DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
2405 GUN SHED ROAD
FORT SAM HOUSTON, TEXAS 78234-1223

REPLY TO
ATTENTION OF

October 3, 2012

Safety Office

Dr. Thomas G. McLaughlin
US Nuclear Regulatory Commission
Mailstop T-8-F-5
FSME/DWMEP/DURLD/MD
Washington, DC 20555-0001

Dear Dr. McLaughlin:

In accordance with the US Army Jefferson Proving Ground License SUB-1435 requirements, we are submitting ~~six~~ three hard copies and ~~four~~ two electronic copies on compact disk-read only memory (CD-ROM) of the Radiation Monitoring Report for License SUB-1435 Jefferson Proving Ground, Summary of Results for the November 2011 Sampling Event.

You may reach me by telephone at (210) 466-0368 or by email at robert.cherry@us.army.mil.

Sincerely,

Robert N. Cherry, Jr.
Radiation Safety Staff Officer

Enclosures

FSME20

RADIATION MONITORING REPORT
FOR LICENSE SUB-1435
JEFFERSON PROVING GROUND

Summary of Results for
November 2011 Sampling Event

FINAL

Submitted to:

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

Prepared by:

Science Applications International Corporation
McLean, Virginia

November 2012

CERTIFICATION 4

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has prepared this Radiation Monitoring Report for Jefferson Proving Ground's Depleted Uranium Impact Area, located in Madison, Indiana. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project, as defined in the Quality Control Plan (QCP). During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.

Joseph N. Skibinski
Project Manager
Science Applications International Corporation

November 5, 2012
Date

Joseph E. Peters
Quality Assurance Officer
Science Applications International Corporation

November 5, 2012
Date

Paul D. Cloud
Independent Technical Review
Science Applications International Corporation

November 5, 2012
Date

Significant concerns and explanation of the resolutions, if any were identified, are documented within the project file. As noted above, all concerns resulting from independent technical review of the project have been considered.

Lisa D. Jones-Bateman
Vice President
Science Applications International Corporation

November 5, 2012
Date

THIS PAGE WAS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

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
JPG	Jefferson Proving Ground
LCL	Lower Control Limit
MDC	Minimum Detectable Concentration
mg/L	Milligrams per liter
mS/cm	MilliSiemens per Centimeter
NRC	(U.S.) Nuclear Regulatory Commission
°C	Degrees Celsius
pCi/g	Picocuries per Gram
pCi/L	Picocuries per Liter
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SAIC	Science Applications International Corporation
SOP	Standard Operating Procedure
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
UCL	Upper Control Limit

THIS PAGE WAS INTENTIONALLY LEFT BLANK

1. INTRODUCTION

Environmental monitoring 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 Command's Institute for Public Health. 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 November 2011 sampling event, which is the second of two planned sampling events in 2011 for this biannual program. The sampling requirements and approach are presented in Section 2. The results of the multimedia sampling event are presented and discussed in Section 3. Historical data 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 logbook (Appendix B), data validation summary (Appendix C), and graph of the "Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium" (Appendix D). All tables and figures are presented at the end of their respective sections.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

2. SAMPLING REQUIREMENTS AND APPROACH

The ERMP (CHPPM 2000) specifies the U.S. Army Institute for Public Health'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 the DU Impact Area. The plan has been approved by the NRC and is described in an SOP, which is provided in Appendix A. Science Applications International Corporation (SAIC) executes the plan and reports the findings in an effort to fulfill the Army's responsibilities for monitoring under NRC Radioactive Material License SUB-1435.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

3. RESULTS

An SAIC field crew prepared for and conducted sampling at JPG in November 2011. Appendix B contains a copy of the field logbook, which documents environmental monitoring report field activities during the sampling effort. Other than low flow conditions, which are commonly encountered during the fall at JPG, no unusual or abnormal conditions (e.g., soil or water discoloration, odd odors, elevated radiation levels) were observed during the sampling effort.

The sample locations for the groundwater, surface water, sediment, and soil samples are depicted in Figure 3-1. Sections 3.1 through 3.4 summarize the sampling results for each medium, respectively, and are reported with a maximum of two significant digits. 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). Information relative to Uranium-238/Uranium-234 (U-238/U-234) activity ratios for mixtures of depleted and natural uranium is provided in Appendix D.

3.1 GROUNDWATER

The concentrations of total dissolved uranium in groundwater at the 11 monitoring wells plus 1 duplicate sample are presented in Table 3-1. Goundwater quality parameter measurements are provided in Table 3-2.

Total uranium concentrations in the November 2011 groundwater samples ranged from 0.60 ± 0.14 picocurie per liter (pCi/L) to 4.5 ± 0.5 pCi/L with an average concentration of 1.8 ± 0.9 pCi/L, computed using the average value for duplicates.

In addition to the individual isotopic concentrations, Table 3-1 presents the U-238/U-234 ratios for each sample, which ranged from 0.20 ± 0.11 to 1.0 ± 0.5. A U-238/U-234 ratio of 3.0 or less is 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. No sample exceeded this criterion, with the highest ratio encountered being the above stated result for MW-DU-008.

3.2 SURFACE WATER

The concentrations of total dissolved uranium in surface water at eight sampling locations plus one duplicate sample are presented in Table 3-3. Surface water quality parameter measurements are presented in Table 3-4. Total uranium concentrations ranged from 0.50 ± 0.14 pCi/L for SW-DU-001 to 1.0 ± 0.2 pCi/L for SW-DU-002, SW-DU-004, and SW-DU-005, with an average concentration of 0.7 ± 0.4 pCi/L, computed using the average values for duplicates. The U-238/U-234 ratios for surface samples ranged from 0.46 ± 0.20 for SW-DU-004 to 3.8 ± 1.8 for SW-DU-002. In addition, results for SW-DU-008 and the duplicate of SW-DU-002 also exhibited a U-238/U-234 ratio exceeding the investigation level of 3.0 with ratios of 3.5 and 3.4, respectively. These ratios together with the associated uncertainties are representative of relative DU activity ratios in the range of 20 to 90 percent of the total uranium activity (see Figure D-1, "Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium"). Investigations revealed that there was limited water flow at stream sampling locations such that SW-DU-002 was collected from pooled water and SW-DU-008 had slow flow at the time of sample collection due to the large amount of debris which had built up at a bridge just downstream from the sample location and restricted water flow (see Figures 3-2 and 3-3, November 2011 Stream Flow). This reduced flow is believed to have contributed to the increase in the DU concentrations at SW-DU-002 and SW-DU-008. Future results for each of these sample locations will continue to be closely monitored.

3.3 SEDIMENT

The concentrations of total uranium in sediment at eight sampling locations plus one duplicate sample are presented in Table 3-5. Sediment samples were collected at the same locations as surface water samples, as shown in Figure 3-1. Total uranium concentrations ranged from 0.28 ± 0.07 picocuries per gram (pCi/g) for SD-DU-008 to 1.8 ± 0.2 pCi/g for SD-DU-001 with an average concentration of 1.5 ± 0.4 pCi/g, computed using the average value for duplicates. The U-238/U-234 ratio for the samples ranged from 0.92 ± 0.27 to 1.7 ± 0.6. 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. No sample exceeded this criterion with the highest ratio encountered being the above stated result for SD-DU-002.

3.4 SOILS

The concentrations of total uranium in surface soils at four surface soil sample locations plus one duplicate sample are presented in Table 3-6. Total uranium concentrations ranged from 1.4 ± 0.2 to 1.5 ± 0.1 pCi/g. The average concentration was 1.4 ± 0.3 pCi/g, computed using the average value for duplicates. The U-238/U-234 ratio ranged from 0.82 ± 0.20 to 1.4 ± 0.3. All surface soil samples exhibited U-238/U-234 ratios of less than the investigation level of 3.0.

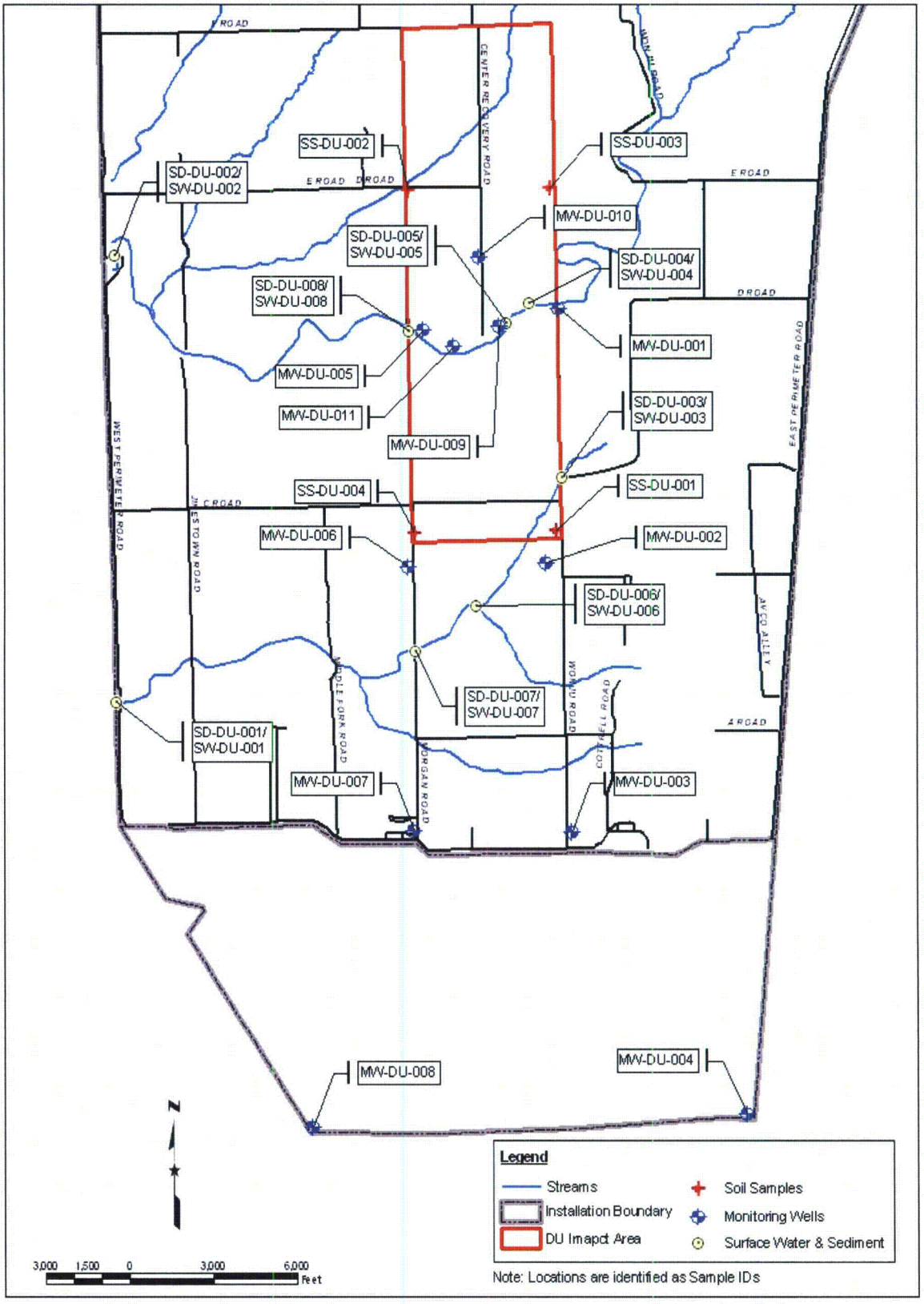


Figure 3-1. Sampling Locations

Figure 3-2. November 2011 Stream Flow at SW-DU-008 (View 1)

Figure 3-3. November 2011 Stream Flow at SW-DU-008 (View 2)

Table 3-1. Uranium in Groundwater
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[d]
	U-234	U-235	U-238	Total Uranium	
MW-DU-001	0.18 ± 0.08	-0.0023 ± 0.0045 U	0.14 ± 0.07	0.32 ± 0.10	0.80 ± 0.51
MW-DU-002	3.3 ± 0.5	0.072 ± 0.059 J	1.2 ± 0.2	4.5 ± 0.51	0.36 ± 0.09
MW-DU-003	0.42 ± 0.12	-0.0025 ± 0.005 U	0.34 ± 0.11	0.76 ± 0.16	0.81± 0.35
MW-DU-004	1.7 ±0.3	0.73 ± 0.05 J	1.3 ± 0.2	3.1 ± 0.4	0.76 ± 0.18
MW-DU-005	0.35 ± 0.11	0.036 ± 0.039 U	0.21 ± 0.08	0.60 ± 0.14	0.61 ± 0.30
MW-DU-006	2.2 ± 0.3	0.076 ±0.054 J	1.8 ± 0.3	4.1 ± 0.43	0.80 ± 0.17
MW-DU-007	1.1 ± 0.2	0.054 ± 0.041 J	0.69 ± 0.14	1.9 ± 0.24	0.62 ± 0.16
MW-DU-007D	1.3 ± 0.24	0.028 ± 0.035 U	0.91 ± 0.19	2.3 ± 0.3	0.69 ± 0.19
MW-DU-008	0.29 ± 0.10	0.049 ± 0.046 J	0.30 ± 0.11	0.64 ± 0.16	1.0 ± 0.5
MW-DU-009	0.76 ± 0.17	0.018 ± 0.029 U	0.15 ± 0.07	0.93 ± 0.19	0.20 ± 0.11
MW-DU-010	1.8 ± 0.3	0.041 ± 0.048 U	0.76 ± 0.18	2.6 ± 0.4	0.42 ± 0.12
MW-DU-011	0.26 ± 0.10	0.003 ± 0.031 U	0.077 ± 0.052	0.34 ± 0.11	0.29 ± 0.22

[a] Represents sample designation developed in previous sampling programs.
[b] I.D. = Identification.
[c] Laboratory uncertainties are specified with two standard deviations (95% confidence level).
[d] Unitless.
MW-DU-007 composited total uranium and U-238/U-234 ratio are 2.0 ± 0.2 and 0.64 ± 0.12, respectively.
J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
U – Indicates that the data met all quality assurance/quality control (QA/QC) requirements and the radionuclide was analyzed for but was not detected above the reported sample quantification limit.

Table 3-2. Groundwater Water Quality Parameters and Exposure Readings
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation*	Sample I.D.	pH	Temp (°C)	Conductivity (Siemens/cm)	Dissolved Oxygen (mg/L)	Exposure Rate (µR/hr)
MW01	MW-DU-001	7.53	16.6	0.600	8.55	6
MW02	MW-DU-002	7.33	12.3	0.592	8.14	6
MW03	MW-DU-003	6.78	11.8	0.637	5.88	6
MW04	MW-DU-004	7.50	18.1	0.820	3.08	5
MW05	MW-DU-005	7.34	14.5	0.366	7.02	6
MW06	MW-DU-006	7.45	14.3	0.777	6.94	7
MW07	MW-DU-007	7.34	14.5	0.366	7.02	6
MW08	MW-DU-008	7.49	15.7	0.531	9.15	7
MW09	MW-DU-009	7.89	17.5	0.938	5.44	7
MW10	MW-DU-0010	7.74	16.6	0.658	5.04	6
MW11	MW-DU-0011	7.50	10.8	0.376	9.37	6

*Represents sample designation developed in previous sampling programs.

Table 3-3. Uranium in Surface Water
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[d]
	U-234	U-235	U-238	Total Uranium	
SW-DU-001	0.31 ± 0.11	0.018 ± 0.030 U	0.17 ± 0.08	0.50 ± 0.14	0.55 ± 0.32
SW-DU-002	0.18 ± 0.08	0.008 ± 0.021 U	0.60 ± 0.15	0.79 ± 0.17	3.4 ± 1.7
SW-DU-002D	0.21 ± 0.09	0.026 ± 0.037 U	0.79 ± 0.18	1.0 ± 0.2	3.8 ± 1.8
SW-DU-003	0.045 ± 0.043 U	0.005 ± 0.02 U	0.029 ± 0.032 U	0.08 ± 0.06 U	ND
SW-DU-004	0.69 ± 0.17	0.011 ± 0.023 U	0.32 ± 0.11	1.0 ± 0.2	0.46 ± 0.20
SW-DU-005	0.45 ± 0.13	0.0 ± 0.0 U	0.46 ± 0.13	0.91 ± 0.18	1.0 ± 0.4
SW-DU-006	0.093 ± 0.058 J	0.010 ± 0.020 U	0.10 ± 0.06 J	0.20 ± 0.09	1.1 ± 0.9
SW-DU-007	0.17 ± 0.08	0.010 ± 0.02 U	0.11 ± 0.06J	0.28 ± 0.10	0.66 ± 0.49
SW-DU-008	0.18 ± 0.08	0.009 ± 0.019 U	0.62 ± 0.15	0.81 ± 0.17	3.5 ± 1.7

[a] Represents sample designation developed in previous sampling programs.
[b] I.D. = Identification.
[c] Laboratory uncertainties are specified with two standard deviations (95% confidence level).
[d] Unitless.
SW-DU-002 composited total uranium and U-238/U-234 ratio are 0.9 ± 0.7 and 3.5 ± 1.2, respectively.
J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
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 3-4. Surface Water Quality Parameters and Exposure Readings
Jefferson Proving Ground, Madison, Indiana

JPG Sample Designation*	Sample I.D.	pH	Temp (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Exposure Rate (µR/hr)
SWS01	SW-DU-001	6.55	6.7	0.397	8.95	6
SWS02	SW-DU-002	7.47	6.7	0.287	7.69	7
SWS03	SW-DU-003	7.52	8.6	0.198	6.61	5
SWS04	SW-DU-004	8.51	9.4	0.294	11.40	7
SWS05	SW-DU-005	8.70	11.0	0.476	12.69	7
SWS06	SW-DU-006	7.35	4.4	0.263	11.17	7
SWS07	SW-DU-007	8.36	10.8	0.275	10.58	5
SWS08	SW-DU-008	7.66	4.9	0.269	8.31	6

*Represents sample designation developed in previous sampling programs.
C - Degrees Celsius
µR/hr – Microroentgens per hour
mg/L – Milligrams per liter
mS/cm – MilliSiemens per centimeter

Table 3-5. Uranium in Sediment
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[d]
	U-234	U-235	U-238	Total Uranium	
SD-DU-001	0.81 ± 0.14	0.053 ± 0.037 J	0.96 ± 0.16	1.8 ± 0.2	1.2 ± 0.3
SD-DU-002	0.22 ± 0.06	0.033 ± 0.025 J	0.36 ± 0.08	0.62 ± 0.10	1.6 ± 0.6
SD-DU-002D	0.23 ± 0.06	0.012 ± 0.016 U	0.39 ± 0.08	0.63 ± 0.10	1.7 ± 0.6
SD-DU-003	0.39 ± 0.08	0.007 ± 0.012 U	0.36 ± 0.08	0.75 ± 0.11	0.92 ± 0.27
SD-DU-004	0.17 ± 0.05	0.021 ± 0.021 U	0.18 ± 0.06	0.37 ± 0.08	1.1 ± 0.5
SD-DU-005	0.36 ± 0.08	0.007 ± 0.014 U	0.44 ± 0.09	0.80 ± 0.12	1.2 ± 0.4
SD-DU-006	0.60 ± 0.11	0.007 ± 0.01 U	0.58 ± 0.11	1.2 ± 0.2	0.97 ± 0.25
SD-DU-007	0.61 ± 0.11	0.028 ± 0.026 J	0.68 ± 0.12	1.3 ± 0.2	1.1 ± 0.3
SD-DU-008	0.12 ± 0.04	0.008 ± 0.01 U	0.15 ± 0.49	0.28 ± 0.07	1.3 ± 0.6

[a] Represents sample designation developed in previous sampling programs.
[b] I.D. = Identification.
[c] Laboratory uncertainties are specified with two standard deviations (95% confidence level).
[d] Unitless.
SD-DU-002 composited total uranium and U-238/U-234 ratio are 0.62 ± 0.07 and 1.7 ± 0.4, respectively.
J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
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 3-6. Uranium in Surface Soil
Jefferson Proving Ground, Madison, Indiana

Sample I.D.[a]	Activity Concentration (pCi/L)[b]				Ratio U-238/U-234[d]
	U-234	U-235	U-238	Total Uranium	
SS-DU-001	0.76 ± 0.13	0.024 ± 0.022 J	0.62 ± 0.11	1.4 ± 0.2	0.82 ± 0.20
SS-DU-002	0.68 ± 0.11	0.027 ± 0.022 J	0.74 ± 0.12	1.4 ± 0.2	1.1 ± 0.3
SS-DU-003	0.74 ± 0.13	0.025 ± 0.024 J	0.65 ± 0.12	1.4 ± 0.2	0.88 ± 0.22
SS-DU-004	0.70 ± 0.13	0.055 ± 0.036 J	0.77 ± 0.14	1.5 ± 0.19	1.1 ± 0.3
SS-DU-004D	0.59 ± 0.11	0.028 ± 0.023 J	0.81 ± 0.13	1.4 ± 0.2	1.4 ± 0.3

[a] Represents sample designation developed in previous sampling programs.
[b] I.D. = Identification .
[c] Laboratory uncertainties are specified with two standard deviations (95% confidence level).
[d] Unitless.
SD-DU-004 composited total uranium and U-238/U-234 ratio are 1.5 ± 0.1 and 1.1 ± 0.2, respectively.]
J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
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.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

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 Environmental Radiation Monitoring (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 in Title 10, Code of Federal Regulations (CFR), Part 20 (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 micrograms per liter (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 November 2011sampling event. 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 178 discrete samples available from 11 monitoring wells (MW01 to MW11) during the period from 2004 through November 2011, the average total uranium activity-concentration is 1.4 pCi/L, the standard deviation is 1.2 pCi/L, and the maximum detected activity-concentration is 5.7 ± 0.6 pCi/L. The activity-concentrations at each well are 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. Where trend lines are provided, the associated coefficient of correlation also is provided (the R^2 value listed on each figure). An R^2 value that approaches 1.0 suggests a strong relationship between the sample results and the sampling dates. The figures for all 11 individual monitoring wells indicate no significant trends. In addition, no monitoring wells exhibited trend lines with R^2 values greater than 0.5 (i.e., somewhat significant).

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 November 2011 sampling effort were within two standard deviations of the mean concentration. An example individual control chart 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 above the UCL applicable to the full data set. Each of these three data points is for MW-DU-006 with the individual values ranging from 4.8 to 5.7 pCi/L with the mean and standard deviation for this point being 3.9 ± 1.1 pCi/L. Clearly, MW-DU-006 has exhibited, and continues to exhibit, total uranium results exceeding that of the other wells. This tendency is reflected in the fact that the MW-DU-006 routinely exhibits total uranium concentrations that are elevated relative to the concentrations encountered for most other monitoring wells. Review of total uranium in SW-DU-006 as depicted in Figure 4-1 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. Most monitoring wells exhibit negative trend lines such that total uranium results generally exhibit decreasing activity. Exceptions are MW-DU-002 and MW-DU-004 which exhibit a limited increasing trend and relatively flat response, respectively. Notably, the U-238/U-234 ratios for the November 2011 groundwater samples reflect a maximum of 1.0 ± 0.5, suggesting that significant concentrations of depleted uranium 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 130 discrete samples available from 8 surface water sampling locations (SW01 to SW08) during the period from 2004 through November 2011, the average total uranium activity-concentration is 0.93 pCi/L, the standard deviation is 2.6 pCi/L, and the maximum detected activity-concentration is 19 ± 2 pCi/L. The highest total uranium concentration among surface water samples for the November 2011 sampling event was 1.0 pCi/L ± 0.2, reflecting activity-concentrations at each sample location that is 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 on 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 eight individual surface water sampling locations indicate no significant trends. In addition, 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 all data collected beginning December 2004 (Figure 4-22).

Figure 4-22 indicates that six data points exceeded the UCL. SW-DU-005 exhibited total uranium concentrations of 6.3, 6.9, and 19 pCi/L in October 2007, October 2008, and October 2010, respectively, with each of these concentrations exceeding the UCL. Analytical results for SW-DU-004 reflected concentrations of 14 and 16 pCi/L for the sample and duplicate, respectively, for the October 2010 sampling event and SW-DU-003 exhibited total uranium activity of 3.5 ± 0.5 pCi/L for the April 2011 sampling event. Each of these values exceeded the UCL of 3.1 pCi/L. All results for the November 2011 sampling event exhibited total uranium concentrations of 1.0 ± 0.2 or less. Nonetheless, given historical concentrations and the fact that SW-DU-002 and SW-DU-008 exhibited U-238/U-234 ratios of 3.5 ± 1.2 and 3.5 ± 1.7, respectively, for the November 2011 sampling event, the Army will continue to monitor all surface water results closely.

4.3 SEDIMENT

For 143 discrete samples available from 8 sediment sampling locations (SD01 to SD08) during the period from 2004 through November 2011, the average total uranium activity-concentration is 0.97 pCi/g, the standard deviation is 0.52 pCi/g, and the maximum detected activity-concentration is 2.8 ± 0.4 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 on 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 eight individual sediment sampling locations indicate no significant trends.

The eight sediment sampling locations also were examined in aggregate to determine if some locations or particular sampling events were distinctive. None of the samples exhibited trend lines with R^2 values greater than 0.5 (i.e., somewhat significant).

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 no new points above the UCL or below the LCL. The November 2011 sediment sampling results vary around the mean, as expected.

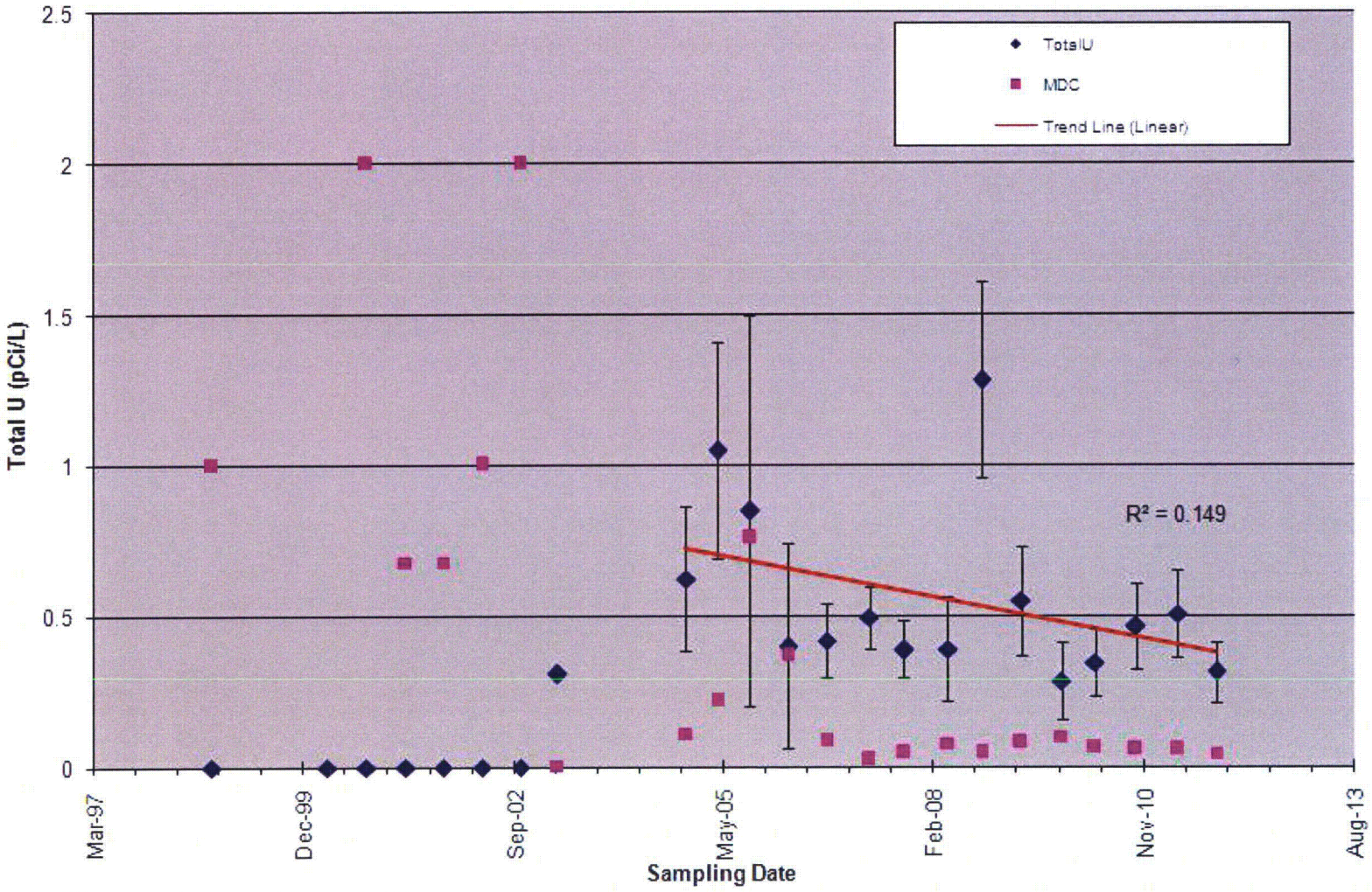
4.4 SOILS

For 81 discrete samples available from 4 surface soil sampling locations (SS01 to SS04) during the period from 2004 through November 2011, the average total uranium activity-concentration is 1.5 pCi/g, the standard deviation is 0.30 pCi/g, and the maximum detected activity-concentration is 2.2 ± 0.5 pCi/g. The activity-concentrations at each location are 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 on 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 although SS-DU-001 exhibits an R^2 value of 0.47,

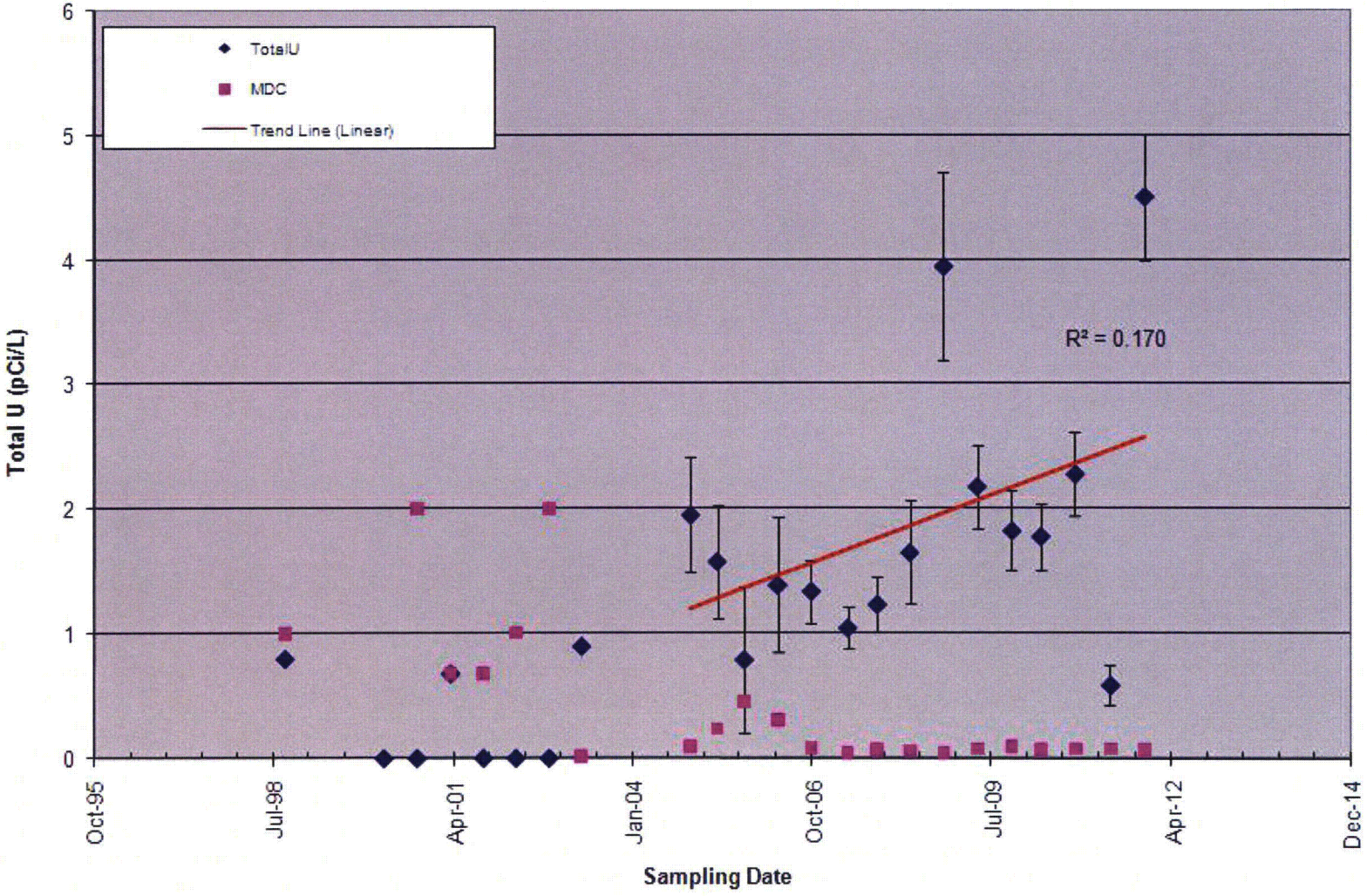
approximating a trend line that is somewhat significant. The slope of the trend line for this location continues to be negative with a decrease in concentration from about 2 pCi/g to approximately 1.5 pCi/g over the period from 2004 to the present. The U-238/U-234 ratios for surface soils for the November 2011 sampling event ranged from 1.0 to 1.4 (1.2 ± 0.2), suggesting that depleted uranium concentrations in surface soil samples were less than or equal to about 5 percent of the uranium activity present.

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 two points, the results for SS-DU-002 (i.e., 0.36 pCi/g) and SS-DU-004D (i.e., 0.88 pCi/g), from prior sampling events were present at concentrations of less than or indistinguishable from the LCL of 0.9. One point, the result for SS-DU-001D for the May 2005 sampling event, exhibited a concentration of 2.3, which is indistinguishable from the UCL of 2.2.



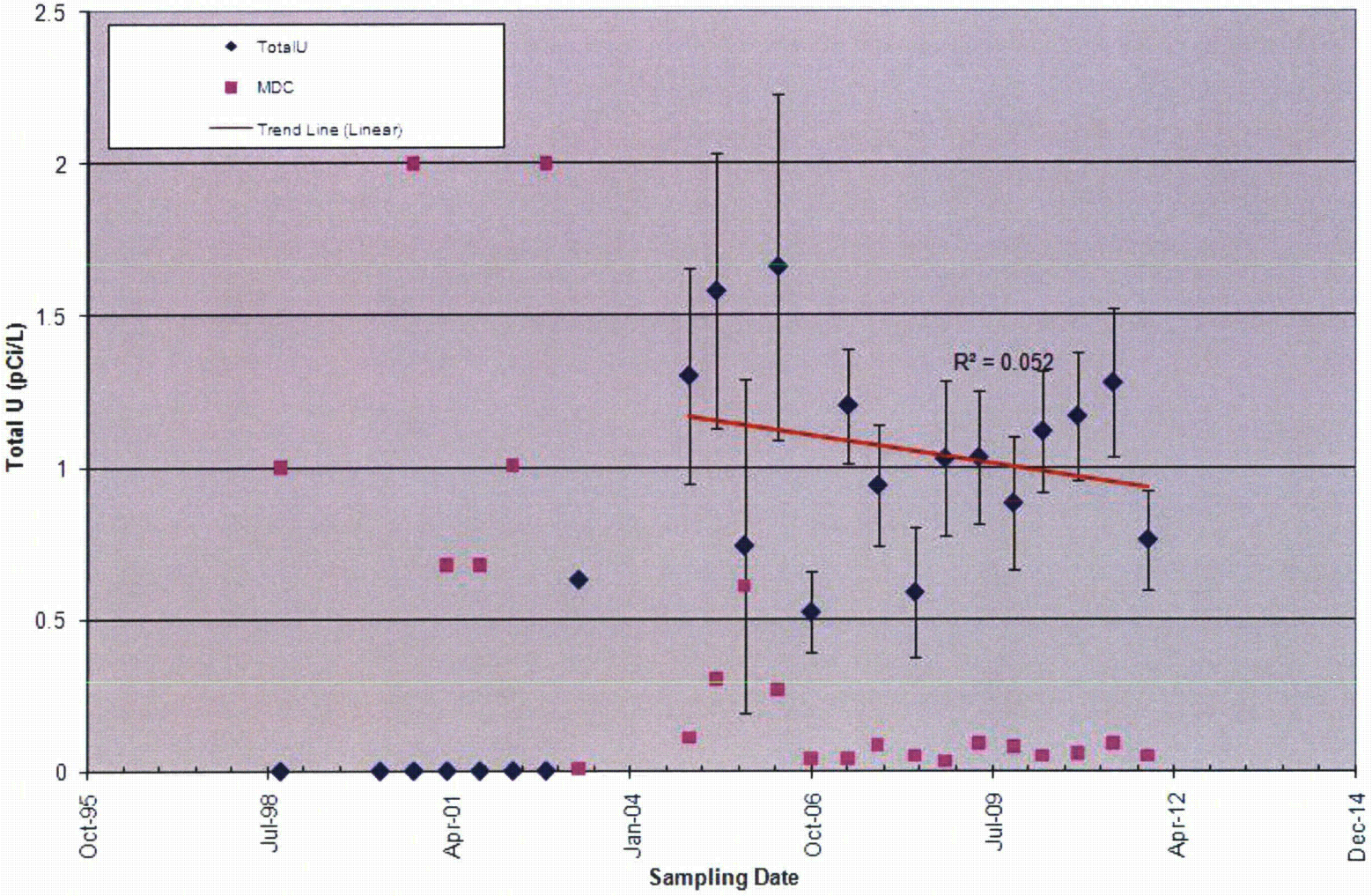
MDC – Minimum Detectable Concentration

Figure 4-1. Total Uranium in MW-DU-001 (1998-2011)



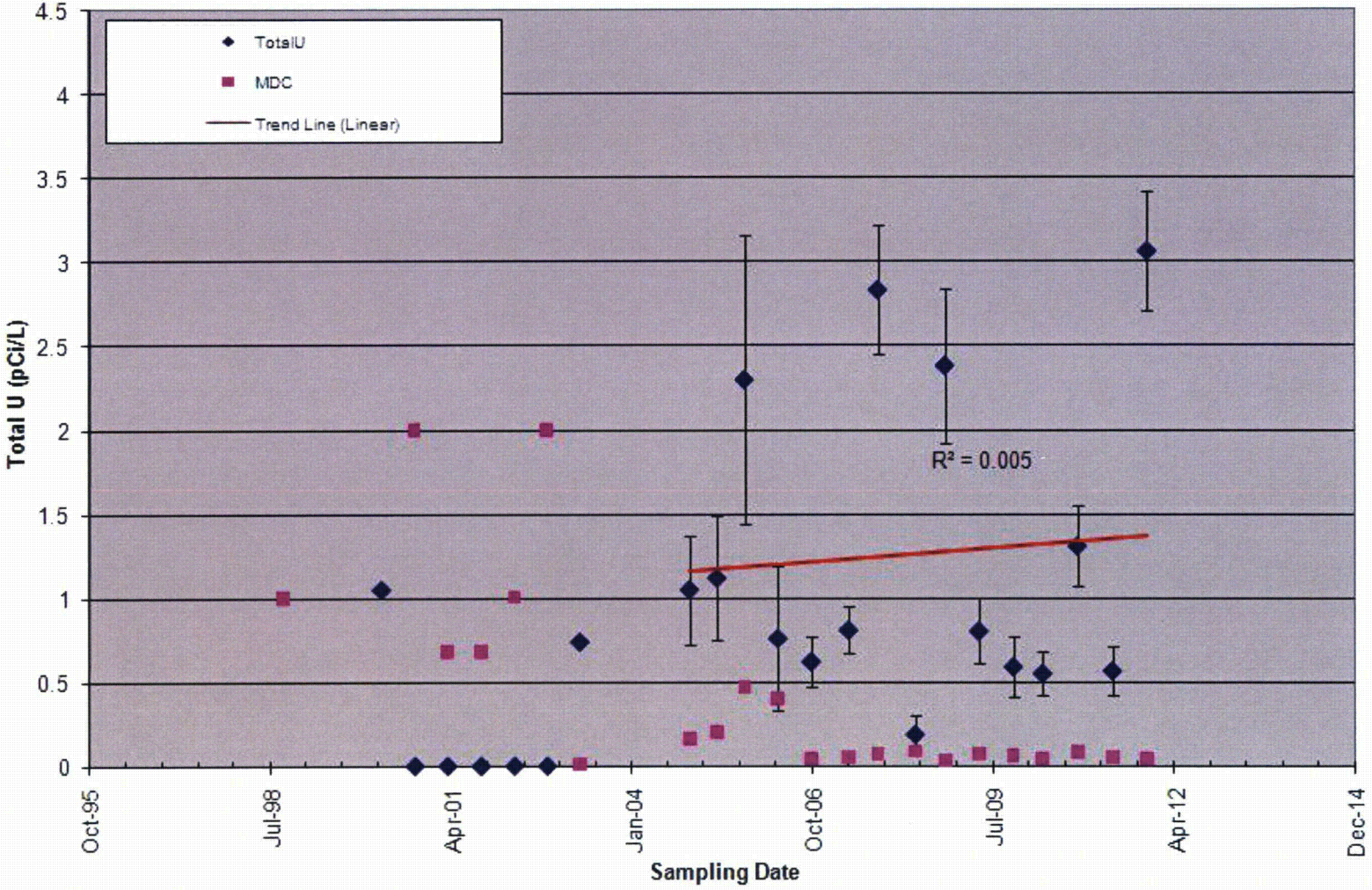
MDC – Minimum Detectable Concentration

Figure 4-2. Total Uranium in MW-DU-002 (1998-2011)



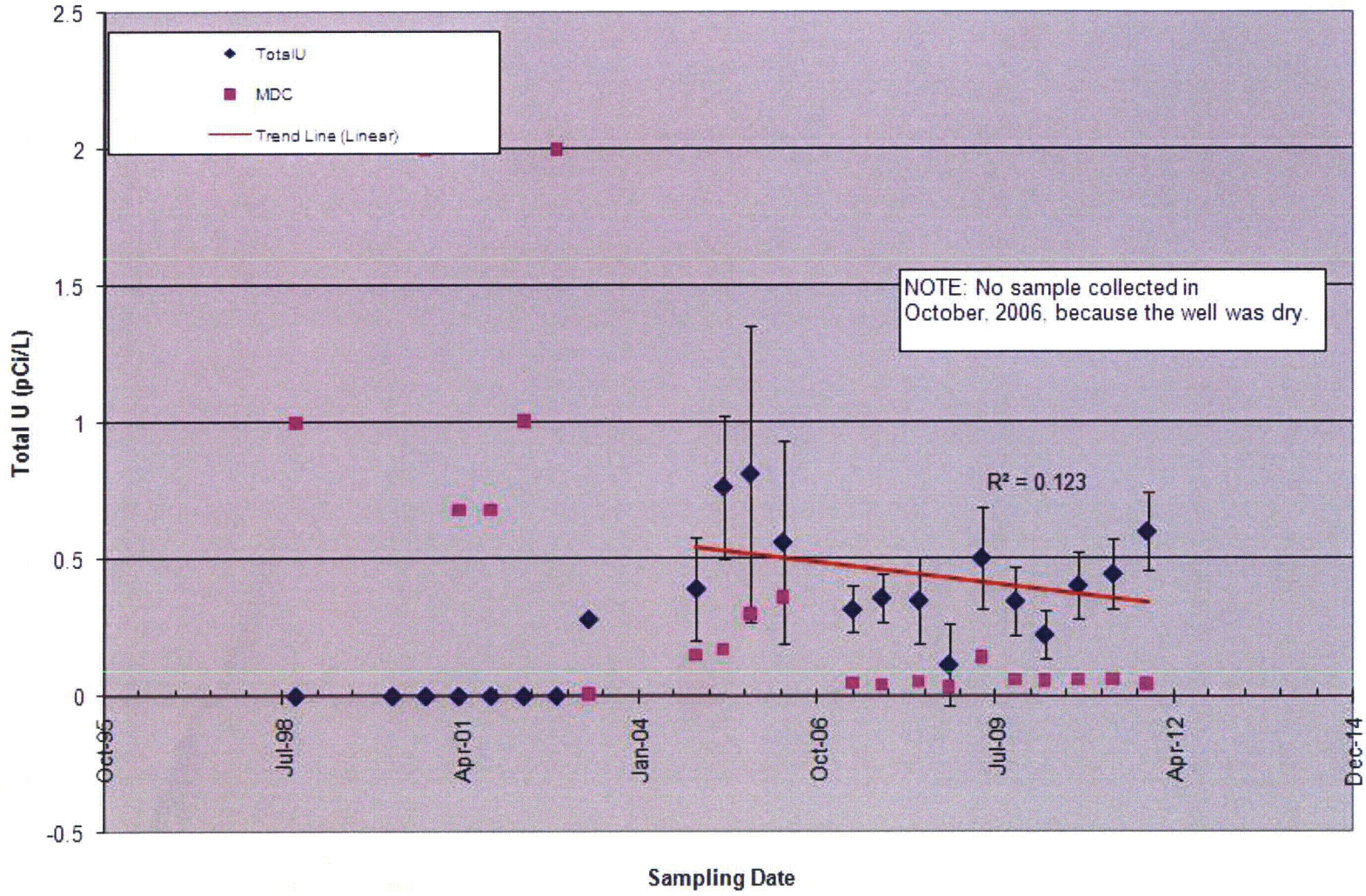
MDC – Minimum Detectable Concentration

Figure 4-3. Total Uranium in MW-DU-003 (1998-2011)



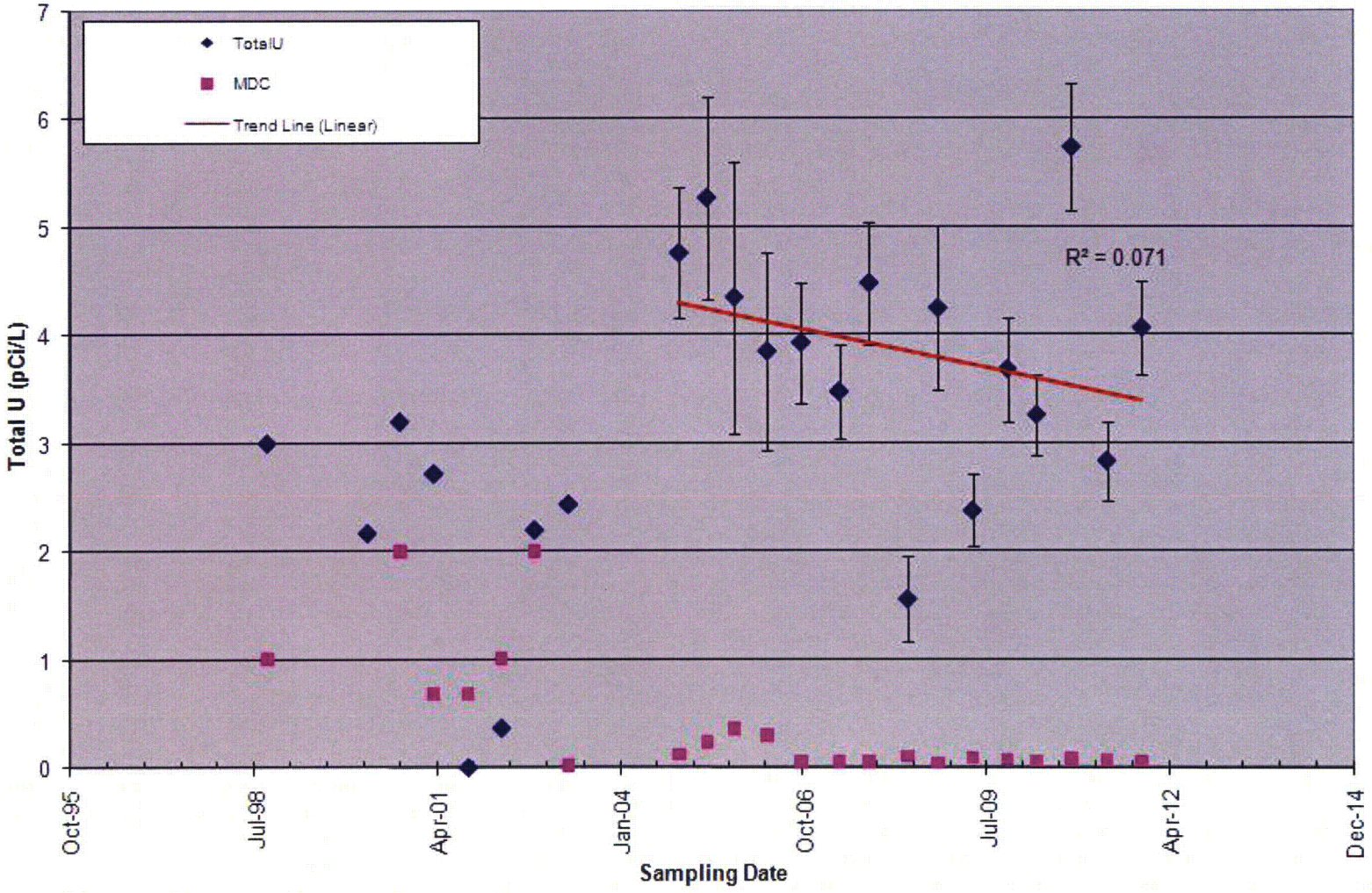
MDC – Minimum Detectable Concentration

Figure 4-4. Total Uranium in MW-DU-004 (1998-2011)



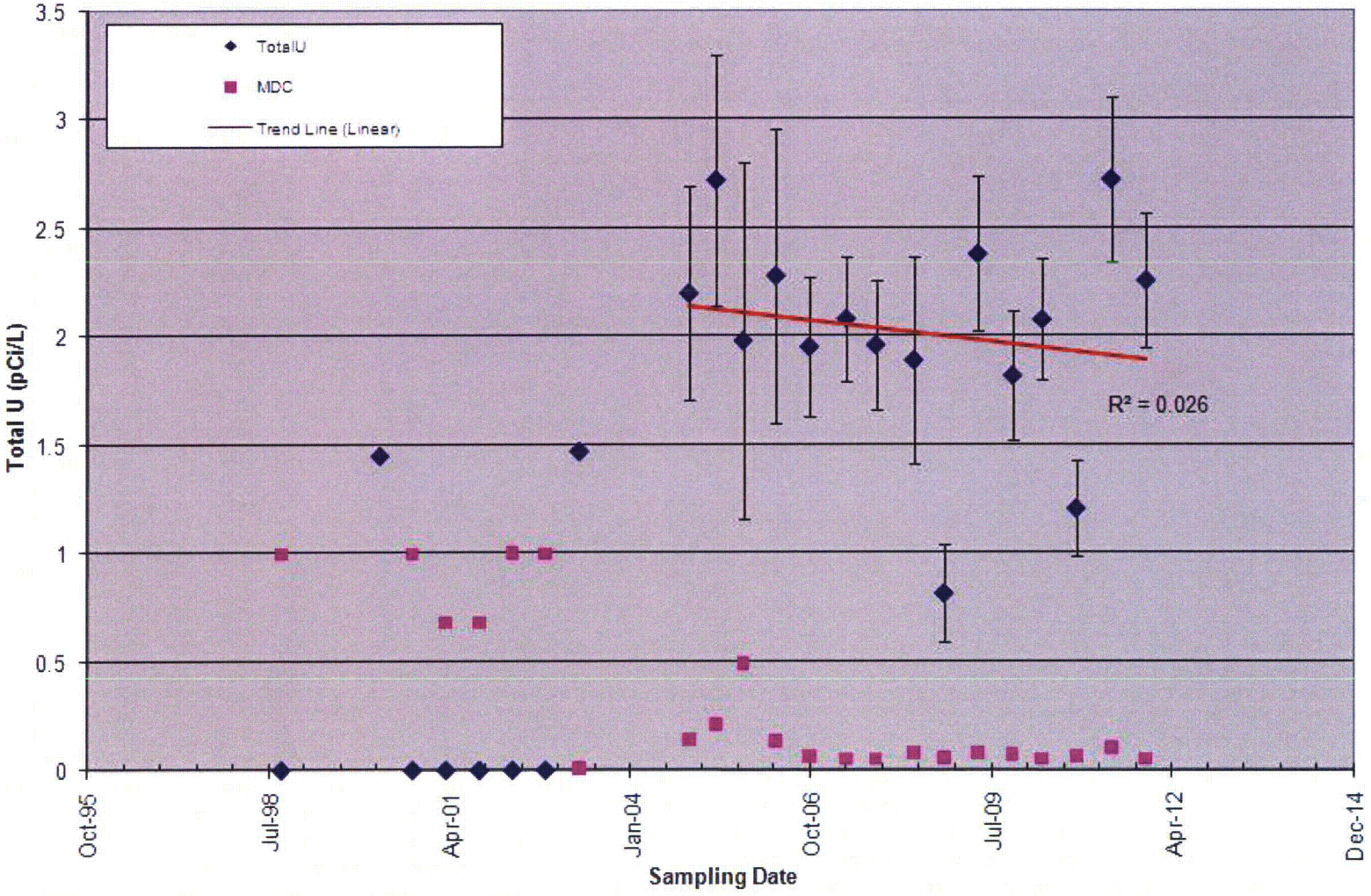
MDC – Minimum Detectable Concentration

Figure 4-5. Total Uranium in MW-DU-005 (1998-2011)



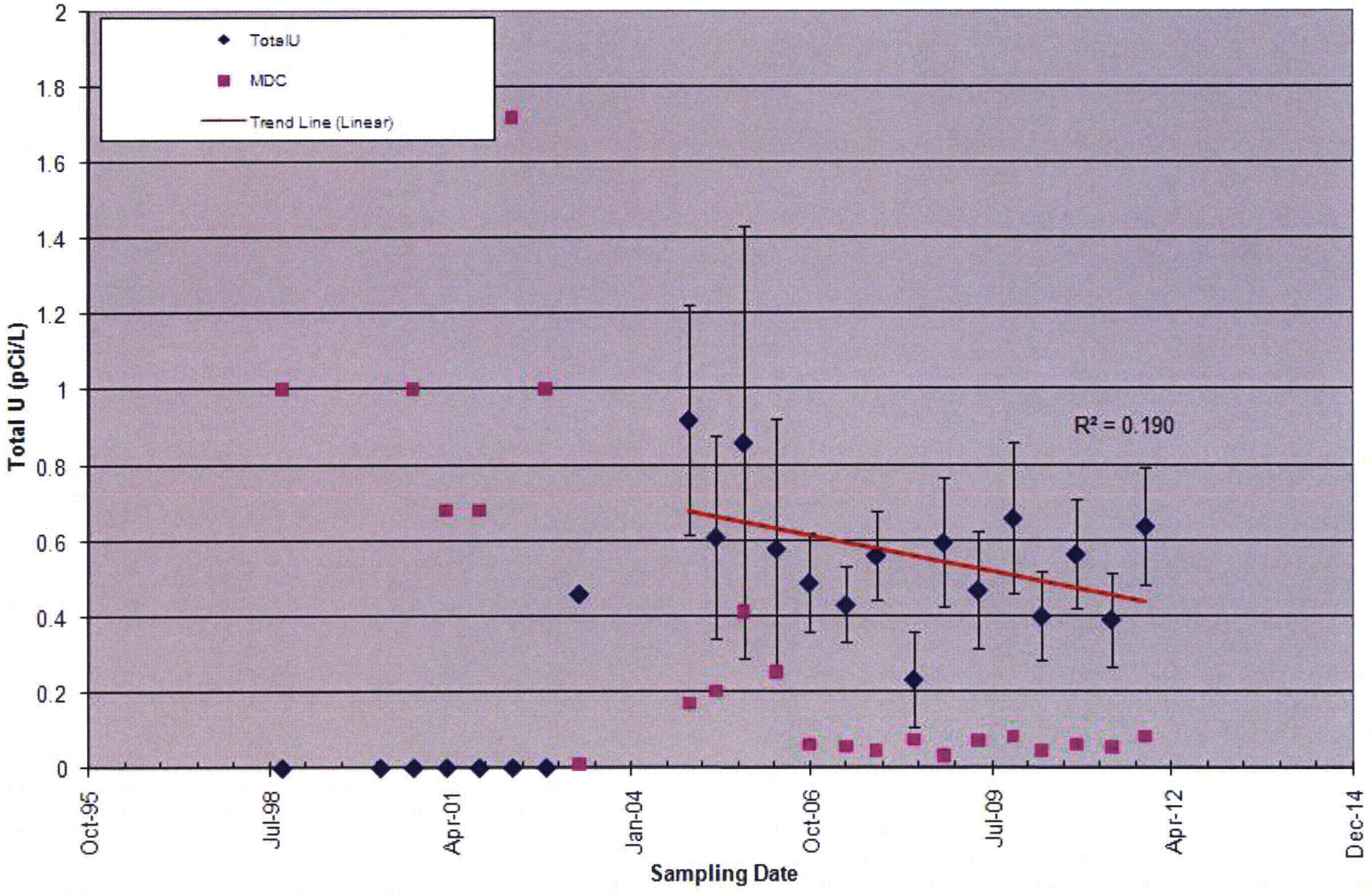
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2006 because the well was dry.

Figure 4-6. Total Uranium in MW-DU-006 (1998-2011)



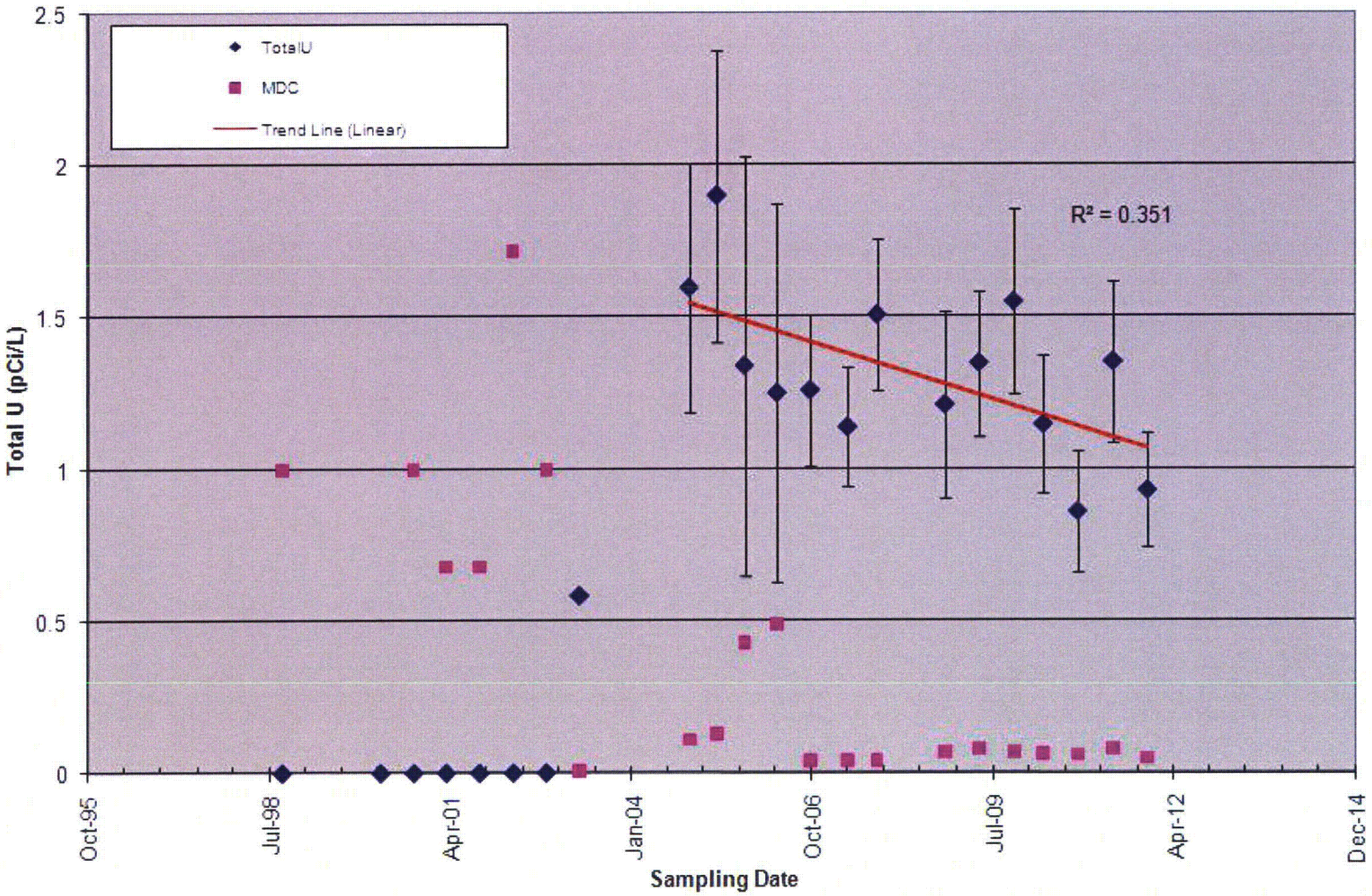
MDC – Minimum Detectable Concentration

Figure 4-7. Total Uranium in MW-DU-007 (1998-2011)



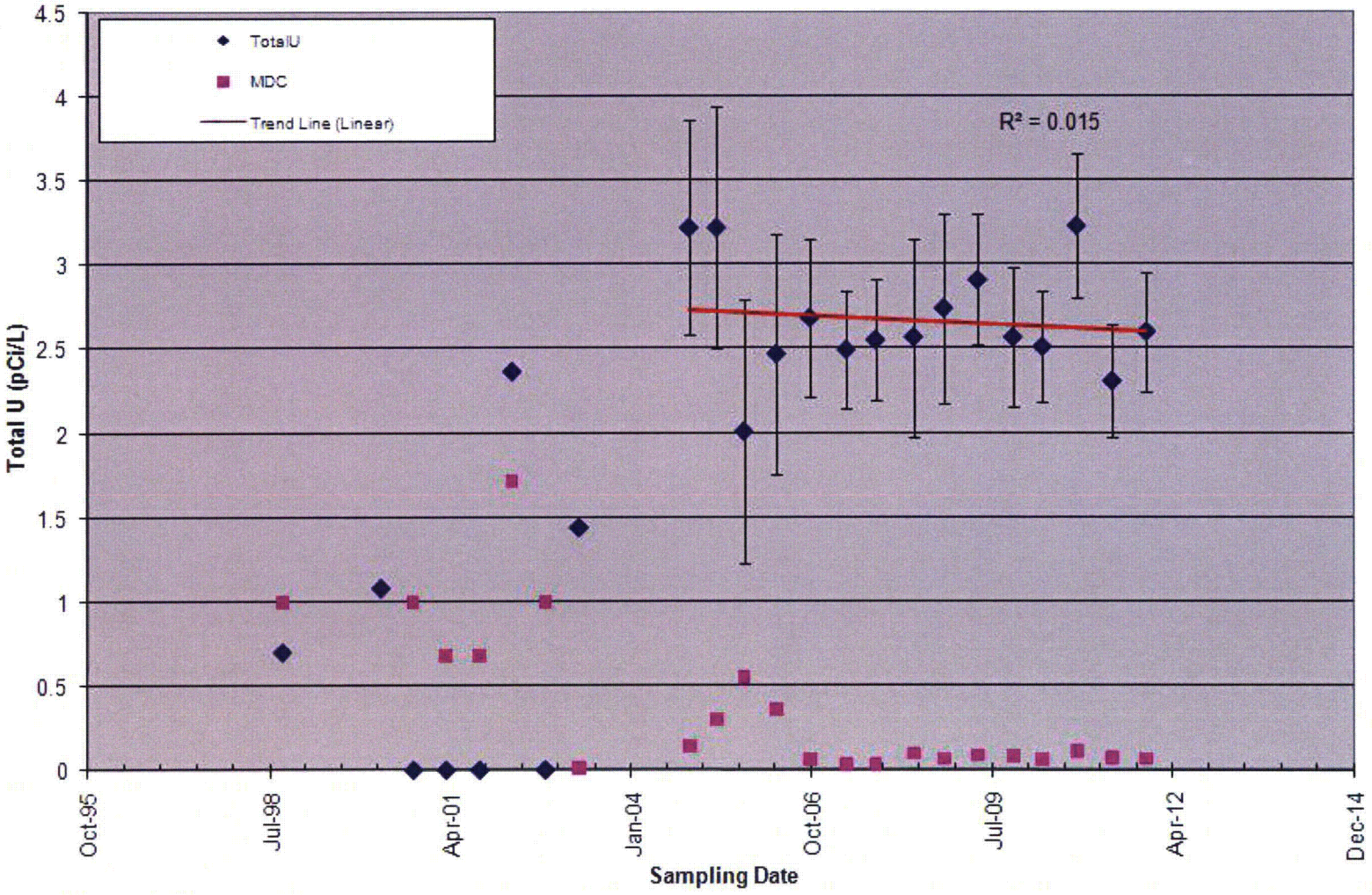
MDC – Minimum Detectable Concentration

Figure 4-8. Total Uranium in MW-DU-008 (1998-2011)



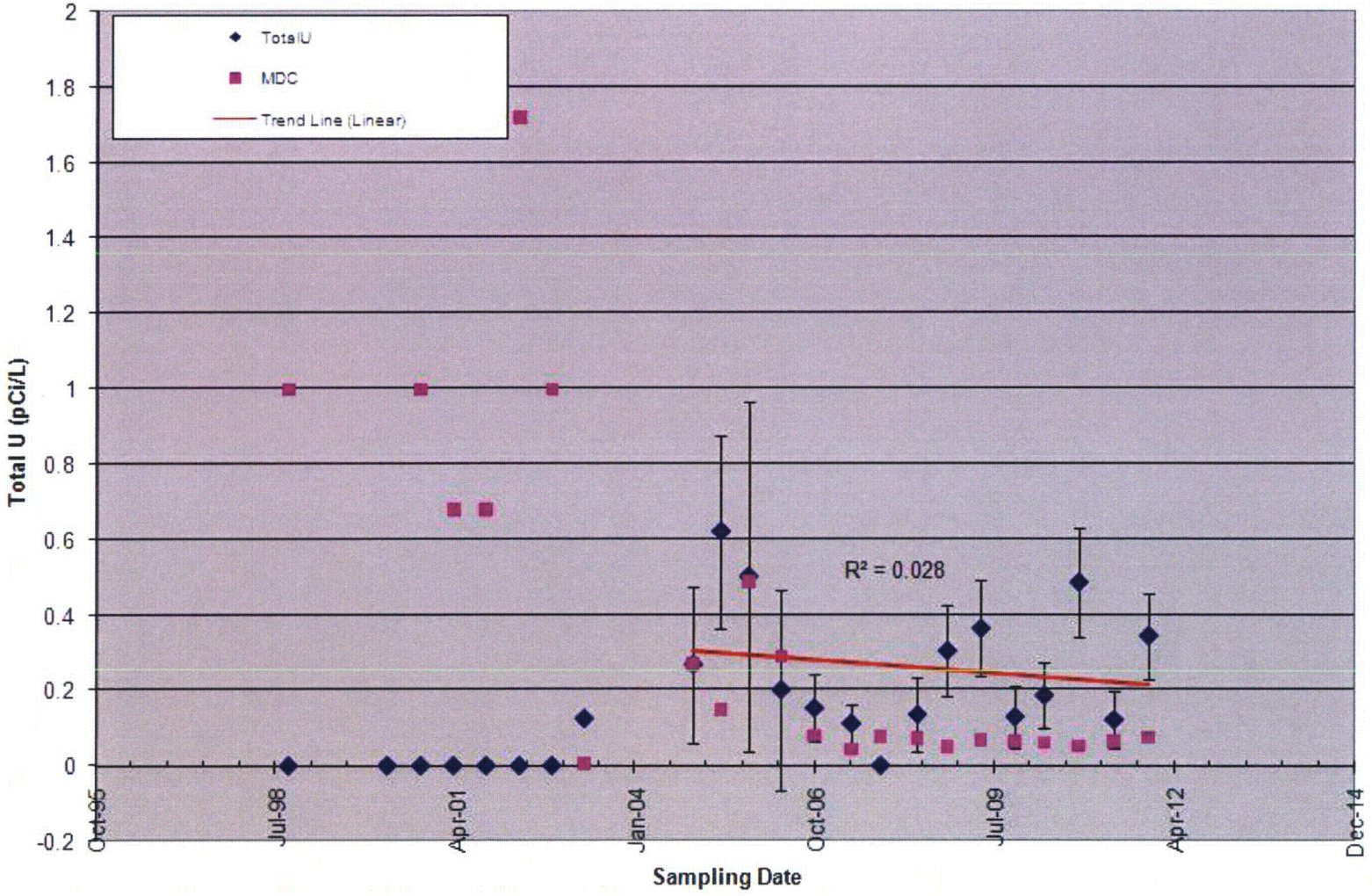
MDC – Minimum Detectable Concentration

Figure 4-9. Total Uranium in MW-DU-009 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-10. Total Uranium in MW-DU-010 (1998-2011)



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

Figure 4-11. Total Uranium in MW-DU-011 (1998-2011)

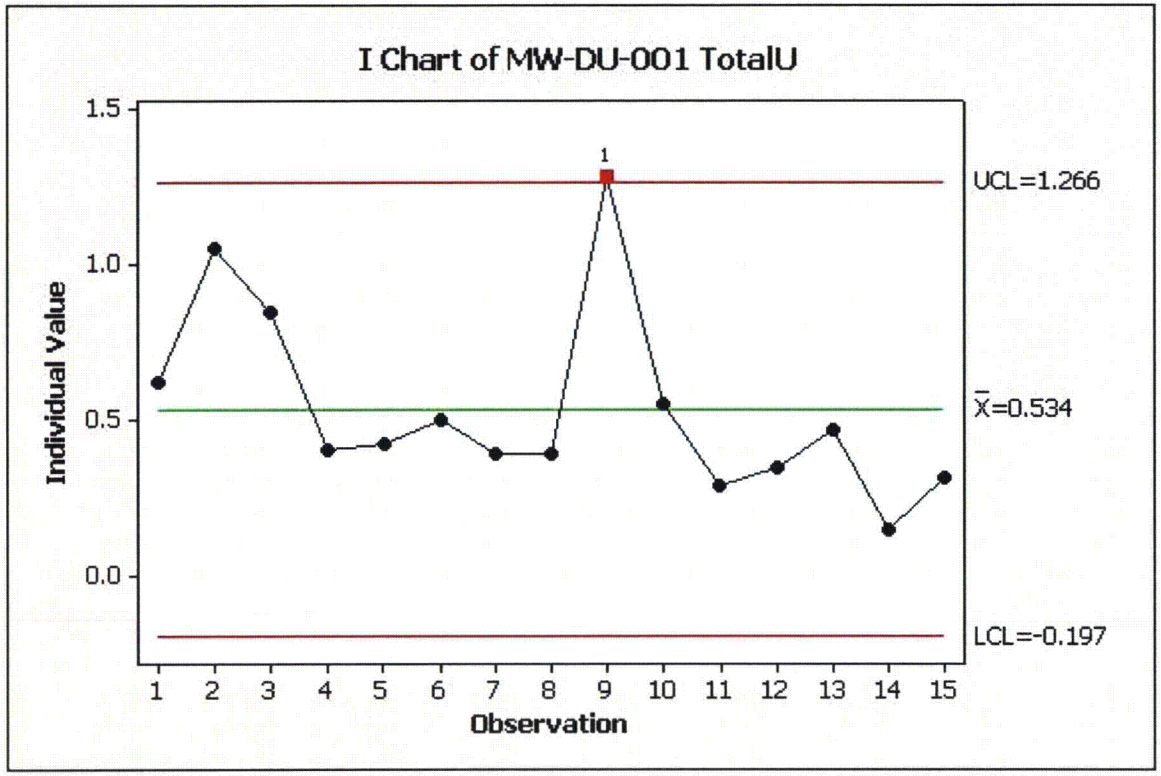


Figure 4-12. Variable Control Chart for Total Uranium in MW-DU-001 (2004-2011)

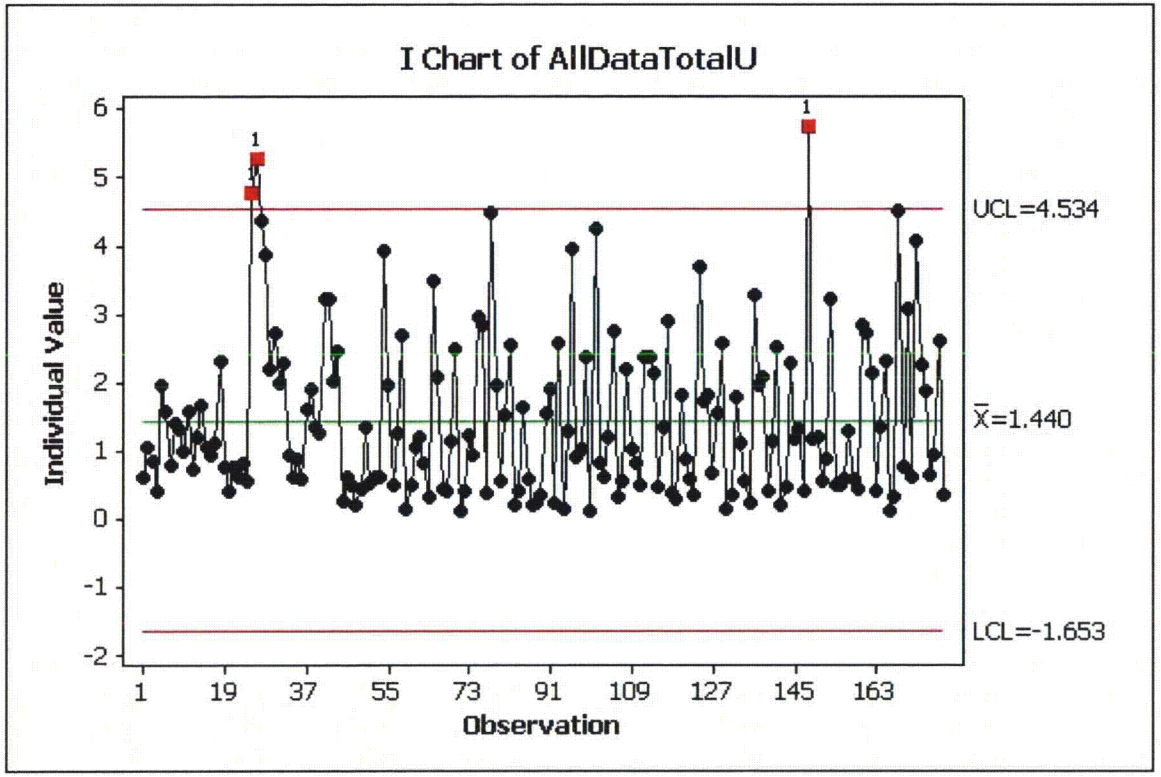
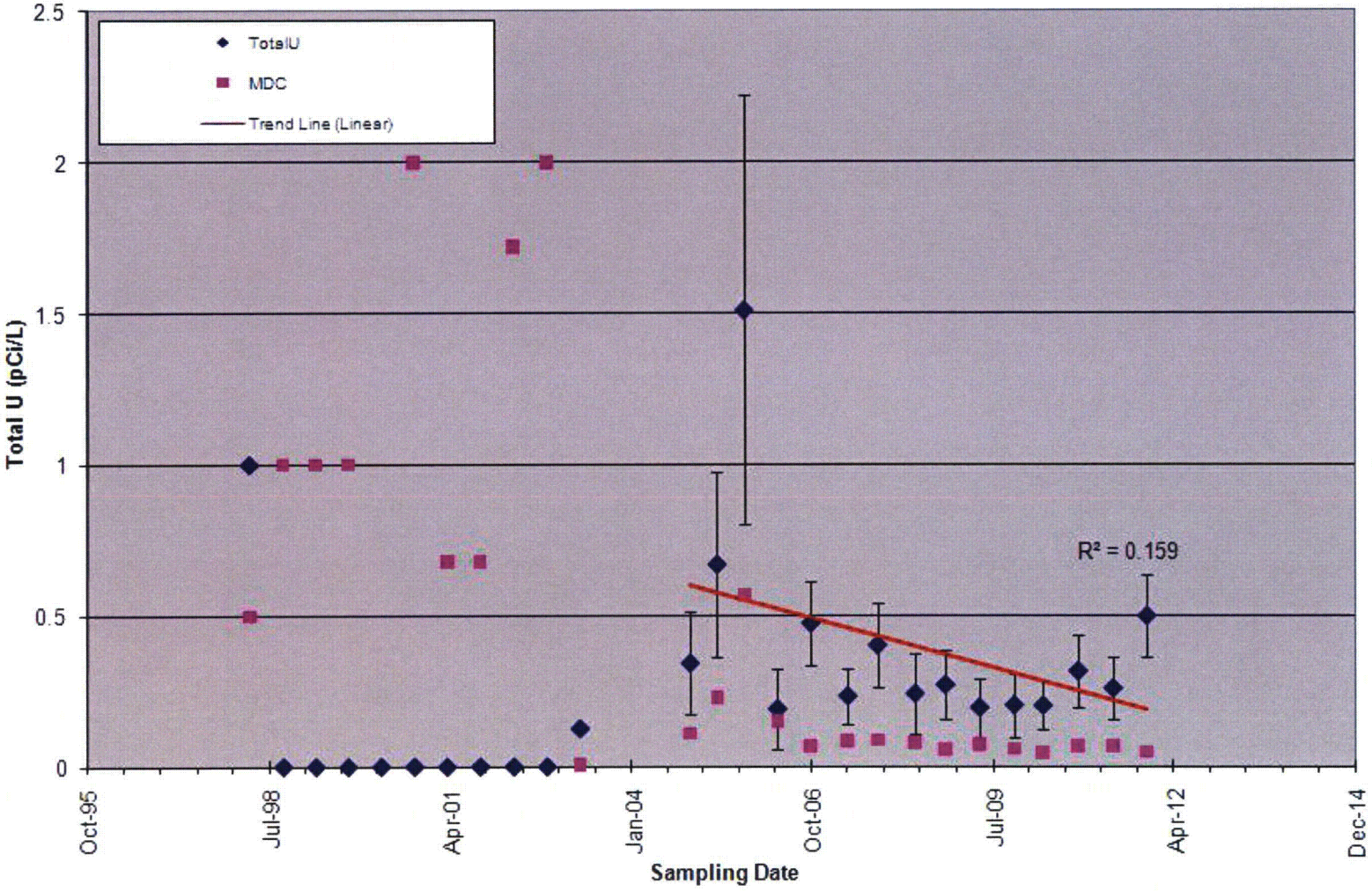
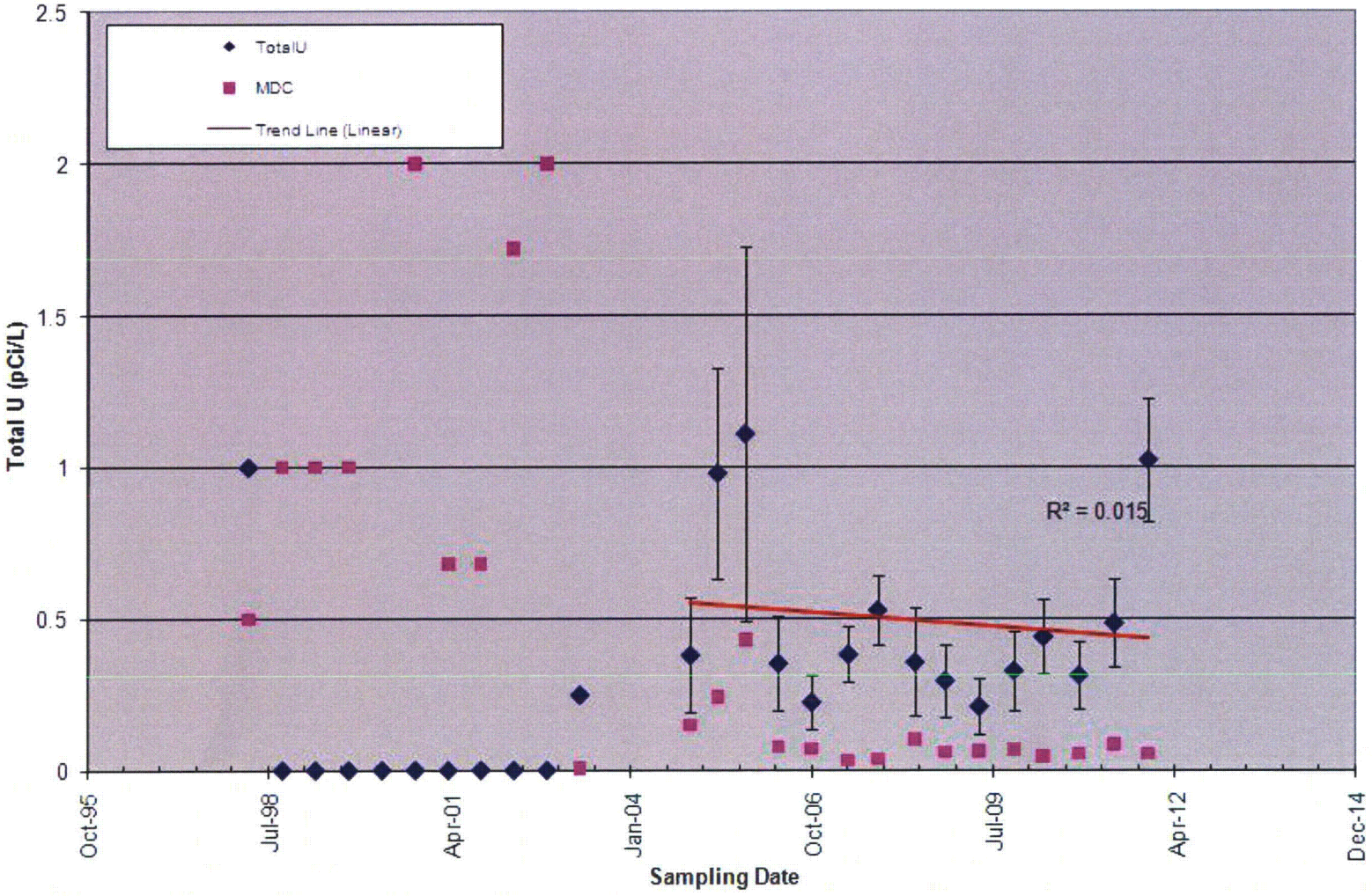


Figure 4-13. Control Chart for All Monitoring Well Data (2004-2011)



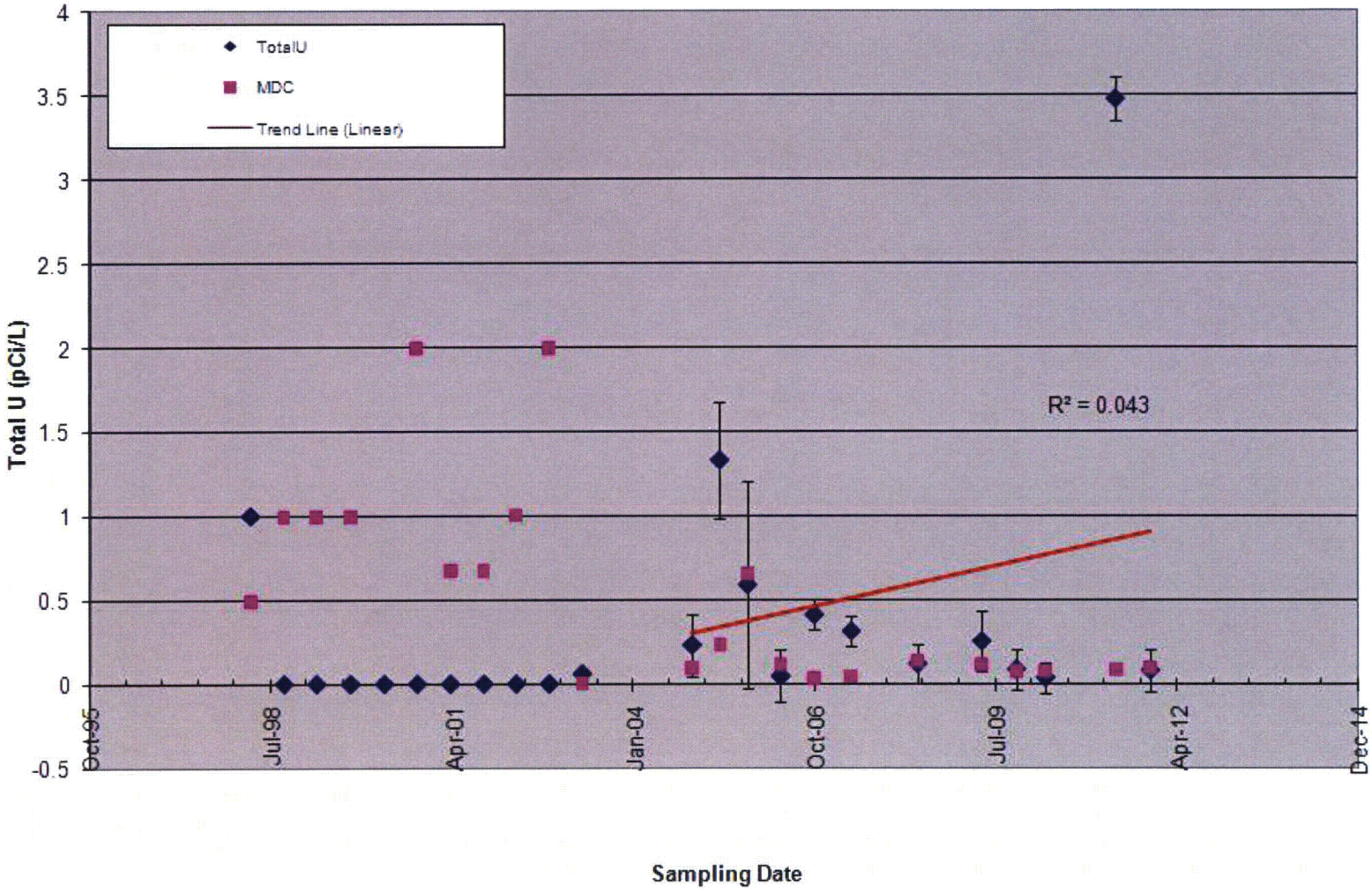
MDC – Minimum Detectable Concentration

Figure 4-14. Total Uranium in SW-DU-001 (1998-2011)



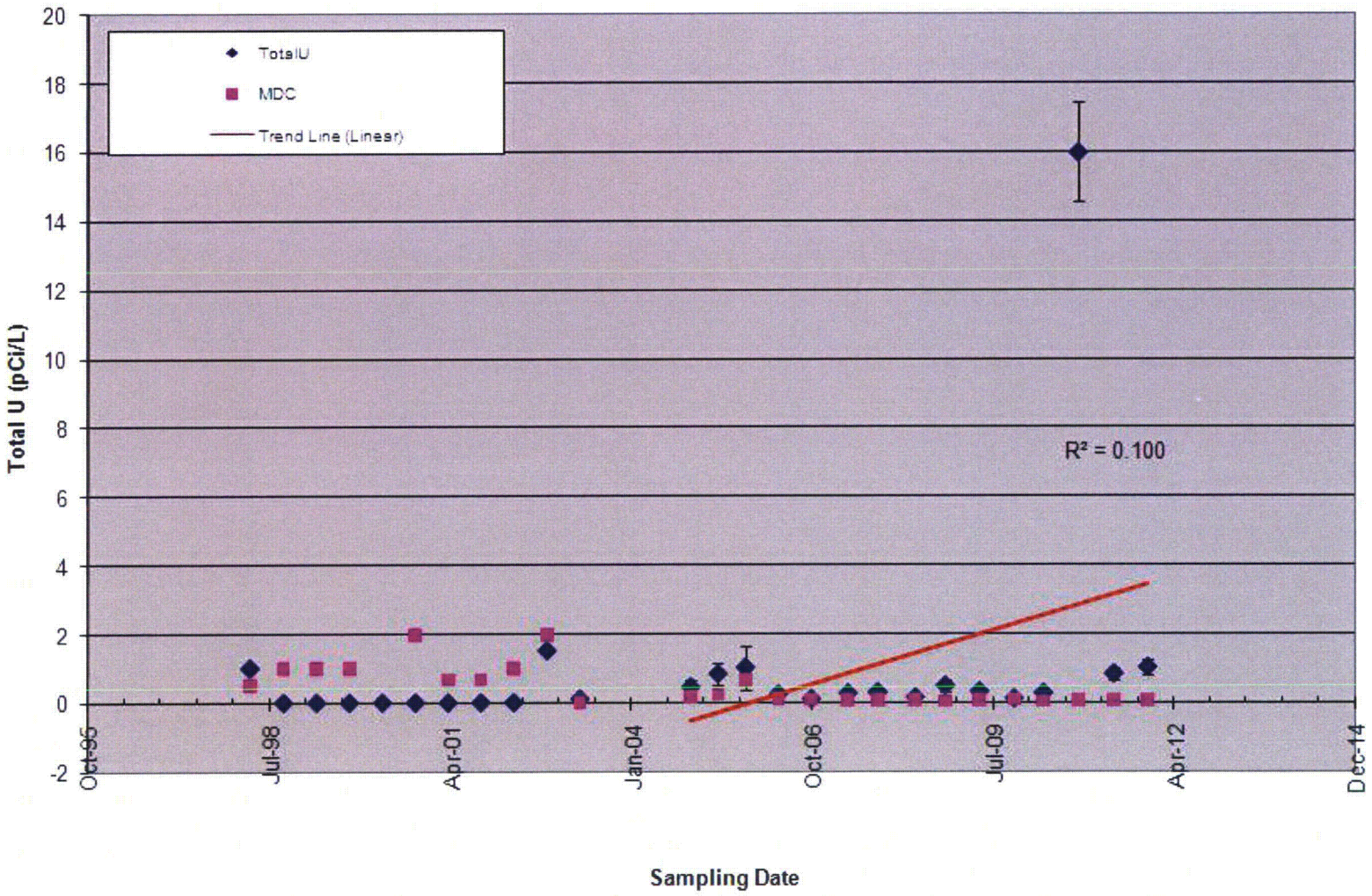
MDC – Minimum Detectable Concentration

Figure 4-15. Total Uranium in SW-DU-002 (1998-2011)



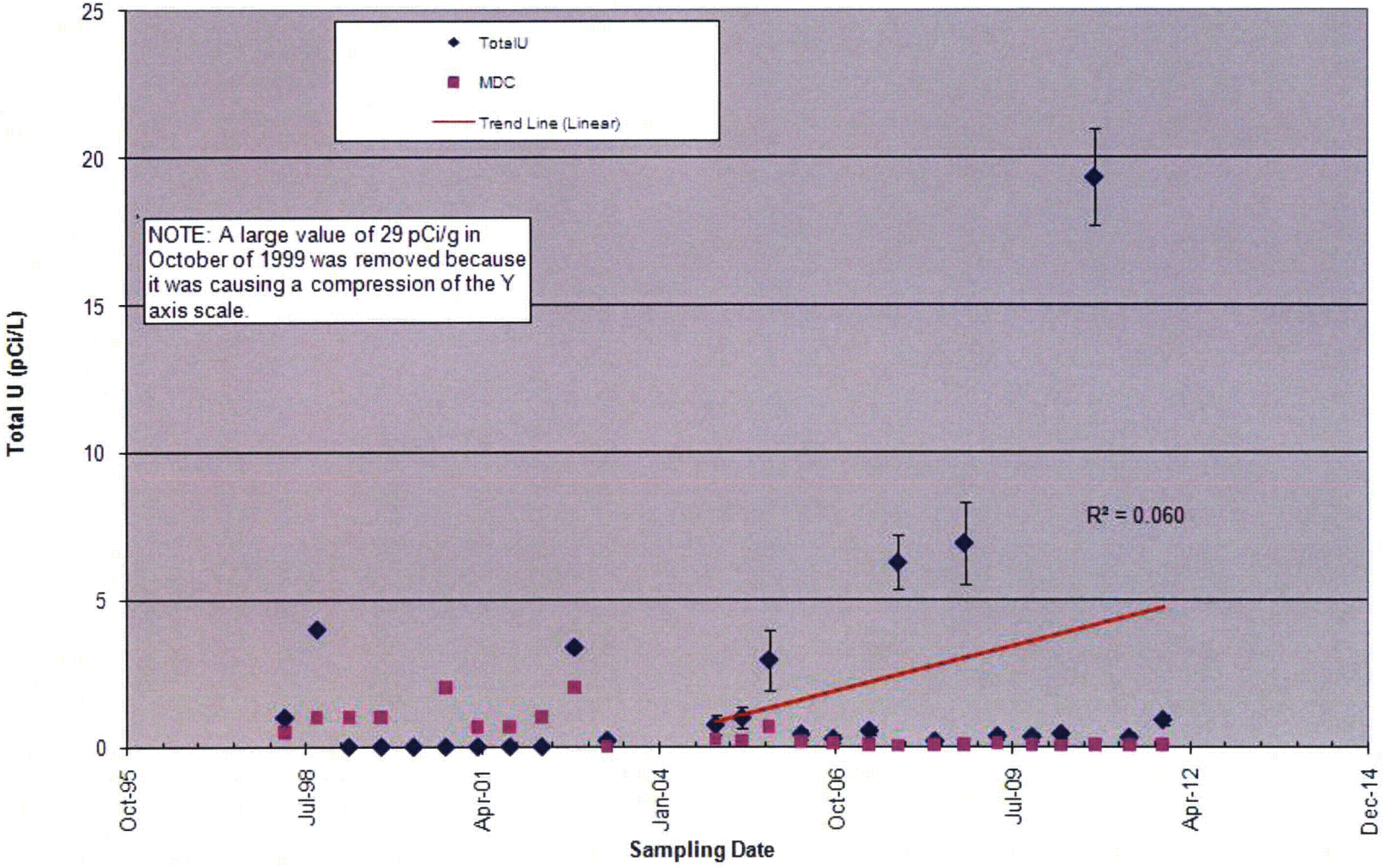
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2007, October 2008, or October 2010 as the creek was dry.

Figure 4-16. Total Uranium in SW-DU-003 (1998-2011)



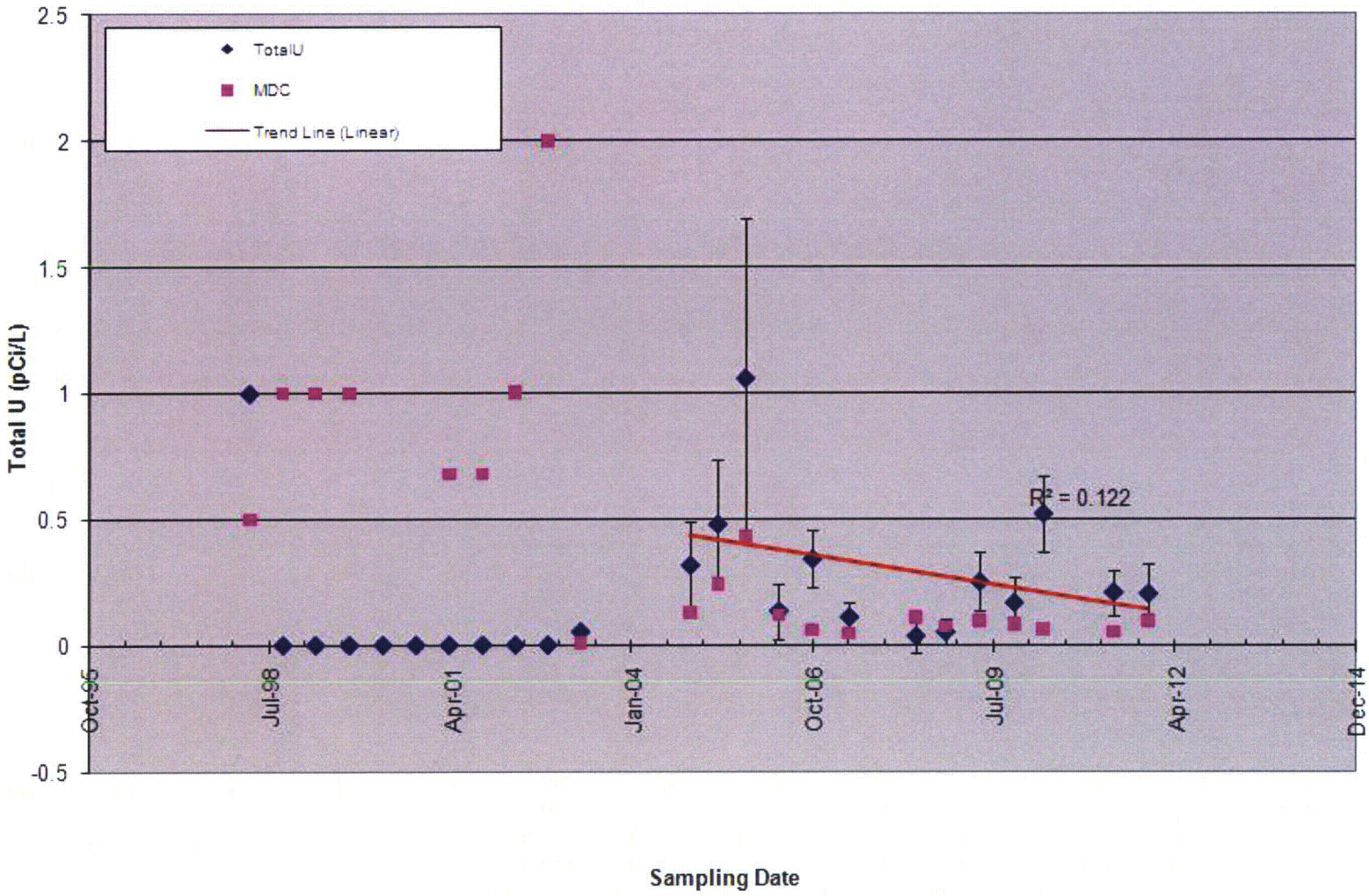
MDC – Minimum Detectable Concentration

Figure 4-17. Total Uranium in SW-DU-004 (1998-2011)



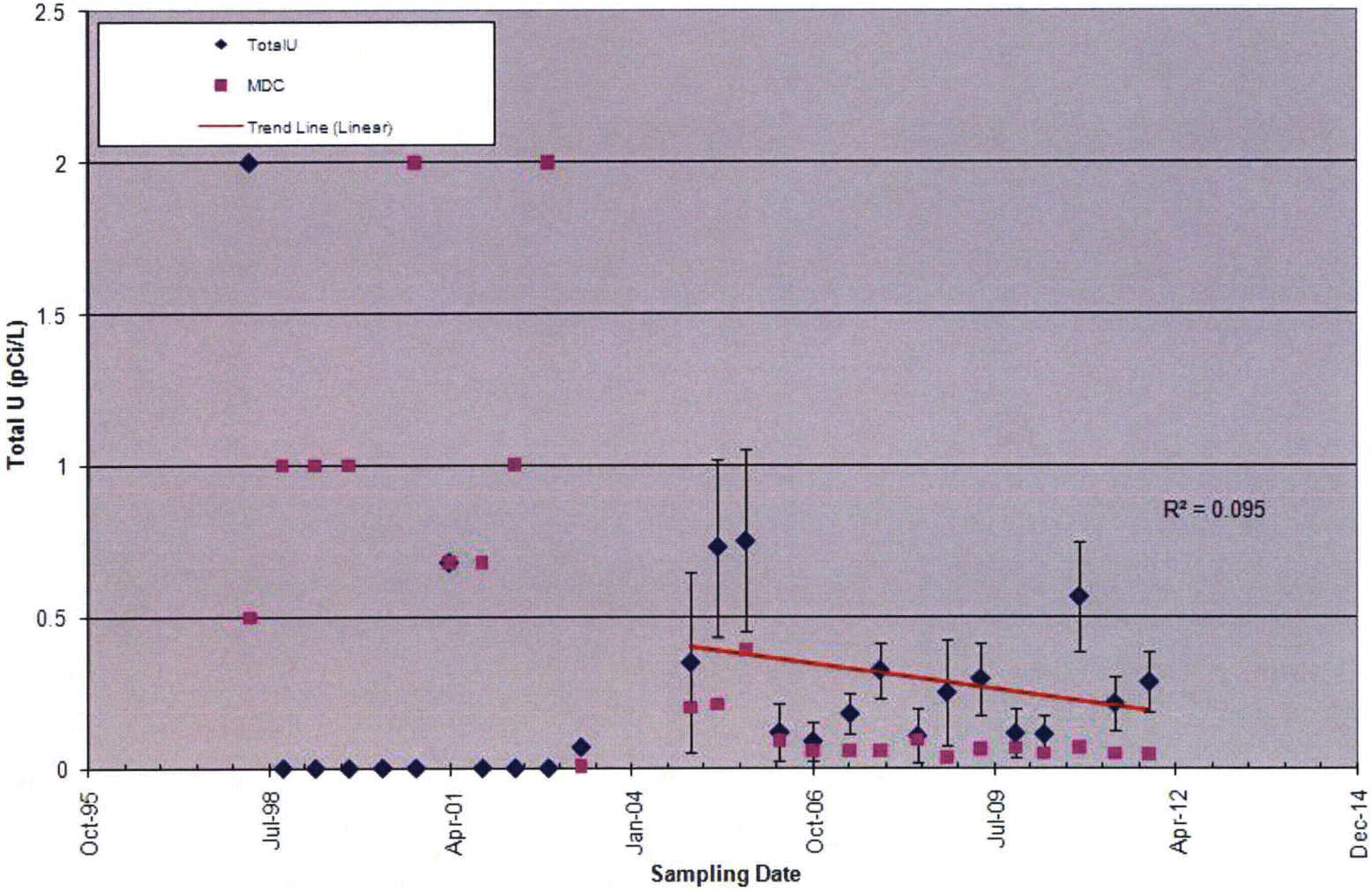
MDC – Minimum Detectable Concentration
NOTE: A large value of 29 pCi/g in October 1999 was removed because it was causing a compression of the Y axis scale.

Figure 4-18. Total Uranium in SW-DU-005 (1998-2011)



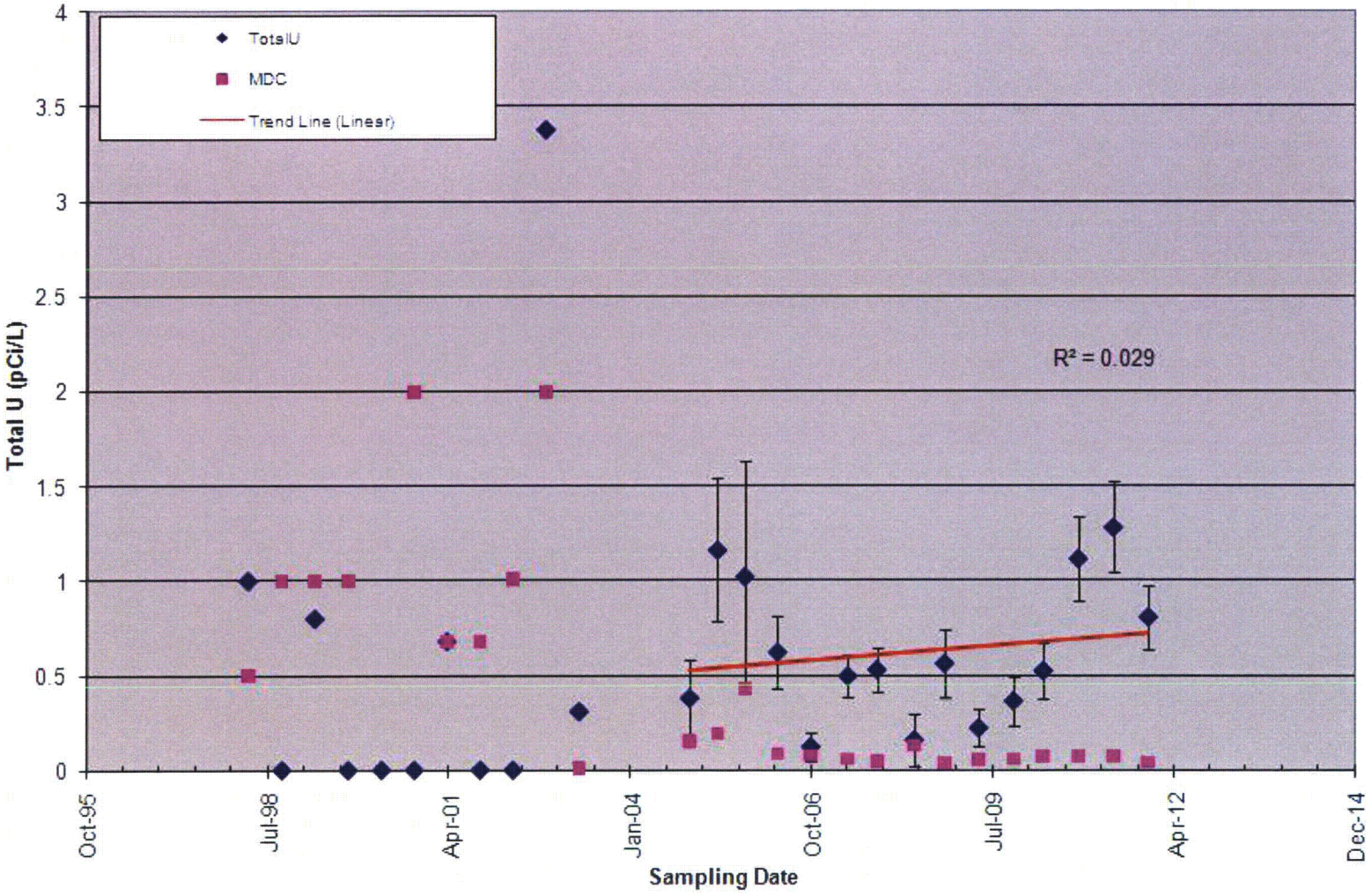
MDC – Minimum Detectable Concentration
NOTE: No sample was collected in October 2007 or October 2010 as the creek was dry.

Figure 4-19. Total Uranium in SW-DU-006 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-20. Total Uranium in SW-DU-007 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-21. Total Uranium in SW-DU-008 (1998-2011)

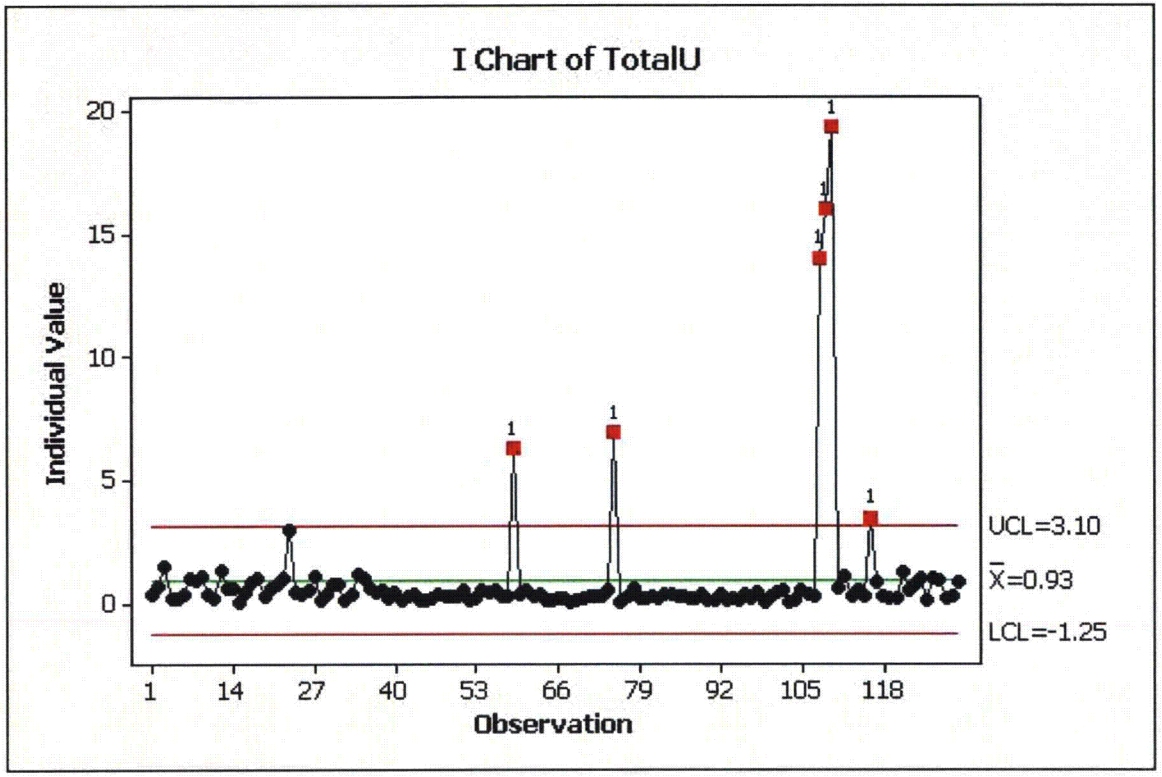
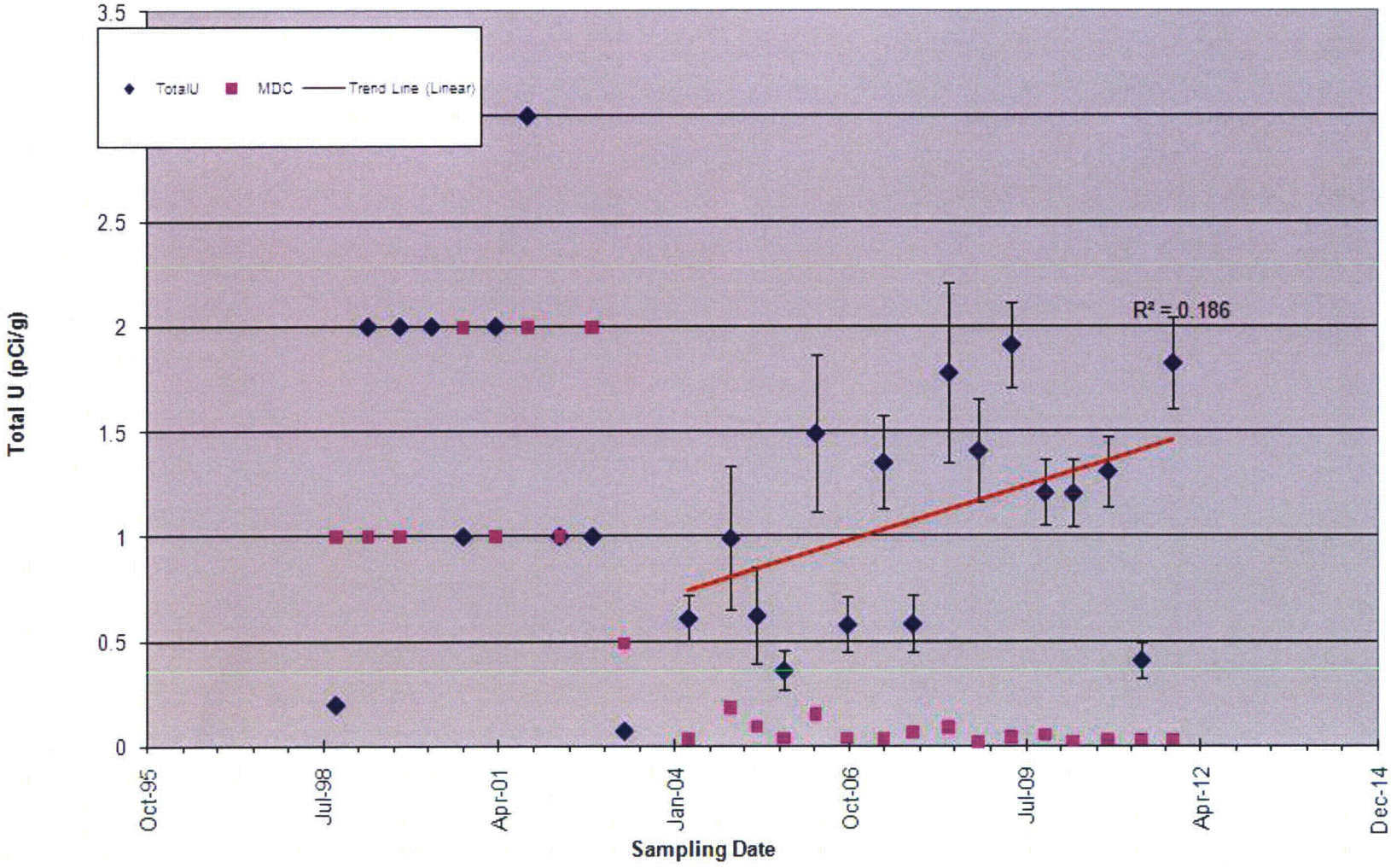
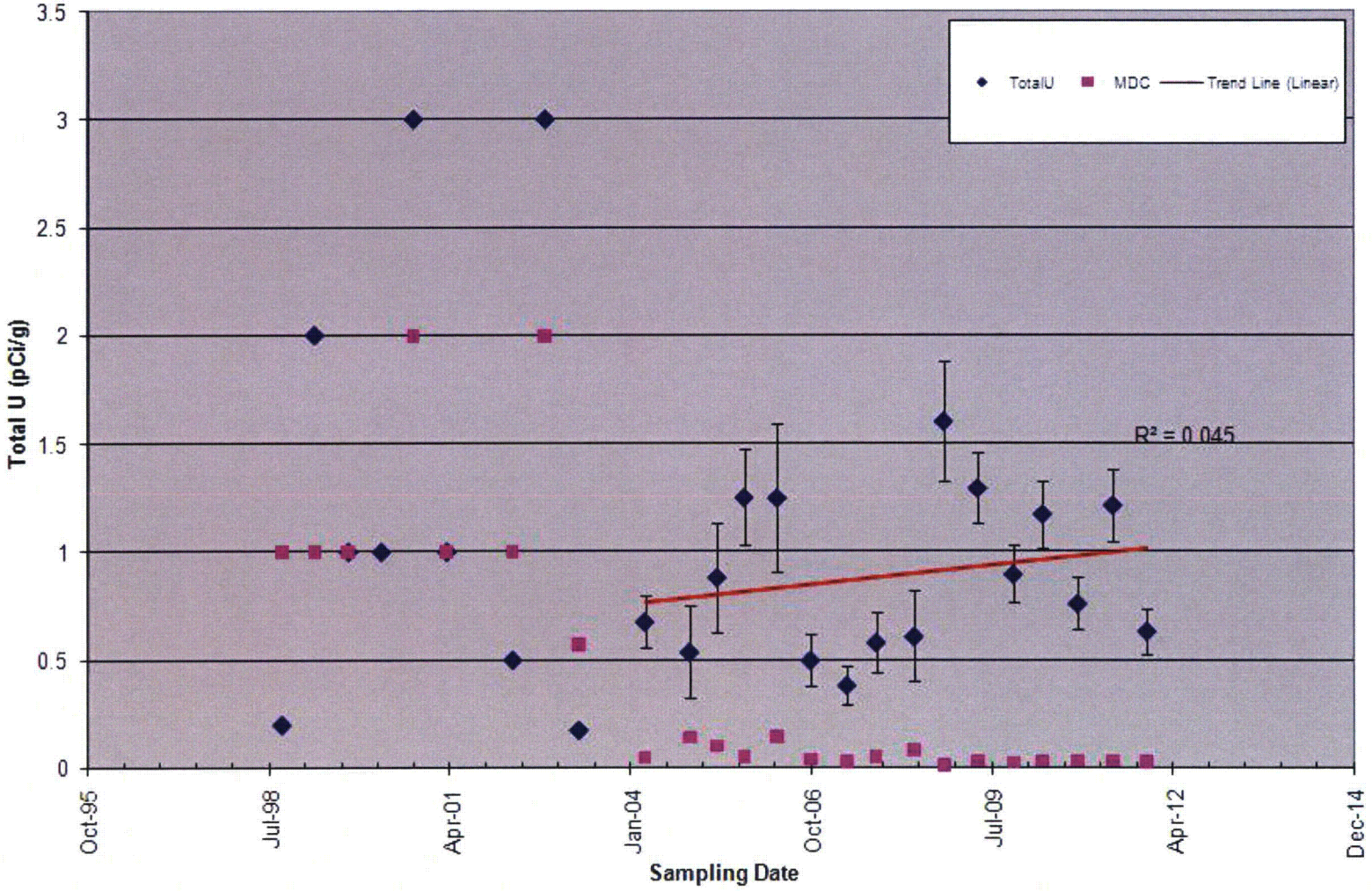


Figure 4-22. Control Chart for All Surface Water Data (2004-2011)



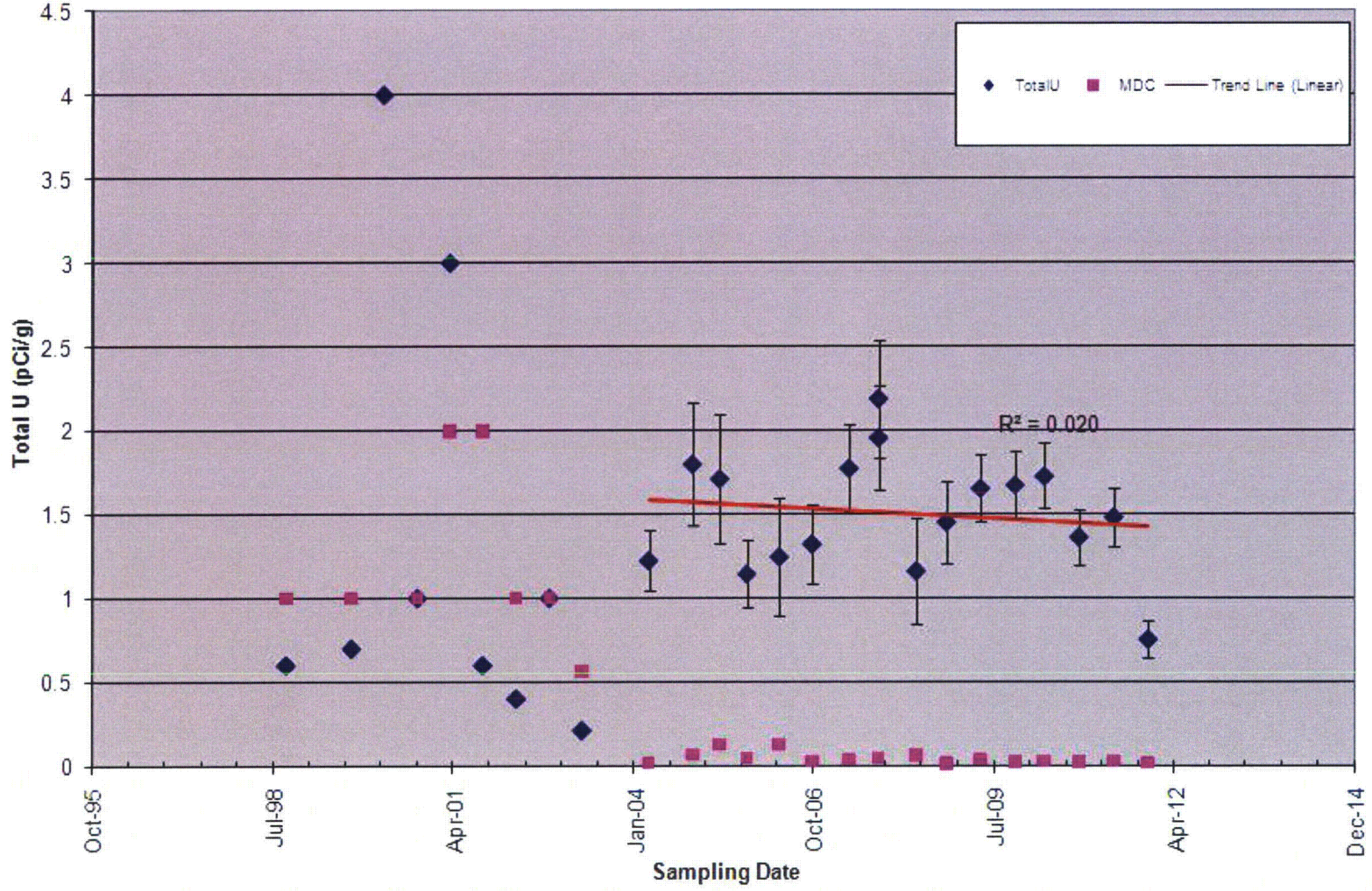
MDC – Minimum Detectable Concentration

Figure 4-23. Total Uranium in SD-DU-001 (1998-2011)



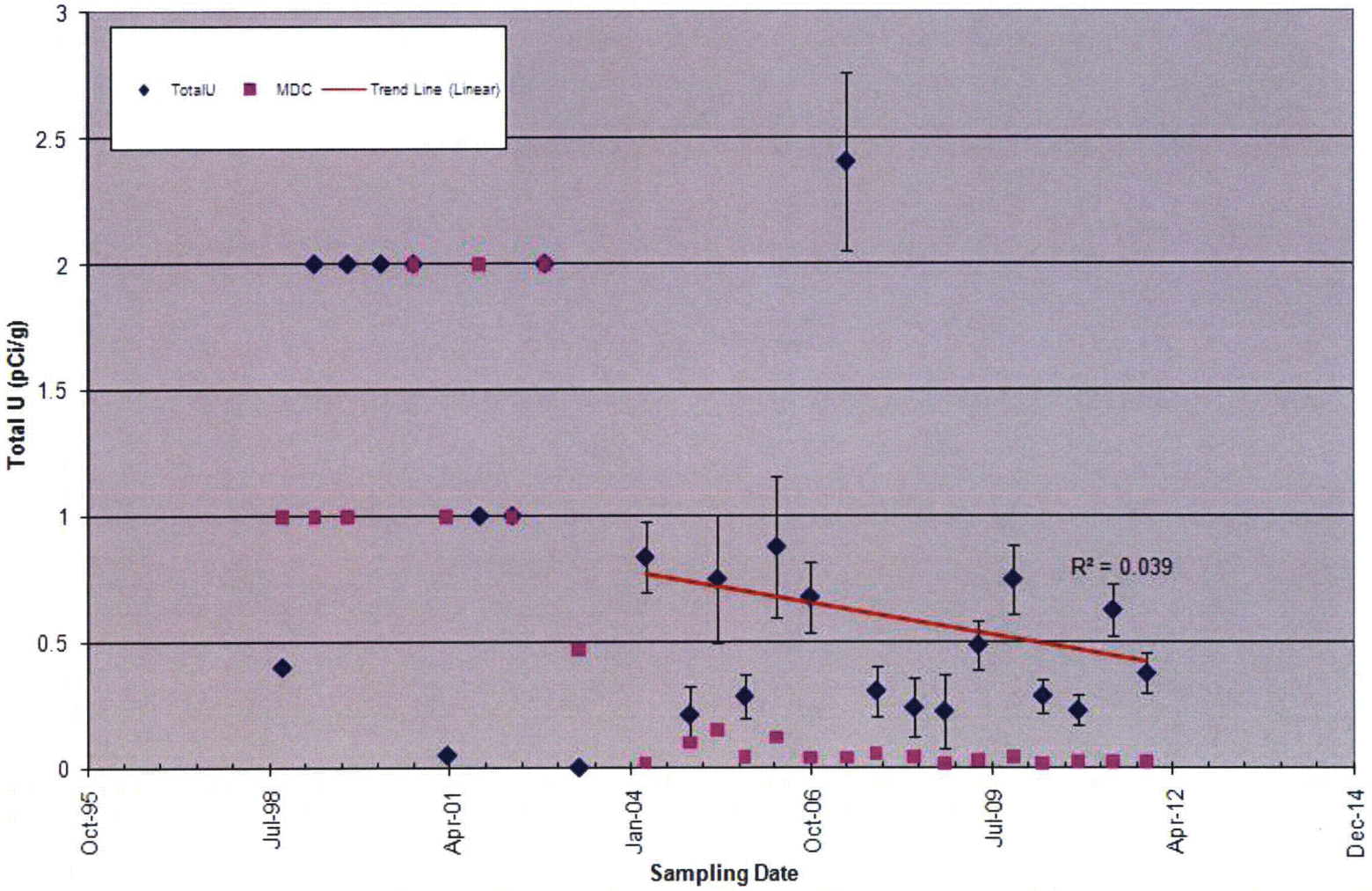
MDC – Minimum Detectable Concentration

Figure 4-24. Total Uranium in SD-DU-002 (1998-2011)



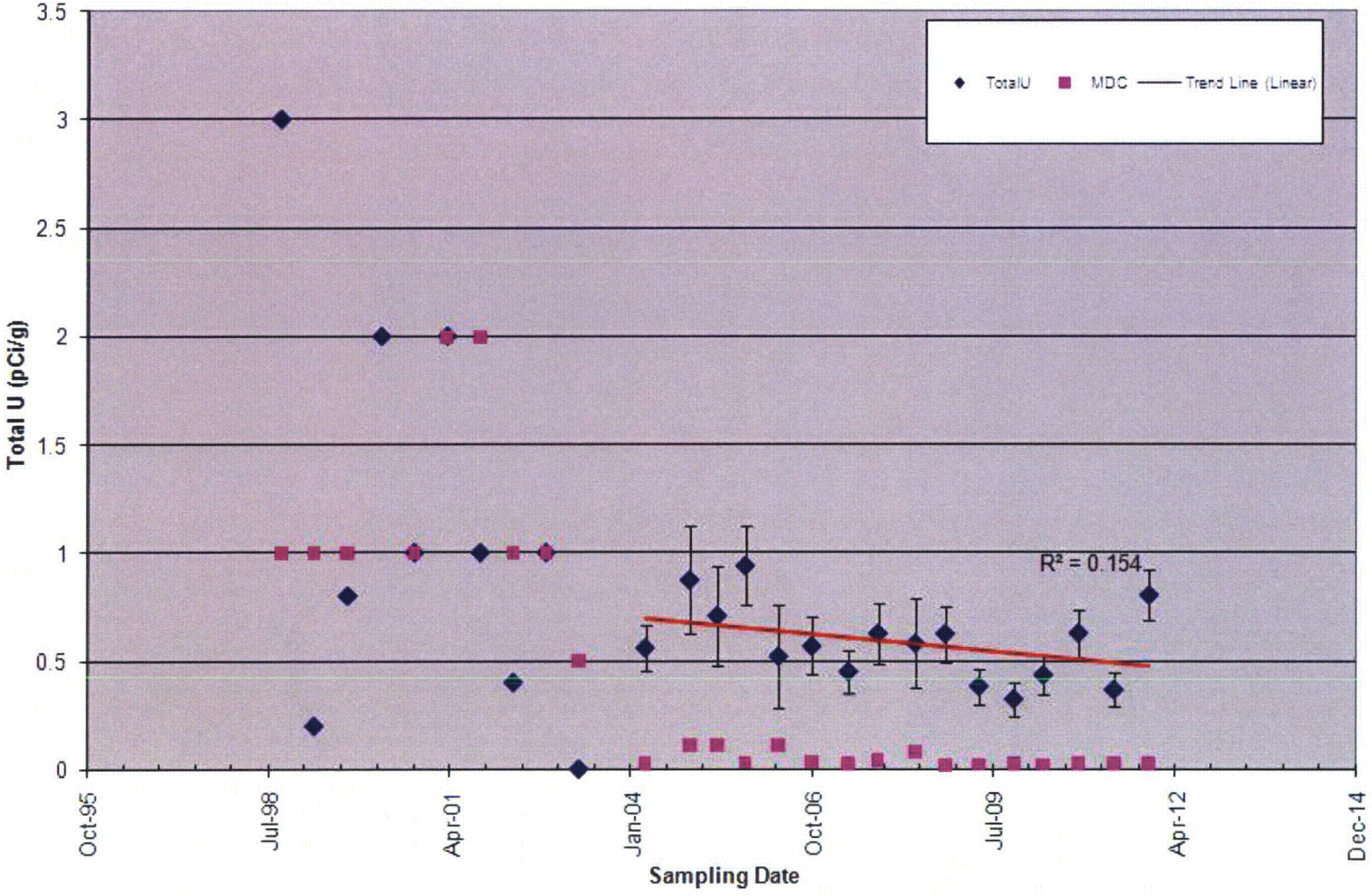
MDC – Minimum Detectable Concentration

Figure 4-25. Total Uranium in SD-DU-003 (1998-2011)



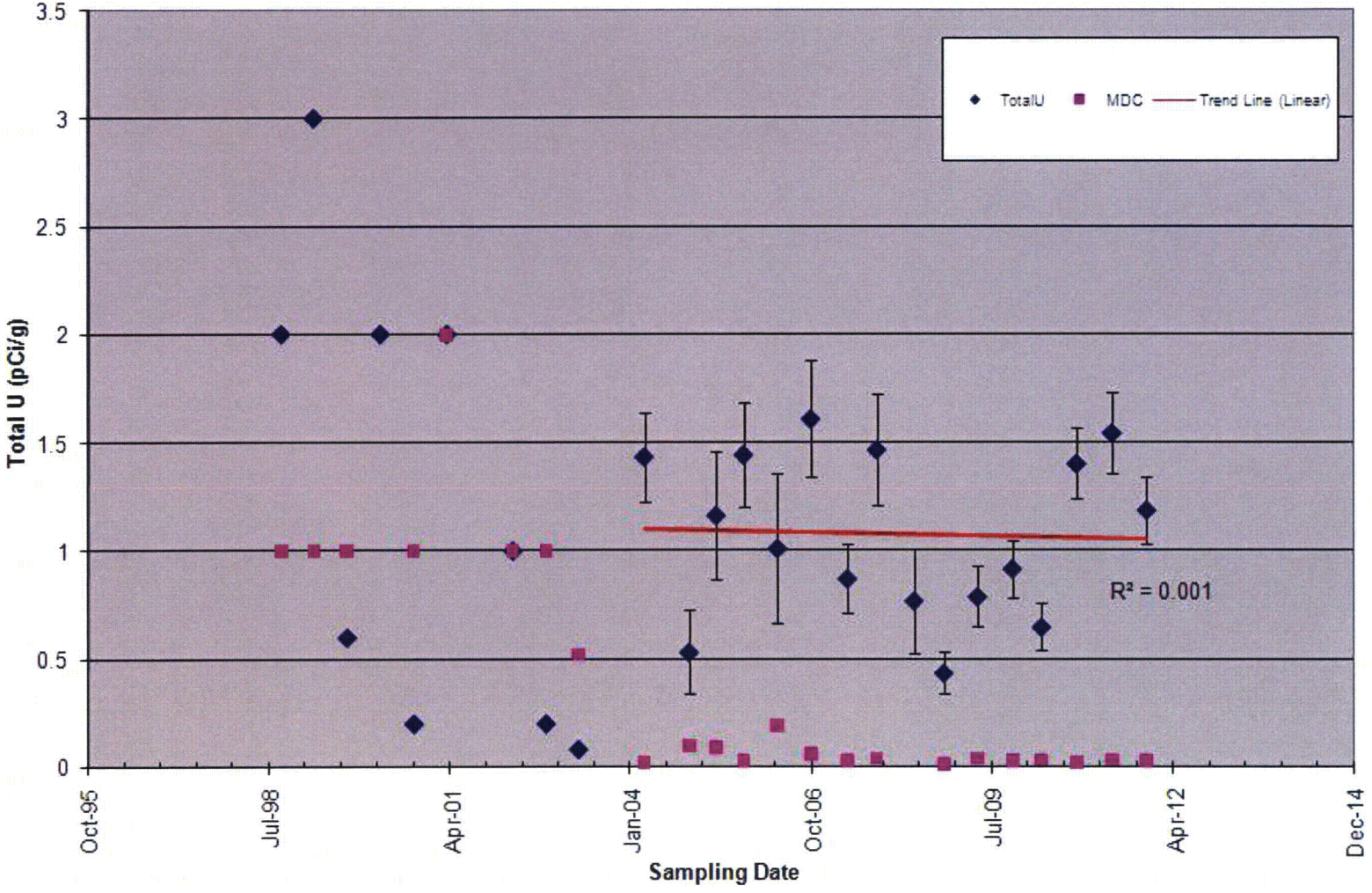
MDC – Minimum Detectable Concentration

Figure 4-26. Total Uranium in SD-DU-004 (1998-2011)



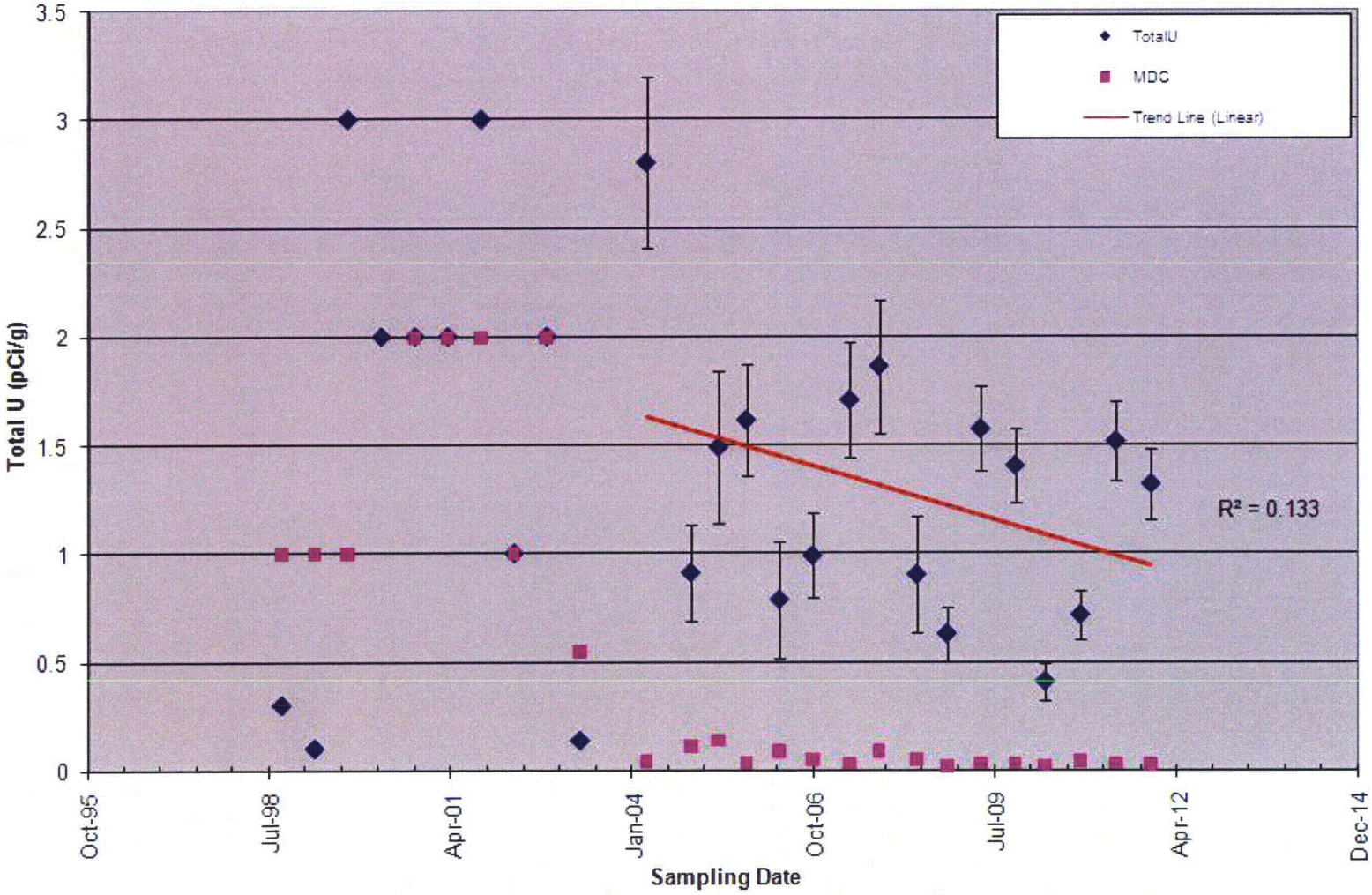
MDC – Minimum Detectable Concentration

Figure 4-27. Total Uranium in SD-DU-005 (1998-2011)



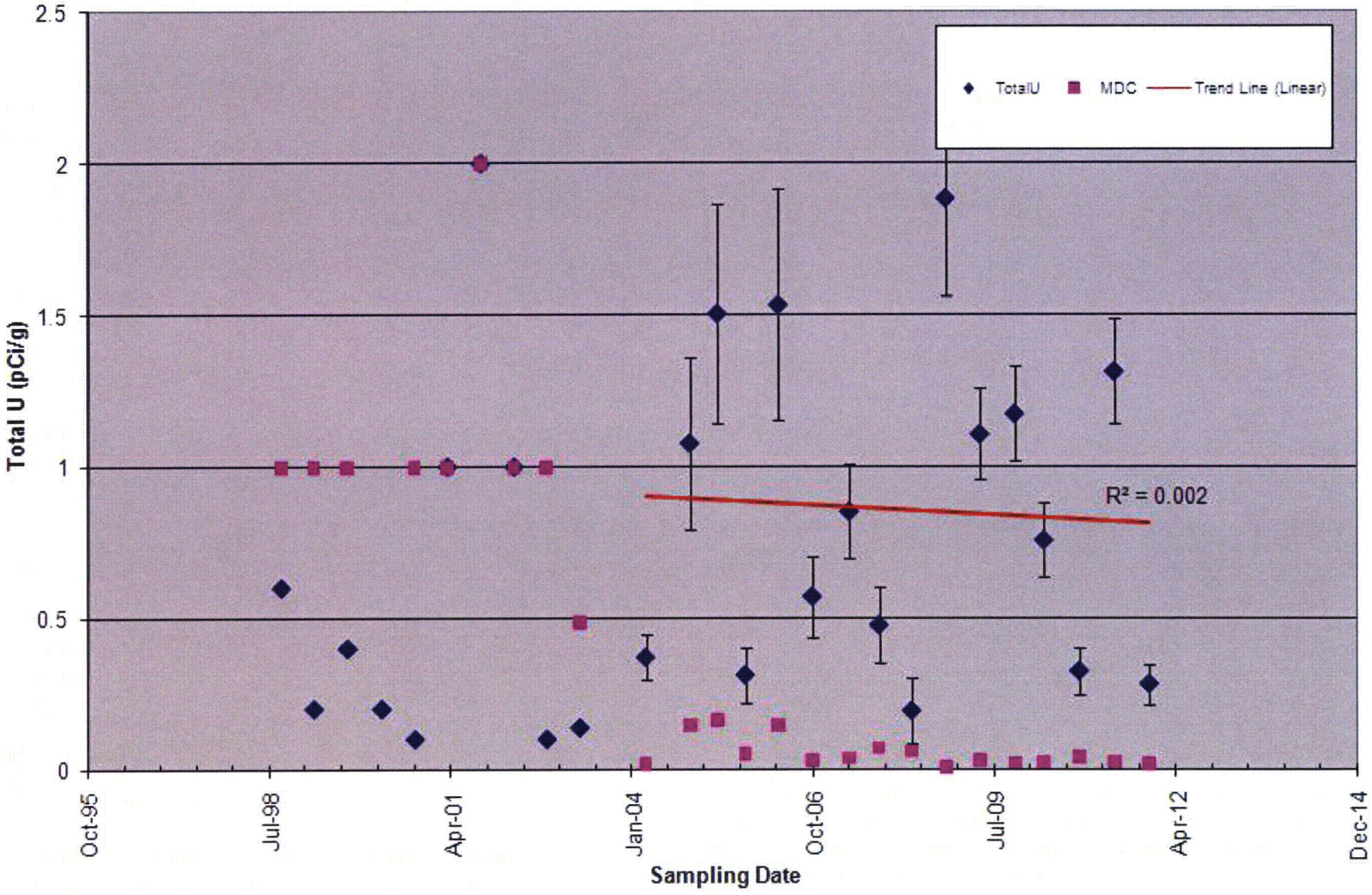
MDC – Minimum Detectable Concentration

Figure 4-28. Total Uranium in SD-DU-006 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-29. Total Uranium in SD-DU-007 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-30. Total Uranium in SD-DU-008 (1998-2011)

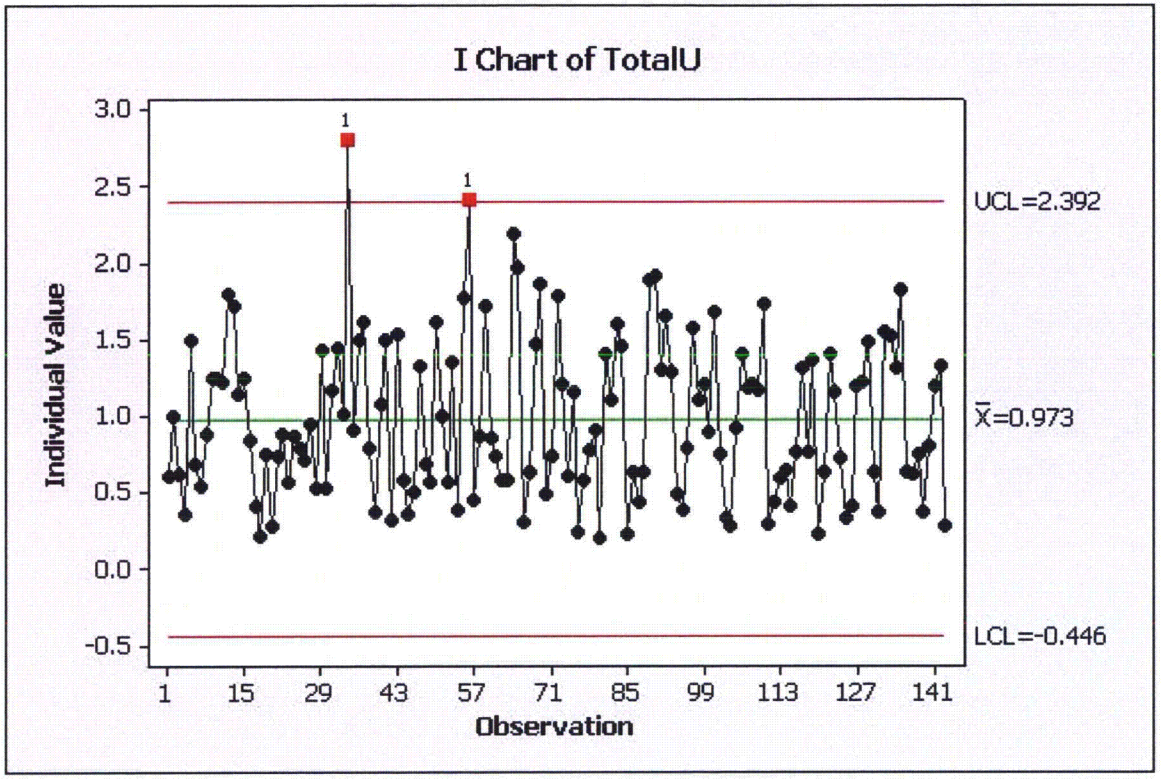
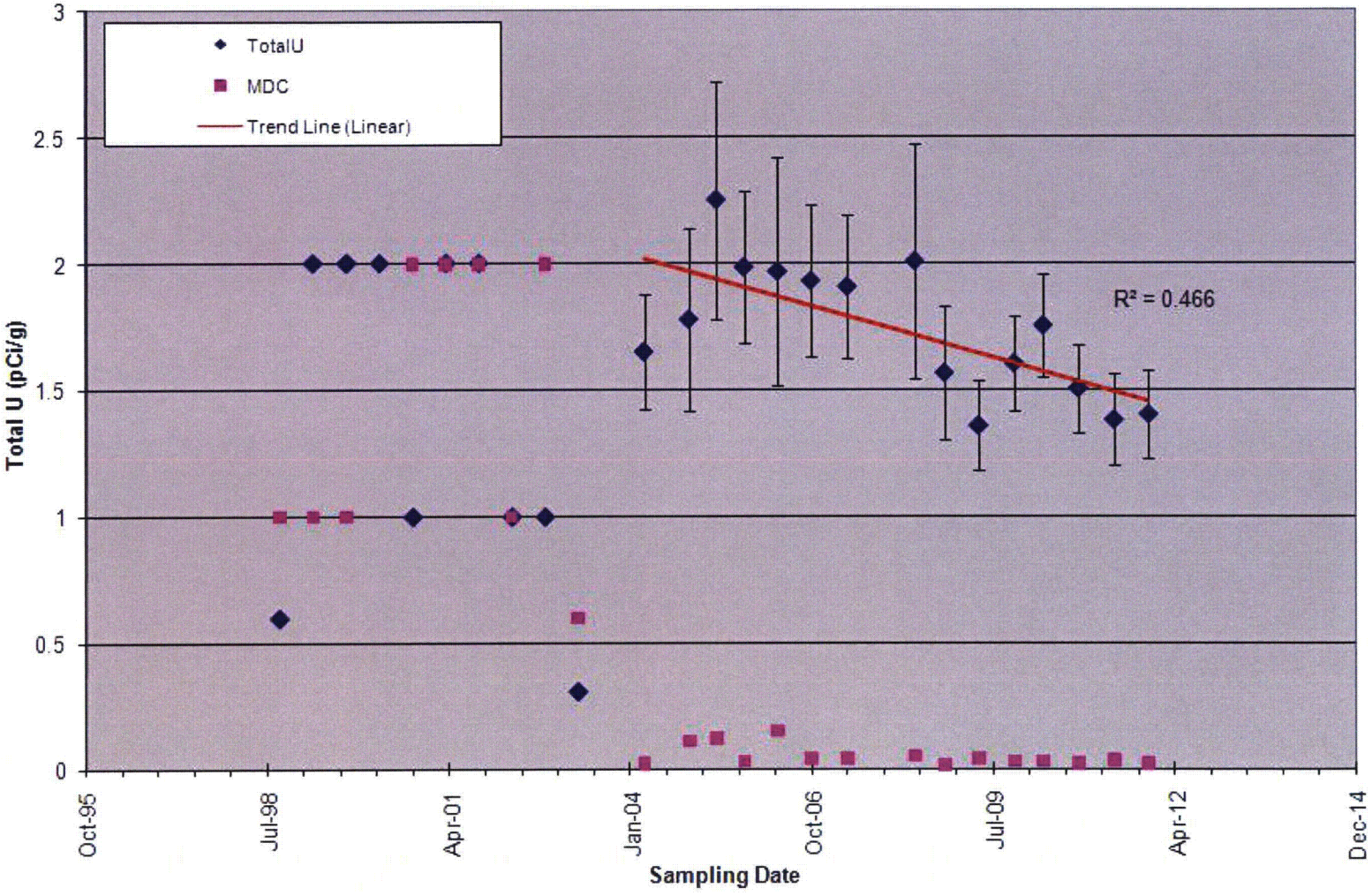
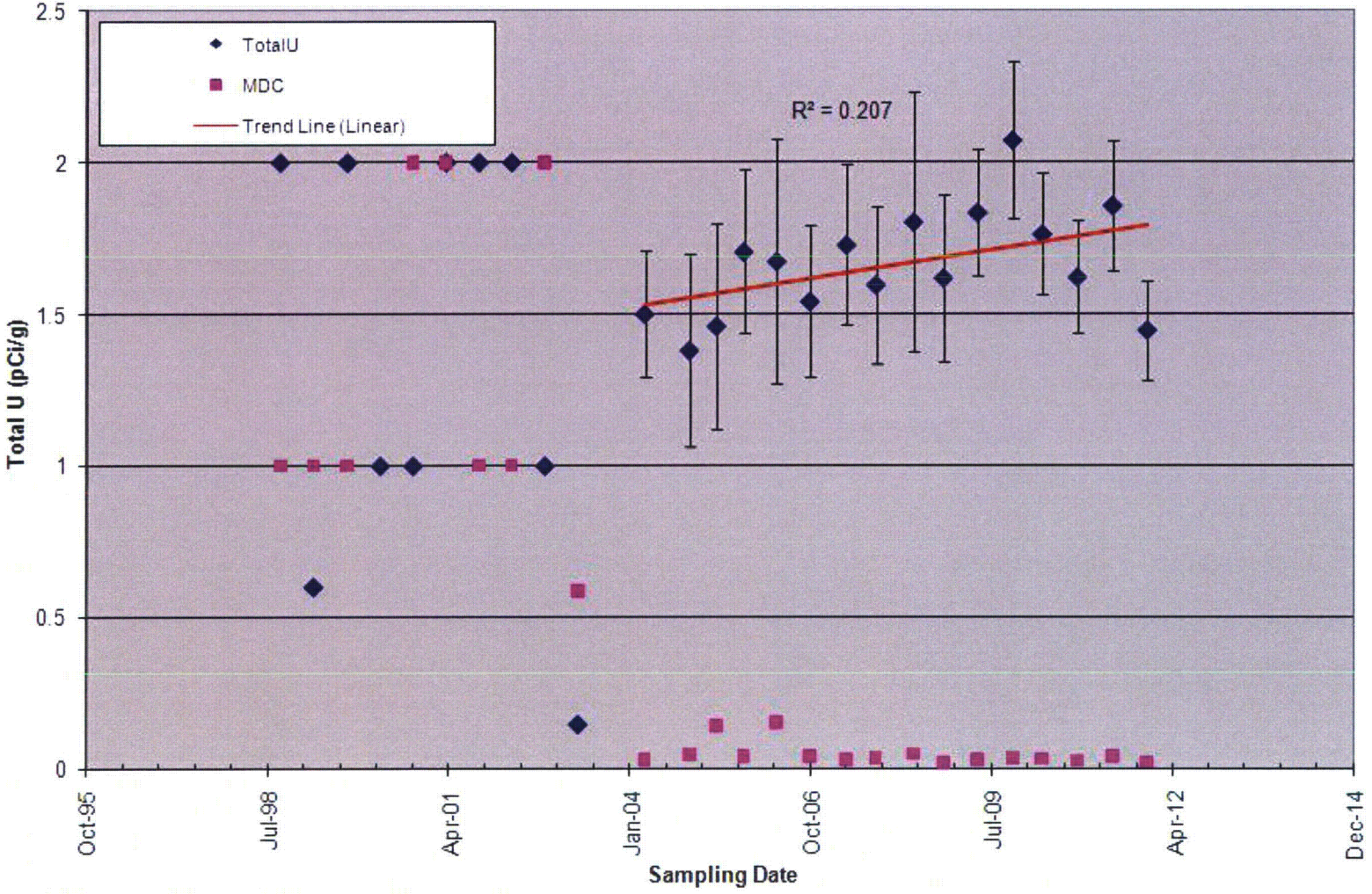


Figure 4-31. Control Chart for All Sediment Data (2004-2011)



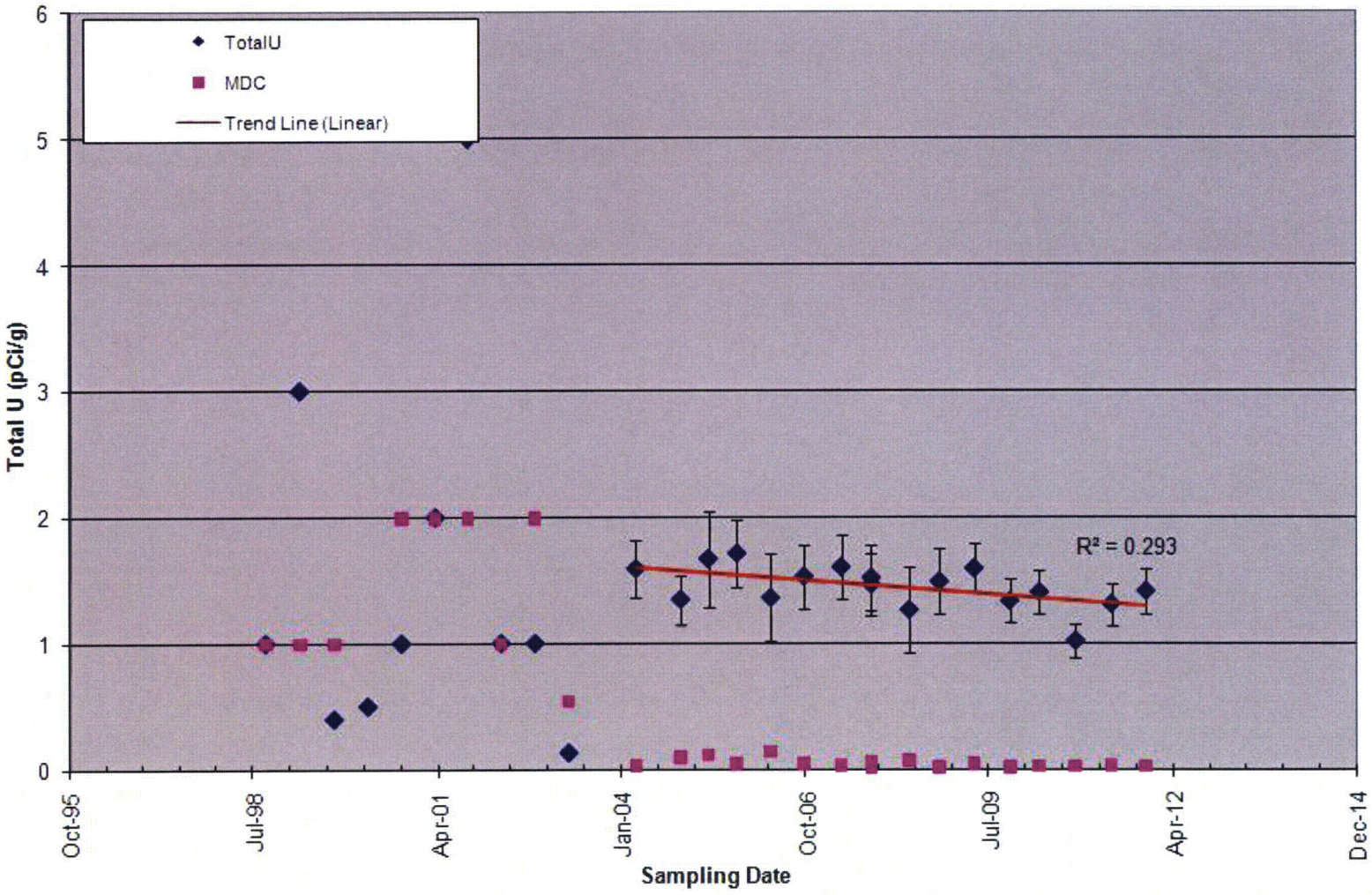
MDC – Minimum Detectable Concentration

Figure 4-32. Total Uranium in SS-DU-001 (1998-2011)



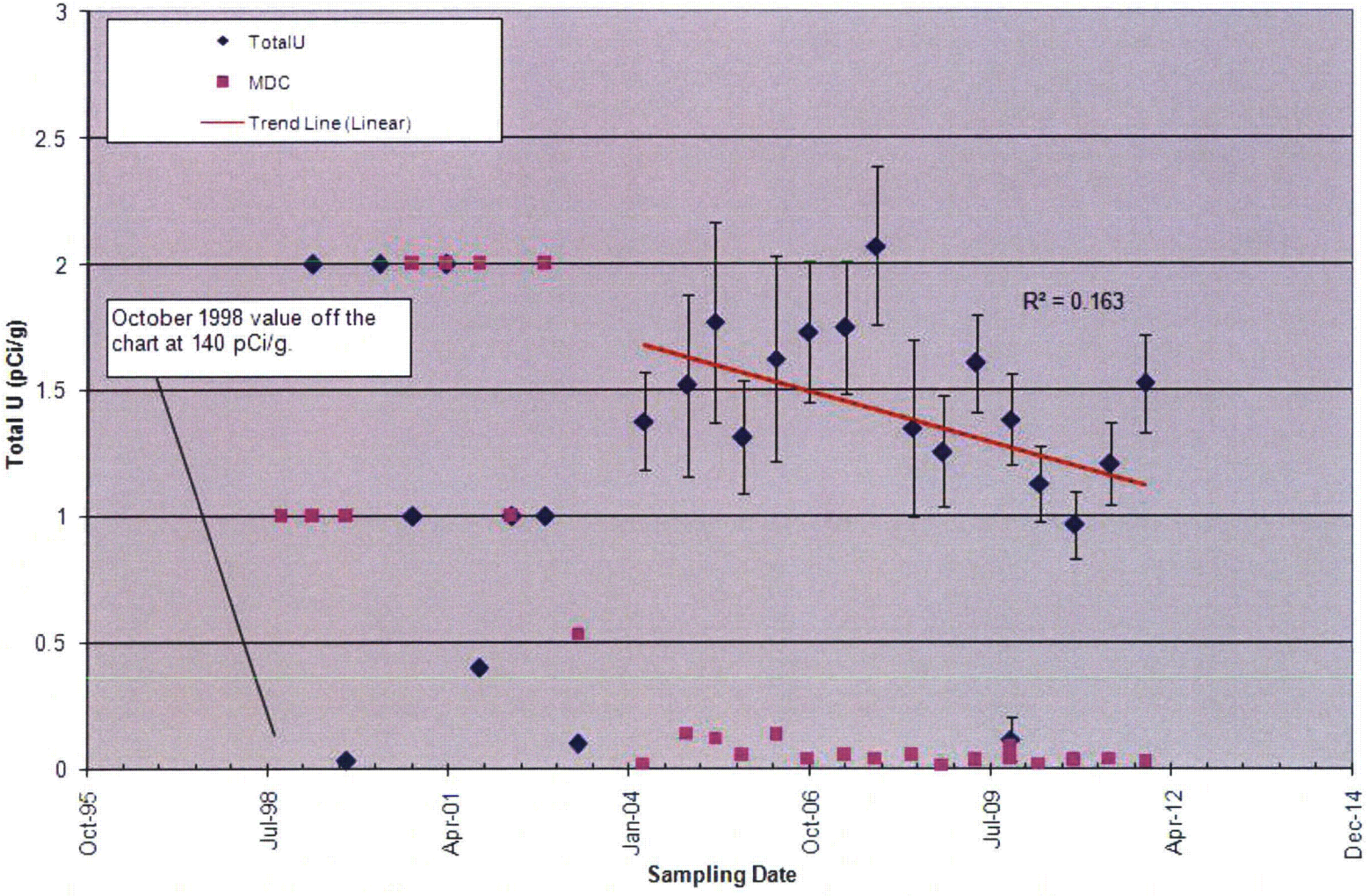
MDC – Minimum Detectable Concentration

Figure 4-33. Total Uranium in SS-DU-002 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-34. Total Uranium in SS-DU-003 (1998-2011)



MDC – Minimum Detectable Concentration

Figure 4-35. Total Uranium in SS-DU-004 (1998-2011)

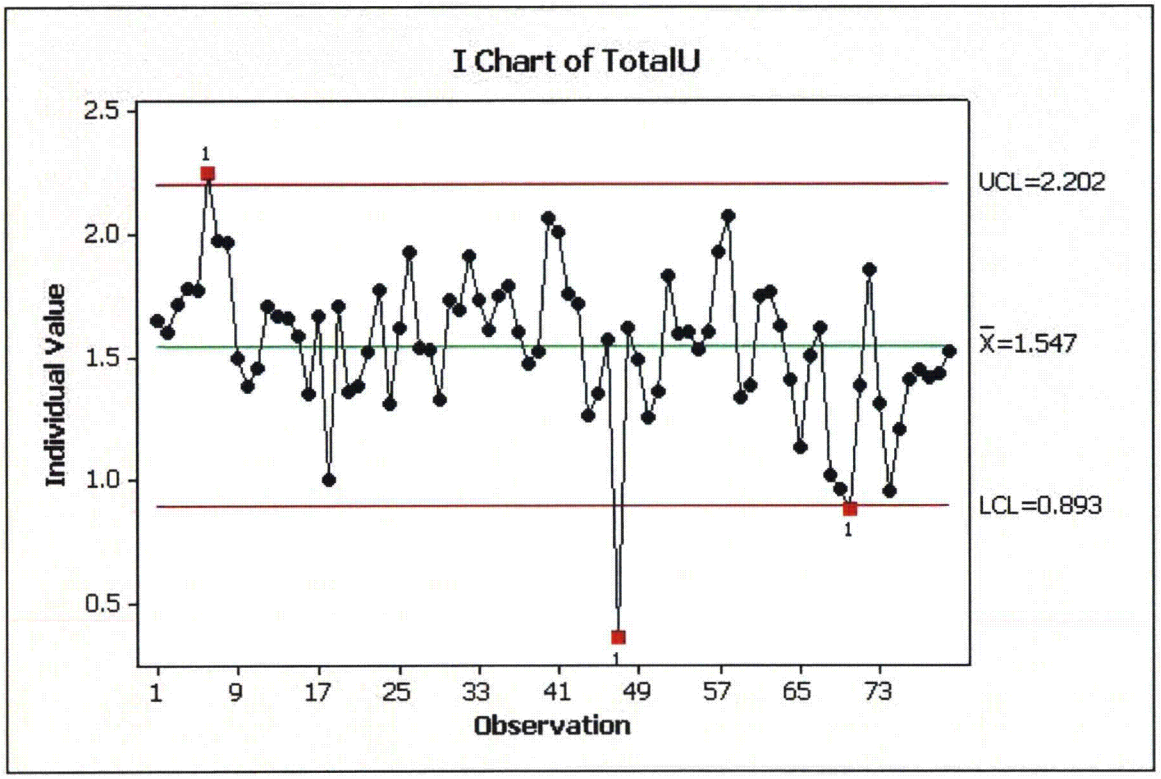


Figure 4-36. Control Chart for All Surface Soil Data (2004-2011)

5. CONCLUSIONS AND RECOMMENDATIONS

The November sampling event was 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 in excess of 3.0 are investigated further to validate whether a sample result is representative of DU or natural uranium. Ratios exceeding 3.0 were encountered for SW-DU-002 and SW-DU-008, which exhibited ratios of 3.5 ± 1.2 and 3.5 ± 1.7, respectively. These ratios together with the associated uncertainties are representative of relative DU activity ratios in the range of 20 to 90 percent (see Figure D-1, "Relative Uranium-238/Uranium-234 Activity Ratios for Mixtures of Depleted and Natural Uranium"). Each of these locations was subjected to additional investigation, which revealed that there was limited water flow at stream sampling locations such that SW-DU-002 was collected from pooled water and SW-DU-008 had slow flow at the time of sample collection due to the large amount of debris that had built up at a bridge just downstream from the sample location and restricted water flow (see Figures 3-2 and 3-3, November 2011 Stream Flow). This reduced flow is believed to have contributed to the increase in the DU concentration at SW-DU-002 and SW-DU-008. Trend analysis reflected that no sample location exhibited an R^2 value indicating that the trend was somewhat significant. No action levels defined in the Army's license were exceeded. Future environmental monitoring will continue to be completed in accordance with the SOP.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

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.

CFR (Code of Federal Regulations). 2008. 10 CFR 20. Energy. Nuclear Regulatory Commission. Standards for Protection Against Radiation.

NRC (Nuclear Regulatory Commission). 1985. License Number SUB-1435, Jefferson Proving Ground, Madison, Indiana. U.S. Army, TECOM, Aberdeen Proving Ground, Maryland.

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.

THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX A
STANDARD OPERATING PROCEDURE

THIS PAGE WAS INTENTIONALLY LEFT BLANK

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)			

SOP No. OHP 40-2

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)
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 _____			

SOP No. OHP 40-2

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.

SOP No. OHP 40-2

Effective Date _____
Date Removed from Service _____

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)

SOP No. OHP 40-2

Effective Date _____
Date Removed from Service _____

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

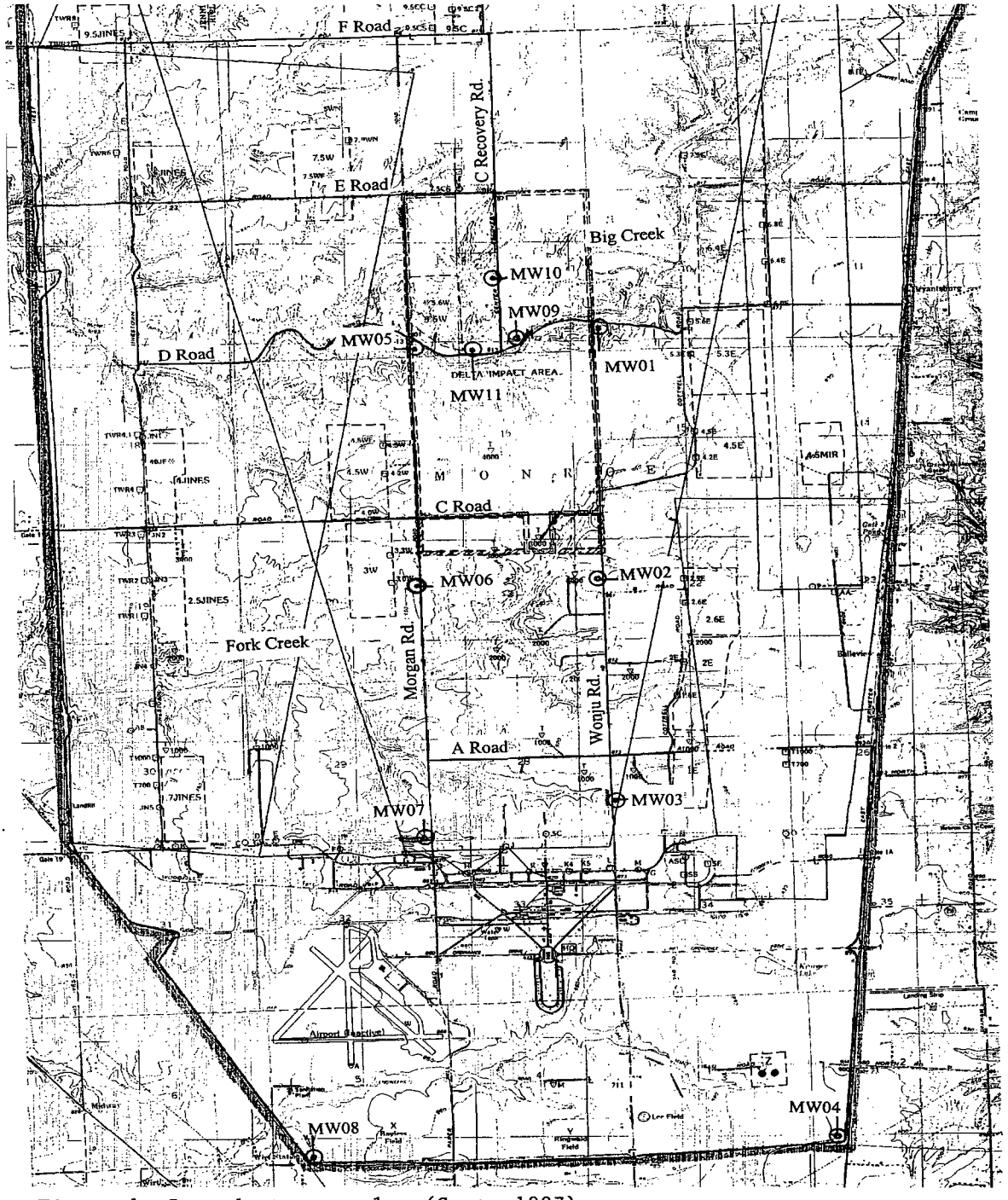


Figure 1: Groundwater samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SOIL SAMPLES

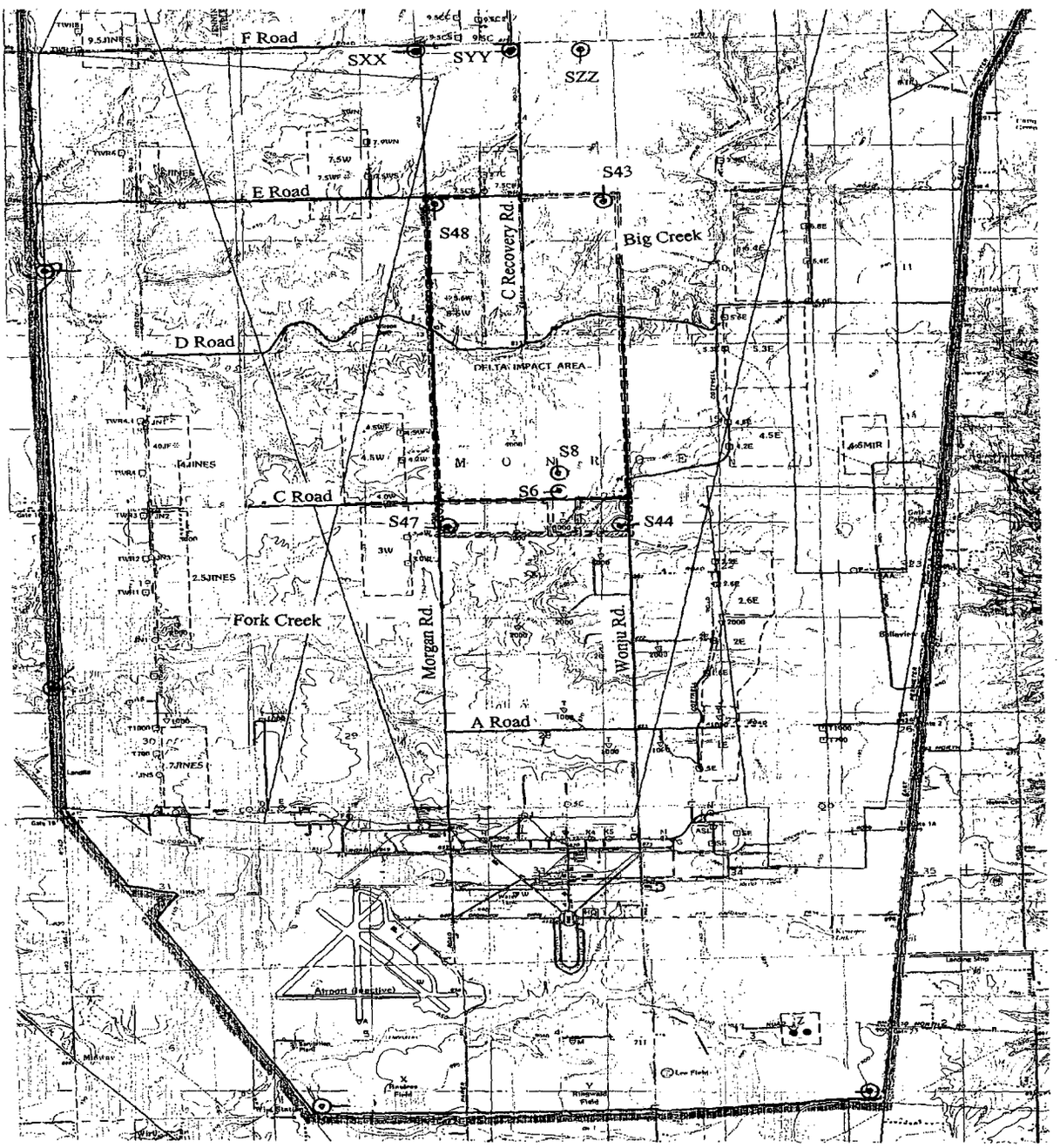


Figure 2: Soil Samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SURFACEWATER & SEDIMENT SAMPLES

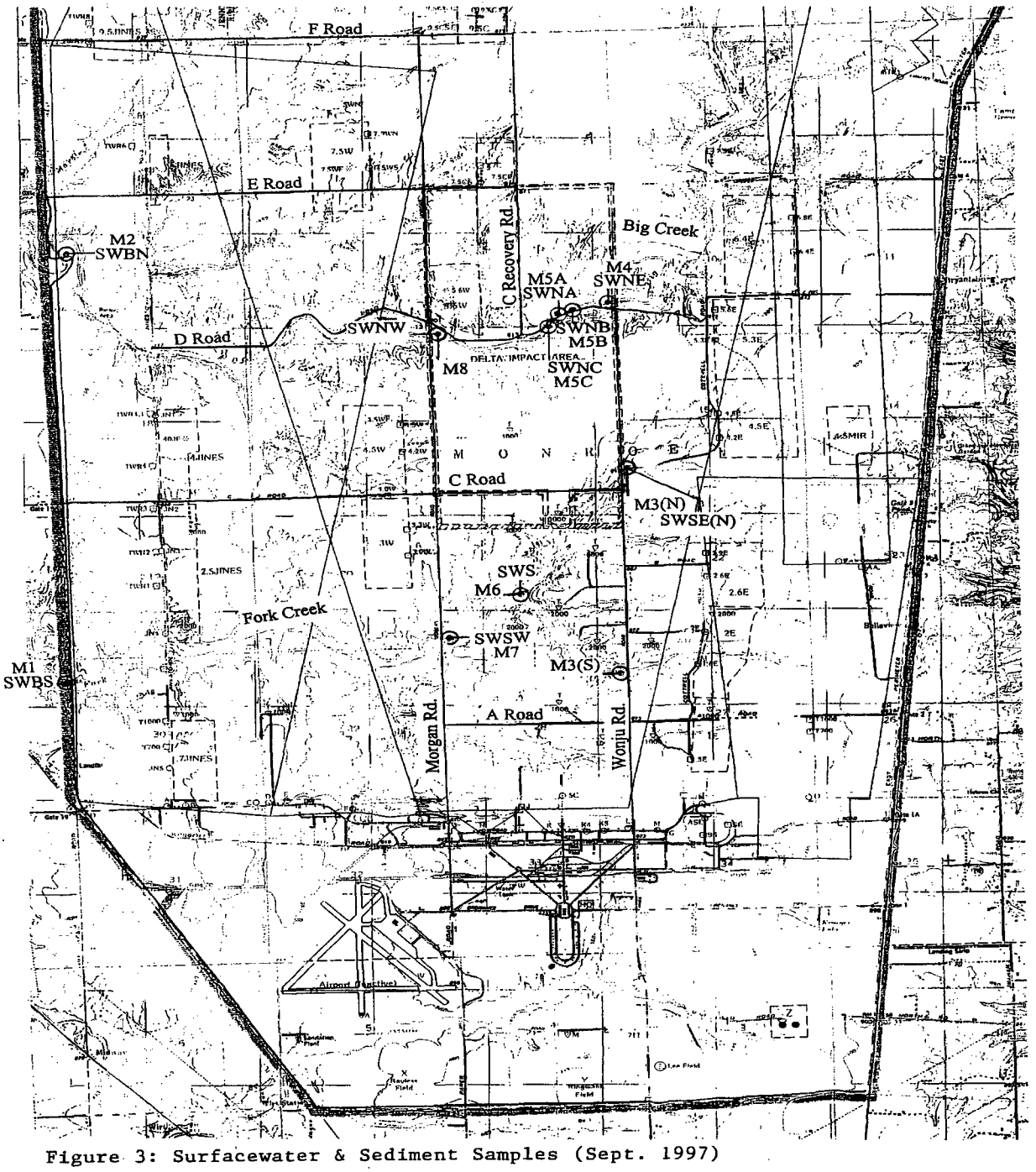


Figure 3: Surfacewater & Sediment Samples (Sept. 1997)

APPENDIX B
FIELD LOGBOOK

THIS PAGE WAS INTENTIONALLY LEFT BLANK

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SS-OU-0001 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 1020

SAMPLING LOCATION CODE: Surface Soil
DESCRIPTION:

SAMPLING POINT CODE:
DESCRIPTION

NORTHING: EASTING: ELEVATION:

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

WEATHER: Sunny 45°F ACTIVITIES IN AREA:
FIELD OBSERVATIONS: Collected SiH w/ plastic scoop just N of southern land to OU area W of Wanju Rd. Dry. Some organics

background: 44 cpm

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	51	cpm		
TEMPERATURE:				
pH:				
CONDUCTIVITY:				
REDOX:				
DO:				
ORGANIC VAPORS:				
TURBIDITY:				
OTHER dose :	5	uR/hr		

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: (Signature) QC Checked By: (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-DU-001 DATE COLLECTED (MM/DD/YY): 11-2-11
TIME: 0745/0750 W / S

SAMPLING LOCATION CODE: Surface water / Sediment
DESCRIPTION: ______

SAMPLING POINT CODE: ______
DESCRIPTION ______

NORTHING: ______ EASTING: ______ ELEVATION: ______

SAMPLE DEPTH CODE: ____:____ TO ______ BLS
SAMPLE MEDIA CODE: ______ DESCRIPTION: ______

WEATHER: Clear, 40°F ACTIVITIES IN AREA: ______
FIELD OBSERVATIONS: Collected silt/clay E of bridge on W Recovery on N bank Middle Fork. Saturated. Water at same location.

background = 41 cpm

FIELD MEASUREMENTS	READING W / S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	37 / 52	cpm		
TEMPERATURE:	6.7	°C		
pH:	6.55	std unit		
CONDUCTIVITY:	0.397	mS/cm		
REDOX:	199	mV		
DO:	8.98	mg/L		
ORGANIC VAPORS:	–	–		
TURBIDITY:	4.6	NTU		
OTHER dose:	6	µR/hr		

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: [signature] (Signature) QC Checked By: ______ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SS-OU-002 DATE COLLECTED (MM/DD/YY): 11-2-11
TIME: 0840

SAMPLING LOCATION CODE: Surface Soil
DESCRIPTION: ______

SAMPLING POINT CODE: ______
DESCRIPTION ______

NORTHING: ______ EASTING: ______ ELEVATION: ______

SAMPLE DEPTH CODE: ____:____ TO ______ BLS
SAMPLE MEDIA CODE: ______ DESCRIPTION: ______

WEATHER: Sunny 45°F ACTIVITIES IN AREA: ______
FIELD OBSERVATIONS: Collected sandy silt, moist. E of Western OU limit at Morgan and E-Road.

background: 43 cpm

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	42	cpm		
TEMPERATURE:				
pH:				
CONDUCTIVITY:				
REDOX:				
DO:				
ORGANIC VAPORS:				
TURBIDITY:				
OTHER dose:	6	uR/hr		

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: [signature] (Signature) QC Checked By: ______ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SD/SW-DU-002 DATE COLLECTED (MM/DD/YY): 11.2.11

TIME: 0800/0815

W/S

SAMPLING LOCATION CODE: Surface Water / Sediment

DESCRIPTION: DUP of water and soil

SAMPLING POINT CODE: _____

DESCRIPTION _____

NORTHING: _____ EASTING: _____ ELEVATION: _____

SAMPLE DEPTH CODE: _____ : _____ TO _____ BLS

SAMPLE MEDIA CODE: _____ DESCRIPTION: _____

WEATHER: Clear 40°F ACTIVITIES IN AREA: _____

FIELD OBSERVATIONS: Collected clay w/ fn sand, saturated on N bank of Big Creek, E of bridge on West ~~Recovery~~ Perimeter. Water at bridge Water pooled

background 43 cpm

FIELD MEASUREMENTS	READING W/S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	45/47	cpm		
TEMPERATURE:	6.7	°C		
pH:	7.47	Standard		
CONDUCTIVITY:	0.287	mS/cm		
REDOX:	166	mV		
DO:	7.69	mg/L		
ORGANIC VAPORS:	-			
TURBIDITY:	5.0	NTU		
OTHER dose:	7	uR/hr		

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: _____ QC Checked By: _____
(Signature) (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SS-DU-003 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 1300

SAMPLING LOCATION CODE: Surface Soil
DESCRIPTION: ______

SAMPLING POINT CODE: ______
DESCRIPTION ______

NORTHING: ______ EASTING: ______ ELEVATION: ______

SAMPLE DEPTH CODE: ____:____ TO ______ BLS
SAMPLE MEDIA CODE: ______ DESCRIPTION: ______

WEATHER: Sunny 60°F ACTIVITIES IN AREA: ______
FIELD OBSERVATIONS: Collected silt w/ organics, dry. West of Eastern edge of DU boundary, west of E Road on former access road

background 50 cpm.

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	48	cpm		
TEMPERATURE:				
pH:				
CONDUCTIVITY:				
REDOX:				
DO:				
ORGANIC VAPORS:				
TURBIDITY:				
OTHER dose:	7	uR/hr		

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: [signature] (Signature) QC Checked By: ______ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-DU-003 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 1035/1040 W/S

SAMPLING LOCATION CODE: Surface water / Sediment
DESCRIPTION: ______

SAMPLING POINT CODE: ______
DESCRIPTION ______

NORTHING: ______ EASTING: ______ ELEVATION: ______

SAMPLE DEPTH CODE: ____:____ TO ______ BLS
SAMPLE MEDIA CODE: ______ DESCRIPTION: ______

WEATHER: Sunny 45°F ACTIVITIES IN AREA: ______
FIELD OBSERVATIONS: Collected fn-med gr sand w/ silt E of bridge on Wonju. Water collected at same location. Water stagnant

background 36 cpm

FIELD MEASUREMENTS	READING W / S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	36 / 31	cpm		
TEMPERATURE:	8.6	°C		
pH:	7.52	std units		
CONDUCTIVITY:	0.198	mS/cm		
REDOX:	114	mV		
DO:	6.61	mg/L		
ORGANIC VAPORS:	–			
TURBIDITY:	13.0	NTU		
OTHER ~~dose~~:	5	µR/hr		

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: [signature] (Signature) QC Checked By: ______ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SS-DU-004 DATE COLLECTED (MM/DD/YY): 11-2-11
TIME: 1150
Dup

SAMPLING LOCATION CODE: Surface Soil
DESCRIPTION:

SAMPLING POINT CODE:
DESCRIPTION

NORTHING: EASTING: ELEVATION:

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

WEATHER: Sunny 50°F ACTIVITIES IN AREA:
FIELD OBSERVATIONS: Collected silt w/ some organics, wet, N of southern limit of DU area, E of Morgan Rd

background 37 = cpm

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	36	cpm		
TEMPERATURE:				
pH:				
CONDUCTIVITY:				
REDOX:				
DO:				
ORGANIC VAPORS:				
TURBIDITY:				
OTHER dose:	7	uR/hr		

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: [signature] (Signature) QC Checked By: (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-DU-004 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 1210/1215
W/S

SAMPLING LOCATION CODE: Surface water / Sediment
DESCRIPTION: ________

SAMPLING POINT CODE: ________
DESCRIPTION ________

NORTHING: ________ EASTING: ________ ELEVATION: ________

SAMPLE DEPTH CODE: ____:____ TO ________ BLS
SAMPLE MEDIA CODE: ________ DESCRIPTION: ________

WEATHER: Sunny 50°F ACTIVITIES IN AREA: ________
FIELD OBSERVATIONS: Collected finger sand on S side of Big Creek at SGS-BC-03. Little flow. Water at same location

background: 30 cpm

FIELD MEASUREMENTS	READING	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	27/39	cpm		
TEMPERATURE:	9.4	°C		
pH:	8.51	std units		
CONDUCTIVITY:	0.294	mS/cm		
REDOX:	100	mV		
DO:	11.40	mg/L		
ORGANIC VAPORS:	—			
TURBIDITY:	32.0	NTU		
OTHER dose:	7	µR/hr		

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: [signature] (Signature) QC Checked By: ________ (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-00-005 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 1450/1455
W / S

SAMPLING LOCATION CODE: Surface Water / Sediment
DESCRIPTION: ______

SAMPLING POINT CODE: ______
DESCRIPTION ______

NORTHING: ______ EASTING: ______ ELEVATION: ______

SAMPLE DEPTH CODE: ____:____ TO ______ BLS
SAMPLE MEDIA CODE: ______ DESCRIPTION: ______

WEATHER: Sunny 60°F ACTIVITIES IN AREA: ______
FIELD OBSERVATIONS: Collected fn-med sand w/ gravel on S side of Big Creek, E of Concrete Bridge on D. Road. Water at same location. Water slow to pooled.

background: 34 cpm

FIELD MEASUREMENTS	READING W / S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	35 / 34	cpm		
TEMPERATURE:	11.0	°C		
pH:	8.70	std units		
CONDUCTIVITY:	0.476	mS/cm		
REDOX:	83	mV		
DO:	12.69	mg/L		
ORGANIC VAPORS:	–	–		
TURBIDITY:	23.1	NTU		
OTHER dose:	7	µR/hr		

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: [signature] (Signature) QC Checked By: ______ (Signature)

99-0.2McP65/046599 FTP-1215, Revision 0, 4/02/99

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-DU-006 DATE COLLECTED (MM/DD/YY): 11-1-11
TIME: 0930/0935 W/S

SAMPLING LOCATION CODE: Surface water / Sediment
DESCRIPTION:

SAMPLING POINT CODE:
DESCRIPTION

NORTHING: EASTING: ELEVATION:

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

WEATHER: Sunny 40°F ACTIVITIES IN AREA:
FIELD OBSERVATIONS: Collected fn-med gr sand just downstream of where N trib and E trib join. Creek at low stage. Water collected at same location

background = 35 cpm

FIELD MEASUREMENTS	READING W / S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	25 / 41	cpm		
TEMPERATURE:	4.4	°C		
pH:	7.35	std units		
CONDUCTIVITY:	0.063	mS/cm		
REDOX:	133	mV		
DO:	11.17	mg/L		
ORGANIC VAPORS:	—			
TURBIDITY:	6.9	NTU		
OTHER dose:	7	uR/hr		

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: [signature] (Signature) QC Checked By: (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-00-007 DATE COLLECTED (MM/DD/YY): 11-2-11
TIME: 1210 / 1215
WTS

SAMPLING LOCATION CODE: Surface Water / Sediment
DESCRIPTION: _____

SAMPLING POINT CODE: _____
DESCRIPTION _____

NORTHING: _____ EASTING: _____ ELEVATION: _____

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

WEATHER: Sunny 55°F ACTIVITIES IN AREA: _____
FIELD OBSERVATIONS: Collected silt w/ sand, wet on W side of bridge at Middle Fork on Mogan. Water at same location. V. low flow.

background: 38 cpm

FIELD MEASUREMENTS	READING WTS	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	39 / 58	cpm		
TEMPERATURE:	10.8	°C		
pH:	8.36	standards		
CONDUCTIVITY:	0.275	mS/cm		
REDOX:	111	mV		
DO:	10.58	mg/L		
ORGANIC VAPORS:	-			
TURBIDITY:	28.1	NTU		
OTHER dose:	5	uR/hr		

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: _____ QC Checked By: _____
(Signature) (Signature)

SAMPLE LOG SHEET

PROJECT NAME: JPG **PROJECT NO:**

SAMPLE ID NUMBER: SW/SD-00-008 DATE COLLECTED (MM/DD/YY): 11-2-11

TIME: 0900 / 0905

W / S

SAMPLING LOCATION CODE: Surface Water / Sediment

DESCRIPTION: _____

SAMPLING POINT CODE: _____

DESCRIPTION _____

NORTHING: _____ EASTING: _____ ELEVATION: _____

SAMPLE DEPTH CODE: _____:_____ TO _____ BLS

SAMPLE MEDIA CODE: _____ DESCRIPTION: _____

WEATHER: Sunny 40°F ACTIVITIES IN AREA: _____

FIELD OBSERVATIONS: Collected fine gr. saturated sand on N side of Big Creek, E of bridge at Morgan & D. Road. Water at same location. Water flowing at sample point.

background = 32 cpm

FIELD MEASUREMENTS	READING W/S	UNITS	SERIAL NO.	LAST CALIB.
RADIOACTIVITY:	75/46	cpm		
TEMPERATURE:	4.9	°C		
pH:	7.66	pH units		
CONDUCTIVITY:	0.269	mS/cm		
REDOX:	166	mV		
DO:	8.31	mg/L		
ORGANIC VAPORS:	-			
TURBIDITY:	9.6	NTU		
OTHER dose:	6	mR/hr		

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: _____ QC Checked By: _____
(Signature) (Signature)

JP6 11/1/11
ERM Sampling

0655 Simon Pang (SAIC) left motel for JP6. Getting 4 bags of ice enroute.

0710 Arrived at JP6. Matt Logan (SAIC), Dave Lawson (SAIC), and UXO support arrived as well. Everyone is getting items ready for sampling. UXO's support is named Bob (SAIC). Weather is dry but cool. Highs in 50s.

0820 Everyone leave field office for ERM Sampling

0825 Arrived at MW-DU-003. DTW = 12.87 ft BPVC. Background dose = 6 uR/hr. RAD screen background = 39 cpm. Water quality parameters are
pH = 6.78 ORP = -2
Conductivity = 0.637
Turbidity = 9.0
DO = 5.88
Temperature = 11.8

0830 Collect sample MW-DU-003, RAD screen bottles = 49 cpm.

0845 Going to download data logger and collect sample at SW/SD-DU-006.

0930 Collect Sample SW-DU-006.

0935 Collect sample SD-DU-006.

11/1/11

JP6 11/1/11
ERM Sampling

1000 Arrive at MW-DU-002. DTW = 10.95 ft BPVC. Background dose = 6 uR/hr. RAD screen background = 34 cpm. Water quality parameters are
pH = 7.33 ORP = +131
Conductivity = 0.592
Turbidity = 7.7
DO = 8.14
Temperature = 12.3

1005 Collect sample MW-DU-002. RAD screen bottles = 34 cpm.

1020 Collect sample SS-DU-001.

1035 Arrived at SW-DU-003. Collect sample.

1040 Collect Sample SD-DU-003.

1055 Downloading data logger.

1117 Lunch break

1130 Downloading data logger.

1147 Arrive at MW-DU-001. DTW = 9.92 ft BPVC. Background dose = 6 uR/hr. RAD screen background = 45 cpm. Water quality parameters are
pH = 7.53 ORP = +114
Conductivity = 0.600
Turbidity = 0
DO = 8.55
Temperature = 16.6

11/1/11

JP6 11/1/11
ERM Sampling

1150 Collect Sample MW-DU-001. RAD screen bottles = 48 cpm.
1210 Collect Sample SW-DU-004.
1215 Collect Sample SD-DU-004.
1300 Arrived at SS-DU-003, Collect Sample.
1400 Arrived at MW-DU-010. DTW = 4.89 ft BTOC. Background dose = 6 MR/hr. RAD screen background = 29 cpm. Water quality parameters are
pH = 7.74 ORP = +121
conductivity = 0.658
Turbidity = 0
DO = 5.04
Temperature = 16.6
1405 Collect Sample MW-DU-010. RAD screen bottles = 45 cpm.
1408 Downloading data loggers.
1423 Arrived at MW-DU-009. DTW = 37.22 ft BTOC. Background dose = 7 MR/hr. RAD screen background = 44 cpm. Water quality parameters are
pH = 7.89 ORP = +110
conductivity = 9.38
Turbidity = 14.3
DO = ~~+0.24~~ 5.44
Temperature = 17.5

11/1/11

JP6 11/1/11
ERM Sampling

1430 Collect Sample MW-DU-009. RAD screen bottles = 37 cpm. Not enough water in well to collect 2, 1L plastic bottles. Only able to retrieve 1.3L for lab.
1450 Collect sample SW-DU-005.
1455 Collect Sample SD-DU-005.
1545 Arrived back at field office. Unloading items.
1600 Everyone leaves JP6. Meet next day at 0700.

SF 11/1/11

11/1/11

JPG 11/2/11

ERM Sampling

0700 Simon Fong (SAIC), Matt Logan (SAIC), Matt Logan (SAIC), ad Bob Klimcbak (SAIC) arrived at field office. Loading up items for sampling. Weather today is dry with some wind. Highs in 60s. Currently it is 38°F.

0737 Everyone leave field office for sampling.

0745 Arrived at SW/SD-DU-001. Collect sample SW-DU-001.

0750 collect Sample SD-DU-001.

0810 collect sample SW-DU-002. Also collect duplicate.

0815 collect sample SD-DU-002. Also collect duplicate.

0840 Collect sample SS-DU-002.

0845 Downloading data loggers.

0900 Collect sample SW-DU-003.

0905 collect sample SD-DU-003.

0915 Downloading data loggers.

0953 Arrived at MW-DU-10 DTW = 17.02 feet BPVC. Background dose = 6 MR/hr. RAD screen background = 43 cpm. Water quality parameters are:

pH = 7.50 ORP = +154

Conductivity = 0.376

Turbidity = 14.8

DO = 9.37

Temperature = 10.8

0955 Collect sample MW-DU-011. RAD screen bottles = 74 cpm.

1015 Downloading data logger.

1055 Arrived at MW-5. DTW = 16.42 feet BPVC. Background dose = 6 MR/hr. RAD screen background = 42 cpm. Water quality parameters are:

pH = 7.34 ORP = +162

Conductivity = 3.66

Turbidity = 3.2

DO = 7.02

Temperature = 14.5

1100 Collect sample MW-DU-005. RAD screen bottles = 65 cpm.

1105 Downloading data logger.

1155 Arrived at MW-6. DTW = 35.80 feet BPVC. Background dose = 7 MR/hr. RAD screen background = 36 cpm. Water quality parameters are:

pH = 7.45 ORP = +138

Conductivity = 0.777

11/2/11

JPG 11/2/11

ERM Sampling

Turbidity = 3.7
DO = 6.94
Temperature = 14.3

1140 Collect sample MW-DU-0006. RAD screen bottles = 47 cpm.

1150 Collect sample SS-DU-0004. Also collect duplicate sample.

1200 Downloading data logger.

1210 Collect sample SW-DU-0007.

1215 Collect sample SD-DU-0007.

1220 Arrive at MW-7. DTW = 12.18 feet BRVC. Background dose = 7 MR/hr. RAD screen background = 43 cpm. Water quality parameters are:
pH = 7.53 ORP = +162
Conductivity = 0.731
Turbidity = 1.8
DO = 3.53
Temperature = 17.5

1225 Collect sample MW-DU-0007. Also collect duplicate sample. RAD screen bottles = 43 cpm.

1240 Arrived at field office. Lunch break.

1310 Bob Klitzbaw left JPG. Everyone else continue with sampling.

11/2/11

JPG 11/2/11

ERM Sampling

1320 Arrive at MW-4. DTW = 10.11 feet BRVC. Background dose = 5 MR/hr. RAD screen background = 41 cpm. Water quality parameters are:
pH = 7.50 ORP = +28
Conductivity = 0.820
Turbidity = 17.4
DO = 3.08
Temperature = 18.1

1325 Collect sample MW-DU-0004. RAD screen bottles = 36 cpm.

1340 Arrive at MW-8. DTW = 23.66 feet BRVC. Background dose = 7 MR/hr. RAD screen background = 31 cpm. Water quality parameters are:
pH = 7.49 ORP = +93
Conductivity = 0.531
Turbidity = 8.2
DO = 9.15
Temperature = 15.7

1345 Collect sample MW-DU-0008. RAD screen bottles = 36 cpm.

1400 Simon is going back to motel to get computer. Matt and Dave are going to field office to unload and RAD survey our equipment.

11/2/11

JPG 11/2/11

ERM Sampling, Demobilization

1425 Arrived back at field office. Sample mangement.

1500 Everyone leave field office for demobilization. Simon is going to FedEx in Columbus, IN.

1615 Arrived at FedEx Columbus, IN. Dropping off 3 coolers for TestAmerica-St. Louis.

Tracking #s 7953-5609-1921
7953-5609-1792
7953-5609-1965

1625 Leave FedEx for Madison, IN. Simon to fly back to Dulles tomorrow.

SF 11/2/11

[signature] 11/2/11

JPG 11/2/11

ERM Sampling

Well Purge Info from Field Sheets

Well ID	Date of Purge	DTW (ft BTOC)	Purge Start Time	Purge End Time	Number of Full Bails	Notes
MW-9	10/24/11	32.56	1000	1015	10	well bailed dry; downloaded troll
MW-10	10/24/11	5.13	1023	1045	20	well not bailed dry; Final DTW = 26.58
MW-11	10/24/11	13.38	1100	1130	17	well not bailed dry; downloaded troll; Final DTW = 39.20
MW-5	10/24/11	16.26	1210	1230	10	well not bailed dry;
MW-6	10/24/11	20.57	1240	1300	13	well not bailed dry
MW-7	10/24/11	12.39	1310	1325	20	well not bailed dry; Final DTW = 18.81
MW-1	10/24/11	9.82	1350	1405	15	well bailed dry
MW-2	10/24/11	10.84	1415	1430	6	well bailed dry; downloaded troll
MW-3	10/24/11	13.05	1440	1500	16	well not bailed dry
MW-8	10/24/11	23.68	1515	1520	4	well bailed dry
MW-4	10/24/11	10.42	1535	1550	10	well not bailed dry

The wells were bailed by LAL St. Louis's E. Schrumpf and D. Lawson.

[signature] 11/2/11

B-17

JPG 11/2/11

ERM Sampling

Sample management Information

Surface Water and Groundwater samples were collected in 2, 1L plastic bottles with no preservatives. Samples are to be preserved and filtered at the lab.

Sediment and surface soil samples were collected in 1, 8oz glass jar with no preservatives.

Aside from groundwater sample at MW-DU-009, all sample locations had sufficient amounts of volume that were sent to the lab. MW-DU-009 only had 1.3L of water in the well during sampling.

JPG 11/2/11

APPENDIX C
DATA VALIDATION SUMMARY

THIS PAGE WAS INTENTIONALLY LEFT BLANK

C. DATA VALIDATION SUMMARY

C.1 TestAmerica SDG F1K030414

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) Environmental Radiation Monitoring (ERM) November 2011 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 Science Applications International Corporation (SAIC) Quality Assurance Technical Procedure (QATP) No. TP-DM-300-7, *Data Validation* (Revision 7, 3/2009). The validation technical review was based on the information and documentation supplied by the associated laboratory. The analyses were evaluated against criteria established in the related analytical procedures and the JPG data quality requirements.

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

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

C.1.1 Analytical Category: Radiochemical

- Uranium-234 (U-234), Uranium-235 (U-235), and Uranium-238 (U-238) were determined by alpha spectrometry (DOE HASL-300 Methods Compendium A-01-R). Total uranium was calculated using a published specific activity value for U-238 and assuming all of the mass originates from U-238.

- All samples were analyzed with SDG F1K030414.

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
Quality control (QC)
- Calibration checks and background
- Preparation blanks
- Laboratory control samples
- Field blanks (if available)
- Field duplicates (if available)
- Chemical yield (tracer recovery)
- Laboratory duplicates

2. The above items were found to be acceptable, except as follows:

- ***Overall Assessment of Data***—U-234, U-235, and U-238 sample data with results greater than the minimum detectable concentration (MDC) were qualified as estimated, *J*, reason code 37 in instances where the associated error was greater than 50 percent of the sample result.

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

SAMPLE INDEX	
Laboratory:	*SDG #:*
Test America Laboratories, Inc.	**F1K030414**

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-003_SAIC16E	F1K030414-001	11/01/2011	Total and Isotopic Uranium
SW-DU-006_SAIC15E	F1K030414-002	11/01/2011	Total and Isotopic Uranium
SD-DU-006_SAIC16E	F1K030414-003	11/01/2011	Total and Isotopic Uranium
MW-DU-002-SAIC16E	F1K030414-004	11/01/2011	Total and Isotopic Uranium
SS-DU-001-SAIC16E	F1K030414-005	11/01/2011	Total and Isotopic Uranium
SW-DU-003-SAIC14E	F1K030414-006	11/01/2011	Total and Isotopic Uranium
SD-DU-003-SAIC16E	F1K030414-007	11/01/2011	Total and Isotopic Uranium
MW-DU-001_SAIC16E	F1K030414-008	11/01/2011	Total and Isotopic Uranium
SW-DU-004_SAIC16E	F1K030414-009	11/01/2011	Total and Isotopic Uranium
SD-DU-004-SAIC16E	F1K030414-010	11/01/2011	Total and Isotopic Uranium
SS-DU-003-SAIC16E	F1K030414-011	11/01/2011	Total and Isotopic Uranium
MW-DU-010_SAIC16E	F1K030414-012	11/01/2011	Total and Isotopic Uranium
MW-DU-009-SAIC16E	F1K030414-013	11/01/2011	Total and Isotopic Uranium
SW-DU-005_SAIC16E	F1K030414-014	11/01/2011	Total and Isotopic Uranium
SD-DU-005_SAIC16E	F1K030414-015	11/01/2011	Total and Isotopic Uranium
SW-DU-001_SAIC16E	F1K030414-016	11/02/2011	Total and Isotopic Uranium
SD-DU-001_SAIC16E	F1K030414-017	11/02/2011	Total and Isotopic Uranium
SW-DU-002-SAIC16E	F1K030414-018	11/02/2011	Total and Isotopic Uranium
SW-DU-002_SAIC16DE	F1K030414-019	11/02/2011	Total and Isotopic Uranium
SD-DU-002_SAIC16E	F1K030414-020	11/02/2011	Total and Isotopic Uranium
SD-DU-002_SAIC16E	F1K030414-021	11/02/2011	Total and Isotopic Uranium
SS-DU-002-SAIC16E	F1K030414-022	11/02/2011	Total and Isotopic Uranium
SW-DU-008_SAIC16E	F1K030414-023	11/02/2011	Total and Isotopic Uranium
SD-DU-008_SAIC16E	F1K030414-024	11/02/2011	Total and Isotopic Uranium
MW-DU-011_SAIC16E	F1K030414-025	11/02/2011	Total and Isotopic Uranium
MW-DU-005_SAIC16E	F1K030414-026	11/02/2011	Total and Isotopic Uranium
MW-DU-006_SAIC16E	F1K030414-027	11/02/2011	Total and Isotopic Uranium
SS-DU-004_SAIC16E	F1K030414-028	11/02/2011	Total and Isotopic Uranium
SW-DU-007_SAIC16E	F1K030414-029	11/02/2011	Total and Isotopic Uranium
SD-DU-007_SAIC16E	F1K030414-030	11/02/2011	Total and Isotopic Uranium
MW-DU-007_SAIC16E	F1K030414-031	11/02/2011	Total and Isotopic Uranium
MW-DU-007_SAIC16DE	F1K030414-032	11/02/2011	Total and Isotopic Uranium
MW-DU-004_SAIC16E	F1K030414-033	11/02/2011	Total and Isotopic Uranium
MW-DU-008_SAIC16E	F1K030414-034	11/02/2011	Total and Isotopic Uranium
SS-DU-004_SAIC16DE	F1K030414-035	11/02/2011	Total and Isotopic Uranium

THIS PAGE WAS INTENTIONALLY LEFT BLANK

ATTACHMENT

JEFFERSON PROVING GROUND
SAMPLE DATA SUMMARY SHEETS

THIS PAGE WAS INTENTIONALLY LEFT BLANK

SAMPLE DATA SUMMARY – WATER Isotopic Uranium A-01-R MOD							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
MW-DU-001 SAIC16E	Uranium	0.42	0.2	0.13	µg/L		
MW-DU-001 SAIC16E	Uranium-234	0.175	0.075	0.046	pCi/L		
MW-DU-001 SAIC16E	Uranium-235	-0.0023	0.0045	0.041	pCi/L	U	
MW-DU-001 SAIC16E	Uranium-238	0.14	0.066	0.043	pCi/L		
MW-DU-002 SAIC16E	Uranium	3.55	0.7	0.15	µg/L		
MW-DU-002 SAIC16E	Uranium-234	3.25	0.45	0.06	pCi/L		
MW-DU-002 SAIC16E	Uranium-235	0.072	0.059	0.032	pCi/L	J	37
MW-DU-002 SAIC16E	Uranium-238	1.18	0.23	0.05	pCi/L		
MW-DU-003 SAIC16E	Uranium	1.01	0.32	0.11	µg/L		
MW-DU-003 SAIC16E	Uranium-234	0.42	0.12	0.05	pCi/L		
MW-DU-003 SAIC16E	Uranium-235	-0.0025	0.005	0.045	pCi/L	U	
MW-DU-003 SAIC16E	Uranium-238	0.34	0.11	0.04	pCi/L		
MW-DU-004 SAIC16E	Uranium	3.87	0.66	0.1	µg/L		
MW-DU-004 SAIC16E	Uranium-234	1.7	0.27	0.04	pCi/L		
MW-DU-004 SAIC16E	Uranium-235	0.073	0.052	0.025	pCi/L	J	37
MW-DU-004 SAIC16E	Uranium-238	1.29	0.22	0.03	pCi/L		
MW-DU-005 SAIC16E	Uranium	0.65	0.25	0.11	µg/L		
MW-DU-005 SAIC16E	Uranium-234	0.35	0.11	0.02	pCi/L		
MW-DU-005 SAIC16E	Uranium-235	0.036	0.039	0.044	pCi/L	U	
MW-DU-005 SAIC16E	Uranium-238	0.213	0.083	0.035	pCi/L		
MW-DU-006 SAIC16E	Uranium	5.32	0.82	0.06	µg/L		
MW-DU-006 SAIC16E	Uranium-234	2.22	0.32	0.05	pCi/L		
MW-DU-006 SAIC16E	Uranium-235	0.076	0.054	0.026	pCi/L	J	37
MW-DU-006 SAIC16E	Uranium-238	1.77	0.28	0.02	pCi/L		
MW-DU-007 SAIC16DE	Uranium	2.73	0.56	0.16	µg/L		
MW-DU-007 SAIC16DE	Uranium-234	1.32	0.24	0.05	pCi/L		
MW-DU-007 SAIC16DE	Uranium-235	0.028	0.035	0.046	pCi/L	U	
MW-DU-007 SAIC16DE	Uranium-238	0.91	0.19	0.05	pCi/L		
MW-DU-007 SAIC16E	Uranium	2.06	0.43	0.15	µg/L		
MW-DU-007 SAIC16E	Uranium-234	1.12	0.19	0.04	pCi/L		
MW-DU-007 SAIC16E	Uranium-235	0.054	0.041	0.021	pCi/L	J	37
MW-DU-007 SAIC16E	Uranium-238	0.69	0.14	0.05	pCi/L		

SAMPLE DATA SUMMARY – WATER Isotopic Uranium A-01-R MOD							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
MW-DU-008 SAIC16E	Uranium	0.92	0.32	0.23	µg/L		
MW-DU-008 SAIC16E	Uranium-234	0.29	0.1	0.06	pCi/L		
MW-DU-008 SAIC16E	Uranium-235	0.049	0.046	0.047	pCi/L	J	37
MW-DU-008 SAIC16E	Uranium-238	0.3	0.11	0.08	pCi/L		
MW-DU-009 SAIC16E	Uranium	0.46	0.22	0.13	µg/L		
MW-DU-009 SAIC16E	Uranium-234	0.76	0.17	0.05	pCi/L		
MW-DU-009 SAIC16E	Uranium-235	0.018	0.029	0.046	pCi/L	U	
MW-DU-009 SAIC16E	Uranium-238	0.152	0.073	0.043	pCi/L		
MW-DU-010 SAIC16E	Uranium	2.27	0.54	0.17	µg/L		
MW-DU-010 SAIC16E	Uranium-234	1.8	0.3	0.06	pCi/L		
MW-DU-010 SAIC16E	Uranium-235	0.041	0.048	0.062	pCi/L	U	
MW-DU-010 SAIC16E	Uranium-238	0.76	0.18	0.06	pCi/L		
MW-DU-011 SAIC16E	Uranium	0.23	0.15	0.13	µg/L		
MW-DU-011 SAIC16E	Uranium-234	0.263	0.096	0.043	pCi/L		
MW-DU-011 SAIC16E	Uranium-235	0.003	0.031	0.076	pCi/L	U	
MW-DU-011 SAIC16E	Uranium-238	0.077	0.052	0.043	pCi/L	J	37
SW-DU-001 SAIC16E	Uranium	0.52	0.23	0.13	µg/L		
SW-DU-001 SAIC16E	Uranium-234	0.31	0.11	0.05	pCi/L		
SW-DU-001 SAIC16E	Uranium-235	0.018	0.03	0.047	pCi/L	U	
SW-DU-001 SAIC16E	Uranium-238	0.171	0.078	0.044	pCi/L		
SW-DU-002 SAIC16DE	Uranium	1.8	0.44	0.11	µg/L		
SW-DU-002 SAIC16DE	Uranium-234	0.178	0.078	0.022	pCi/L		
SW-DU-002 SAIC16DE	Uranium-235	0.008	0.021	0.046	pCi/L	U	
SW-DU-002 SAIC16DE	Uranium-238	0.6	0.15	0.04	pCi/L		
SW-DU-002 SAIC16E	Uranium	2.37	0.52	0.13	µg/L		
SW-DU-002 SAIC16E	Uranium-234	0.208	0.085	0.023	pCi/L		
SW-DU-002 SAIC16E	Uranium-235	0.026	0.037	0.055	pCi/L	U	
SW-DU-002 SAIC16E	Uranium-238	0.79	0.18	0.04	pCi/L		
SW-DU-003 SAIC14E	Uranium	0.09	0.095	0.11	µg/L	U	
SW-DU-003 SAIC14E	Uranium-234	0.045	0.043	0.054	pCi/L	U	
SW-DU-003 SAIC14E	Uranium-235	0.005	0.021	0.052	pCi/L	U	
SW-DU-003 SAIC14E	Uranium-238	0.029	0.032	0.036	pCi/L	U	

SAMPLE DATA SUMMARY – WATER Isotopic Uranium A-01-R MOD							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SW-DU-004 SAIC16E	Uranium	0.94	0.33	0.17	µg/L		
SW-DU-004 SAIC16E	Uranium-234	0.69	0.17	0.07	pCi/L		
SW-DU-004 SAIC16E	Uranium-235	0.011	0.023	0.03	pCi/L	U	
SW-DU-004 SAIC16E	Uranium-238	0.32	0.11	0.06	pCi/L		
SW-DU-005 SAIC16E	Uranium	1.38	0.39	0.07	µg/L		
SW-DU-005 SAIC16E	Uranium-234	0.45	0.13	0.05	pCi/L		
SW-DU-005 SAIC16E	Uranium-235	0	0.01	0.028	pCi/L	U	
SW-DU-005 SAIC16E	Uranium-238	0.46	0.13	0.02	pCi/L		
SW-DU-006 SAIC15E	Uranium	0.3	0.18	0.14	µg/L		
SW-DU-006 SAIC15E	Uranium-234	0.093	0.058	0.048	pCi/L	J	37
SW-DU-006 SAIC15E	Uranium-235	0.01	0.02	0.028	pCi/L	U	
SW-DU-006 SAIC15E	Uranium-238	0.101	0.06	0.048	pCi/L	J	37
SW-DU-007 SAIC16E	Uranium	0.33	0.19	0.14	µg/L		
SW-DU-007 SAIC16E	Uranium-234	0.165	0.075	0.022	pCi/L		
SW-DU-007 SAIC16E	Uranium-235	0.01	0.02	0.028	pCi/L	U	
SW-DU-007 SAIC16E	Uranium-238	0.109	0.063	0.048	pCi/L	J	37
SW-DU-008 SAIC16E	Uranium	1.84	0.43	0.1	µg/L		
SW-DU-008 SAIC16E	Uranium-234	0.178	0.076	0.04	pCi/L		
SW-DU-008 SAIC16E	Uranium-235	0.009	0.019	0.025	pCi/L	U	
SW-DU-008 SAIC16E	Uranium-238	0.62	0.15	0.03	pCi/L		

SAMPLE DATA SUMMARY – SOILS Isotopic Uranium A-01-R MOD							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SD-DU-001 SAIC16E	Uranium	2.88	0.47	0.04	mg/kg		
SD-DU-001 SAIC16E	Uranium-234	0.81	0.14	0.02	pCi/g		
SD-DU-001 SAIC16E	Uranium-235	0.053	0.037	0.028	pCi/g	J	37
SD-DU-001 SAIC16E	Uranium-238	0.96	0.16	0.01	pCi/g		
SD-DU-002 SAIC16DE	Uranium	1.17	0.25	0.05	mg/kg		
SD-DU-002 SAIC16DE	Uranium-234	0.23	0.062	0.02	pCi/g		
SD-DU-002 SAIC16DE	Uranium-235	0.012	0.016	0.025	pCi/g	U	
SD-DU-002 SAIC16DE	Uranium-238	0.39	0.083	0.017	pCi/g		
SD-DU-002 SAIC16E	Uranium	1.09	0.24	0.05	mg/kg		
SD-DU-002 SAIC16E	Uranium-234	0.224	0.062	0.02	pCi/g		
SD-DU-002 SAIC16E	Uranium-235	0.033	0.025	0.013	pCi/g	J	37
SD-DU-002 SAIC16E	Uranium-238	0.361	0.08	0.017	pCi/g		
SD-DU-003 SAIC16E	Uranium	1.07	0.22	0.05	mg/kg		
SD-DU-003 SAIC16E	Uranium-234	0.388	0.079	0.019	pCi/g		
SD-DU-003 SAIC16E	Uranium-235	0.007	0.012	0.019	pCi/g	U	
SD-DU-003 SAIC16E	Uranium-238	0.358	0.075	0.018	pCi/g		
SD-DU-004 SAIC16E	Uranium	0.55	0.16	0.06	mg/kg		
SD-DU-004 SAIC16E	Uranium-234	0.172	0.053	0.01	pCi/g		
SD-DU-004 SAIC16E	Uranium-235	0.021	0.021	0.025	pCi/g	U	
SD-DU-004 SAIC16E	Uranium-238	0.181	0.055	0.02	pCi/g		
SD-DU-005 SAIC16E	Uranium	1.31	0.27	0.08	mg/kg		
SD-DU-005 SAIC16E	Uranium-234	0.359	0.08	0.024	pCi/g		
SD-DU-005 SAIC16E	Uranium-235	0.007	0.014	0.025	pCi/g	U	
SD-DU-005 SAIC16E	Uranium-238	0.438	0.089	0.027	pCi/g		
SD-DU-006 SAIC16E	Uranium	1.72	0.32	0.07	mg/kg		
SD-DU-006 SAIC16E	Uranium-234	0.6	0.11	0.02	pCi/g		
SD-DU-006 SAIC16E	Uranium-235	0.007	0.014	0.026	pCi/g	U	
SD-DU-006 SAIC16E	Uranium-238	0.58	0.11	0.02	pCi/g		
SD-DU-007 SAIC16E	Uranium	2.03	0.36	0.04	mg/kg		
SD-DU-007 SAIC16E	Uranium-234	0.61	0.11	0.02	pCi/g		
SD-DU-007 SAIC16E	Uranium-235	0.028	0.026	0.027	pCi/g	J	37
SD-DU-007 SAIC16E	Uranium-238	0.68	0.12	0.01	pCi/g		

SAMPLE DATA SUMMARY – SOILS Isotopic Uranium A-01-R MOD							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SD-DU-008 SAIC16E	Uranium	0.46	0.15	0.03	mg/kg		
SD-DU-008 SAIC16E	Uranium-234	0.12	0.043	0.021	pCi/g		
SD-DU-008 SAIC16E	Uranium-235	0.008	0.013	0.02	pCi/g	U	
SD-DU-008 SAIC16E	Uranium-238	0.154	0.049	0.01	pCi/g		
SS-DU-001 SAIC16E	Uranium	1.86	0.33	0.03	mg/kg		
SS-DU-001 SAIC16E	Uranium-234	0.76	0.13	0.02	pCi/g		
SS-DU-001 SAIC16E	Uranium-235	0.024	0.022	0.013	pCi/g	J	37
SS-DU-001 SAIC16E	Uranium-238	0.62	0.11	0.01	pCi/g		
SS-DU-002 SAIC16E	Uranium	2.21	0.36	0.03	mg/kg		
SS-DU-002 SAIC16E	Uranium-234	0.68	0.11	0.02	pCi/g		
SS-DU-002 SAIC16E	Uranium-235	0.027	0.022	0.012	pCi/g	J	37
SS-DU-002 SAIC16E	Uranium-238	0.74	0.12	0.01	pCi/g		
SS-DU-003 SAIC16E	Uranium	1.96	0.36	0.07	mg/kg		
SS-DU-003 SAIC16E	Uranium-234	0.74	0.13	0.02	pCi/g		
SS-DU-003 SAIC16E	Uranium-235	0.025	0.024	0.024	pCi/g	J	37
SS-DU-003 SAIC16E	Uranium-238	0.65	0.12	0.02	pCi/g		
SS-DU-004 SAIC16DE	Uranium	0	0	0	mg/kg		
SS-DU-004 SAIC16DE	Uranium-234	0.59	0.11	0.02	pCi/g		
SS-DU-004 SAIC16DE	Uranium-235	0.028	0.023	0.012	pCi/g	J	37
SS-DU-004 SAIC16DE	Uranium-238	0.81	0.13	0.02	pCi/g		
SS-DU-004 SAIC16E	Uranium	2.33	0.4	0.06	mg/kg		
SS-DU-004 SAIC16E	Uranium-234	0.7	0.13	0.02	pCi/g		
SS-DU-004 SAIC16E	Uranium-235	0.055	0.036	0.026	pCi/g	J	37
SS-DU-004 SAIC16E	Uranium-238	0.77	0.14	0.02	pCi/g		

Data Validation Reason Code

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

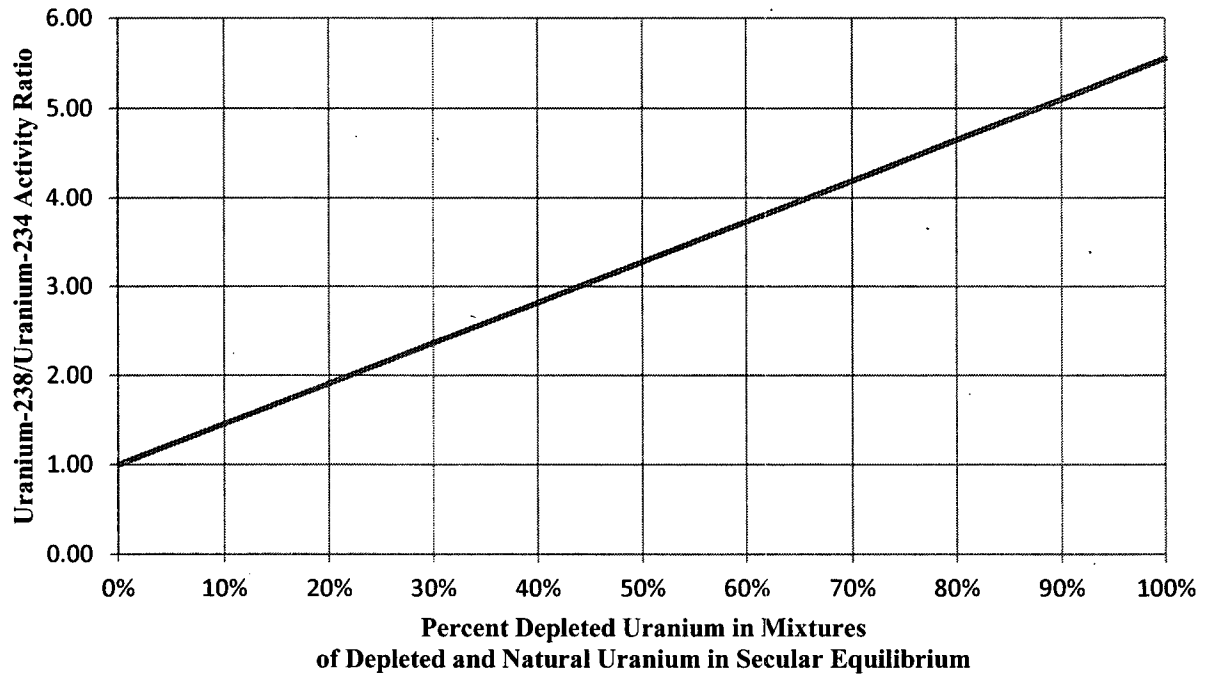
THIS PAGE WAS INTENTIONALLY LEFT BLANK

APPENDIX D

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

THIS PAGE WAS INTENTIONALLY LEFT BLANK

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



THIS PAGE WAS INTENTIONALLY LEFT BLANK