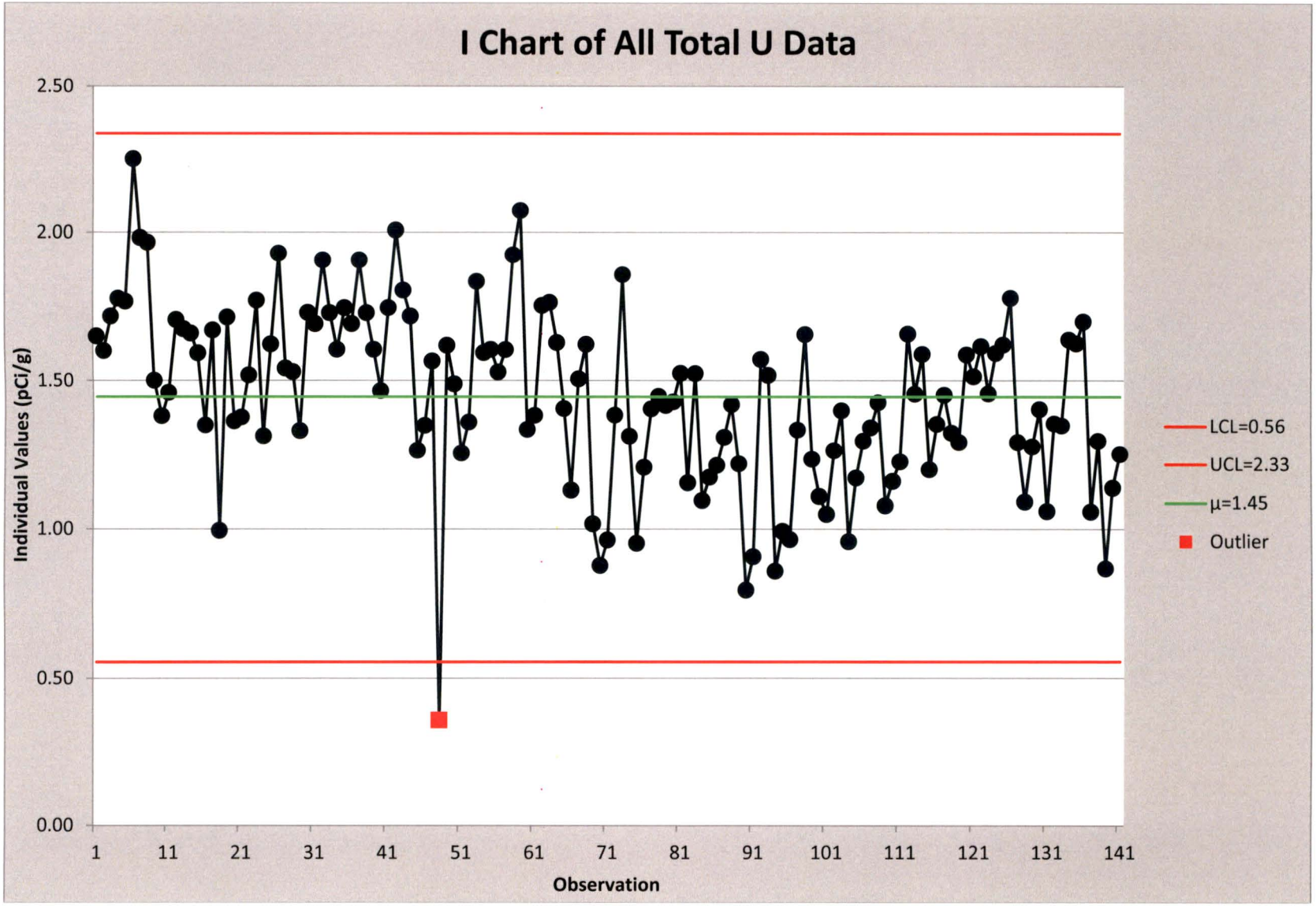


Figure 4-36. Control Chart for All Surface Soil Data (2004-2017)

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

5. CONCLUSIONS AND RECOMMENDATIONS

The April and October 2017 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 samples for which the U-238/U-234 ratio could exceed 3.0 were SD-DU-005 (4.6 ± 2.4 for the April 2017 sample), SW-DU-004 (1.8 ± 1.5 for the October 2017 sample), and SW-DU-005 (4.9 ± 2.5 for the October 2017 sample).

ICP-MS results for SD-DU-005 from the April 2017 sample equated to 0.64, non-detect, non-detect, and 0.64 mg/kg for total uranium, U-234, U-235, and U-238, respectively. Given that the mass of U-235 was not detected, the evaluation of weight percent U-235 could not be performed to determine if the results are suggestive of the possible presence of DU in sediment at SD-DU-005.

ICP-MS results for SW-DU-004 from the October 2017 sample equated to 0.65, non-detect, non-detect, and 0.65 µg/L for total uranium, U-234, U-235, and U-238, respectively. Given that the mass of U-235 was not detected, the evaluation of weight percent U-235 could not be performed to determine if the results are suggestive of the possible presence of DU in surface water at SW-DU-004.

ICP-MS results for SW-DU-005 from the October 2017 sample equated to 3.9, non-detect, non-detect, and 3.9 µg/L for total uranium, U-234, U-235, and U-238, respectively. Given that the mass of U-235 was not detected, the evaluation of weight percent U-235 could not be performed to determine if the results are suggestive of the possible presence of DU in surface water at SW-DU-005.

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 R^2 value of 1.0, which would have indicated a strong relationship between sampling results and sampling dates. The lone sample that reflected an R^2 value exceeding 0.50 (i.e., somewhat significant) was monitoring well sample MW-DU-009. The samples from this location reflected an R^2 value of 0.71. 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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SOP No. OHP 40-2

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

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.

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

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).

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)

SOIL:

- Perimeter and background samples:

  ≤ 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 ≤ 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 3.0×10^{-1} pCi/ml

  < 1.5×10^{-1} pCi/ml - no corrective action.

  > 1.5×10^{-1} pCi/ml - resample; if results above 1.5×10^{-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.

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

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.

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.

l. **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
c.	g	gram
d.	HPP	Health Physics Program
e.	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
l.	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

Request for Laboratory Services

Directorate of Laboratory Sciences
REQUEST FOR LABORATORY SERVICES

PLEASE PRINT OR TYPE ALL REQUESTED INFORMATION

For DLS Use Only
LIMS JOB#
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
8. NAME OF SAMPLE COLLECTOR: Mr David Collins
9. PROJECT DESCRIPTION/OBJECTIVE *(Screen, Monitoring, Regulatory or Health Concern*, Etc.):
   Sampling required as part of the Environmental Radiation Monitoring Plan
10. SAMPLE OR SITE HISTORY (High Toxicity, Etc):
    DU Firing Range
11. PROJECT COORDINATOR/DLS TECHNICAL CONSULTANT - Was project coordinated with DLS? ☒ 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 Made 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 Subject to Cost Surcharges.)

PART 3: REPORT DISTRIBUTION OPTIONS

1. REPORT RESULTS BY: *(Indicate Preference)*
   ☒ cc:MAIL/E-MAIL TO ADDRESS: david.collins@apg.amedd.army.mil
   ☐ FAX TO *(Write Fax#)*:
   ☒ MAIL:

REQUESTED BY: Mr. David Collins
PRINT NAME: SIGNATURE:
(Note: Signature Required if Submitted by Hard Copy)

CHPPM Form 330-R-E, 1 May 96, (MCHB-DC-LLI) Replaces AEHA Form 330-R, Jul 93, which is obsolete.

Figure B-1a

PART 4: PROJECT COORDINATION INFORMATION

1. DATE SAMPLES TO ARRIVE AT DLS: 12/04/2000

(Note: Prior Arrangements Must Be Made with SML for Samples That Will Arrive Outside of Routine Duty Hours which are M-F 0730 -1700)

Special Comments: Samples will arrive from the field without preservation or filtration.

2. SPECIAL HANDLING REQUIREMENTS:

[x] CHAIN-OF-CUSTODY (COC)

[ ] SAFETY CONSIDERATION/HAZARDOUS MATERIALS (Specify):

[x] ANALYSES WITH SHORT-HOLDING TIMES (List Specific Analyses):
Filter water samokes and test for dissolved U-238, No preservative add in the field.

[ ] OTHER (Specify):

3. SAMPLE COLLECTION KIT:

DATE REQUIRED: 07/04/2000

CHECK PREFERENCE:

[ ] 1. TO BE PICKED UP AT DLS BY PROJECT OFFICER

[x] 2. SHIP TO: *(Please include Bldg # and Phone #)*

3 large coolers and bags for soil samples need to be shipped to site
U.S. Army Hefferson Proving Ground
1661 West J.P.G. Niblo Road (Bldg 125)
Madison, IN 47250
(812) 273-2551

PART 5: SAMPLE ANALYSIS INFORMATION

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)

Table May Be Continued on Next Page if Additional Space is Required.

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 Date	Exposure Reading (µR/hr)	Sample Locations	Comments		
				pH	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 _____

JEFFERSON PROVING GROUND
DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R_-8260-__

GROUND WATER SAMPLES						
Sample ID	Sample Date	Exposure Reading (µR/hr)	Sample Locations	Comments		
				pH	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 _____			

Effective Date _____
Date Removed from Service _____

JEFFERSON PROVING GROUND
DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R_-8260-__

SOIL 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.

JEFFERSON PROVING GROUND
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)

JEFFERSON PROVING GROUND
DU SAMPLING PROGRAM
PROJECT NUMBER: 26-MA-R_-8260-__

SEDIMENT 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)

ANNEX C

SAMPLE LOCATION MAPS

Jefferson Proving Ground: DU Sampling
GROUNDWATER MONITORING WELLS

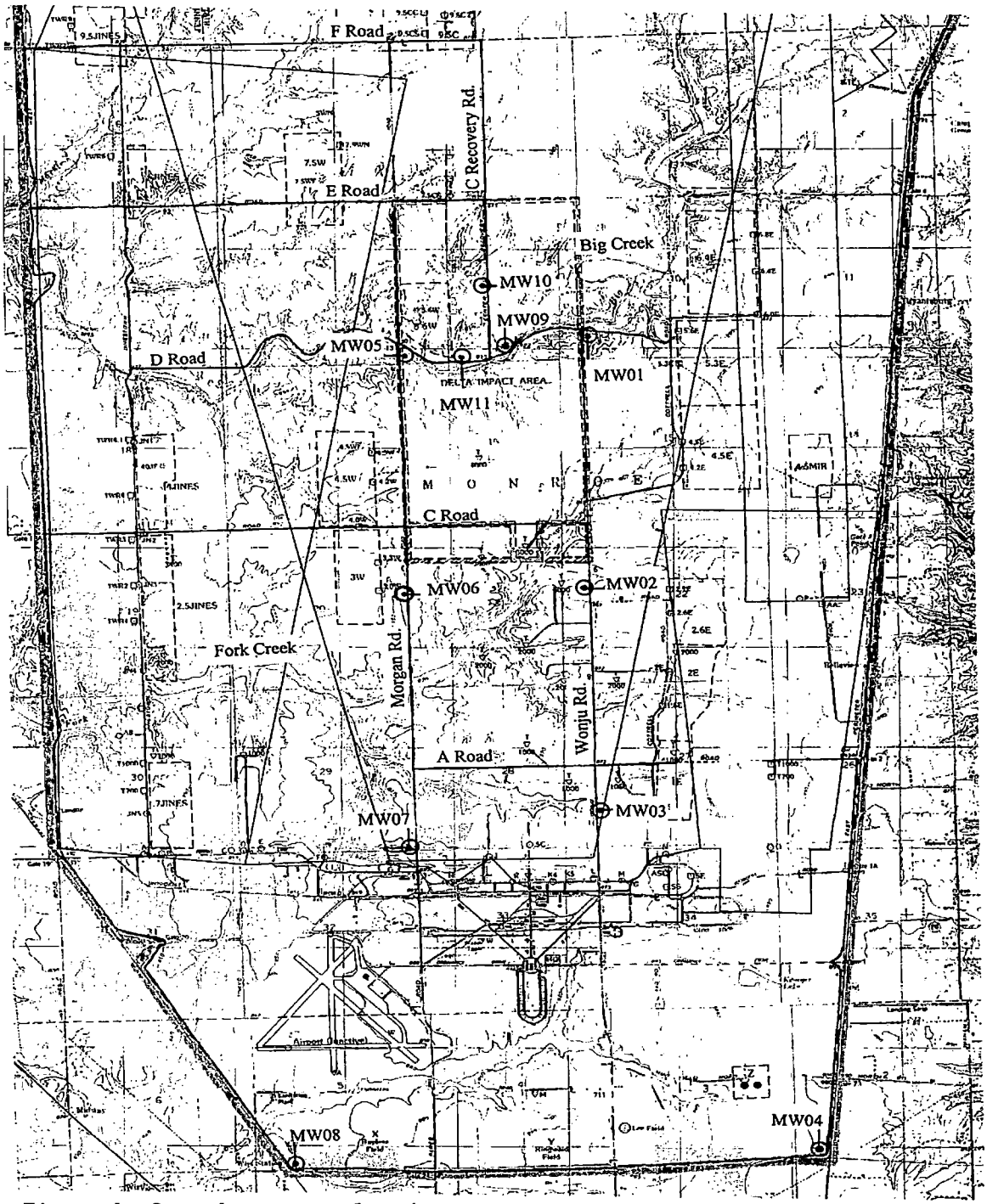

Figure 1: Groundwater samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SOIL SAMPLES

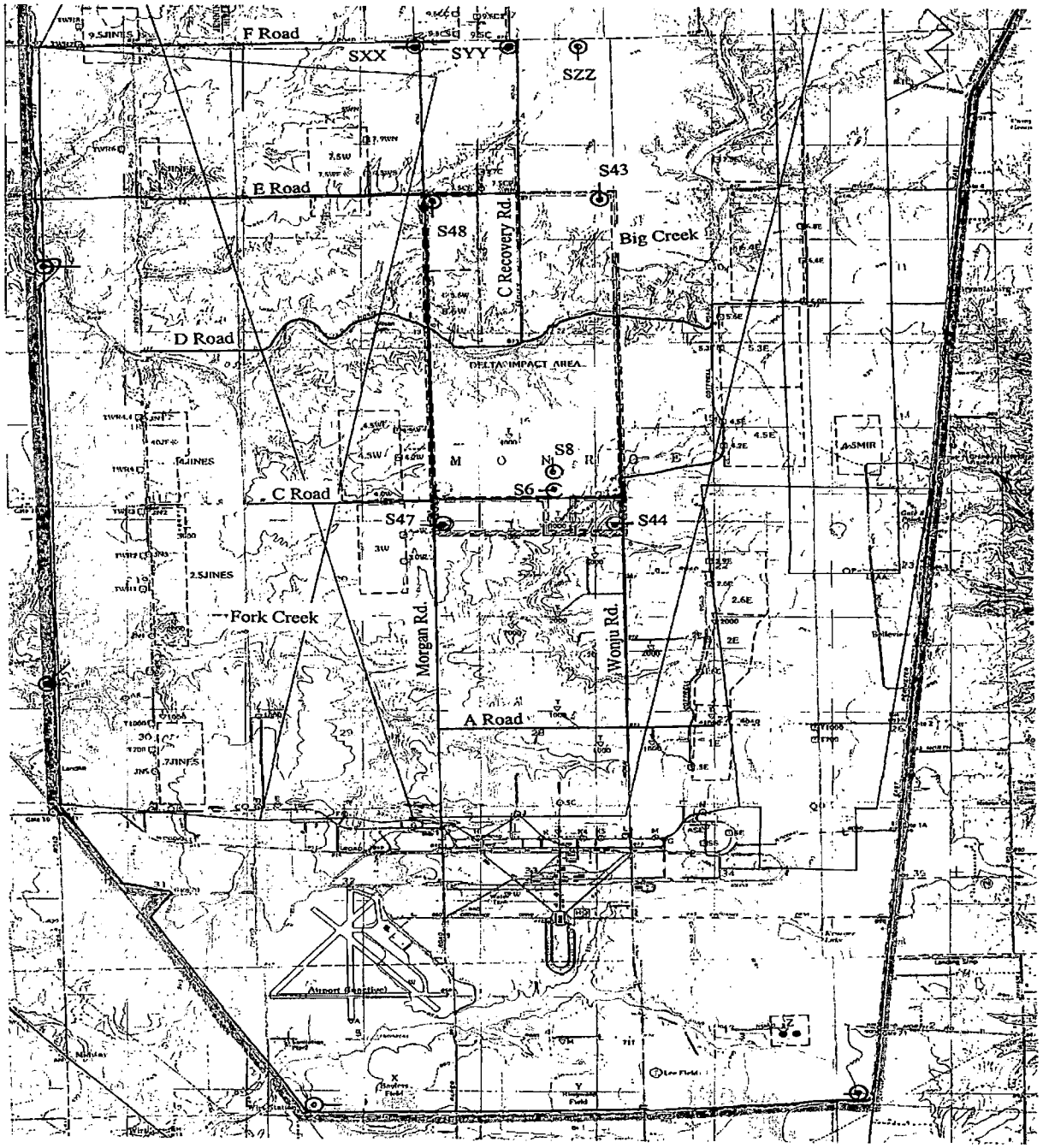

Figure 2: Soil Samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SURFACEWATER & SEDIMENT SAMPLES

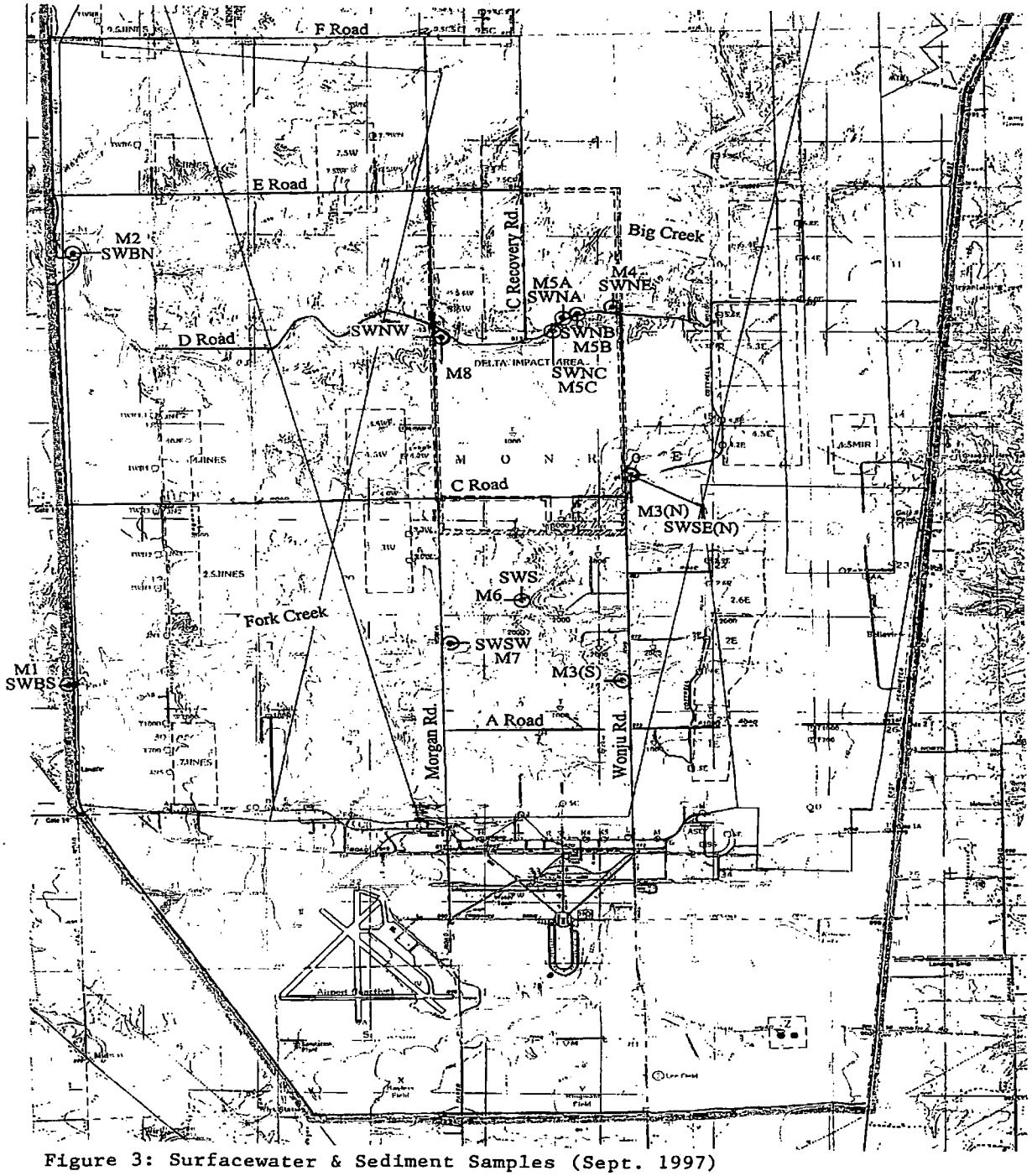

Figure 3: Surfacewater & Sediment Samples (Sept. 1997)

APPENDIX B

FIELD LOGBOOK AND SAMPLING FORMS

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GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & T. Farmer
Checked by: _____ & _____

Well Identification: MW-1
Project Location: Madison, IN
Date: 4-18-17
Date: 4-25-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft
8" I.D., K=2.61 gal/ft
10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (35.03 ft) - Depth to Water (9.79 ft) = Height of water column (25.24 ft)
Height of water column (25.24 ft) x K value (0.163 gal/ft) = 1 Well Volume (4.11 gal)

Purge Volume:

1 Well Volume (4.11 gallons) x 3 = 3 Well Volumes (12.34 gallons)
Purge Rate (_____ gpm) x (_____ min) = 1 Well Volume
Purge Rate (_____ gpm) x (_____ min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
0933	14.67	7.40	0.417	1.8	20.0	207	—	—	9.93'	—

PURGE INFORMATION:

Time / Date Started: 0922 | 4-18-17
Time Purge End: 0938
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: _____ (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 0933 | 4-25-17
Sampled by: D. Lawson & T. Farmer
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 2 - 1000 ml
Bottle Preservatives: none
Recovering WL: —
Duplicate Sampling: No
Laboratory: TA
COC Form: Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HTI HTI III Ground water at 9.93 ft below top of casing.

Rad: Dose: 5 μR/hr.
Background: 37 cpm
Sample : 38 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MS 4-18-17 ~~4-18-17~~ MW-2
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	D. Lawson & T. Farmer	Date:	4-25-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (25.94 ft) - Depth to Water (9.87 ft) = Height of water column (16.07 ft)

Height of water column (16.07 ft) x K value (0.163 gal/ft) = 1 Well Volume (2.62 gal)

Purge Volume:

1 Well Volume (2.62 gallons) x 3 = 3 Well Volumes (7.86 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
0853	14.27	7.59	0.517	1.0	37.40	217	—	—	9.77'	—

PURGE INFORMATION:

Time / Date Started:	0910 | 4-18-17
Time Purge End:	0913
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	(gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set @	NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	0853 | 4-25-17
Sampled by:	D. Lawson & T. Farmer
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	No
Laboratory:	TA
COC Form:	Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HT 111 Groundwater at 9.77 ft below casing

Rad: Dose: 5 μR/h.

BG: 50 cpm

Sample: 41 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-3
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	D. Lawson & T. Farmer	Date:	4-25-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft; 8" I.D., K=2.61 gal/ft; 10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (45.48 ft) - Depth to Water (6.42 ft) = Height of water column (39.06 ft)

Height of water column (39.06 ft) x K value (0.163 gal/ft) = 1 Well Volume (6.37 gal)

Purge Volume:

1 Well Volume (6.37 gallons) x 3 = 3 Well Volumes (19.10 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
0747	14.66	6.48	0.604	9.2	39.32	313	—	—	5.93'	—

PURGE INFORMATION:

Time / Date Started: 0843 | 4-18-17

Time Purge End: 0857

Purge Method: Pump _____ Bailer X

Depth to Intake: NA (ft)

Pump Type and ID: NA

Purge Rate: NA (gpm)

Purged Volume: _____ (gal)

Water Quality Meter: Horiba U-22#

How was yield measured? NA

Was well cavitated? Yes_____ No_____

Water containerized/Amount _____

Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 0747 | 4-25-17

Sampled by: D. Lawson & T. Farmer

Sample Method: Bailer X Other _____

Grab X Composite _____

# of Bottles Collected: 2- 1000ml

Bottle Preservatives: none

Recovering WL: —

Duplicate Sampling: No

Laboratory: TA

COC Form: Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HT HT HT HT Depth to groundwater = 5.93 ft below top of casing

Radiation:

Dose - 4 μR/hr

Background - 41 cpm

Sample - 33 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-4
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	M. Caldwell & T. Farmer	Date:	4-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (30.27 ft) - Depth to Water (3.81 ft) = Height of water column (27.46 ft)

Height of water column (27.46 ft) x K value (0.163 gal/ft) = 1 Well Volume (4.48 gal)

Purge Volume:

1 Well Volume (4.48 gallons) x 3 = 3 Well Volumes (13.43 gallons)

Purge Rate (_____ gpm) x (_____ min) = 1 Well Volume

Purge Rate (_____ gpm) x (_____ min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
~~1335~~	~~19.21~~	~~8.33~~	~~0.558~~	~~1.3~~	~~16.23~~	~~154~~	—	—	~~23.67~~	—
1348	19.62	8.03	0.643	23.4	43.82	152	—	—	3.80	—

MC 4-24-17

MC 4-24-17

PURGE INFORMATION:

Time / Date Started:	1402	|	4-18-17
Time Purge End:	1408		
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:		(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?	NA		
Was well cavitated?	Yes_____	No_____	
Water containerized/Amount			
Grunfos controller set	@ NA	(Hertz)	

SAMPLING INFORMATION: 1348 MC 4-24-17

Time / Date Started:	1392	|	4-24-17
Sampled by:	M. Caldwell	&	T. Farmer
Sample Method: Bailer	X	Other	
Grab	X	Composite	
# of Bottles Collected:	4 x 1000 ml		MC 4-24-17
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	No Yes		MC 4-24-17
Laboratory:	TA		
COC Form:	Yes		

3.80 ft MC 4-24-17

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HH HH III Water level at ~~23.67'~~ below top of casing on 4-24-17.

Duplicate sample collected

Rad: Dose: 6 µR/hr MC 4-25-17

Background: 44 cpm

Sample : 31 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground		Well Identification:	MW-5	
Project Number:	ERM Sampling		Project Location:	Madison, IN	
Purged by:	D. Lawson	& M. Sherman	Date:	4-18-17	
Sampled by:	D. Lawson	& T. Farmer	Date:	4-25-17	
Checked by:		&	Date:		

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (35.85 ft) - Depth to Water (18.05 ft) = Height of water column (17.80 ft)

Height of water column (17.80 ft) x K value (0.163 gal/ft) = 1 Well Volume (2.90 gal)

Purge Volume:

1 Well Volume (2.90 gallons) x 3 = 3 Well Volumes (8.70 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1519	24.24	6.95	0.928	26.9	6.19	220	—	—	18.57	—

PURGE INFORMATION:

Time / Date Started:	1240	|	4-18-17
Time Purge End:			
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:		(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?	NA		
Was well cavitated?	Yes_____	No_____	
Water containerized/Amount			
Grunfos controller set @	NA	(Hertz)	

SAMPLING INFORMATION:

Time / Date Started:	1519	|	4-25-17
Sampled by:	D. Lawson	&	T. Farmer
Sample Method: Bailer	X	Other	
Grab	X	Composite	
# of Bottles Collected:	2- 1000 ml		
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	No		
Laboratory:	TA		
COC Form:	Yes		

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HTTTTT Groundwater at 18.57 ft below top of casing.

RAD: Dose: 5 uR/hr

Background: 50 cpm

Sample : 32 cpm

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GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & T. Farmer
Checked by: _____ & _____

Well Identification: MW-6
Project Location: Madison, IN
Date: 4-18-17
Date: 4-25-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft
8" I.D., K=2.61 gal/ft
10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (42.78 ft) - Depth to Water (18.26 ft) = Height of water column (24.52 ft)
Height of water column (24.52 ft) x K value (0.163 gal/ft) = 1 Well Volume (4.00 gal)

Purge Volume:

1 Well Volume (4.00 gallons) x 3 = 3 Well Volumes (11.99 gallons)
Purge Rate (_____gpm) x (_____min) = 1 Well Volume
Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1455	21.17	7.14	0.335	34.9	9.63	225	–	–	31.38	–

PURGE INFORMATION:

Time / Date Started: 1256 | 4-18-17
Time Purge End: 1305
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: _____ (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 1455 | 4-26-17
Sampled by: D. Lawson & T. Farmer
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 2 - 1000 ml
Bottle Preservatives: none
Recovering WL: –
Duplicate Sampling: NO
Laboratory: TA
COC Form: Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

LHT HHT II Groundwater at 31.38 ft below top of casing.

RAD: Dose: 5 μR/hr
Background: 40 cpm
Sample : 39 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-7
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	D. Lawson & T. Farmer	Date:	4-25-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (56.41 ft) - Depth to Water (8.36 ft) = Height of water column (48.05 ft)

Height of water column (48.05 ft) x K value (0.163 gal/ft) = 1 Well Volume (7.83 gal)

Purge Volume:

1 Well Volume (7.83 gallons) x 3 = 3 Well Volumes (23.50 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1425	17.98	7.14	0.424	17.6	28.38	169	—	—	8.30	—

PURGE INFORMATION:

Time / Date Started:	12:08 | 4-18-17
Time Purge End:	1223
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	(gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set	@ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1425 | 4-25-17
Sampled by:	D. Lawson & T. Farmer
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	No
Laboratory:	TA
COC Form:	Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HH HH HH HH III Groundwater @ 8.30 ft below casing.

RAD: Dose: 5

Background: 35

Sample : 39

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GROUNDWATER SAMPLE LOG

MW-4 MC 4-24-17 MW-8

Project Name:	Jefferson Proving Ground	Well Identification:	~~MW-8~~
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	M. Caldwell & T. Farmer	Date:	4-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (30.51 ft) - Depth to Water (23.69 ft) = Height of water column (6.82 ft)

Height of water column (6.82 ft) x K value (0.163 gal/ft) = 1 Well Volume (1.11 gal)

Purge Volume:

1 Well Volume (1.11 gallons) x 3 = 3 Well Volumes (3.33 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
~~1348~~	19.02	8.03	0.643	29.4	43.82	152	—	—	3.80	—
1332	19.21	8.33	0.565	1.3	16.23	154	—	—	23.67	-

MC 4-24-17

MC 4-24-17

PURGE INFORMATION:

Time / Date Started:	1342	4-18-17	
Time Purge End:	1344		
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:		(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?		NA	
Was well cavitated?	Yes_____	No_____	
Water containerized/Amount			
Grunfos controller set	@	NA (Hertz)	

SAMPLING INFORMATION: 1332

Time / Date Started:	~~1348~~	4.24-17	
Sampled by:	M Caldwell &	T. Farmer	
Sample Method: Bailer	X	Other	
Grab	X	2 Composite	
# of Bottles Collected:	4 - 1000ml	MC 4-24-17	
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	~~Yes~~ No	MC 4-24-17	
Laboratory:	TA		
COC Form:	Yess		

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

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MC 4-24-17

~~Duplicate sample taken~~: Water level at 23.67 ft below top of casing on 4-24-17.

Rad: Dose: 6 mR/hr

Background: 44 cpm

Sample: 24 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-9
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	D. Lawson & T. Farmer	Date:	4.25-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (38.11 ft) - Depth to Water (24.76 ft) = Height of water column (13.35 ft)

Height of water column (13.35 ft) x K value (0.163 gal/ft) = 1 Well Volume (2.18 gal)

Purge Volume:

1 Well Volume (2.18 gallons) x 3 = 3 Well Volumes (6.53 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1208	18.62	7.28	5.05	0.5	25.53	164	—	—	27.89	—

PURGE INFORMATION:

Time / Date Started:	1042 | 4-18-17
Time Purge End:	1046
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	(gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set	@ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1208 | 4-25-17
Sampled by:	D. Lawson & T. Farmer
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	No
Laboratory:	TA
COC Form:	Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

LHT 11 Ground water at 27.89 ft below top of casing.

RAD: Dose - 5 μR/hr
Background - 29 cpm
Sample - 41 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground		Well Identification:	MW-10	
Project Number:	ERM Sampling		Project Location:	Madison, IN	
Purged by:	D. Lawson	& M. Sherman	Date:	4-18-17	
Sampled by:	D. Lawson	& T. Farmer	Date:	4-25-17	
Checked by:		&	Date:		

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (41.53 ft) - Depth to Water (1.75 ft) = Height of water column (39.78 ft)

Height of water column (39.78 ft) x K value (0.163 gal/ft) = 1 Well Volume (6.48 gal)

Purge Volume:

1 Well Volume (6.48 gallons) x 3 = 3 Well Volumes (19.45 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1137	18.84	7.50	0.570	0.0	28.11	145	—	—	2.02'	—

PURGE INFORMATION:

Time / Date Started:	1015 | 4-18-17
Time Purge End:	
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	(gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set	@ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1137 | 4-25-17
Sampled by:	D. Lawson & T. Farmer
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	No
Laboratory:	TA
COC Form:	Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HTI HTI HTI HTI Groundwater is 2.02 ft below top of casing.

Dose: 6 µR/h.

RAD → BG: 29 cpm

Sample: 37 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-11
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	4-18-17
Sampled by:	D. Lawson & T. Farmer	Date:	4-25-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (42.30 ft) - Depth to Water (6.63 ft) = Height of water column (35.67 ft)

Height of water column (35.67 ft) x K value (0.163 gal/ft) = 1 Well Volume (5.81 gal)

Purge Volume:

1 Well Volume (5.81 gallons) x 3 = 3 Well Volumes (17.44 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water	Purge Rate
1237	16.21	8.52	0.303	4.2	41.95	186	—	—	7.14	—

PURGE INFORMATION:

Time / Date Started:	1054 | 4-18-17
Time Purge End:	1104
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	(gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set	@ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1237 | 4-25-17
Sampled by:	D. Lawson & T. Farmer
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	No
Laboratory:	TA
COC Form:	Yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

HHT HHT HHT III Groundwater at 7.14 ft below top of casing.

RAD: Dose: 4 MR/hr

Background: 43 cpm

Sample: 39 cpm

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW-001
SD-001

DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: 1359 ✓

SAMPLING LOCATION CODE: —
DESCRIPTION: Surface water & sediment

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 36 cpm
Sample Rad : 35 cpm (SW)
" " : 45 cpm (Sed)
DOSE: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	20.18	°C		
pH:	8.07	pH		
CONDUCTIVITY:	0.195	mS/cm		
REDOX:	204	mV		
DO:	20.51	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	4.8	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW-002
SD-002
SD-002-DUP

DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: 1344

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 : 32 cpm
Sample Rad : 47 cpm (SW)
" " : 30 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	21.06	°C		
pH:	8.13	pH		
CONDUCTIVITY:	0.182	mS/cm		
REDOX:	195	mV		
DO:	9.30	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	5.2	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:
Duplicate sediment sample collected.

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SD-003
SW-003

DATE COLLECTED (MM/DD/YY): 04-25-17
TIME: 0914

SAMPLING LOCATION CODE: —
DESCRIPTION: Surface water & sediment

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 36 cpm
Sample Rad : 37 cpm (SW)
" " : 42 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	16.91	°C		
pH:	7.53	pH		
CONDUCTIVITY:	0.123	mS/cm		
REDOX:	189	mV		
DO:	10.88	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	15.2	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SD-004 DATE COLLECTED (MM/DD/YY): 04-25-17
MC 4.25.17 SW ~~SD~~-004-DUP TIME: 0940
SW-004

SAMPLING LOCATION CODE: —
DESCRIPTION: surface water & sediment

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 37 cpm
Sample Rad : 28 cpm (SW)
" " : 40 cpm (Sed)
Dose: 7 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	7	μR/hr		
TEMPERATURE:	18.21	°C		
pH:	7.69	pH		
CONDUCTIVITY:	0.204	mS/cm		
REDOX:	193	mV		
DO:	7.81	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	4.6	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:
A duplicate surface water sample was collected

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW-005
SD-005

DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: ~~120~~ 1220
MC
4-25-17

SAMPLING LOCATION CODE: —
DESCRIPTION: Surface water & sediment

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 29 cpm
Sample Rad : 46 cpm (SW)
" " : 45 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	20.55	°C		
pH:	8.99	pH		
CONDUCTIVITY:	0.282	mS/cm		
REDOX:	154	mV		
DO:	24.71	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	4.8	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW-006
SD-006

DATE COLLECTED (MM/DD/YY): 04-25-17
TIME: 0816

SAMPLING LOCATION CODE: —
DESCRIPTION: Surface water & sediment

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 36 cpm
Sample Rad : 38 cpm (SW)
" " : 39 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	15.58	°C		
pH:	5.72	pH		
CONDUCTIVITY: 4-25-17	0.123	mS/cm		
REDOX: 4-25-17	244	mV		
DO:	11.27	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	5.3	NTU		
OTHER _____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW-007 / SD-007 DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: 1442

SAMPLING LOCATION CODE: —
DESCRIPTION: Surface water & sediment

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 : 25 cpm (SW)
" " : 52 cpm (Sed)
Dose: 4 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	4	μR/hr		
TEMPERATURE:	21.85	°C		
pH:	7.58	pH		
CONDUCTIVITY:	0.109	mS/cm		
REDOX:	185	mV		
DO:	20.71	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	22.5	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SW - 008 DATE COLLECTED (MM/DD/YY): 4-25-17
SD - 008 TIME: 1249

SAMPLING LOCATION CODE: —
DESCRIPTION: surface water and sediment

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 : 41 cpm (SW)
" " : 38 cpm (Sed)
Dose : 4 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	4	μR/hr		
TEMPERATURE:	19.57	°C		
pH:	8.14	pH		
CONDUCTIVITY:	0.196	mS/cm		
REDOX:	185	mV		
DO:	15.16	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	6.3	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SS-001 DATE COLLECTED (MM/DD/YY): 4-25-17
SS-001-DUP TIME: 0904

SAMPLING LOCATION CODE: —
DESCRIPTION: Soil

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 : 55 cpm ~~(Soil)~~ Soil
" " : — cpm ~~(Sed)~~ MC
Dose: 6 μR/hr 4-25-16

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	—	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:
A duplicate sample was also collected.

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SS - 002 DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: 1313

SAMPLING LOCATION CODE: —
DESCRIPTION: Soil

SAMPLING POINT CODE: —
DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS
SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —
FIELD OBSERVATIONS:

Background Rad : 40 cpm
~~Sample Rad : cpm (Sw)~~
" " : 53 cpm ~~(Sed)~~ Soil MC
Dose : 5 µR/hr 4-25-17

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	—	µR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SS-003 DATE COLLECTED (MM/DD/YY): 4-25-17

TIME: ~~1044~~ ~~1040~~ 1041 MC 4-26-17

SAMPLING LOCATION CODE: —

DESCRIPTION: Soil

SAMPLING POINT CODE: —

DESCRIPTION —

NORTHING: — EASTING: — ELEVATION: —

SAMPLE DEPTH CODE: — : — TO — BLS

SAMPLE MEDIA CODE: — DESCRIPTION: —

WEATHER: — ACTIVITIES IN AREA: —

FIELD OBSERVATIONS:

Background Rad : 36 cpm

~~Sample Rad : cpm (Sw)~~

" " : 48 cpm ~~(Sed)~~ Soil

Dose: 6 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	—	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER _____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG ERM Spring '17 **PROJECT NO:** —

SAMPLE ID NUMBER: SS-004 DATE COLLECTED (MM/DD/YY): 4-25-17
TIME: 1503

SAMPLING LOCATION CODE: —
DESCRIPTION: Soil

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 : cpm (SW)~~ MC 4-25-17
" " : 41 cpm ~~(Sed)~~ Soil
Dose : 4 µR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	—	µR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

Location JPG Date 4-24-17

Project / Client JPG Spring '17 Sampling / USACE

1138: Arrived at Bldg 125. Terry Farmer and Mark Caldwell (field book author) of XCEL Engineering. preparing to sample groundwater at MW-04 and MW-08. Calibrated Horiba for the day. Horiba U-52/53, Model # U-5000, Serial # 4K6KP6NG. All water samples will be measured using the Horiba for basic parameters. All results of measuring & monitoring will be documented on individual sample logs and not in this log book. All samples, both solid and liquid, will be scanned for radiological parameters. The rad readings will also be recorded on the individual sample forms.

1156: Taking (watching) the Big Oaks safety video. Signed forms are kept by Big Oaks staff.

Mark Caldwell 4-24-17

Location JPG Date 4-24-17

Project / Client Spring '17 Sampling / USACE

1216: David Lawson of Leidos at Bldg 125. Preparing to sample

1332: At MW-08 collecting sample Water level at 23.67'

1338: Leaving well.

1348: Sampling groundwater from MW-04. A duplicate sample will also be taken. Water level at 3.80 ft below top of casing.

1400: Completed sampling and data collection. Going back to Bldg 125.

1411: At Bldg 125. Collecting rad data of samples. Using:
→ MicroR, Model 19, SN 207483
→ 2221/44-9, SN 202364/212133.

1558: Complete sampling activity. Prepared for tomorrows activities. Leaving Bldg 125 for hotel in Madison.

Mark Caldwell 4-24-17

Project / Client Spring 17 Sampling / USACE

0654: T. Farmer & M. Caldwell (author) are at Bldg 125. Andy Bennett of VRH on site. Preparing for daily activities and coordinating with Parsons personnel. Calibrated Horiba.
0726: Conducting safety briefings.
0738: Leaving Bldg 125
0747: Collecting sample at MW-03.
0755: Leaving for SD/SW-06.
0801: Hiking to SD/SW-06.
0816: Collecting sample
0839: Leaving for next sampling location.
0848: At MW-002
0853: Collecting sample. Ground water at 9.77' below top of casing.
0904: Collecting soil sample at location of SS-001. Also collecting a duplicate sample.
0907: Leaving for next sample.
0914: Collecting SW-003 & SD-003
0922: Leaving for next samples. MC 4-25-17
0927: At location. ~~Hiking to sample location.~~

Mark Caldwell 4-25-17

Project / Client Spring 17 Sampling - USACE

0933: Collecting sample MW-001. 9.93' to water.
~~1011: Took a break~~ MC 4-25-17
0940: Collecting SW-004, SW-004-Dup, and SD-004
1011: After break, leaving for next sample location.
1019: Hiking to sample location.
1041: Collecting SS-003 sample
1106: Leaving to next sample location.
1137: At MW-010 collecting sample
1208: Collecting sample at MW-009
1220: Collecting samples at SD-005 & SW-005.
1237: Collecting sample at MW-011.
1249: Collecting samples at SD-008 & SW-008.
1313: Collecting sample at SS-002.
1344: Collecting samples SW-002, SD-002 and SD-002-DUP
1359: Collecting samples SW-001 & SD-001
1425: Collecting sample at MW-007.
1442: Collecting samples SD-007 & SW-007
1455: Collecting sample MW-006

Mark Caldwell 4-25-17

12

Location JPG - Madison, IN Date 4-25-17

Project / Client Spring '17 Sampling - USACE

1503: Collecting SS-004.
1519: Collecting sample at MW-005
1546: In building 125 storing equipment and organizing paperwork.
1641: Leaving Bldg 125 for the day.

Mark Caldwell 4-25-17

M Caldwell 4-25-17

B-26

Location JPG Date ~~4-25-17~~ 4-26-17

73

Project / Client Spring '17 Sampling - USACE

0717: Entire crew at Bldg 125. We'll scan all equipment and prepare samples for shipment.
1053: Equipment scanned and samples packaged - Leaving Bldg 125.

M Caldwell 4-26-17

Mark Caldwell 4-26-17

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-1
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-18-17
Sampled by:	D. Lawson & M. Caldwell	Date:	10-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (35.03 ft) - Depth to Water (10.19 ft) = Height of water column (24.84 ft)

Height of water column (24.84 ft) x K value (0.163 gal/ft) = 1 Well Volume (4.05 gal)

Purge Volume:

1 Well Volume (4.05 gallons) x 3 = 3 Well Volumes (12.15 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water *	Purge Rate
0934	14.21	6.47	0.647	5.0	12.78	246	-	-	11.23'	-

PURGE INFORMATION:

Time / Date Started:	1438	|	10-18-17
Time Purge End:	1443		
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:	13	(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?	NA		
Was well cavitated?	Yes_____	No_____	
Water containerized/Amount			
Grunfos controller set	@ NA	(Hertz)	

SAMPLING INFORMATION:

Time / Date Started:	0934	|	10-24-17
Sampled by:	D. Lawson	&	M. Caldwell
Sample Method: Bailer	X	Other	
Grab	X	Composite	
# of Bottles Collected:	2 - 1000 ml		
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	no		
Laboratory:	TA		
COC Form:	yes		

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NN NN III * water level at 11.23' below top of casing (TOC)

Rad:

Dose : 5 μR/hr

Background : 35 cpm

Sample : 39 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & M. Caldwell
Checked by: _____ & _____

Well Identification: MW-2 & MW-02-DUP
Project Location: Madison, IN
Date: 10-18-17
Date: 10-24-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft
8" I.D., K=2.61 gal/ft
10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (25.94 ft) - Depth to Water (10.31 ft) = Height of water column (15.63 ft)
Height of water column (_____ ft) x K value (0.163 gal/ft) = 1 Well Volume (2.55 gal)

Purge Volume:

1 Well Volume (_____ gallons) x 3 = 3 Well Volumes (7.64 gallons)
Purge Rate (_____ gpm) x (_____ min) = 1 Well Volume
Purge Rate (_____ gpm) x (_____ min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
0853	14.05	6.56	0.629	5.2	11.32	407	—	—	10.08'	—

PURGE INFORMATION:

Time / Date Started: 1425 | 10-18-17
Time Purge End: 1429
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: 8 (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 0853 | 10-24-17
Sampled by: D. Lawson & M. Caldwell
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 4 - 1000 ml
Bottle Preservatives: none
Recovering WL: —
Duplicate Sampling: YES
Laboratory: TA
COC Form: yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NH 111 * Water level at 10.08' below TOC Duplicate sample collected

Rad:
Dose: 5 µR/hr
Background: 33 cpm
Sample: 38 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-3
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-18-17
Sampled by:	D. Lawson & M. Caldwell	Date:	10-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (45.48 ft) - Depth to Water (10.50 ft) = Height of water column (34.98 ft)

Height of water column (34.98 ft) x K value (0.163 gal/ft) = 1 Well Volume (5.70 gal)

Purge Volume:

1 Well Volume (5.70 gallons) x 3 = 3 Well Volumes (17.11 gallons)

Purge Rate (____ gpm) x (____ min) = 1 Well Volume

Purge Rate (____ gpm) x (____ min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
0749	16.07	6.76	0.623	5.4	3.01	213	—	—	10.12'	—

PURGE INFORMATION:

Time / Date Started:	1407	|	10-18-17
Time Purge End:	1420		
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:	18	(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?	NA		
Was well cavitated?	Yes____	No____	
Water containerized/Amount			
Grunfos controller set @	NA	(Hertz)	

SAMPLING INFORMATION:

Time / Date Started:	0749	|	10-24-17
Sampled by:	D. Lawson	&	M. Caldwell
Sample Method: Bailer	X	Other	
Grab	X	Composite	
# of Bottles Collected:	2 - 1000 ml		
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	no		
Laboratory:	TA		
COC Form:	yes		

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NN NN NN 11 * Water level at 10.12' below TOC

Rad:

Dose: 5 uR/hr

Background: 38 cpm

Sample: 31 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-4
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-19-17
Sampled by:	M. Caldwell &	Date:	10-23-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (31.27 ft) - Depth to Water (10.86 ft) = Height of water column (20.41 ft)

Height of water column (20.41 ft) x K value (0.163 gal/ft) = 1 Well Volume (3.33 gal)

Purge Volume:

1 Well Volume (3.33 gallons) x 3 = 3 Well Volumes (9.98 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water *	Purge Rate
1049	18.30	5.46	0.728	1.9	2.81	418	—	—	10.60	—

PURGE INFORMATION:

Time / Date Started:	0801 | 10-19-17
Time Purge End:	0807
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	10 (gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set @	NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1049 | 10-23-17
Sampled by:	M Caldwell &
Sample Method: Bailer	X Other
Grab	X Composite
# of Bottles Collected:	2-1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	no
Laboratory:	TA
COC Form:	yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NM NM * Water level at 10.60' below TOC

Rad: Dose: 6 μR/hr

Background: 40 cpm

Sample: 46 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & M. Caldwell
Checked by: _____ & _____

Well Identification: MW-5
Project Location: Madison, IN
Date: 10-18-17
Date: 10-24-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft; 8" I.D., K=2.61 gal/ft; 10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (35.85 ft) - Depth to Water (15.74 ft) = Height of water column (20.11 ft)
Height of water column (20.11 ft) x K value (0.163 gal/ft) = 1 Well Volume (3.28 gal)

Purge Volume:

1 Well Volume (3.28 gallons) x 3 = 3 Well Volumes (9.83 gallons)
Purge Rate (_____gpm) x (_____min) = 1 Well Volume
Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water *	Purge Rate
1258	14.16	6.59	1.17	4.2	11.47	407	-	-	15.41'	-

PURGE INFORMATION:

Time / Date Started: 1638 | 10-18-17
Time Purge End: 1643
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: 10 (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 1258 | 10-24-17
Sampled by: D. Lawson & M. Caldwell
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 2- 1000 ml
Bottle Preservatives: none
Recovering WL: -
Duplicate Sampling: no
Laboratory: TA
COC Form: yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

TTM MW * Water level at 15.41' below TOC

Rad:
Dose: 5 µR/hr
Background: 38 cpm
Sample: 36 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-6
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-18-17
Sampled by:	D. Lawson & M. Caldwell	Date:	10-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft; 8" I.D., K=2.61 gal/ft; 10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (42.78 ft) - Depth to Water (20.11 ft) = Height of water column (22.67 ft)

Height of water column (22.67 ft) x K value (0.163 gal/ft) = 1 Well Volume (3.70 gal)

Purge Volume:

1 Well Volume (3.70 gallons) x 3 = 3 Well Volumes (11.09 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water *	Purge Rate
1436	12.63	7.07	0.771	14.3	11.42	216	—	~	33.29'	—

PURGE INFORMATION:

Time / Date Started:	1656 | 10-18-17
Time Purge End:	1702
Purge Method: Pump	Bailer X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	12 (gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set @	NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1436 | 10-24-17
Sampled by:	D. Lawson & M. Caldwell
Sample Method: Bailer	X Other _____
Grab	X Composite _____
# of Bottles Collected:	2- 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	no
Laboratory:	TA
COC Form:	yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NM NM 11 * Water level at 33.29' below TOC

Rad:

Dose : 5 µR/hr

Background : 33 cpm

Sample : 25 cpm

leidos

GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & M. Caldwell
Checked by: _____ & _____

Well Identification: MW-7
Project Location: Madison, IN
Date: 10-18-17
Date: 10-24-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft
8" I.D., K=2.61 gal/ft
10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (56.41 ft) - Depth to Water (10.68 ft) = Height of water column (45.73 ft)
Height of water column (45.73 ft) x K value (0.163 gal/ft) = 1 Well Volume (7.45 gal)

Purge Volume:

1 Well Volume (7.45 gallons) x 3 = 3 Well Volumes (22.36 gallons)
Purge Rate (_____ gpm) x (_____ min) = 1 Well Volume
Purge Rate (_____ gpm) x (_____ min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
1503	15.83	6.76	0.767	22.8	8.55	435	—	—	10.44'	—

PURGE INFORMATION:

Time / Date Started: 1711 | 10-18-17
Time Purge End: 1722
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: 23 (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 1503 | 10-24-17
Sampled by: D. Lawson & M. Caldwell
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 2 - 1000 ml
Bottle Preservatives: none
Recovering WL: —
Duplicate Sampling: no
Laboratory: TA
COC Form: yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NN NN NN NN /// * Water level at 10.44' below TOC

Rad:
Dose : 4 µR/hr
Background : 32 cpm
Sample : 36 cpm

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GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: M. Caldwell & —
Checked by: _____ & _____

Well Identification: MW-8
Project Location: Madison, IN
Date: 10-19-17
Date: 10-23-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft; 8" I.D., K=2.61 gal/ft; 10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (30.51 ft) - Depth to Water (23.68 ft) = Height of water column (6.83 ft)
Height of water column (6.83 ft) x K value (0.163 gal/ft) = 1 Well Volume (1.11 gal)

Purge Volume:

1 Well Volume (1.11 gallons) x 3 = 3 Well Volumes (3.34 gallons)
Purge Rate (_____gpm) x (_____min) = 1 Well Volume
Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water *	Purge Rate
1112	17.66	5.70	0.659	2.3	1.76	338	-	-	23.79	-

PURGE INFORMATION:

Time / Date Started: 0822 | 10-19-17
Time Purge End: 0826
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: 4 (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: _____ | _____
Sampled by: _____ & _____
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: _____
Bottle Preservatives: _____
Recovering WL: _____
Duplicate Sampling: _____
Laboratory: _____
COC Form: _____

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

1111 * Water level @ 23.79' below TOC

Rad: Dose: 5 µR/h.
Background: 40 cpm
Sample: 43 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-9
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-18-17
Sampled by:	D. Lawson & M. Caldwell	Date:	10-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K used 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 Volume:

Total Depth (38.11 ft) - Depth to Water (25.33 ft) = Height of water column (12.78 ft)

Height of water column (12.78 ft) x K value (0.163 gal/ft) = 1 Well Volume (2.08 gal)

Purge Volume:

1 Well Volume (2.08 gallons) x 3 = 3 Well Volumes (6.25 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
1211	13.24	6.14	~~3.72~~ 0.749 mc 10-24-17	5.2	10.82	476	—	—	28.25'	—

PURGE INFORMATION:

Time / Date Started:	1531	|	10-18-17
Time Purge End:	1534		
Purge Method: Pump		Bailer X	
Depth to Intake:	NA	(ft)	
Pump Type and ID:	NA		
Purge Rate:	NA	(gpm)	
Purged Volume:	7	(gal)	
Water Quality Meter:	Horiba U-22#		
How was yield measured?	NA		
Was well cavitated?	Yes_____	No_____	
Water containerized/Amount			
Grunfos controller set	@ NA	(Hertz)	

SAMPLING INFORMATION:

Time / Date Started:	1211	|	10-24-17
Sampled by:	D. Lawson	&	M. Caldwell
Sample Method: Bailer	X	Other	
Grab	X	Composite	
# of Bottles Collected:	2 - 1000 ml		
Bottle Preservatives:	none		
Recovering WL:	—		
Duplicate Sampling:	no		
Laboratory:	TA		
COC Form:	yes		

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NNW * Water level at 28.25' below TOC

Rad:

Dose: 6 µR/hr

Background: 43 cpm

Sample: 29 cpm

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GROUNDWATER SAMPLE LOG

Project Name: Jefferson Proving Ground
Project Number: ERM Sampling
Purged by: D. Lawson & M. Sherman
Sampled by: D. Lawson & M. Caldwell
Checked by: _____ & _____

Well Identification: MW-10
Project Location: Madison, IN
Date: 10-18-17
Date: 10-24-17
Date: _____

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft
8" I.D., K=2.61 gal/ft
10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (41.53 ft) - Depth to Water (5.39 ft) = Height of water column (36.14 ft)
Height of water column (36.14 ft) x K value (0.163 gal/ft) = 1 Well Volume (5.89 gal)

Purge Volume:

1 Well Volume (5.89 gallons) x 3 = 3 Well Volumes (17.67 gallons)
Purge Rate (_____gpm) x (_____min) = 1 Well Volume
Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
1156	14.81	6.06	0.745	11.6	12.09	168	—	—	4.28'	—

PURGE INFORMATION:

Time / Date Started: 1513 | 10-18-17
Time Purge End: 1521
Purge Method: Pump _____ Bailer X
Depth to Intake: NA (ft)
Pump Type and ID: NA
Purge Rate: NA (gpm)
Purged Volume: 18 (gal)
Water Quality Meter: Horiba U-22#
How was yield measured? NA
Was well cavitated? Yes_____ No_____
Water containerized/Amount _____
Grunfos controller set @ NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started: 1156 | 10-24-17
Sampled by: D. Lawson & M. Caldwell
Sample Method: Bailer X Other _____
Grab X Composite _____
# of Bottles Collected: 2 - 1000 ml
Bottle Preservatives: none
Recovering WL: —
Duplicate Sampling: no
Laboratory: TA
COC Form: yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

NM NM NM III * Water level at 4.28' below TOC

Rad:
Dose: 5 μR/h
Background: 45 cpm
Sample: 39 cpm

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GROUNDWATER SAMPLE LOG

Project Name:	Jefferson Proving Ground	Well Identification:	MW-11
Project Number:	ERM Sampling	Project Location:	Madison, IN
Purged by:	D. Lawson & M. Sherman	Date:	10-18-17
Sampled by:	D. Lawson & M. Caldwell	Date:	10-24-17
Checked by:	&	Date:	

WELL VOLUME CALCULATION:

Circle diameter and K 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=1.469 gal/ft; 8" I.D., K=2.61 gal/ft; 10" ID, K=4.08 gal/ft

1 Well Volume:

Total Depth (42.30 ft) - Depth to Water (6.81 ft) = Height of water column (35.49 ft)

Height of water column (35.49 ft) x K value (0.163 gal/ft) = 1 Well Volume (5.78 gal)

Purge Volume:

1 Well Volume (5.78 gallons) x 3 = 3 Well Volumes (17.35 gallons)

Purge Rate (_____gpm) x (_____min) = 1 Well Volume

Purge Rate (_____gpm) x (_____min) = 3 Well Volume

Time	Temp °C	pH	Cond mS/cm	Turbidity NTU	D.O. mg/l	ORP mv	Purged Quantity	Well Volume	Depth to Water*	Purge Rate
1241	14.24	7.29	0.333	14.0	13.01	186	—	—	6.04'	—

PURGE INFORMATION:

Time / Date Started:	1545 | 10-18-17
Time Purge End:	1555
Purge Method: Pump	Baller X
Depth to Intake:	NA (ft)
Pump Type and ID:	NA
Purge Rate:	NA (gpm)
Purged Volume:	18 (gal)
Water Quality Meter:	Horiba U-22#
How was yield measured?	NA
Was well cavitated?	Yes_____ No_____
Water containerized/Amount	
Grunfos controller set @	NA (Hertz)

SAMPLING INFORMATION:

Time / Date Started:	1241 | 10-24-17
Sampled by:	D. Lawson & M. Caldwell
Sample Method: Baller	X Other
Grab	X Composite
# of Bottles Collected:	2 - 1000 ml
Bottle Preservatives:	none
Recovering WL:	—
Duplicate Sampling:	no
Laboratory:	TA
COC Form:	yes

ADDITIONAL INFORMATION: (i.e. weather conditions, problems encountered, maintenance required, unusual color/odor, etc.)

MW MW MW 11 * Water level at 6.04' below TOC.

Rad:

Dose: 5 uR/hr

Background: 39 cpm

Sample: 42 cpm

SAMPLE LOG SHEET

PROJECT NAME: Former JPG / Fall '17 ERM **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-001 DATE COLLECTED (MM/DD/YY): 10-24-17
SW-DU-001-DUP TIME: 1402
SD-DU-001

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 : 51 cpm
Sample Rad : 36 cpm (SW)
" " : 45 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	12.98	°C		
pH:	7.31	pH		
CONDUCTIVITY:	0.355	mS/cm		
REDOX:	206	mV		
DO:	6.49	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	4.4	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:
Duplicate surface water collected.

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-002 / SD-DU-002 DATE COLLECTED (MM/DD/YY): 10-24-17
TIME: 1346

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 : 49 cpm
Sample Rad : 37 cpm (SW)
" " : 48 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	13.08	°C		
pH:	7.38	pH		
CONDUCTIVITY:	0.334	mS/cm		
REDOX:	325	mV		
DO:	20.55	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	3.0	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-003 DATE COLLECTED (MM/DD/YY): 10-24-17
SD-DU-003 TIME: 0921

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 : 28 cpm
Sample Rad : 32 cpm (SW)
" " : 34 cpm (Sed)
Dose: 6 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:		μR/hr		
TEMPERATURE:	12.26	°C		
pH:	6.93	pH		
CONDUCTIVITY:	0.209	mS/cm		
REDOX:	-42	mV		
DO:	7.01	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	11.5	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-004 DATE COLLECTED (MM/DD/YY): 10-24-17
SD-DU-004 TIME: 0953

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 : 35 cpm
Sample Rad : 50 cpm (SW)
" " : 43 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	12.12	°C		
pH:	6.97	pH		
CONDUCTIVITY:	0.337	mS/cm		
REDOX:	418	mV		
DO:	20.07	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	2.0	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-005 DATE COLLECTED (MM/DD/YY): 10-24-17
SD-DU-005 TIME: 1224

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 : 43 cpm
Sample Rad : 38 cpm (SW)
" " : 49 cpm (Sed)
Dose: 6 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:		μR/hr		
TEMPERATURE:	12.48	°C		
pH:	7.16	pH		
CONDUCTIVITY:	0.392	mS/cm		
REDOX:	270	mV		
DO:	42.31	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	10.6	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG Fall '17 ERM **PROJECT NO:** —

SAMPLE ID NUMBER: SW-006 DATE COLLECTED (MM/DD/YY): 10-24-17
SD-006 TIME: 0826
SD-006-DUP

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 : 28 cpm
Sample Rad : 46 cpm (SW)
" " : 48 cpm (Sed)
Dose : 4 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	4	μR/hr		
TEMPERATURE:	12.21	°C		
pH:	6.78	pH		
CONDUCTIVITY:	0.258	mS/cm		
REDOX:	266	mV		
DO:	14.10	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	4.0	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:
Duplicate sediment sample collected

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-OU-007 DATE COLLECTED (MM/DD/YY): 10-24-17
SD-OU-007 TIME: 1451

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 : 34 cpm
Sample Rad : 51 cpm (SW)
" " : 47 cpm (Sed)
Dose : 4 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	4	μR/hr		
TEMPERATURE:	12.66	°C		
pH:	7.36	pH		
CONDUCTIVITY:	0.304	mS/cm		
REDOX:	198	mV		
DO:	13.40	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	3.5	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: **PROJECT NO:**

SAMPLE ID NUMBER: SW-DU-00B DATE COLLECTED (MM/DD/YY): 10-24-17
SD-DU-00B TIME: ~1306

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 : 38 cpm
Sample Rad : 33 cpm (SW)
" " : 33 cpm (Sed)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	13.06	°C		
pH:	7.25	pH		
CONDUCTIVITY:	0.234	mS/cm		
REDOX:	205	mV		
DO:	16.89	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	15.5	NTU		
OTHER _____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: Former JPG / Fall '17 ERM **PROJECT NO:**

SAMPLE ID NUMBER: SS-DU-001 DATE COLLECTED (MM/DD/YY): 10-24-17
TIME: 0905

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 : 48 cpm
Sample Rad : ~~cpm (SW)~~ MC 10-24-17
" " : 44 cpm ~~(Sed)~~ (Soil)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: Fall '17 ERM **PROJECT NO:** —

SAMPLE ID NUMBER: SS-DU-002 DATE COLLECTED (MM/DD/YY): 10-24-17
TIME: 1140

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 : ~~cpm (SW)~~ NC 10-24-17
" " : 61 cpm ~~(Sed)~~ (Soil)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER ____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) ____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: ____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: Former JAG / Fall '17 ERM **PROJECT NO:**

SAMPLE ID NUMBER: SS-DU-003 DATE COLLECTED (MM/DD/YY): 10-24-17
TIME: 1034

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 : ~~cpm (Sw)~~ ME 10-24-17
" " : 55 cpm ~~(Sed)~~ (Soil)
Dose: 6 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	—	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mV		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER _____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: Former JPG / Fall '17 ERM **PROJECT NO:**

SAMPLE ID NUMBER: SS-004
SS-004-Dup

DATE COLLECTED (MM/DD/YY): 10-24-17
TIME: 1423

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 : 35 cpm
Sample Rad : ~~cpm (SW)~~ MC 10-24-17
" " : 47 cpm ~~(Sed)~~ (Soil)
Dose: 5 μR/hr

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	5	μR/hr		
TEMPERATURE:	—	°C		
pH:	—	pH		
CONDUCTIVITY:	—	mS/cm		
REDOX:	—	mv		
DO:	—	mg/l		
ORGANIC VAPORS:	—	—		
TURBIDITY:	—	NTU		
OTHER _____:	—			

SAMPLE TYPE: ☒ GRAB ☐ SPATIAL COMPOSITE ☐ TIME COMPOSITE
☐ QC TRIP BLANK ☐ QC RINSATE ☐ QC FIELD BLANK
☐ OTHER (SPECIFY) _____

SAMPLE COLLECTED: ☒ YES ☐ NO SAP SAMPLING PROCEDURE WAS FOLLOWED: ☒ YES ☐ NO
IF SAP WAS NOT FOLLOWED, SPECIFY WHAT DEVIATIONS WERE NECESSARY AND WHY:

Duplicate sample taken.

Recorded By: Mark Caldwell (Signature) QC Checked By: _____ (Signature)

Location Former JPG - Madison, IN Date Oct 23, 2017 Monday

Project / Client Fall '17 ERM

Weather: Mostly raining, temp ~60s

0842: Mark Caldwell (field-book author) of XCEL Engineering at Army / Big Oaks HQ (Bldg 125). Spring '17 ERM will be conducted this week. Details regarding water-level measurements, water-quality measurements, radiological measurements, etc. will be recorded on individual sample log forms and will not be also recorded in this fieldbook.

0941: Andy & Jed with VRH at Bldg 125. Conducting safety briefing. Will collect samples at MW-004 & MW-00B. Also calibrating Horiba. MC 10-23-17

Horiba U-52 / U-53; Serial No: P4SYN7B2.

1049: Collecting groundwater sample at MW-04 with Jed of VRH. Water level at 10.60' below top of casing (TOC).

1112 Collecting groundwater sample at MW-08. Water level at 23.79' below TOC.

1146: Returned to Bldg 125.

M Caldwell 10-23-17

Location Former JPG Date Oct 23, 2017

Project / Client Fall '17 ERM / USACE

1206: David Lawson of Leidos in Bldg 125. He's calibrating his equipment.

Rad meters used:

→ MicroR Model 19, SN: 207483

→ 2221 / 44-9 SN: 202364 / 212133

1451: D. Lawson has completed scanning all instruments to be used on site. Jed Braddord & Andy Bennett are at Bldg 125. Jed is taking Rad Worker training (site specific).

1516: Andy, Jed, and David have left Bldg. 125. M. Caldwell is leaving soon and will continue paperwork at hotel.

Mark Caldwell 10-23-17

Mark Caldwell 10-23-17

Location Former JPG - Madison, IN Date Oct 24, 2017 Tuesday

Project / Client Fall '17 ERM / USACE

Rain with thunder!

0651: At Bldg 125. Mark Caldwell of XCEL is field book author. David Lawson of Leidos and Andy Bennett of URH are on site. Conducting safety briefing and POD. We'll conduct sampling starting in the southeast corner of Big Oaks Refuge. We'll delay sampling due to heavy rain and thunder.

0710: Equipment being calibrated.

0749: Collecting sample at MW-03. Water level at 10.12' below TOC

0826: Collecting SW-06, SD-06, & SD-06-Dup

0853: Sampling at MW-02. Collecting duplicate.

0905: Sampling at SS-01.

0921: Sampling at SW-03 & SD-03

0934: Sampling at MW-01. Water level at 11.23' below TOC.

0953: Sampling at SW-004 & SD-004

1034: Sampling at SS-003

M Caldwell 10-24-17

Location Former JPG - Madison, IN Date Oct 24, '17 Tues

Project / Client Fall '17 ERM / USACE

1140: Sampling at SS-DU-002.

1156: Sampling at MW-DU-010. Water level at 4.28' below TOC.

1211: Sampling at MW-DU-009. Water level at 28.25' below TOC.

1224: Sampling at SW-005 & SD-005.

1241: Sampling at MW-011. Water level at 6.04' below TOC.

1258: Sampling at MW-005. Water level at 15.41' below TOC. Background rad: 38 cpm.

1306: Sampling at SW-008 & SD-008.

1346: Sampling at SW-002 & SD-002

1402: Sampling at SW-001, SW-001-DUP, and SD-001. Duplicate surface water taken.

1423: Sampling at SS-004 & SS-004-Dup. Duplicate sample taken.

1436: Sampling at MW-006. Water level at 33.29' below TOC.

1503: Sampling at MW-DU-007. Water level at

1521: At Bldg 125 storing equipment, etc.

1551: Leaving Bldg 125.

M Caldwell 10-24-17

7 78

Location Former IAAP - Madison, IN Date 10-25-17

Project / Client Fall '17 ERM / USACE

0733: Mark Caldwell (field book author) of XCEL at Bldg 125. D. Lawson (leidos) & Andy Bennett (VRH) on site. We will scan equipment and prepare samples today.

0951: D. Lawson & A. Bennett off site. Equipment scanned and samples packaged. M. Caldwell leaving for UPS station to ship samples.

MC 10-25-17

Mark Caldwell 10-25-17

Location

Project / Client

MC 10-25-17

Mark Caldwell 10-25-17

APPENDIX C

DATA VALIDATION SUMMARY

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SPRING 2017 DATA VALIDATION

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C. DATA VALIDATION SUMMARY

C.1 TESTAMERICA SDG 160-22082

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) Environmental Radiation Monitoring (ERM) April 2017 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 inductively couple plasma-mass spectrometry (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 160-22082-1. Total uranium was calculated using a published specific activity value for U-238 and assuming all the mass originates from U-238.
- U-234, U-235, and U-238 were reanalyzed on one sediment sample by ICP-MS (SW846 6020A) per client request with SDG 160-22082-2. All results were reported.
- All total/isotopic uranium samples were analyzed by DOE A-01-R-MOD with SDG 160-22082-1.
- One sample was reanalyzed for total and isotopic uranium by method SW846 6020A with SDG 160-22082-2. All data quality objectives (DQOs) 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)
  - Field duplicates (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.
   - ***Method Blank Uncertainty***—U-234 sample data were qualified as estimated, J, with reason code 6 where the sample result is greater than the MDA and the uncertainty is 50 to 100 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: **Test America Laboratories, Inc.**	*SDG #s:* **160-22082-1, 160-22082-2**

Client I.D.	Sample I.D.*	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-001	LDOS27E	160-22082-1	4/25/2017	Total and Isotopic Uranium
MW-DU-002	LDOS27E	160-22082-2	4/25/2017	Total and Isotopic Uranium
MW-DU-003	LDOS27E	160-22082-3	4/25/2017	Total and Isotopic Uranium
MW-DU-004	LDOS27E	160-22082-4	4/24/20147	Total and Isotopic Uranium
MW-DU-004	LDOS27DE	160-22082-5	4/24/20147	Total and Isotopic Uranium
MW-DU-005	LDOS27E	160-22082-6	4/25/2017	Total and Isotopic Uranium
MW-DU-006	LDOS27E	160-22082-7	4/25/2017	Total and Isotopic Uranium
MW-DU-007	LDOS27E	160-22082-8	4/25/2017	Total and Isotopic Uranium
MW-DU-008	LDOS27E	160-22082-9	4/24/2017	Total and Isotopic Uranium
MW-DU-009	LDOS27E	160-22082-10	4/25/2017	Total and Isotopic Uranium
MW-DU-010	LDOS27E	160-22082-11	4/25/2017	Total and Isotopic Uranium
MW-DU-011	LDOS27E	160-22082-12	4/25/2017	Total and Isotopic Uranium
SW-DU-001	LDOS27E	160-22082-13	4/25/2017	Total and Isotopic Uranium
SW-DU-002	LDOS27E	160-22082-14	4/25/2017	Total and Isotopic Uranium
SW-DU-003	LDOS24E	160-22082-15	4/25/2017	Total and Isotopic Uranium
SW-DU-004	LDOS27E	160-22082-16	4/25/2017	Total and Isotopic Uranium
SW-DU-004	LDOS27DE	160-22082-17	4/25/2017	Total and Isotopic Uranium
SW-DU-005	LDOS27E	160-22082-18	4/25/2017	Total and Isotopic Uranium
SW-DU-006	LDOS26E	160-22082-19	4/25/2017	Total and Isotopic Uranium
SW-DU-007	LDOS27E	160-22082-20	4/25/2017	Total and Isotopic Uranium
SW-DU-008	LDOS27E	160-22082-21	4/25/2017	Total and Isotopic Uranium
SD-DU-001	LDOS27E	160-22082-22	4/25/2017	Total and Isotopic Uranium
SD-DU-002	LDOS27E	160-22082-23	4/25/2017	Total and Isotopic Uranium
SD-DU-002	LDOS27DE	160-22082-24	4/25/2017	Total and Isotopic Uranium
SD-DU-003	LDOS27E	160-22082-25	4/25/2017	Total and Isotopic Uranium
SD-DU-004	LDOS27E	160-22082-26	4/25/2017	Total and Isotopic Uranium
SD-DU-005	LDOS27E	160-22082-27	4/25/2017	Total and Isotopic Uranium
SD-DU-006	LDOS27E	160-22082-28	4/25/2017	Total and Isotopic Uranium
SD-DU-007	LDOS27E	160-22082-29	4/25/2017	Total and Isotopic Uranium
SD-DU-008	LDOS27E	160-22082-30	4/25/2017	Total and Isotopic Uranium
SS-DU-001	LDOS27E	160-22082-31	4/25/2017	Total and Isotopic Uranium
SS-DU-001	LDOS27DE	160-22082-32	4/25/2017	Total and Isotopic Uranium
SS-DU-002	LDOS27E	160-22082-33	4/25/2017	Total and Isotopic Uranium
SS-DU-003	LDOS27E	160-22082-34	4/25/2017	Total and Isotopic Uranium
SS-DU-004	LDOS27E	160-22082-35	4/25/2017	Total and Isotopic Uranium

* The Leidos sample I.D. (LDOS27E) 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

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Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
MW-DU-001	LDOS27E	DOE A-01-R MOD	Total Uranium	0.699	0.108			
MW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 234	0.148	0.0564	0.0277		
MW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00831	0.024	0.0502	U	
MW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 238	0.234	0.0723	0.0369		
MW-DU-002	LDOS27E	DOE A-01-R MOD	Total Uranium	1.3	0.146			
MW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 234	0.971	0.16	0.0357		
MW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0517	0.0367	0.0333	J	37
MW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 238	0.43	0.098	0.0145		
MW-DU-003	LDOS27E	DOE A-01-R MOD	Total Uranium	0.797	0.117			
MW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 234	0.678	0.13	0.0425		
MW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 235	-0.00255	0.0051	0.0338	U	
MW-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 238	0.268	0.0789	0.0498		
MW-DU-004	LDOS27DE	DOE A-01-R MOD	Total Uranium	1.04	0.141			
MW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 234	0.489	0.116	0.0431		
MW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 235	0.0115	0.0215	0.0402	U	
MW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 238	0.347	0.095	0.0322		
MW-DU-004	LDOS27E	DOE A-01-R MOD	Total Uranium	1.12	0.148			
MW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 234	0.42	0.106	0.0388		
MW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 235	-0.00306	0.00612	0.0406	U	
MW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 238	0.377	0.0994	0.0177		
MW-DU-005	LDOS27E	DOE A-01-R MOD	Total Uranium	0.236	0.0633			
MW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 234	0.576	0.122	0.0398		
MW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00392	0.0146	0.0371	U	
MW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 238	0.0786	0.0425	0.0298	J	37
MW-DU-006	LDOS27E	DOE A-01-R MOD	Total Uranium	5.45	0.388			
MW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 234	2.11	0.29	0.0532		
MW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 235	0.115	0.06	0.023	J	37
MW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 238	1.81	0.26	0.0339		
MW-DU-007	LDOS27E	DOE A-01-R MOD	Total Uranium	2.68	0.23			
MW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 234	1.37	0.204	0.0414		
MW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0767	0.0447	0.0192	J	37
MW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 238	0.887	0.155	0.0337		
MW-DU-008	LDOS27E	DOE A-01-R MOD	Total Uranium	0.567	0.0985			
MW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 234	0.267	0.0787	0.016		
MW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 235	0.021	0.0277	0.0436	U	
MW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 238	0.187	0.0661	0.035		
MW-DU-009	LDOS27E	DOE A-01-R MOD	Total Uranium	0.384	0.0817			
MW-DU-009	LDOS27E	DOE A-01-R MOD	Uranium 234	0.442	0.105	0.0164		
MW-DU-009	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0176	0.0243	0.0376	U	

Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
MW-DU-009	LDOS27E	DOE A-01-R MOD	Uranium 238	0.126	0.0548	0.0358		
MW-DU-010	LDOS27E	DOE A-01-R MOD	Total Uranium	2.33	0.225			
MW-DU-010	LDOS27E	DOE A-01-R MOD	Uranium 234	1.84	0.26	0.0615		
MW-DU-010	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0765	0.0487	0.0399	J	37
MW-DU-010	LDOS27E	DOE A-01-R MOD	Uranium 238	0.77	0.151	0.0637		
MW-DU-011	LDOS27E	DOE A-01-R MOD	Total Uranium	0.113	0.0489			
MW-DU-011	LDOS27E	DOE A-01-R MOD	Uranium 234	0.0716	0.0415	0.0384	J	37
MW-DU-011	LDOS27E	DOE A-01-R MOD	Uranium 235	0.013	0.0184	0.0194	U	
MW-DU-011	LDOS27E	DOE A-01-R MOD	Uranium 238	0.0359	0.0328	0.0449	U	
SW-DU-001	LDOS27E	DOE A-01-R MOD	Total Uranium	0.471	0.0879			
SW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 234	0.202	0.0677	0.0448		
SW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0192	0.0254	0.0399	U	
SW-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 238	0.155	0.059	0.0421		
SW-DU-002	LDOS27E	DOE A-01-R MOD	Total Uranium	0.632	0.0995			
SW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 234	0.158	0.0575	0.0269		
SW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00605	0.0121	0.0181	U	
SW-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 238	0.211	0.0669	0.0268		
SW-DU-003	LDOS24E	DOE A-01-R MOD	Total Uranium	0.107	0.0423			
SW-DU-003	LDOS24E	DOE A-01-R MOD	Uranium 234	0.178	0.064	0.0505		
SW-DU-003	LDOS24E	DOE A-01-R MOD	Uranium 235	0.0242	0.0341	0.0575	U	
SW-DU-003	LDOS24E	DOE A-01-R MOD	Uranium 238	0.0321	0.0279	0.0351	U	
SW-DU-004	LDOS27DE	DOE A-01-R MOD	Total Uranium	0.523	0.0974			
SW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 234	0.128	0.0566	0.0414		
SW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 235	0.00815	0.0214	0.0459	U	
SW-DU-004	LDOS27DE	DOE A-01-R MOD	Uranium 238	0.175	0.0654	0.0368		
SW-DU-004	LDOS27E	DOE A-01-R MOD	Total Uranium	0.307	0.0681			
SW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 234	0.0957	0.0446	0.027		
SW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0182	0.0211	0.0182	J	37
SW-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 238	0.1	0.0457	0.027		
SW-DU-005	LDOS27E	DOE A-01-R MOD	Total Uranium	0.67	0.106			
SW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 234	0.185	0.0644	0.0371		
SW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0287	0.0286	0.0346	U	
SW-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 238	0.221	0.0712	0.0435		
SW-DU-006	LDOS26E	DOE A-01-R MOD	Total Uranium	0.048	0.0292			
SW-DU-006	LDOS26E	DOE A-01-R MOD	Uranium 234	0.0585	0.0388	0.0402	J	37
SW-DU-006	LDOS26E	DOE A-01-R MOD	Uranium 235	0.0136	0.0192	0.0203	U	
SW-DU-006	LDOS26E	DOE A-01-R MOD	Uranium 238	0.014	0.0194	0.03	U	
SW-DU-007	LDOS27E	DOE A-01-R MOD	Total Uranium	0.158	0.0453			
SW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 234	0.148	0.0547	0.0334		

Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0225	0.0226	0.0169	J	37
SW-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 238	0.0497	0.0303	0.0136	J	37
SW-DU-008	LDOS27E	DOE A-01-R MOD	Total Uranium	0.711	0.112			
SW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 234	0.191	0.0692	0.0473		
SW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00681	0.0136	0.0204	U	
SW-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 238	0.238	0.0753	0.0302		

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Soil Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SD-DU-001	LDOS27E	DOE A-01-R MOD	Total Uranium	1.63	0.174			
SD-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 234	0.768	0.144	0.0295		
SD-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0266	0.0267	0.02	J	37
SD-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 238	0.544	0.117	0.016		
SD-DU-002	LDOS27DE	DOE A-01-R MOD	Total Uranium	0.584	0.0926			
SD-DU-002	LDOS27DE	DOE A-01-R MOD	Uranium 234	0.235	0.0685	0.0376	U	6
SD-DU-002	LDOS27DE	DOE A-01-R MOD	Uranium 235	-0.00451	0.00639	0.0356	U	
SD-DU-002	LDOS27DE	DOE A-01-R MOD	Uranium 238	0.197	0.0622	0.035		
SD-DU-002	LDOS27E	DOE A-01-R MOD	Total Uranium	0.929	0.124			
SD-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 234	0.373	0.093	0.0555		
SD-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0441	0.0392	0.054	U	
SD-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 238	0.305	0.0833	0.0518		
SD-DU-003	LDOS27E	DOE A-01-R MOD	Total Uranium	1.8	0.175			
SD-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 234	0.545	0.111	0.0419		
SD-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0237	0.0263	0.0373	U	
SD-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 238	0.6	0.118	0.0462		
SD-DU-004	LDOS27E	DOE A-01-R MOD	Total Uranium	0.917	0.119			
SD-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 234	0.27	0.0757	0.0345	U	6
SD-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0117	0.0165	0.0175	U	
SD-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 238	0.306	0.0803	0.0258		
SD-DU-005	LDOS27E	SW846 6020A	Total Uranium	0.64		0.005		
SD-DU-005	LDOS27E	DOE A-01-R MOD	Total Uranium	1.31	0.143			
SD-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 234	0.096	0.0454	0.041	U	6
SD-DU-005	LDOS27E	SW846 6020A	Uranium 234	0.0025		0.0061	U	
SD-DU-005	LDOS27E	SW846 6020A	Uranium 235	0.0025		0.0061	U	
SD-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0278	0.025	0.0167	J	37
SD-DU-005	LDOS27E	DOE A-01-R MOD	Uranium 238	0.437	0.0961	0.0293		
SD-DU-005	LDOS27E	SW846 6020A	Uranium 238	0.64		0.0061	D	
SD-DU-006	LDOS27E	DOE A-01-R MOD	Total Uranium	1.27	0.148			
SD-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 234	0.459	0.108	0.0717		
SD-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00561	0.0241	0.053	U	
SD-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 238	0.427	0.0997	0.0425		
SD-DU-007	LDOS27E	DOE A-01-R MOD	Total Uranium	2.33	0.201			
SD-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 234	0.928	0.152	0.0539		
SD-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 235	0.042	0.0318	0.0306	J	37
SD-DU-007	LDOS27E	DOE A-01-R MOD	Uranium 238	0.776	0.135	0.0384		
SD-DU-008	LDOS27E	DOE A-01-R MOD	Total Uranium	0.669	0.101			
SD-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 234	0.187	0.0632	0.0424	U	6
SD-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 235	0.00335	0.0124	0.0317	U	
SD-DU-008	LDOS27E	DOE A-01-R MOD	Uranium 238	0.224	0.0681	0.034		

Soil Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SS-DU-001	LDOS27DE	DOE A-01-R MOD	Total Uranium	2.08	0.192			
SS-DU-001	LDOS27DE	DOE A-01-R MOD	Uranium 234	0.626	0.122	0.0314		
SS-DU-001	LDOS27DE	DOE A-01-R MOD	Uranium 235	0.0282	0.0304	0.0438	U	
SS-DU-001	LDOS27DE	DOE A-01-R MOD	Uranium 238	0.693	0.129	0.0263		
SS-DU-001	LDOS27E	DOE A-01-R MOD	Total Uranium	2.05	0.197			
SS-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 234	0.655	0.132	0.0687		
SS-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0111	0.0239	0.047	U	
SS-DU-001	LDOS27E	DOE A-01-R MOD	Uranium 238	0.688	0.132	0.0282		
SS-DU-002	LDOS27E	DOE A-01-R MOD	Total Uranium	2.52	0.214			
SS-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 234	0.731	0.132	0.0255		
SS-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 235	0.055	0.0369	0.0317	J	37
SS-DU-002	LDOS27E	DOE A-01-R MOD	Uranium 238	0.839	0.144	0.0371		
SS-DU-003	LDOS27E	DOE A-01-R MOD	Total Uranium	1.76	0.166			
SS-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 234	0.454	0.0972	0.0392		
SS-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 235	0.0146	0.0226	0.0391	U	
SS-DU-003	LDOS27E	DOE A-01-R MOD	Uranium 238	0.589	0.112	0.0235		
SS-DU-004	LDOS27E	DOE A-01-R MOD	Total Uranium	1.3	0.144			
SS-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 234	0.41	0.0945	0.0341		
SS-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 235	0.024	0.0267	0.0378	U	
SS-DU-004	LDOS27E	DOE A-01-R MOD	Uranium 238	0.434	0.0966	0.0138		

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

Data Validation Reason Code

6 Method blank contamination.

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

FALL 2017 DATA VALIDATION

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C. DATA VALIDATION SUMMARY

C.1 TESTAMERICA SDG 160-25288

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) Environmental Radiation Monitoring (ERM) October 2017 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*	152
Total Number of Rejected Data Points	0
Percent Completeness (approval to rejection ratio)	100%

*Includes 140 alpha spectrometry results and 12 inductively couple plasma/mass spectrometry (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 160-25288-1.
- Total uranium was calculated using a published specific activity value for U-238 and assuming all the mass originates from U-238.
- U233, U-234, U-235, U-236, and U-238 were reanalyzed on two surface water samples by ICP-MS (SW846 6020A) per client request with SDG 160-25288-2. All results were reported.
- All total/isotopic uranium samples were analyzed by DOE A-01-R-MOD with SDG 160-25288-1.
- Two surface water samples were reanalyzed for total uranium by method SW846 6020A with SDG 160-25288-2. All data quality objectives (DQOs) 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)
  - Field duplicates (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.
   - ***Sample Specific Chemical Yield***—Sample-specific recoveries must be within limits as demonstrated by the applicable analytical procedures. Recoveries between 30 and110 percent are considered acceptable. If recoveries are above the upper control limit, detected results are qualified as estimated, J, with reason code 38.

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

SAMPLE INDEX	
Laboratory: **Test America Laboratories, Inc.**	*SDG #s:* **160-25288-1, 160-25288-2**

Client I.D.	Sample I.D.*	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-001	LDOS28E	160-25255-01	10/24/2017	Total and Isotopic Uranium
MW-DU-002	LDOS28E	160-25255-02	10/24/2017	Total and Isotopic Uranium
MW-DU-002	LDOS28DE	160-25255-03	10/24/2017	Total and Isotopic Uranium
MW-DU-003	LDOS28E	160-25255-04	10/24/2017	Total and Isotopic Uranium
MW-DU-004	LDOS28E	160-25255-05	10/23/2017	Total and Isotopic Uranium
MW-DU-005	LDOS28E	160-25255-06	10/24/2017	Total and Isotopic Uranium
MW-DU-006	LDOS28E	160-25255-07	10/24/2017	Total and Isotopic Uranium
MW-DU-007	LDOS28E	160-25255-08	10/24/2017	Total and Isotopic Uranium
MW-DU-008	LDOS28E	160-25255-09	10/23/2017	Total and Isotopic Uranium
MW-DU-009	LDOS28E	160-25255-10	10/24/2017	Total and Isotopic Uranium
MW-DU-010	LDOS28E	160-25255-11	10/24/2017	Total and Isotopic Uranium
MW-DU-011	LDOS28E	160-25255-12	10/24/2017	Total and Isotopic Uranium
SW-DU-001	LDOS28E	160-25255-13	10/24/2017	Total and Isotopic Uranium
SW-DU-001	LDOS28DE	160-25255-14	10/24/2017	Total and Isotopic Uranium
SW-DU-002	LDOS28E	160-25255-15	10/24/2017	Total and Isotopic Uranium
SW-DU-003	LDOS25E	160-25255-16	10/24/2017	Total and Isotopic Uranium
SW-DU-004	LDOS28E	160-25255-17	10/24/2017	Total and Isotopic Uranium
SW-DU-005	LDOS28E	160-25255-18	10/24/2017	Total and Isotopic Uranium
SW-DU-006	LDOS27E	160-25255-19	10/24/2017	Total and Isotopic Uranium
SW-DU-007	LDOS28E	160-25255-20	10/24/2017	Total and Isotopic Uranium
SW-DU-008	LDOS28E	160-25255-21	10/24/2017	Total and Isotopic Uranium
SD-DU-001	LDOS28E	160-25255-22	10/24/2017	Total and Isotopic Uranium
SD-DU-002	LDOS28E	160-25255-23	10/24/2017	Total and Isotopic Uranium
SD-DU-003	LDOS28E	160-25255-24	10/24/2017	Total and Isotopic Uranium
SD-DU-004	LDOS28E	160-25255-25	10/24/2017	Total and Isotopic Uranium
SD-DU-005	LDOS28E	160-25255-26	10/24/2017	Total and Isotopic Uranium
SD-DU-006	LDOS28E	160-25255-27	10/24/2017	Total and Isotopic Uranium
SD-DU-006	LDOS28DE	160-25255-28	10/24/2017	Total and Isotopic Uranium
SD-DU-007	LDOS28E	160-25255-29	10/24/2017	Total and Isotopic Uranium
SD-DU-008	LDOS28E	160-25255-30	10/24/2017	Total and Isotopic Uranium
SS-DU-001	LDOS28E	160-25255-31	10/24/2017	Total and Isotopic Uranium
SS-DU-002	LDOS28E	160-25255-32	10/24/2017	Total and Isotopic Uranium
SS-DU-003	LDOS28E	160-25255-33	10/24/2017	Total and Isotopic Uranium
SS-DU-004	LDOS28E	160-25255-34	10/24/2017	Total and Isotopic Uranium
SS-DU-004	LDOS28DE	160-25255-35	10/24/2017	Total and Isotopic Uranium

* The Leidos sample I.D. (LDOS28E) 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

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Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SW-DU-001	LDOS28DE	DOE A-01-R MOD	Total Uranium	0.521	0.137			
SW-DU-001	LDOS28DE	DOE A-01-R MOD	Uranium 234	0.248	0.11	0.0805		
SW-DU-001	LDOS28DE	DOE A-01-R MOD	Uranium 235	-0.00566	0.0113	0.0751	U	
SW-DU-001	LDOS28DE	DOE A-01-R MOD	Uranium 238	0.176	0.0919	0.0716	J	37
SW-DU-001	LDOS28E	DOE A-01-R MOD	Total Uranium	0.516	0.137			
SW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 234	0.18	0.102	0.109	J	37
SW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0244	0.0524	0.103	U	
SW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 238	0.17	0.0916	0.0736	J	37
SW-DU-002	LDOS28E	DOE A-01-R MOD	Total Uranium	0.924	0.177			
SW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 234	0.219	0.104	0.0867		
SW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0212	0.0396	0.0741	U	
SW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 238	0.307	0.119	0.0594		
SW-DU-003	LDOS25E	DOE A-01-R MOD	Total Uranium	0.296	0.106			
SW-DU-003	LDOS25E	DOE A-01-R MOD	Uranium 234	0.0537	0.0534	0.0647	U	
SW-DU-003	LDOS25E	DOE A-01-R MOD	Uranium 235	-0.00607	0.0122	0.0805	U	
SW-DU-003	LDOS25E	DOE A-01-R MOD	Uranium 238	0.1	0.0713	0.0646	J	37
SW-DU-004	LDOS28E	DOE A-01-R MOD	Total Uranium	0.54	0.137			
SW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 234	0.102	0.0684	0.0588	J	37
SW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 235	-0.00552	0.011	0.0732	U	
SW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 238	0.182	0.0922	0.0698	J	37
SW-DU-004	LDOS28E	SW846 6020A	Total Uranium	0.65		0.010		
SW-DU-004	LDOS28E	SW846 6020A	Uranium 233	0.020		0.020	U	
SW-DU-004	LDOS28E	SW846 6020A	Uranium 234	0.020		0.020	U	
SW-DU-004	LDOS28E	SW846 6020A	Uranium 235	0.020		0.020	U	
SW-DU-004	LDOS28E	SW846 6020A	Uranium 236	0.020		0.020	U	
SW-DU-004	LDOS28E	SW846 6020A	Uranium 238	0.65		0.020		
SW-DU-005	LDOS28E	DOE A-01-R MOD	Total Uranium	3.92	0.405			
SW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 234	0.267	0.123	0.109		
SW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0295	0.0418	0.0442	U	
SW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 238	1.31	0.272	0.0355		
SW-DU-005	LDOS28E	SW846 6020A	Uranium 233	0.020		0.020	U	
SW-DU-005	LDOS28E	SW846 6020A	Uranium 234	0.020		0.020	U	
SW-DU-005	LDOS28E	SW846 6020A	Uranium 235	0.020		0.020	U	
SW-DU-005	LDOS28E	SW846 6020A	Uranium 236	0.020		0.020	U	
SW-DU-005	LDOS28E	SW846 6020A	Uranium 238	3.9		0.020		
SW-DU-005	LDOS28E	SW846 6020A	Total Uranium	3.9		0.010		
SW-DU-006	LDOS27E	DOE A-01-R MOD	Total Uranium	0.466	0.126			
SW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 234	0.123	0.0804	0.0894	J	37
SW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 235	0	0.0107	0.0386	U	
SW-DU-006	LDOS27E	DOE A-01-R MOD	Uranium 238	0.156	0.0845	0.0678	J	37
SW-DU-007	LDOS28E	DOE A-01-R MOD	Total Uranium	0.294	0.104			
SW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 234	0.142	0.0847	0.0883	J	37
SW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 235	-0.00317	0.0313	0.0937	U	
SW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 238	0.0993	0.0696	0.0751	J	37
SW-DU-008	LDOS28E	DOE A-01-R MOD	Total Uranium	2.45	0.317			

Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 234	0.146	0.111	0.155	U	
SW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0294	0.0416	0.0441	U	
SW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 238	0.819	0.213	0.108		
MW-DU-001	LDOS28E	DOE A-01-R MOD	Total Uranium	0.677	0.164			
MW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 234	0.335	0.129	0.0937		
MW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 235	-0.00337	0.0332	0.0995	U	
MW-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 238	0.228	0.11	0.105		
MW-DU-002	LDOS28DE	DOE A-01-R MOD	Total Uranium	1.45	0.243			
MW-DU-002	LDOS28DE	DOE A-01-R MOD	Uranium 234	0.958	0.225	0.0346		
MW-DU-002	LDOS28DE	DOE A-01-R MOD	Uranium 235	-0.00958	0.0559	0.143	U	
MW-DU-002	LDOS28DE	DOE A-01-R MOD	Uranium 238	0.488	0.163	0.115		
MW-DU-002	LDOS28E	DOE A-01-R MOD	Total Uranium	1.08	0.202			
MW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 234	1.08	0.248	0.115		
MW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0467	0.0616	0.0969	U	
MW-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 238	0.357	0.136	0.0777		
MW-DU-003	LDOS28E	DOE A-01-R MOD	Total Uranium	0.685	0.148			
MW-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 234	0.324	0.116	0.0534		
MW-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 235	0.00701	0.0261	0.0665	U	
MW-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 238	0.229	0.0993	0.0711		
MW-DU-004	LDOS28E	DOE A-01-R MOD	Total Uranium	0.688	0.14			
MW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 234	0.331	0.116	0.0811		
MW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0064	0.0238	0.0607	U	
MW-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 238	0.23	0.0941	0.0579		
MW-DU-005	LDOS28E	DOE A-01-R MOD	Total Uranium	0.611	0.141			
MW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 234	0.3	0.125	0.114		
MW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0129	0.0259	0.0388	U	
MW-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 238	0.203	0.0947	0.0573		
MW-DU-006	LDOS28E	DOE A-01-R MOD	Total Uranium	4.64	0.443			
MW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 234	1.84	0.333	0.126		
MW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 235	0.104	0.0889	0.114	U	
MW-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 238	1.54	0.297	0.0918		
MW-DU-007	LDOS28E	DOE A-01-R MOD	Total Uranium	2.47	0.289			
MW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 234	1.17	0.24	0.0862		
MW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 235	0.062	0.0557	0.0372	J	37
MW-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 238	0.821	0.194	0.055		
MW-DU-008	LDOS28E	DOE A-01-R MOD	Total Uranium	0.605	0.133			
MW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 234	0.271	0.105	0.0671		
MW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0132	0.0347	0.0744	U	
MW-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 238	0.201	0.0893	0.0597		
MW-DU-009	LDOS28E	DOE A-01-R MOD	Total Uranium	0.857	0.171			
MW-DU-009	LDOS28E	DOE A-01-R MOD	Uranium 234	0.536	0.158	0.0764		
MW-DU-009	LDOS28E	DOE A-01-R MOD	Uranium 235	0.00751	0.0279	0.0712	U	
MW-DU-009	LDOS28E	DOE A-01-R MOD	Uranium 238	0.287	0.115	0.0762		
MW-DU-010	LDOS28E	DOE A-01-R MOD	Total Uranium	2.47	0.291			
MW-DU-010	LDOS28E	DOE A-01-R MOD	Uranium 234	1.61	0.29	0.0874		

Water Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
MW-DU-010	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0377	0.0437	0.0377	J	37
MW-DU-010	LDOS28E	DOE A-01-R MOD	Uranium 238	0.823	0.195	0.0557		
MW-DU-011	LDOS28E	DOE A-01-R MOD	Total Uranium	0.0987	0.055			
MW-DU-011	LDOS28E	DOE A-01-R MOD	Uranium 234	0.0127	0.0506	0.102	U	
MW-DU-011	LDOS28E	DOE A-01-R MOD	Uranium 235	0.00653	0.0242	0.0618	U	
MW-DU-011	LDOS28E	DOE A-01-R MOD	Uranium 238	0.0321	0.0368	0.0496	U	

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

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Soil Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SD-DU-001	LDOS28E	DOE A-01-R MOD	Total Uranium	1.04	0.128			
SD-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 234	0.458	0.104	0.0555		
SD-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 235	0.021	0.0241	0.0325	U	
SD-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 238	0.345	0.0862	0.031		
SD-DU-002	LDOS28E	DOE A-01-R MOD	Total Uranium	0.684	0.104			
SD-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 234	0.237	0.0686	0.0249		
SD-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0154	0.0238	0.0413	U	
SD-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 238	0.227	0.0695	0.0456		
SD-DU-003	LDOS28E	DOE A-01-R MOD	Total Uranium	2.31	0.203			
SD-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 234	0.886	0.15	0.0348		
SD-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0622	0.0396	0.0325	J	37
SD-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 238	0.766	0.136	0.026		
SD-DU-004	LDOS28E	DOE A-01-R MOD	Total Uranium	0.541	0.0968			
SD-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 234	0.202	0.0708	0.0618		
SD-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0271	0.0342	0.0553	U	
SD-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 238	0.178	0.0648	0.053		
SD-DU-005	LDOS28E	DOE A-01-R MOD	Total Uranium	0.974	0.122			
SD-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 234	0.228	0.0674	0.0326		
SD-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0119	0.0201	0.0361	U	
SD-DU-005	LDOS28E	DOE A-01-R MOD	Uranium 238	0.326	0.0819	0.0381		
SD-DU-006	LDOS28DE	DOE A-01-R MOD	Total Uranium	1.86	0.176			
SD-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 234	0.856	0.144	0.0335		
SD-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 235	0.0202	0.0231	0.0312	U	
SD-DU-006	LDOS28DE	DOE A-01-R MOD	Uranium 238	0.621	0.119	0.0298		
SD-DU-006	LDOS28E	DOE A-01-R MOD	Total Uranium	1.42	0.149			
SD-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 234	0.504	0.106	0.0487	J	38
SD-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 235	0.011	0.0156	0.0165	U	
SD-DU-006	LDOS28E	DOE A-01-R MOD	Uranium 238	0.475	0.1	0.0244	J	38
SD-DU-007	LDOS28E	DOE A-01-R MOD	Total Uranium	1.88	0.181			
SD-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 234	0.733	0.134	0.0354		
SD-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0393	0.0322	0.033	J	37
SD-DU-007	LDOS28E	DOE A-01-R MOD	Uranium 238	0.625	0.122	0.0265		
SD-DU-008	LDOS28E	DOE A-01-R MOD	Total Uranium	0.652	0.106			
SD-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 234	0.153	0.0601	0.042		
SD-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 235	0.013	0.0184	0.0195	U	
SD-DU-008	LDOS28E	DOE A-01-R MOD	Uranium 238	0.217	0.071	0.0384		
SS-DU-001	LDOS28E	DOE A-01-R MOD	Total Uranium	2.45	0.215			
SS-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 234	0.782	0.142	0.0538	J	38
SS-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0386	0.0361	0.049	U	
SS-DU-001	LDOS28E	DOE A-01-R MOD	Uranium 238	0.817	0.145	0.0393	J	38
SS-DU-002	LDOS28E	DOE A-01-R MOD	Total Uranium	2.48	0.213			
SS-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 234	0.83	0.145	0.0384		
SS-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0415	0.0316	0.0178	J	37

Soil Sample Summary								
Site I.D.	Sample I.D.	Method	Analyte	Value	Error	MDC	Final Qual	Reason Code
SS-DU-002	LDOS28E	DOE A-01-R MOD	Uranium 238	0.827	0.143	0.0143		
SS-DU-003	LDOS28E	DOE A-01-R MOD	Total Uranium	2.13	0.198			
SS-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 234	0.543	0.114	0.0396		
SS-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0429	0.0326	0.0184	J	37
SS-DU-003	LDOS28E	DOE A-01-R MOD	Uranium 238	0.709	0.133	0.0395		
SS-DU-004	LDOS28DE	DOE A-01-R MOD	Total Uranium	1.77	0.176			
SS-DU-004	LDOS28DE	DOE A-01-R MOD	Uranium 234	0.624	0.123	0.0468		
SS-DU-004	LDOS28DE	DOE A-01-R MOD	Uranium 235	0.0371	0.0328	0.0395	U	
SS-DU-004	LDOS28DE	DOE A-01-R MOD	Uranium 238	0.589	0.118	0.0317		
SS-DU-004	LDOS28E	DOE A-01-R MOD	Total Uranium	1.69	0.171			
SS-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 234	0.559	0.116	0.0526		
SS-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 235	0.0109	0.0331	0.0654	U	
SS-DU-004	LDOS28E	DOE A-01-R MOD	Uranium 238	0.567	0.115	0.0352		

Data Validation Reason Code

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

38 Chemical yield exceeded the control limits.

APPENDIX D

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

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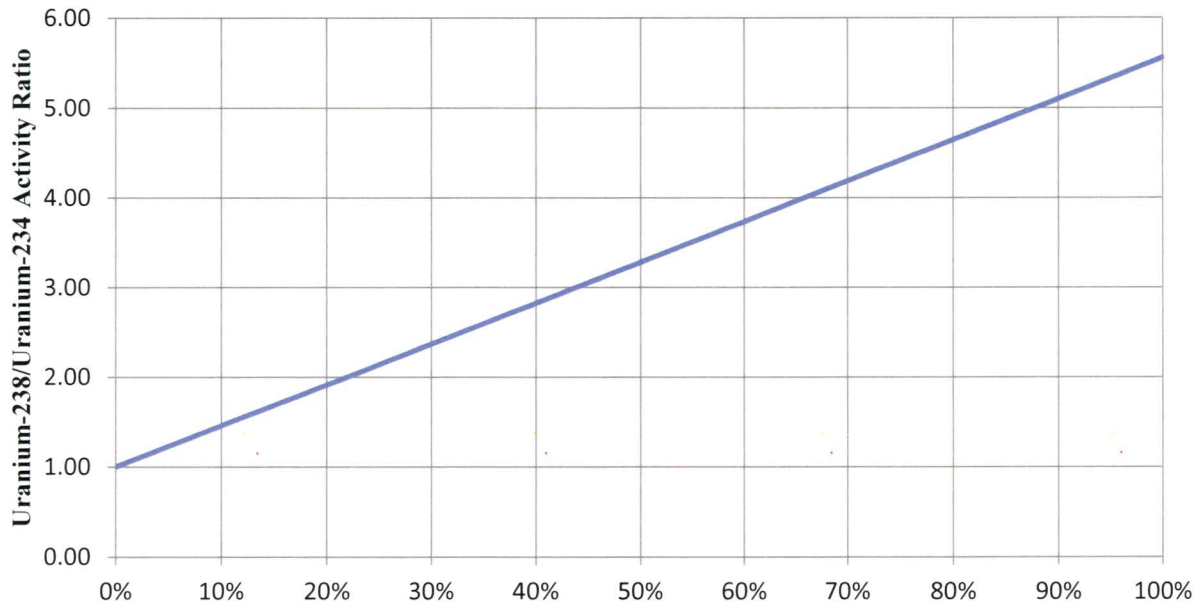
Figure D-1. Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium



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