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April 30, 2008

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Dear Dr. McLaughlin:

In accordance with the U.S. Army Jefferson Proving Ground License SUB-1435 requirements, and at the U.S. Army's request, Science Applications International Corporation (SAIC) is submitting six hard copies and 4 electronic copy on compact disk-read only memory (CD-ROM) of the *Radiation Monitoring Report for License SUB-1435 Jefferson Proving Ground, Summary of Results for 3 – 4 October 2007 Sampling Event*.

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**RADIATION MONITORING REPORT  
FOR LICENSE SUB-1435  
JEFFERSON PROVING GROUND**

**Summary of Results for  
3-4 October 2007 Sampling Event**

**FINAL**

**Submitted to:**

**U.S. Department of Army  
Installation Support Management Agency  
Aberdeen Proving Ground, Maryland**

**Prepared by:**

**Science Applications International Corporation  
Reston, Virginia**

**May 2008**

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## LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
DQO	Data Quality Objective
DU	Depleted Uranium
ERM	Environmental Radiation Monitoring
ERMP	Environmental Radiation Monitoring Program
I.D.	Identification
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
JPG	Jefferson Proving Ground
LCL	Lower Control Limit
MDC	Minimum Detectable Concentration
mS/cm	MilliSiemens per Centimeter
NRC	Nuclear Regulatory Commission
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
UCL	Upper Control Limit

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## 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), described in the standard operating procedure (SOP) in Appendix A (CHPPM 2000), 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 1988).

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 October 2007 sampling event, which is the second of two planned sampling events in 2007 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), and data validation summary (Appendix C). All tables and figures are presented at the end of their respective sections.

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## **2. SAMPLING REQUIREMENTS AND APPROACH**

The ERMP (U.S. Army 2000) specifies the U.S. Army Center for Health Promotion and Preventive Medicine's (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.

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### 3. RESULTS

A two-person SAIC field crew prepared for and conducted field sampling at JPG on 3-4 October 2007. Appendix B contains a copy of the field logbook, which documents the field activities during the sampling effort.

No unusual or abnormal conditions (e.g., soil or water discoloration, odd odors, or elevated radiation levels) were observed during the sampling effort. One water conductivity reading was again found to be unusually high and is discussed in Section 3.1.

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. 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).

#### 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. Water quality parameter measurements are presented in Table 3-2. Total uranium concentrations ranged from 0.16 picocuries per liter (pCi/L) to 4.48 pCi/L with an average concentration of 1.55. In addition to the individual isotopic concentrations, Table 3-1 presents the U-238/U-234 ratios for each sample, which ranged from  $0.29 \pm 0.10$  to  $0.89 \pm 0.24$ .

A U-238/U-234 ratio of 3 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 are investigated further to validate if the sample is representative of DU or natural uranium. No investigations are warranted.

As indicated by the relatively low total uranium results and the U-238/U-234 ratios, there is no evidence of the presence of DU in the groundwater samples. A U-238/U-234 ratio was not calculated for the sample from monitoring well MW11, since U-238 was not detected in the sample.

The groundwater sample from monitoring well MW09 (sample MW-DU-009) again exhibited a conductivity value well in excess of all other ERMP water samples. Historically, the conductivity values have been the highest in this well and have ranged from 7.0 to 12.2 milliSiemens per centimeter (mS/cm), reaching a new high this time at 12.2 mS/cm. Conductivity values of this magnitude have been observed in other, non-ERMP, monitoring wells (see CHPPM 2003).

#### 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. Water quality parameter measurements are presented in Table 3-4. Total uranium concentrations ranged from 0.28 to 6.26 pCi/L, with an average concentration of 1.4 pCi/L. The U-238/U-234 ratio for location SWS05 was 6.3. The U-238/U-234 ratio for each of the other samples was in the range of  $0.70 \pm 0.65$  to  $2.16 \pm 1.0$ .

As a result of having a U-238/U-234 ratio exceeding 3, location SWS05 was subjected to additional investigation consisting of the following activities:

- Review of the laboratory data package and recounting of the applicable sample to assess the potential for laboratory counting error
- Review of field logbooks and associated data to assess basis for elevated concentration

- Visual examination of the area from which the sample was obtained for the presence of readily identifiable DU
- Re-collection of the sample for subsequent analysis using both alpha spectrometry and inductively couple plasma/ mass spectrometry (ICP/MS).

This area also was subjected to special emphasis during gamma walkover surveys of portions of the creek bank.

Gamma walkover surveys reflected no elevated gamma count rates in the vicinity where the sample was collected nor visible evidence of DU penetrators or portions thereof. Alpha spectrometry results for the re-collected sample reflect U-238 of  $0.159 \pm 0.087$  pCi/L with concentrations of U-234 and U-235 being below their respective minimum detectable concentrations (MDCs) of 0.093 and 0.061 pCi/L, respectively. ICP/MS results reflected a total uranium concentration of 0.37  $\mu$ g/L or about 0.13 pCi/L.

As indicated by the relatively low total uranium results and the U-238/U-234 ratios of the other samples, there was no evidence of the presence of DU in the remaining surface water samples. Samples were not collected from locations SWS03 or SWS06 as the creek was dry in each of these locations.

### 3.3 SEDIMENT

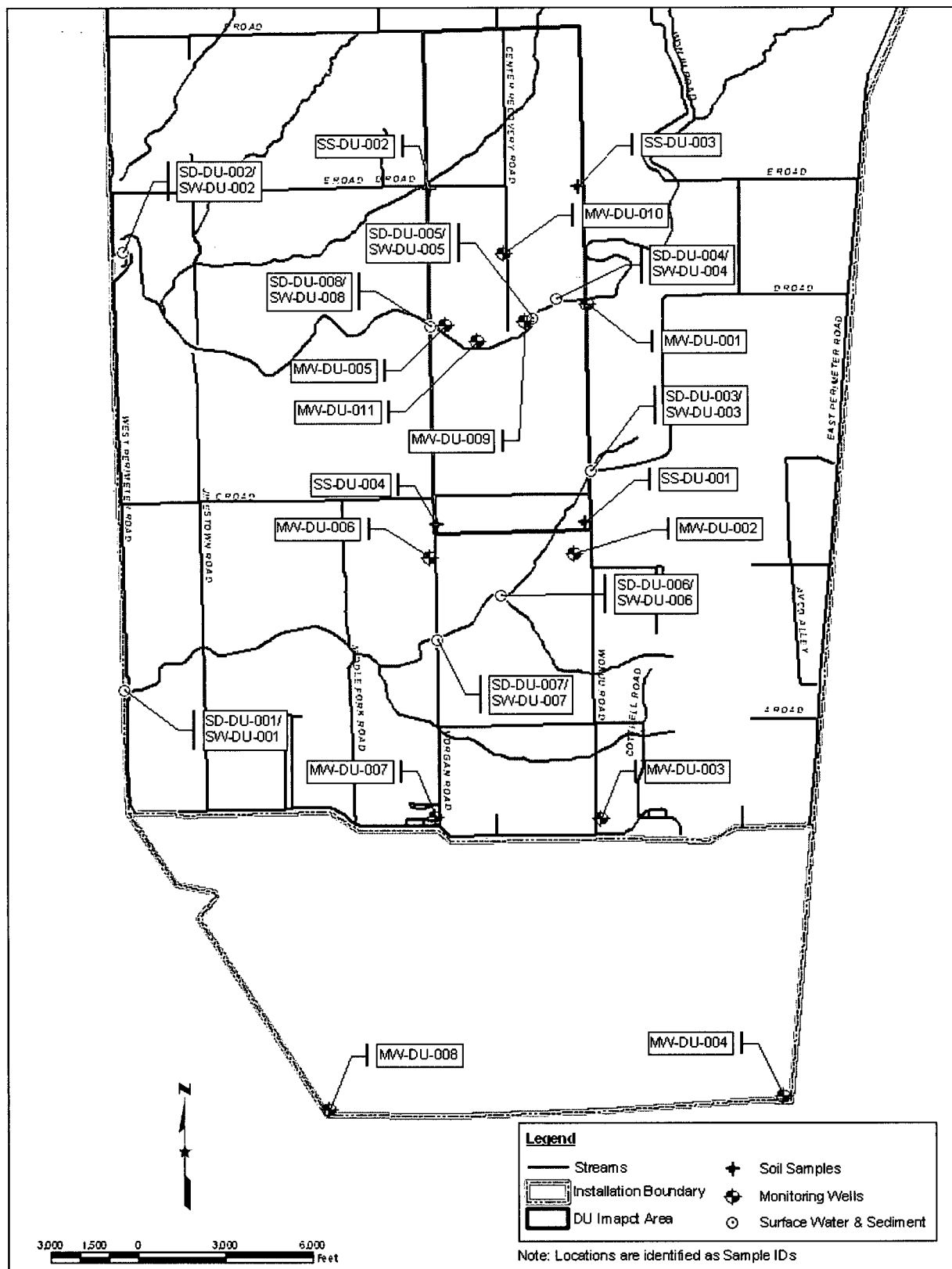
The concentrations of total uranium in sediment at eight sampling locations plus one duplicate sample are presented in Table 3-5. Sediment samples were collected at the same locations as surface water samples, as shown in Figure 3-1. Total uranium concentrations ranged from 0.30 to 2.19 picocuries per gram (pCi/g), with an average concentration of 1.0 pCi/g. The U-238/U-234 ratio for the samples ranged from  $0.78 \pm 0.25$  to  $1.17 \pm 0.76$ .

As indicated by the relatively low total uranium results and the U-238/U-234 ratios, there is no evidence of the presence of DU in the sediment samples.

### 3.4 SOIL

The concentrations of total uranium in surface soil at four surface soil sample locations plus one duplicate sample are presented in Table 3-6. Total uranium concentrations ranged from  $1.49 \pm 0.35$  to  $2.07 \pm 0.31$  with an average concentration of 1.74 pCi/g. The U-238/U-234 ratios ranged from  $0.78 \pm 0.26$  to  $1.26 \pm 0.43$ .

As indicated by the relatively low total uranium results and the U-238/U-234 ratios, there is no evidence of the presence of DU in the surface soil samples.



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

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/L)
MW01	MW-DU-001	U-234	0.237 J
MW01	MW-DU-001	U-235	-0.008 U
MW01	MW-DU-001	U-238	0.152
<b>Total Uranium</b>			<b>0.39</b>
U-238/U-234 Ratio <sup>b</sup>			0.64
MW02	MW-DU-002	U-234	0.82
MW02	MW-DU-002	U-235	0.024 U
MW02	MW-DU-002	U-238	0.39
<b>Total Uranium</b>			<b>1.23</b>
U-238/U-234 Ratio <sup>b</sup>			0.48
MW03	MW-DU-003	U-234	0.55
MW03	MW-DU-003	U-235	0.059 U
MW03	MW-DU-003	U-238	0.33
<b>Total Uranium</b>			<b>0.94</b>
U-238/U-234 Ratio <sup>b</sup>			0.60
MW04	MW-DU-004	U-234	1.48
MW04	MW-DU-004	U-235	0.084 J
MW04	MW-DU-004	U-238	1.27
<b>Total Uranium</b>			<b>2.83</b>
U-238/U-234 Ratio <sup>b</sup>			0.86
MW04	MW-DU-004D	U-234	1.52
MW04	MW-DU-004D	U-235	0.082 J
MW04	MW-DU-004D	U-238	1.36
<b>Total Uranium</b>			<b>2.96</b>
U-238/U-234 Ratio <sup>b</sup>			0.89
MW05	MW-DU-005	U-234	0.222 J
MW05	MW-DU-005	U-235	0.029 U
MW05	MW-DU-005	U-238	0.106
<b>Total Uranium</b>			<b>0.36</b>
U-238/U-234 Ratio <sup>b</sup>			0.48
MW06	MW-DU-006	U-234	2.35
MW06	MW-DU-006	U-235	0.131
MW06	MW-DU-006	U-238	2.00
<b>Total Uranium</b>			<b>4.48</b>
U-238/U-234 Ratio <sup>b</sup>			0.85
MW07	MW-DU-007	U-234	1.18
MW07	MW-DU-007	U-235	0.070 J
MW07	MW-DU-007	U-238	0.71
<b>Total Uranium</b>			<b>1.96</b>
U-238/U-234 Ratio <sup>b</sup>			0.60

**Table 3-1. Uranium in Groundwater  
Jefferson Proving Ground, Madison, Indiana (Continued)**

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/L)
MW08	MW-DU-008	U-234	0.313
MW08	MW-DU-008	U-235	0.029 U
MW08	MW-DU-008	U-238	0.220
<b>Total Uranium</b>			<b>0.56</b>
U-238/U-234 Ratio <sup>b</sup>			0.70
MW09	MW-DU-009	U-234	1.15
MW09	MW-DU-009	U-235	0.026 U
MW09	MW-DU-009	U-238	0.332
<b>Total Uranium</b>			<b>1.51</b>
U-238/U-234 Ratio <sup>b</sup>			0.29
MW010	MW-DU-010	U-234	1.71
MW010	MW-DU-010	U-235	0.081 J
MW010	MW-DU-010	U-238	0.76
<b>Total Uranium</b>			<b>2.55</b>
U-238/U-234 Ratio <sup>b</sup>			0.44
MW011	MW-DU-011	U-234	0.133 J
MW011	MW-DU-011	U-235	-0.025 U
MW011	MW-DU-011	U-238	0.052 U
<b>Total Uranium</b>			<b>ND</b>
U-238/U-234 Ratio <sup>b</sup>			ND

<sup>a</sup> Represents sample designation developed in previous sampling programs.

<sup>b</sup> Unitless.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

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

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 3-2. Groundwater 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)	Rad (μR/hr)
MW01	MW-DU-001	7.60	18.3	0.524	12.69	6
MW02	MW-DU-002	6.44	16.1	0.533	11.06	5
MW03	MW-DU-003	6.69	16.7	0.513	10.55	5
MW04	MW-DU-004	7.16	23.8	0.593	10.06	5.5
MW05	MW-DU-005	7.30	17.6	4.10	12.58	5
MW06	MW-DU-006	7.20	16.1	0.563	11.36	5
MW07	MW-DU-007	7.18	17.8	0.356	10.08	6
MW08	MW-DU-008	7.49	17.1	0.517	12.62	6
MW09	MW-DU-009	7.27	15.8	12.2	12.96	5
MW10	MW-DU-0010	6.96	18.9	0.500	10.78	5
MW11	MW-DU-0011	7.48	15.9	1.82	12.62	6

\* Represents sample designation developed in previous sampling programs.

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

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/g)
SWS01	SW-DU-001	U-234	0.197J
SWS01	SW-DU-001	U-235	0.010U
SWS01	SW-DU-001	U-238	0.195
<b>Total Uranium</b>			<b>0.40</b>
U-238/U-234 Ratio <sup>b</sup>			0.99
SWS02	SW-DU-002	U-234	0.206J
SWS02	SW-DU-002	U-235	0.026U
SWS02	SW-DU-002	U-238	0.295
<b>Total Uranium</b>			<b>0.53</b>
U-238/U-234 Ratio <sup>b</sup>			1.43
SWS04	SW-DU-004	U-234	0.102J
SWS04	SW-DU-004	U-235	0.025U
SWS04	SW-DU-004	U-238	0.151
<b>Total Uranium</b>			<b>0.28</b>
U-238/U-234 Ratio <sup>b</sup>			1.48
SWS04	SW-DU-004D	U-234	0.107J
SWS04	SW-DU-004D	U-235	0.011U
SWS04	SW-DU-004D	U-238	0.181
<b>Total Uranium</b>			<b>0.30</b>
U-238/U-234 Ratio <sup>b</sup>			1.69
SWS05	SW-DU-005	U-234	0.85
SWS05	SW-DU-005	U-235	0.059J
SWS05	SW-DU-005	U-238	5.35
<b>Total Uranium</b>			<b>6.26</b>
U-238/U-234 Ratio <sup>b</sup>			6.29
SWS07	SW-DU-007	U-234	0.176J
SWS07	SW-DU-007	U-235	0.023U
SWS07	SW-DU-007	U-238	0.124
<b>Total Uranium</b>			<b>0.32</b>
U-238/U-234 Ratio <sup>b</sup>			0.70
SWS08	SW-DU-008	U-234	0.158J
SWS08	SW-DU-008	U-235	0.029J
SWS08	SW-DU-008	U-238	0.342
<b>Total Uranium</b>			<b>0.53</b>
U-238/U-234 Ratio <sup>b</sup>			2.16

<sup>a</sup> Represents sample designation developed in previous sampling programs.

<sup>b</sup> Unitless.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

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

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

**Table 3-4. Surface Water Quality Parameters and Exposure Readings  
Jefferson Proving Ground, Madison, Indiana**

JPG Sample Designation <sup>a</sup>	Sample I.D.	pH	Temp (°C)	Conductivity (microSiemens/cm)	Dissolved Oxygen (mg/L)	Rad (μR/hr)
SWS01	SW-DU-001	5.98	17.9	0.307	2.40	6
SWS02	SW-DU-002	6.43	18.4	0.214	5.02	5
SWS03 <sup>b</sup>	SW-DU-003					
SWS04	SW-DU-004	7.90	18.6	0.249	5.02	5
SWS05	SW-DU-005	7.84	17.4	0.233	5.68	6
SWS06 <sup>b</sup>	SW-DU-006					
SWS07	SW-DU-007	7.81	23.3	0.257	1.12	5
SWS08	SW-DU-008	6.99	18.4	0.251	1.95	5

<sup>a</sup> Represents sample designation developed in previous sampling programs

<sup>b</sup> Dry stream precluded collection of sample and associated data.

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

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/g)
SES01	SD-DU-001	U-234	0.31
SES01	SD-DU-001	U-235	0.028U
SES01	SD-DU-001	U-238	0.244
<b>Total Uranium</b>			<b>0.58</b>
U-238/U-234 Ratio <sup>b</sup>			0.79
SES02	SD-DU-002	U-234	0.257
SES02	SD-DU-002	U-235	0.033U
SES02	SD-DU-002	U-238	0.289
<b>Total Uranium</b>			<b>0.58</b>
U-238/U-234 Ratio <sup>b</sup>			1.12
SES03	SD-DU-003	U-234	1.20
SES03	SD-DU-003	U-235	0.048U
SES03	SD-DU-003	U-238	0.94
<b>Total Uranium</b>			<b>2.19</b>
U-238/U-234 Ratio <sup>b</sup>			0.78
SES03D	SD-DU-003D	U-234	1.03
SES03D	SD-DU-003D	U-235	0.025U
SES03D	SD-DU-003D	U-238	0.90
<b>Total Uranium</b>			<b>1.96</b>
U-238/U-234 Ratio <sup>b</sup>			0.87
SES04	SD-DU-004	U-234	0.138
SES04	SD-DU-004	U-235	0.005U
SES04	SD-DU-004	U-238	0.161
<b>Total Uranium</b>			<b>0.30</b>
U-238/U-234 Ratio <sup>b</sup>			1.17
SES05	SD-DU-005	U-234	0.277
SES05	SD-DU-005	U-235	0.028J
SES05	SD-DU-005	U-238	0.32
<b>Total Uranium</b>			<b>0.63</b>
U-238/U-234 Ratio <sup>b</sup>			1.16

**Table 3-5. Uranium in Sediment  
Jefferson Proving Ground, Madison, Indiana (Continued)**

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/g)
SES06	SD-DU-006	U-234	0.79
SES06	SD-DU-006	U-235	0.046J
SES06	SD-DU-006	U-238	0.63
<b>Total Uranium</b>			<b>1.47</b>
U-238/U-234 Ratio <sup>b</sup>			0.80
SES07	SD-DU-007	U-234	0.98
SES07	SD-DU-007	U-235	0.062J
SES07	SD-DU-007	U-238	0.82
<b>Total Uranium</b>			<b>1.86</b>
U-238/U-234 Ratio <sup>b</sup>			0.84
SES08	SD-DU-008	U-234	0.261
SES08	SD-DU-008	U-235	0.009U
SES08	SD-DU-008	U-238	0.207
<b>Total Uranium</b>			<b>0.48</b>
U-238/U-234 Ratio <sup>b</sup>			0.79

<sup>a</sup> Represents sample designation developed in previous sampling programs.

<sup>b</sup> Unitless.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

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

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



**Table 3-6. Uranium in Surface Soil  
Jefferson Proving Ground, Madison, Indiana**

JPG Sample Designation <sup>a</sup>	Sample I.D.	Analyte	Result (pCi/g)
SOS01	SS-DU-001	U-234	0.82
SOS01	SS-DU-001	U-235	0.090J
SOS01	SS-DU-001	U-238	0.88
<b>Total Uranium</b>			<b>1.79</b>
U-238/U-234 Ratio <sup>b</sup>			1.07
SOS02	SS-DU-002	U-234	0.87
SOS02	SS-DU-002	U-235	0.047J
SOS02	SS-DU-002	U-238	0.68
<b>Total Uranium</b>			<b>1.60</b>
U-238/U-234 Ratio <sup>b</sup>			0.78
SOS03	SS-DU-003	U-234	0.66
SOS03	SS-DU-003	U-235	0.029U
SOS03	SS-DU-003	U-238	0.83
<b>Total Uranium</b>			<b>1.52</b>
U-238/U-234 Ratio <sup>b</sup>			1.26
SOS03D	SS-DU-003D	U-234	0.68
SOS03D	SS-DU-003D	U-235	0.046J
SOS03D	SS-DU-003D	U-238	0.74
<b>Total Uranium</b>			<b>1.47</b>
U-238/U-234 Ratio <sup>b</sup>			1.09
SOS04	SS-DU-004	U-234	1.07
SOS04	SS-DU-004	U-235	0.070J
SOS04	SS-DU-004	U-238	0.93
<b>Total Uranium</b>			<b>2.07</b>
U-238/U-234 Ratio <sup>b</sup>			0.87

<sup>a</sup> Represents sample designation developed in previous sampling programs.

<sup>b</sup> Unitless.

J – Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.

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

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

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## 4. HISTORICAL DATA ASSESSMENT AND TREND ANALYSIS

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

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.<sup>1</sup> Therefore, while historical data are reported since 1998, trend analyses included in this ERM report address the time period from December 2004 to the present. Surface water and groundwater results for the April 2004 sampling event also were not trended, given that the results were provided in units of micrograms per liter ( $\mu\text{g/L}$ ) rather than pCi/L.

As noted above, the April 2006 Radiation Monitoring Report (SAIC 2006) provided detailed information about the trending methods employed and why certain data were or were not included in the initial trend analysis. To avoid confusion, that information is not repeated in this report. This report section re-examines the ERMP data for historical trends following the addition of the ERMP data collected during the October 2007 sampling 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 83 discrete samples available from 11 monitoring wells (MW01 to MW11) during the period from 2004 through October 2007, the average total uranium activity-concentration is 1.42 pCi/L, the standard deviation is 1.13 pCi/L, and the maximum detected activity-concentration is 5.27 pCi/L. The activity-concentrations at each well are well below the 150 pCi/L action level for groundwater.

Data for each monitoring well are summarized in run charts, as shown in Figures 4-1 through 4-11. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. 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. Only samples from MW-DU-008 and MW-DU-011 exhibited trend lines with  $R^2$  values greater than 0.5 (i.e., somewhat significant) (0.569 and 0.597, respectively). In these instances, however, there is a decreasing trend in total uranium concentrations.

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 3 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 re-examined in this report, with no samples warranting further scrutiny (i.e., all total uranium results

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<sup>1</sup> Total uranium is now analyzed by alpha spectroscopy using American Society for Testing and Materials (ASTM) Method D3972-90M rather than the fluorometry and gamma spectroscopy methods applied previously.

at each sampling location were within 3 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 four points that lie above the UCL. Each of the four points is for MW-DU-006. Clearly, this well has exhibited (and continues to exhibit) total uranium results exceeding that of the other wells. The U-238/U-234 ratio for each of these samples was about 1.0, eliminating DU as a likely cause. This well will continue to be monitored closely.

## 4.2 SURFACE WATER

For 63 discrete samples available from 8 surface water sampling locations (SW01 to SW08) during the period from 2004 through October 2007, the average total uranium activity-concentration is 0.52 pCi/L, the standard deviation is 0.46 pCi/L, and the maximum detected activity-concentration is 2.95 pCi/L. The activity-concentrations at each sample location are well below the 150 pCi/L action level for surface water.

Data for each surface water sampling location are summarized in run charts, as shown in Figures 4-14 through 4-21. Total uranium results are displayed along with each measurement's associated error bars. The error bars are expressed at 1.96 standard deviations and represent a 95 percent confidence interval. Where trend lines are provided, the associated coefficient of correlation also is provided (the  $R^2$  value listed 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. 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 after December 2004 (Figure 4-22).

Figure 4-22 indicates that only the data point from SW-DU-005 exceeded the UCL or was below the LCL. All of the surface water results for the October sampling event were below the mean except MW-DU-005, suggesting a general decrease in the overall uranium concentrations. These data will continue to be monitored to determine if there is a seasonal trend. Surface water sample SW-DU-005 was above the UCL in October 2005, and the April 2006 Radiation Monitoring Report (SAIC 2006) indicated that this sampling location should be monitored closely. The October 2007 result for SW-DU-005 is a factor of about 2 higher than any previous result for this location. In addition, the U-238:U-234 isotopic ratio of 6.29 is much higher than would be expected. Investigation into the aberrant results consisted of review of the laboratory data package; recounting of the applicable sample to assess the potential for laboratory error; review of field logbooks and associated information to assess the basis for the elevated results; visual examination of the area where the sample was collected for visual evidence of DU; special emphasis during gamma walkover surveys of the creek banks; and re-collection and re-analysis of the sample. This investigation did not reveal a definitive cause for the aberrant result. Alpha spectrometry results for the re-collected sample reflected U-238 of  $0.159 \pm 0.087$  pCi/L with concentrations of U-234 and U-235 being below their respective MDCs of 0.093 and 0.061 pCi/L, respectively, while ICP/MS results indicated a total uranium concentration of 0.37  $\mu$ g/L or about 0.13 pCi/L.

### 4.3 SEDIMENT

For 70 discrete samples available from 8 sediment sampling locations (SD01 to SD08) during the period from 2004 through October 2007, the average total uranium activity-concentration is 1.01 pCi/g, the standard deviation is 0.55 pCi/g, and the maximum detected activity-concentration is 2.80 pCi/g. The activity-concentrations at each location are well below the lowest action level of 35 pCi/g.

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 October 2007 sediment sampling results vary around the mean, as expected.

### 4.4 SOILS

For 40 discrete samples available from 4 surface soil sampling locations (SS01 to SS04) during the period from 2004 through October 2007, the average total uranium activity-concentration is 1.64 pCi/g, the standard deviation is 0.23 pCi/g, and the maximum detected activity-concentration is 2.25 pCi/g. The activity-concentrations at each location are well below the lowest action level of 100 pCi/g. The October 2007 surface soil sampling results vary around the mean, as expected.

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.

Only one of the surface soil sampling locations (SS-DU-004) exhibited trend lines with  $R^2$  values greater than 0.5 (i.e., somewhat significant). SS-DU-004 has an  $R^2$  value of about 0.57 and a potentially increasing trend with respect to the total uranium concentration. Although the total uranium concentration at this location exhibited its maximum concentration in October 2007, this maximum was within the range typically expected for uranium in surface soils. It will, nonetheless, continue to be monitored and assessed.

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 after December 2004 (Figure 4-36). As data are added to the control chart, the UCL, mean, and LCL are automatically recalculated. Figure 4-36 indicates no new points above the UCL. Re-calculation of the control limits leads to one point falling below the LCL, which suggests that a single sample result might be lower than expected (as compared to the remainder). A single low result has no immediate significance to the project.

**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	$\geq 150$ pCi/L*  Less than 150 pCi/L	<p>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 Commander based on its evaluation.</p> <p>No action.</p>
Soil and Sediment:		
Perimeter and Background Samples	$\geq 35$ pCi/g  Less than 35 pCi/g	<p>Collect five additional samples in a 1-meter grid. If average activity exceeds 35 pCi/g, decontaminate to 35 pCi/g.</p> <p>No corrective action.</p>
Samples Along the Firing Line	<p>100 – 300 pCi/g</p> <p>Less than 100 pCi/g</p>	<p>Collect five additional samples in a 1-meter grid. If average activity exceeds 100 pCi/g, investigate and determine reason for high level. If &gt; 300 pCi/g verified, investigate to determine cause and contact NRC.</p> <p>No corrective action.</p>

\* Effluent concentration limit for uranium is 300 pCi/L in 10 CFR 20, Appendix B, Table 2, Column 2.

Source: CHPPM 2000 (see Appendix A, pages A-6 and A-7).

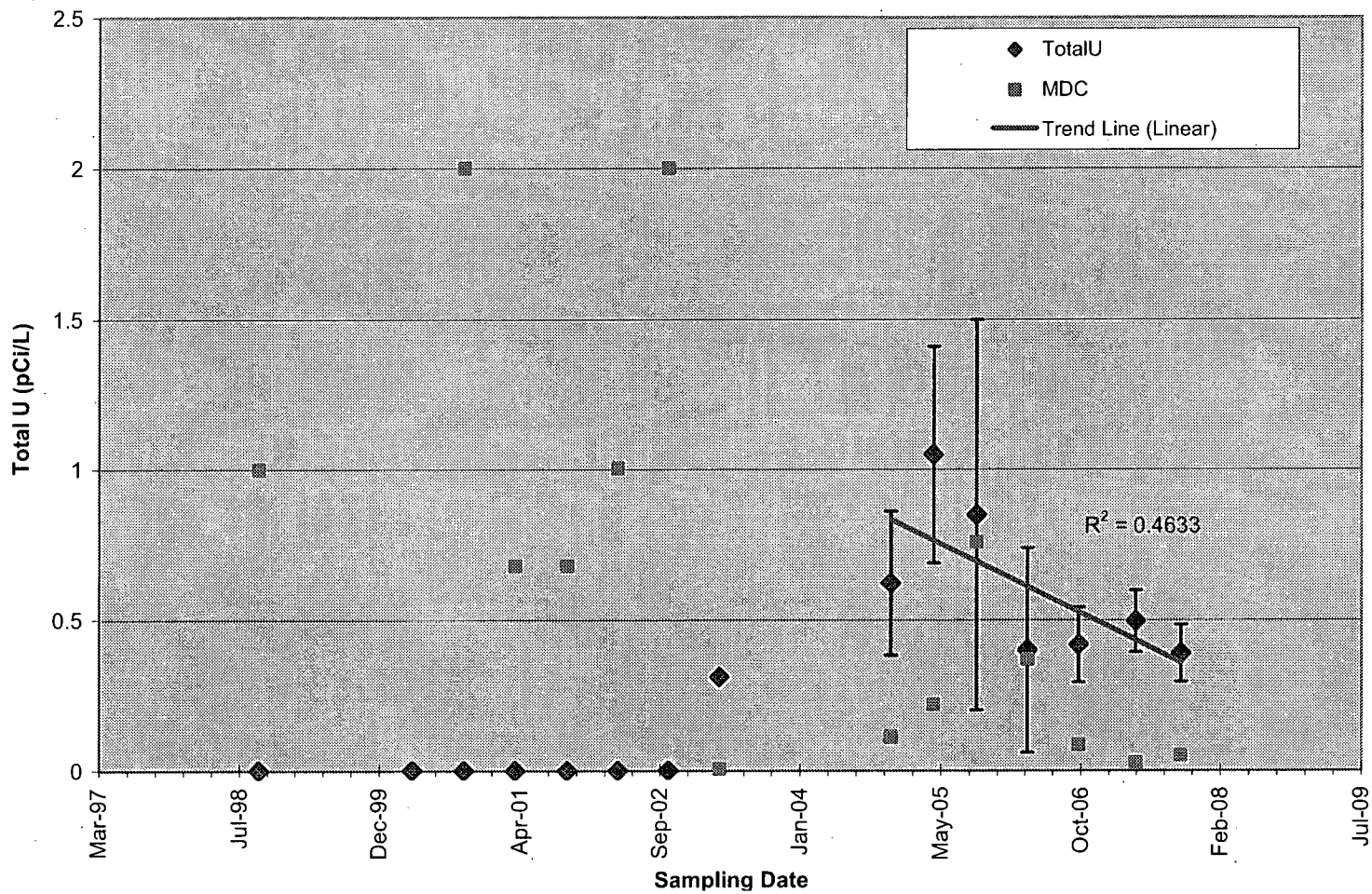


Figure 4-1. Total Uranium in MW-DU-001 (1998-2007)

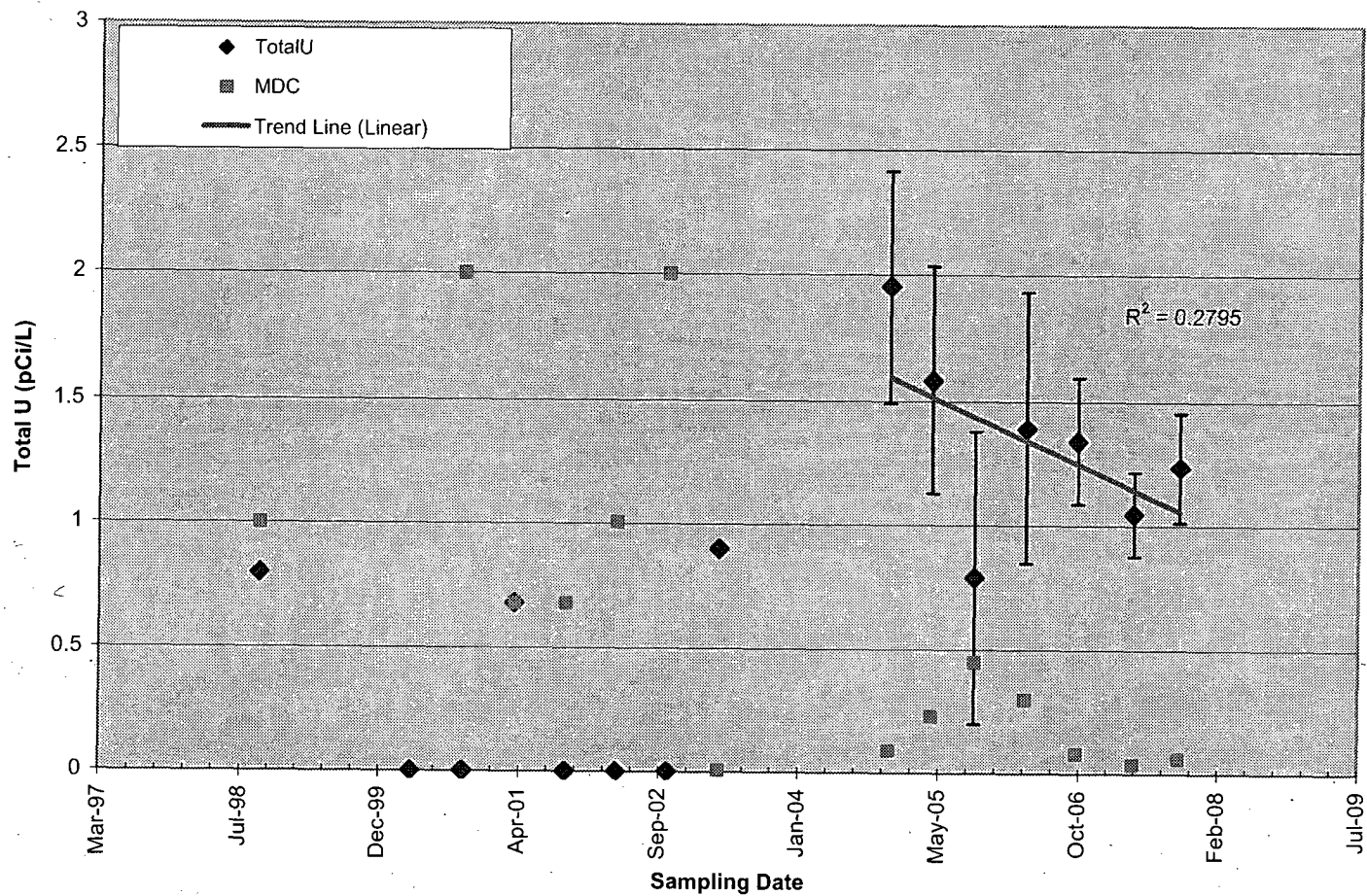


Figure 4-2. Total Uranium in MW-DU-002 (1998-2007)



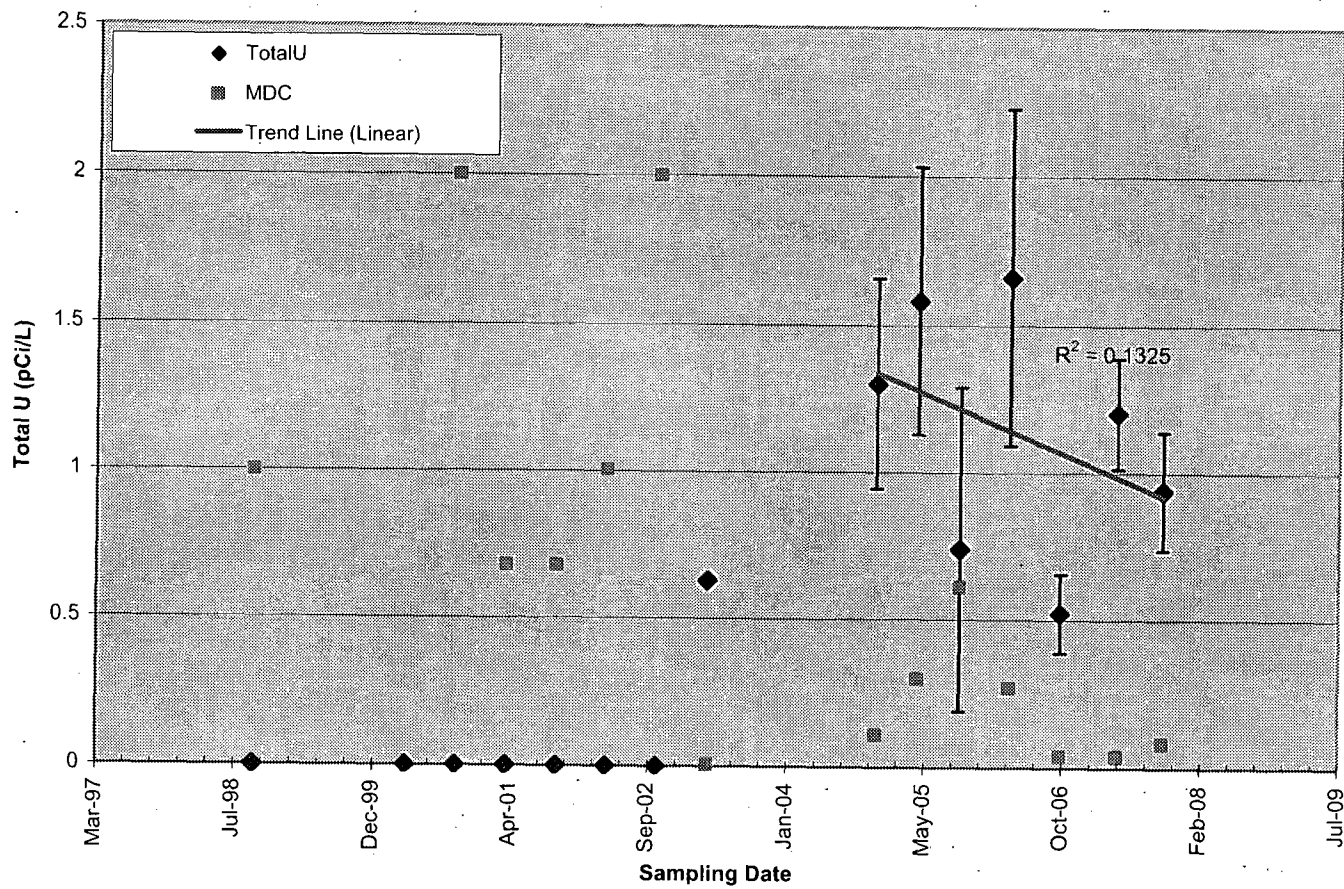


Figure 4-3. Total Uranium in MW-DU-003 (1998-2007)

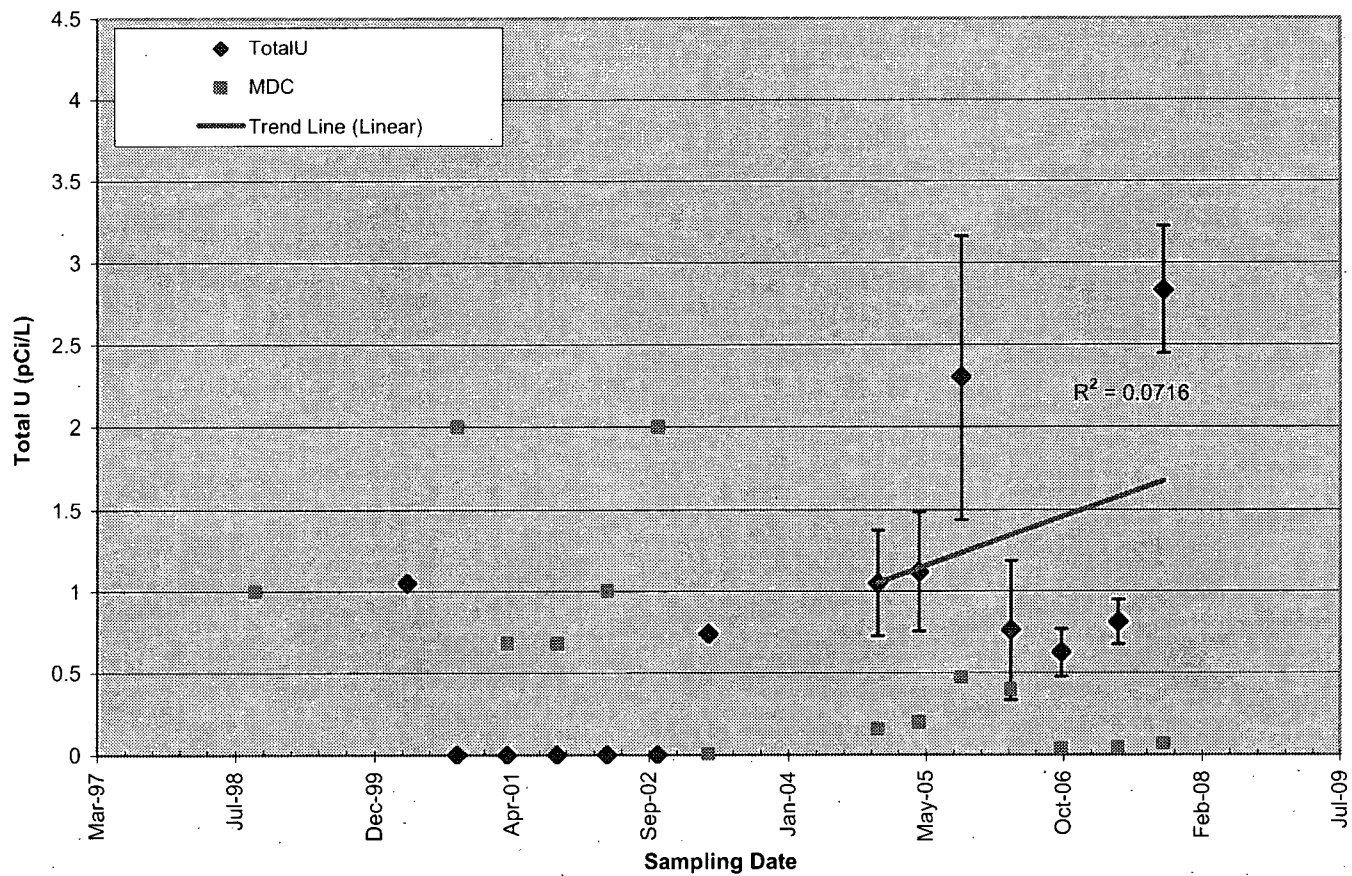


Figure 4-4. Total Uranium in MW-DU-004 (1998-2007)

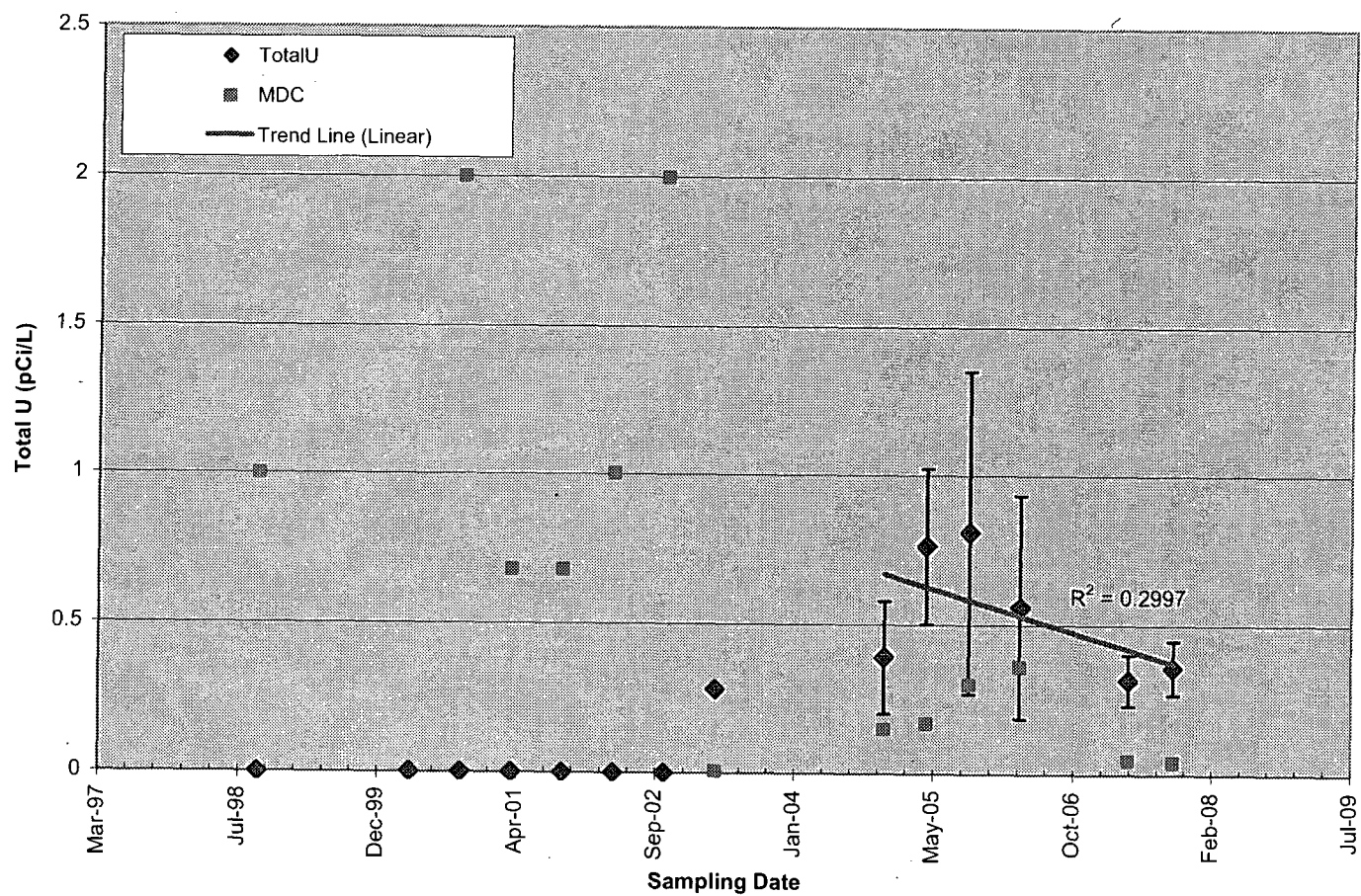
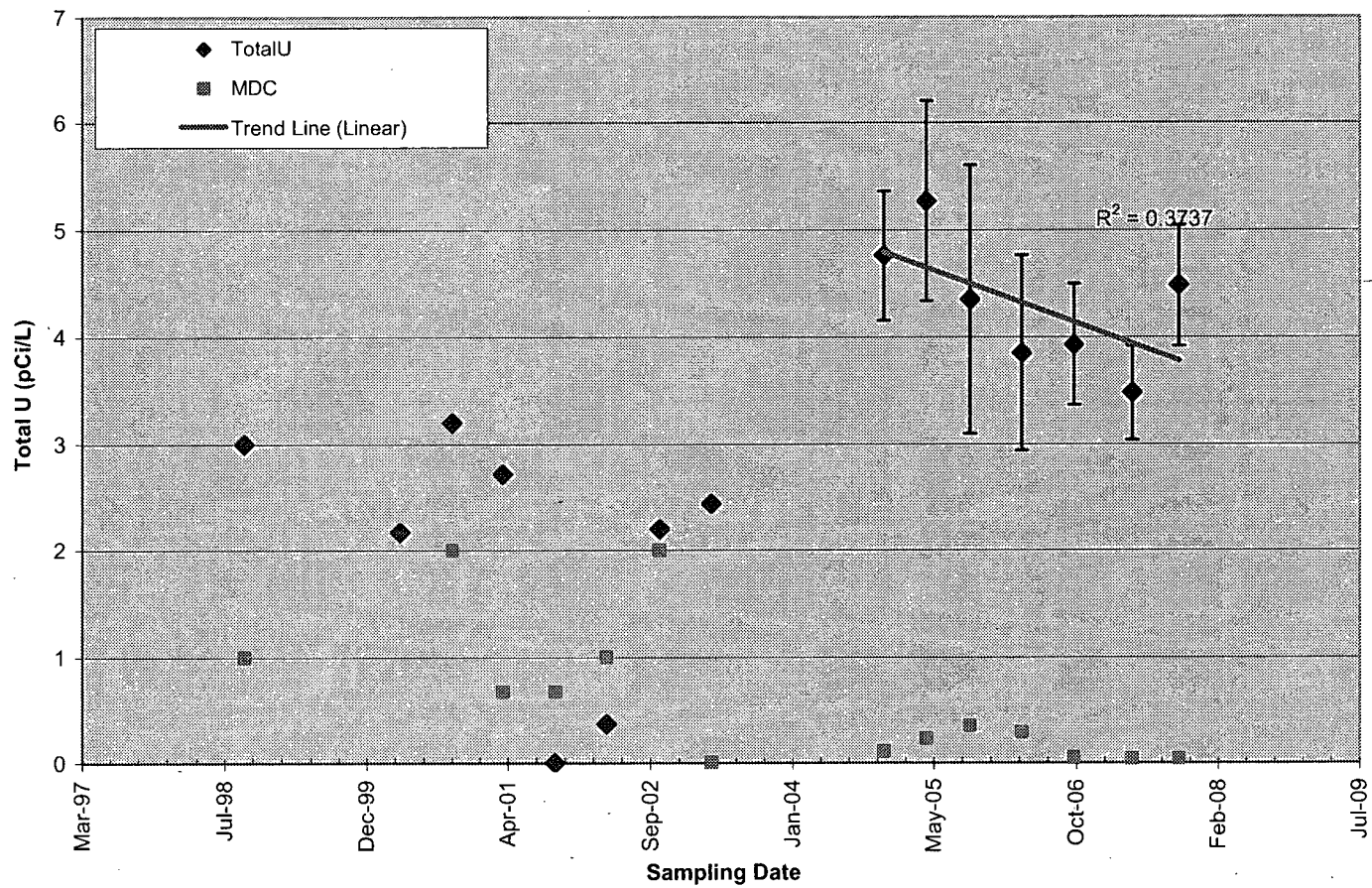


Figure 4-5. Total Uranium in MW-DU-005 (1998-2007)



NOTE: No sample was collected in October 2006 because the well was dry.

Figure 4-6. Total Uranium in MW-DU-006 (1998-2007)

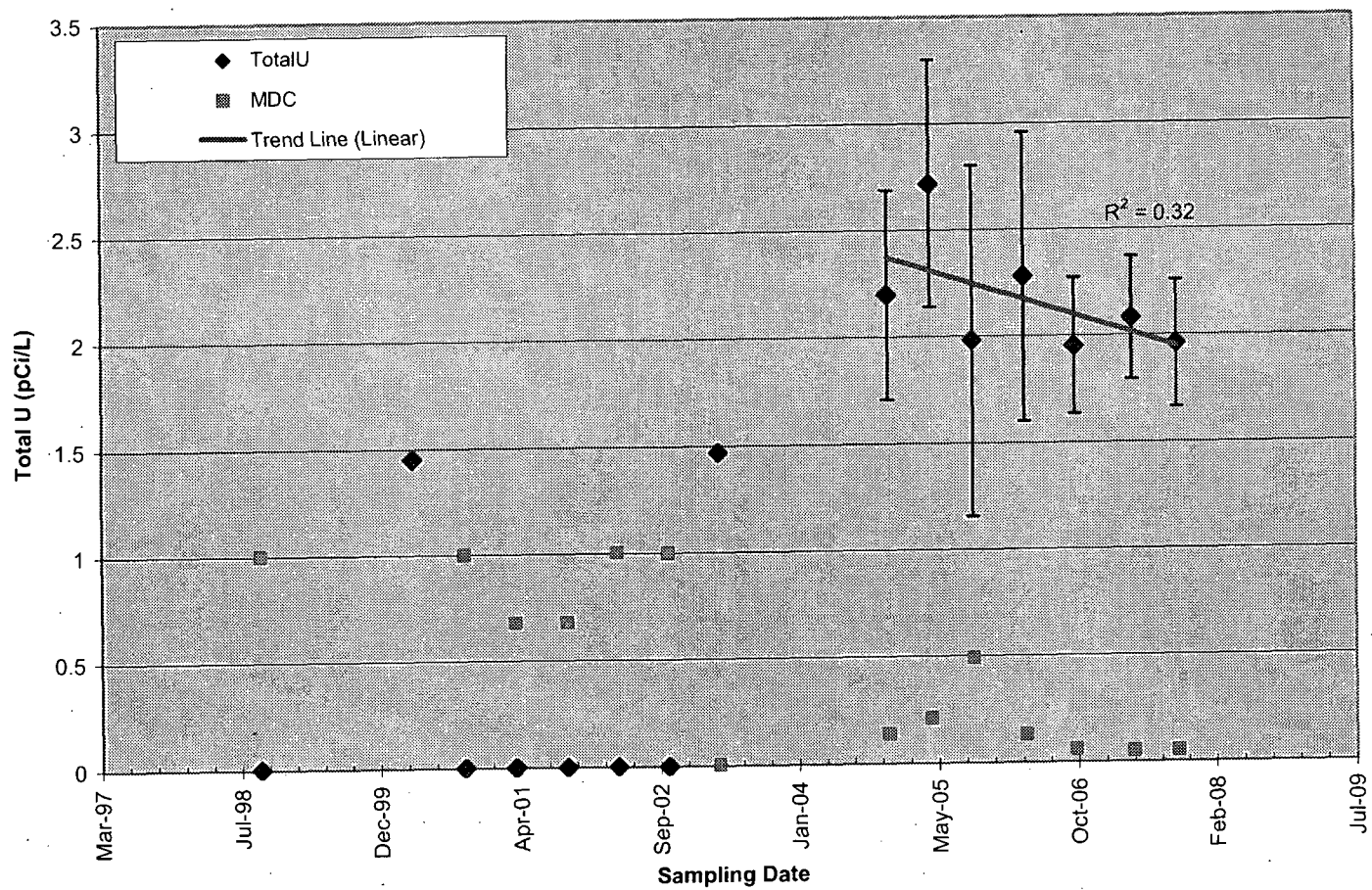


Figure 4-7. Total Uranium in MW-DU-007 (1998-2007)



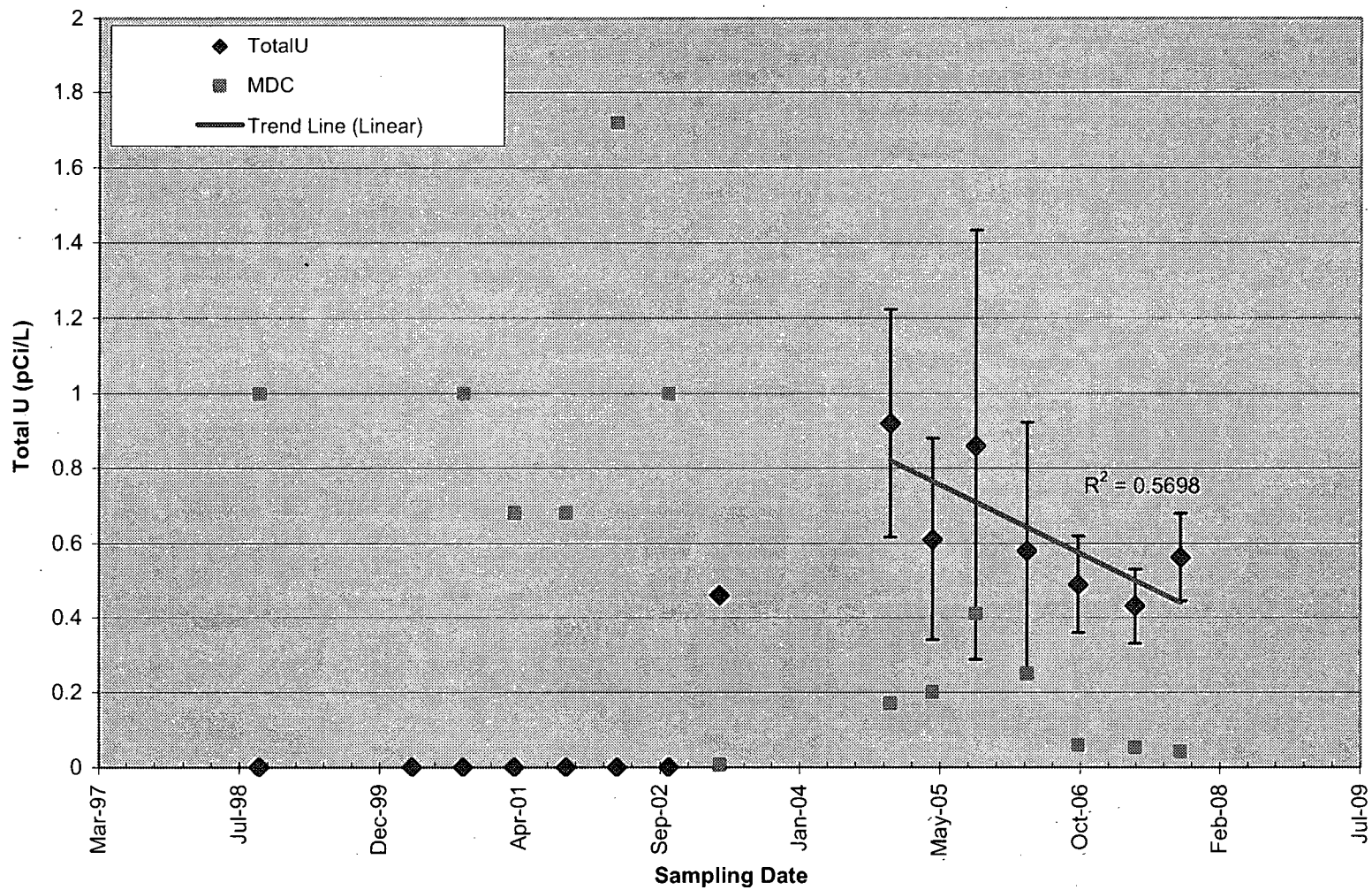


Figure 4-8. Total Uranium in MW-DU-008 (1998-2007)

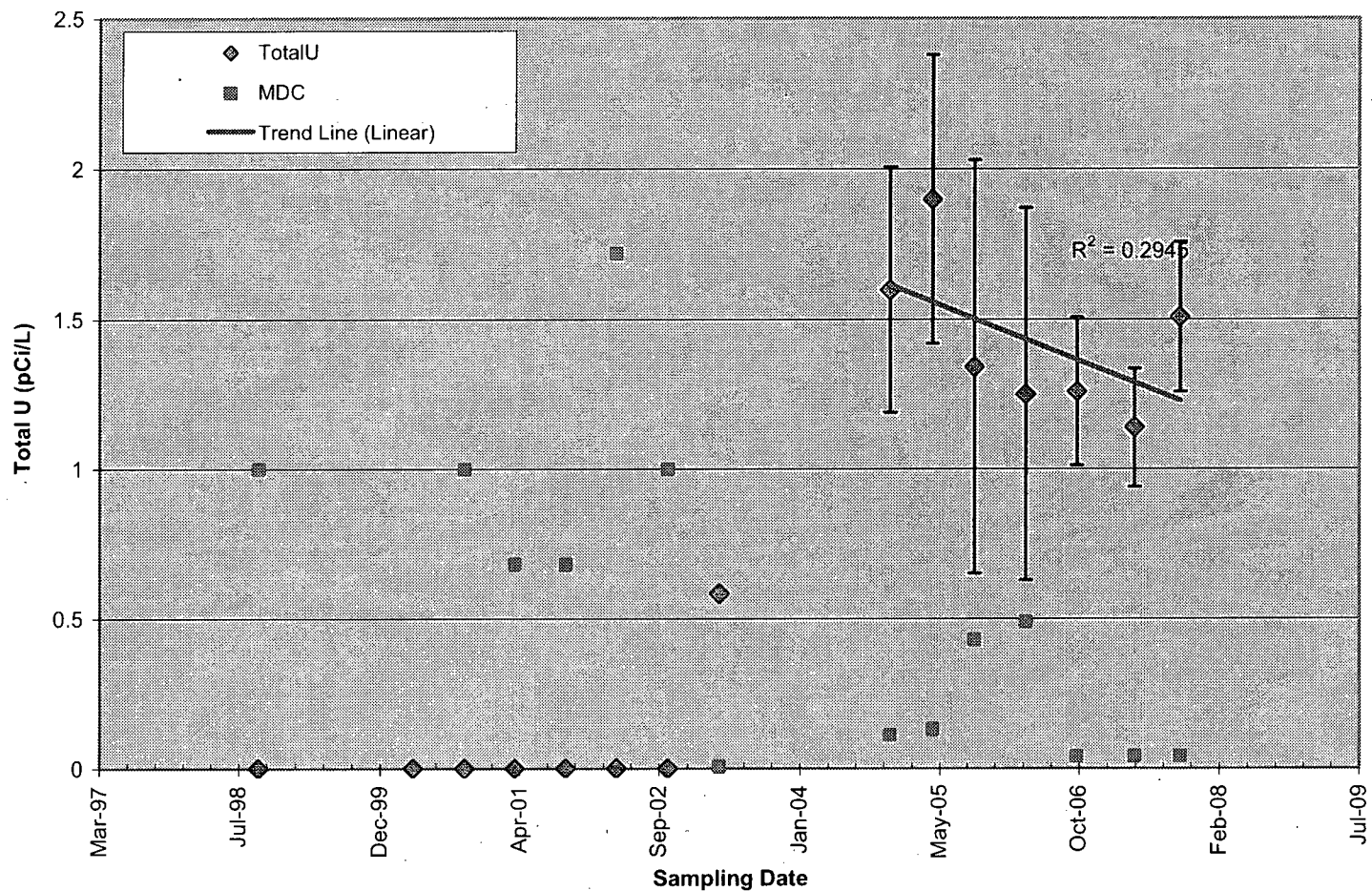


Figure 4-9. Total Uranium in MW-DU-009 (1998-2007)

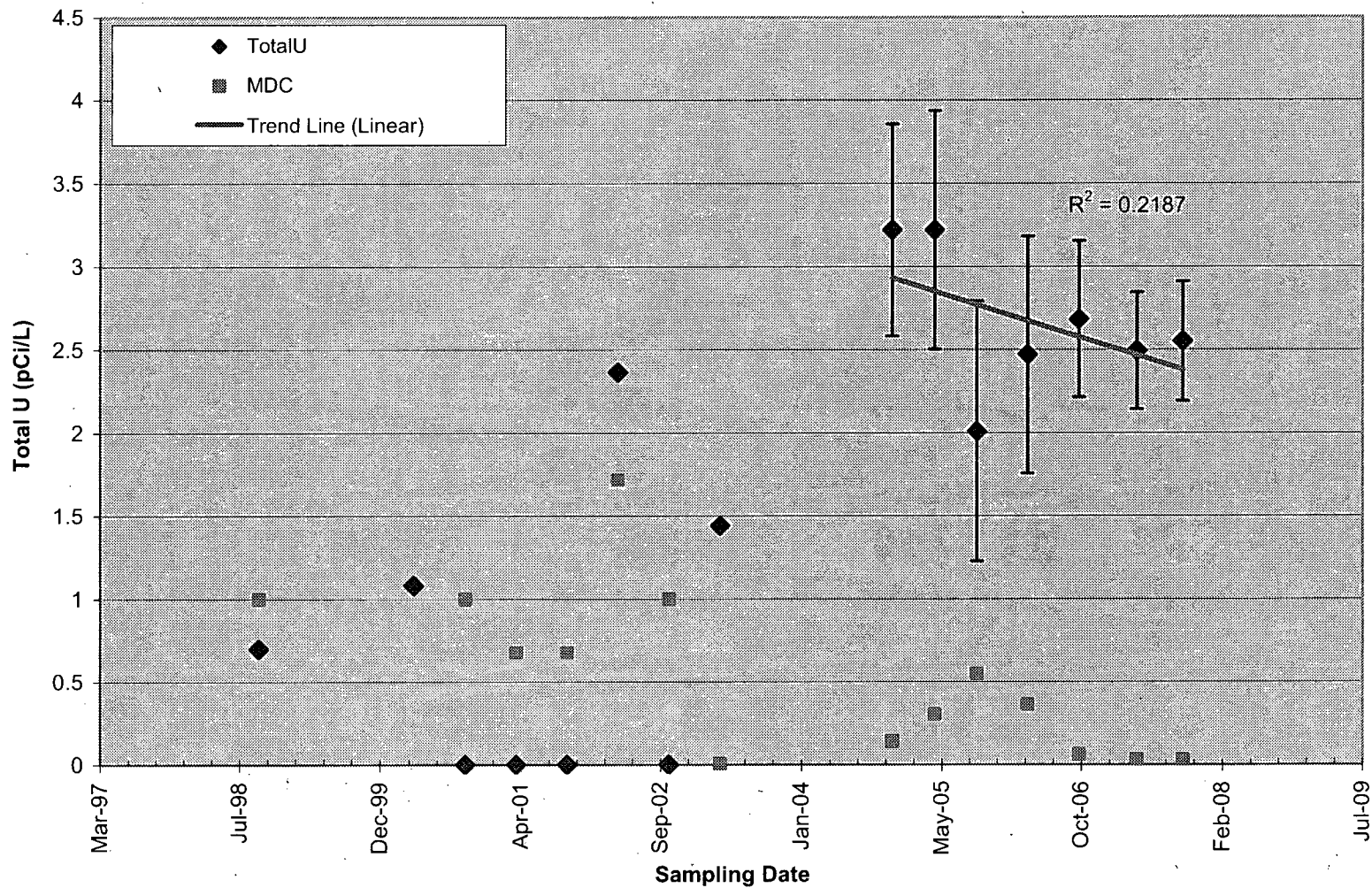
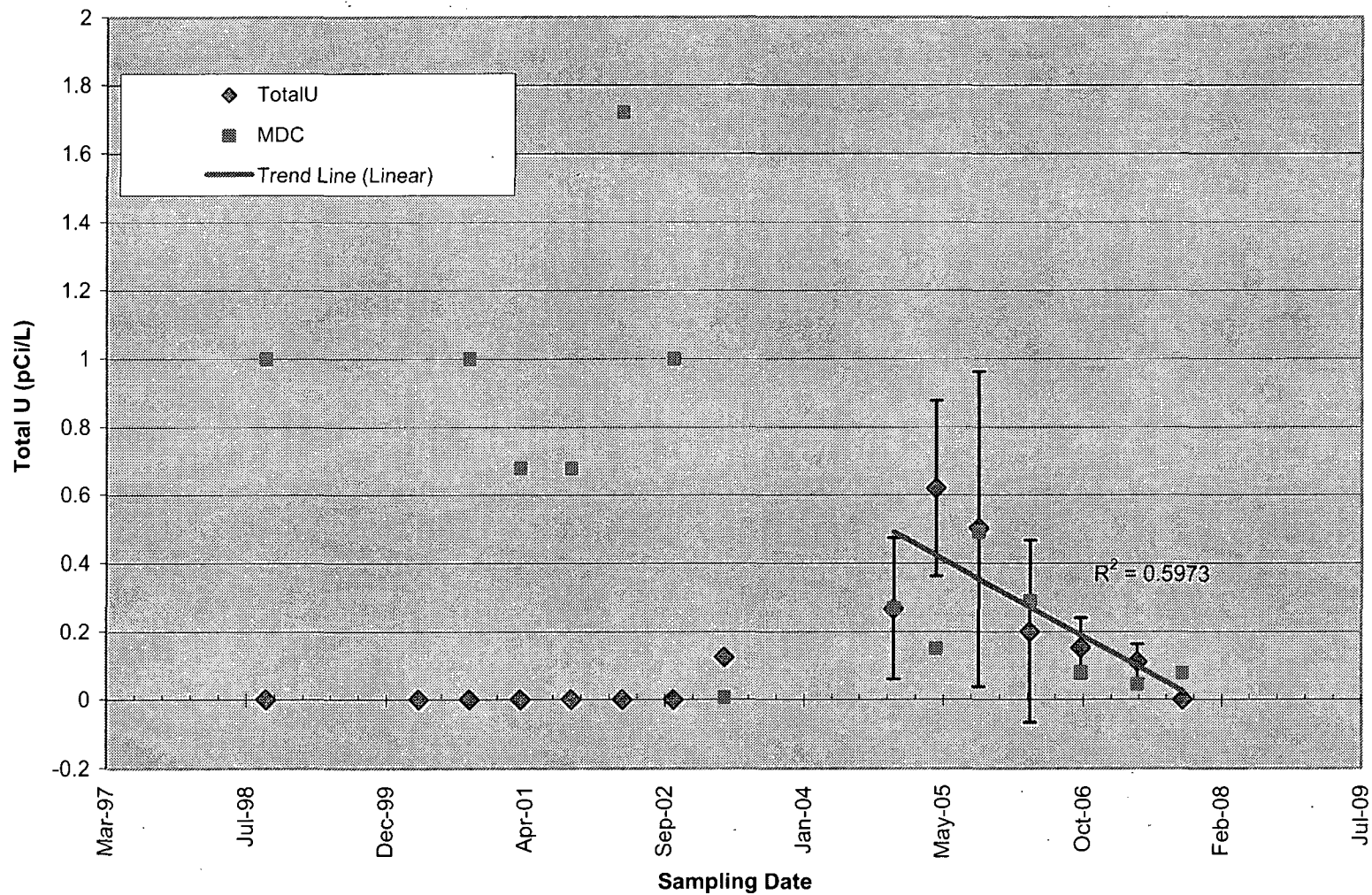


Figure 4-10. Total Uranium in MW-DU-010 (1998-2007)





NOTE: Uranium was not detected in the October 2007 sample.

Figure 4-11. Total Uranium in MW-DU-011 (1998-2007)

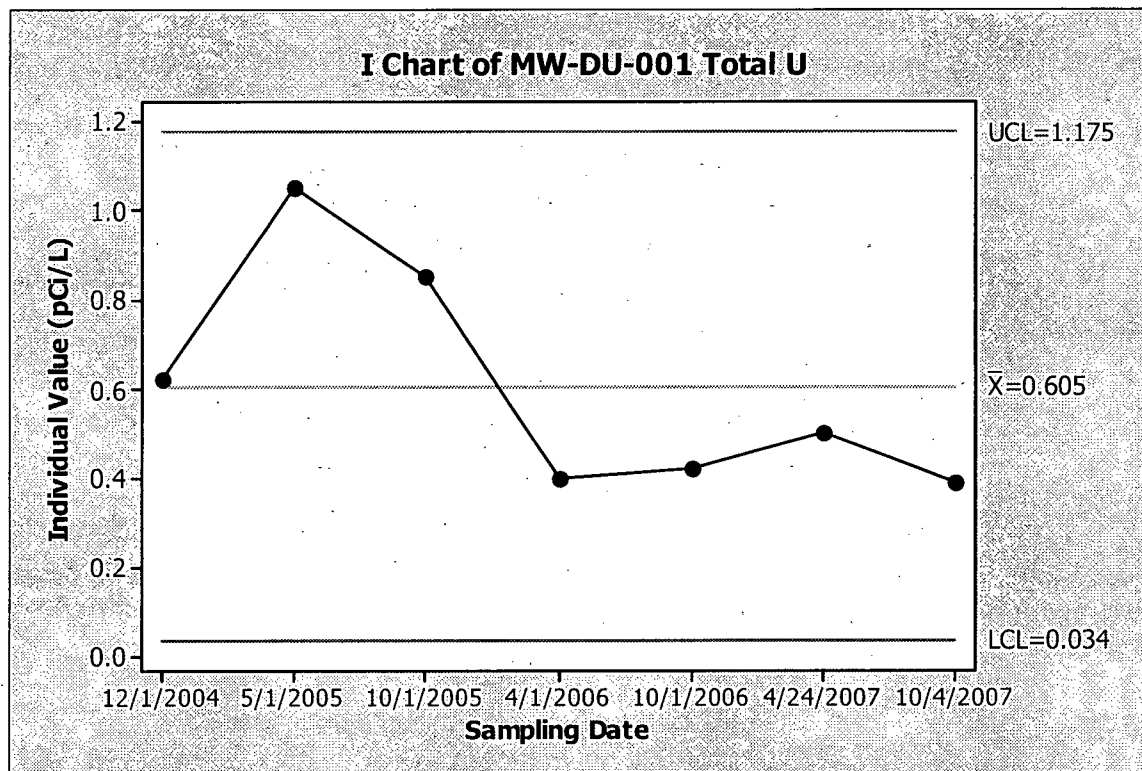


Figure 4-12. Variable Control Chart for Total Uranium in MW-DU-001 (2004-2007)

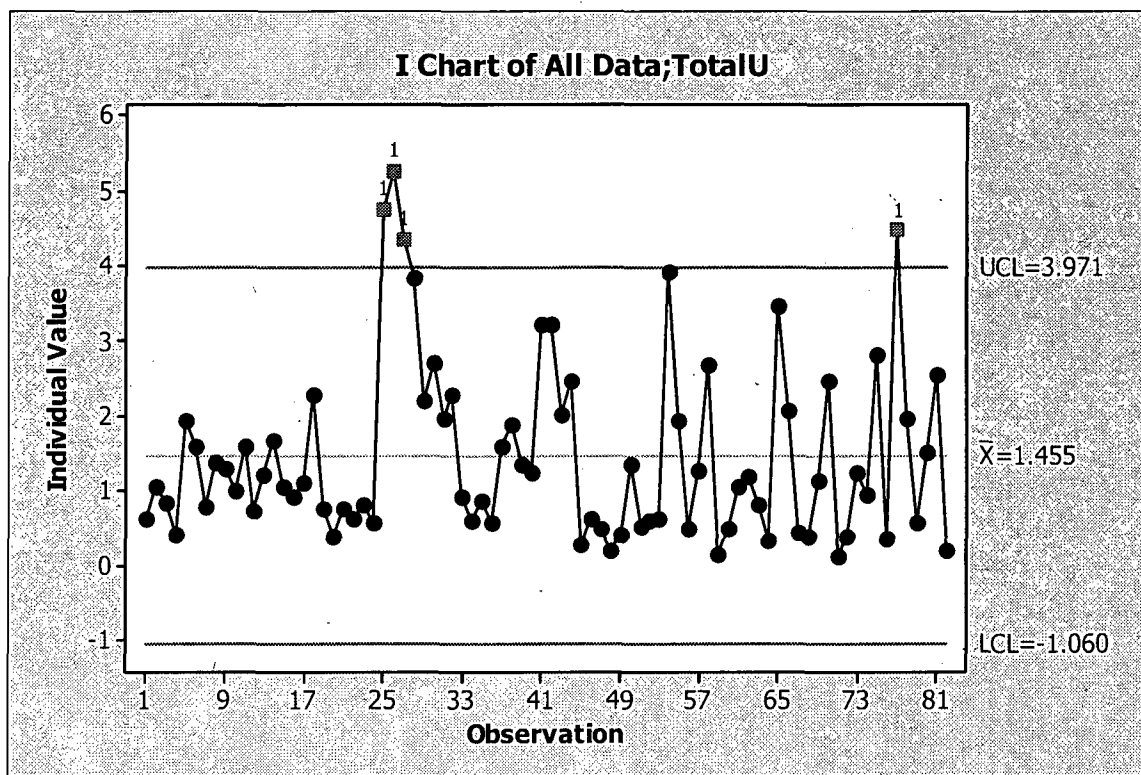


Figure 4-13. Control Chart for All Monitoring Well Data (2004-2007)

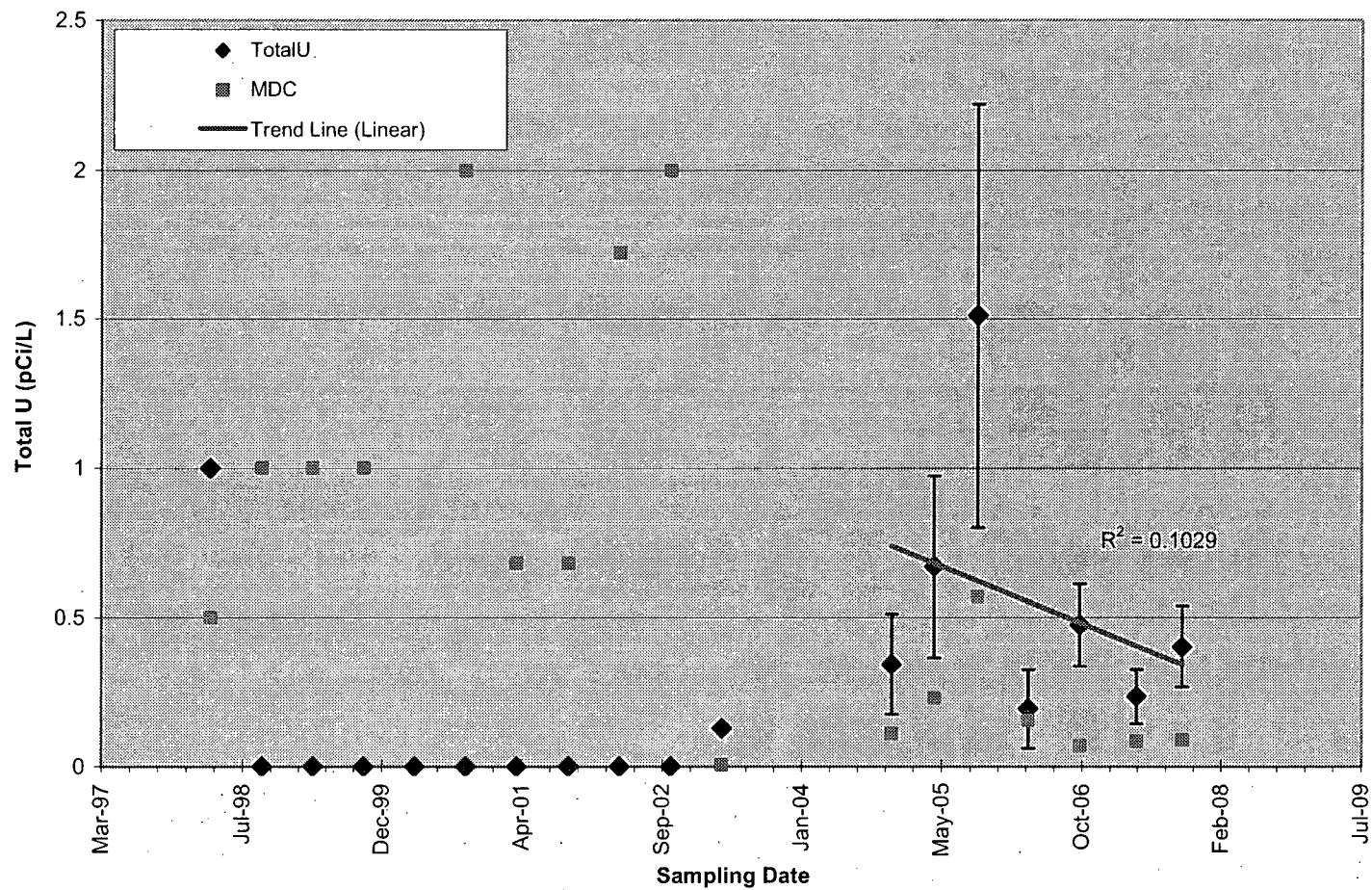


Figure 4-14. Total Uranium in SW-DU-001 (1998-2007)

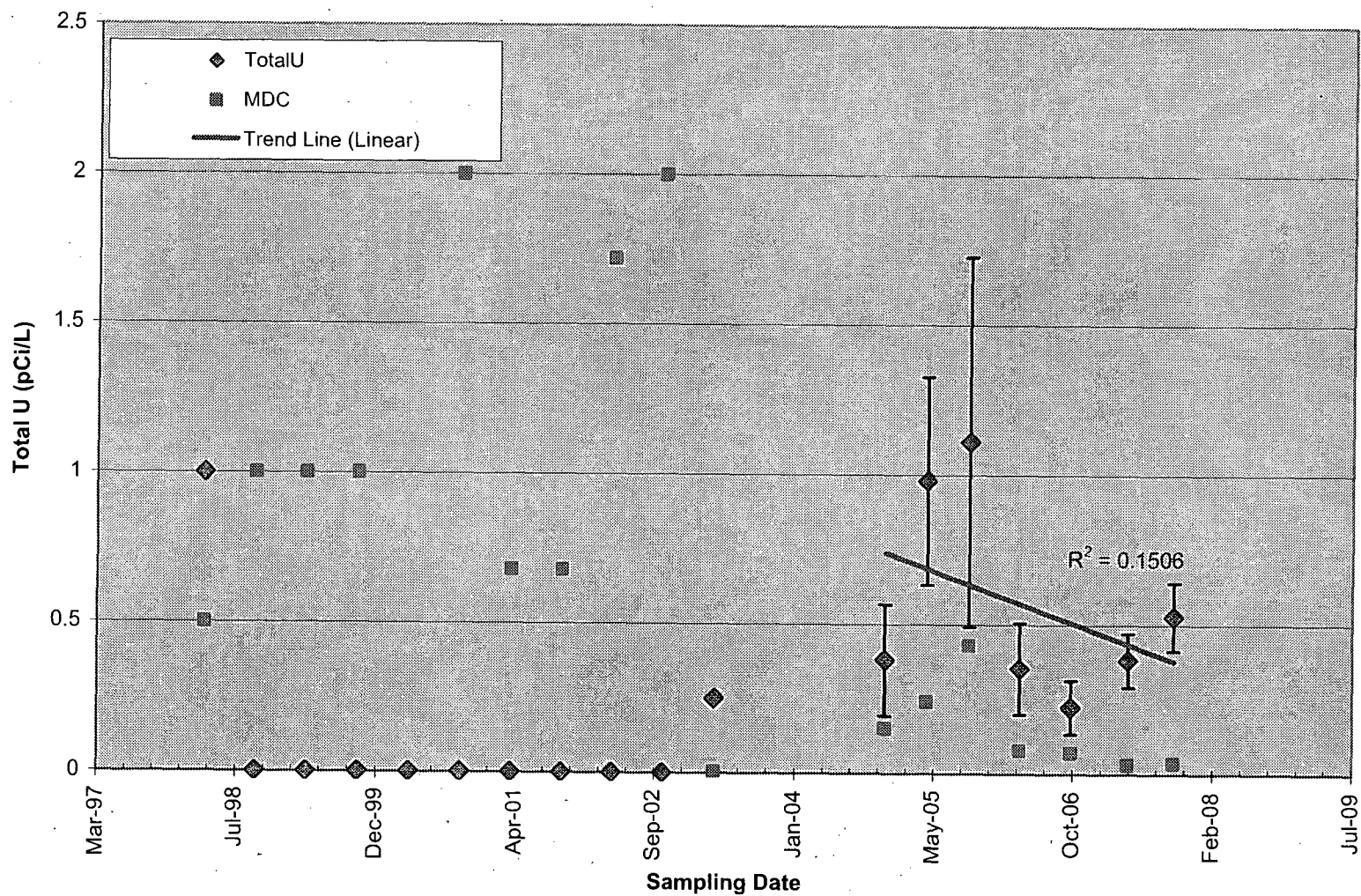
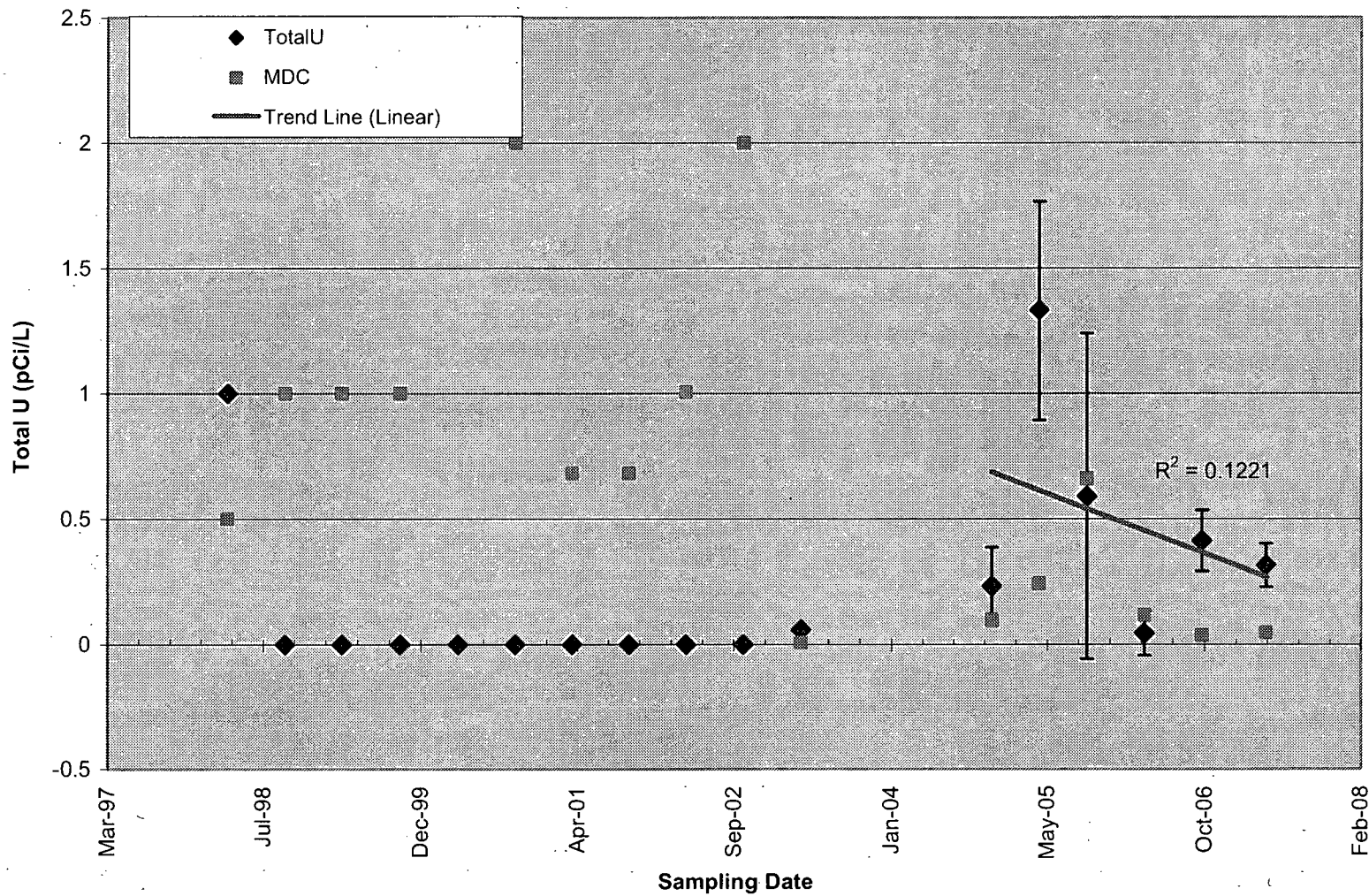


Figure 4-15. Total Uranium in SW-DU-002 (1998-2007)





NOTE: No sample collected in October 2007 as the creek was dry.

Figure 4-16. Total Uranium in SW-DU-003 (1998-2007)

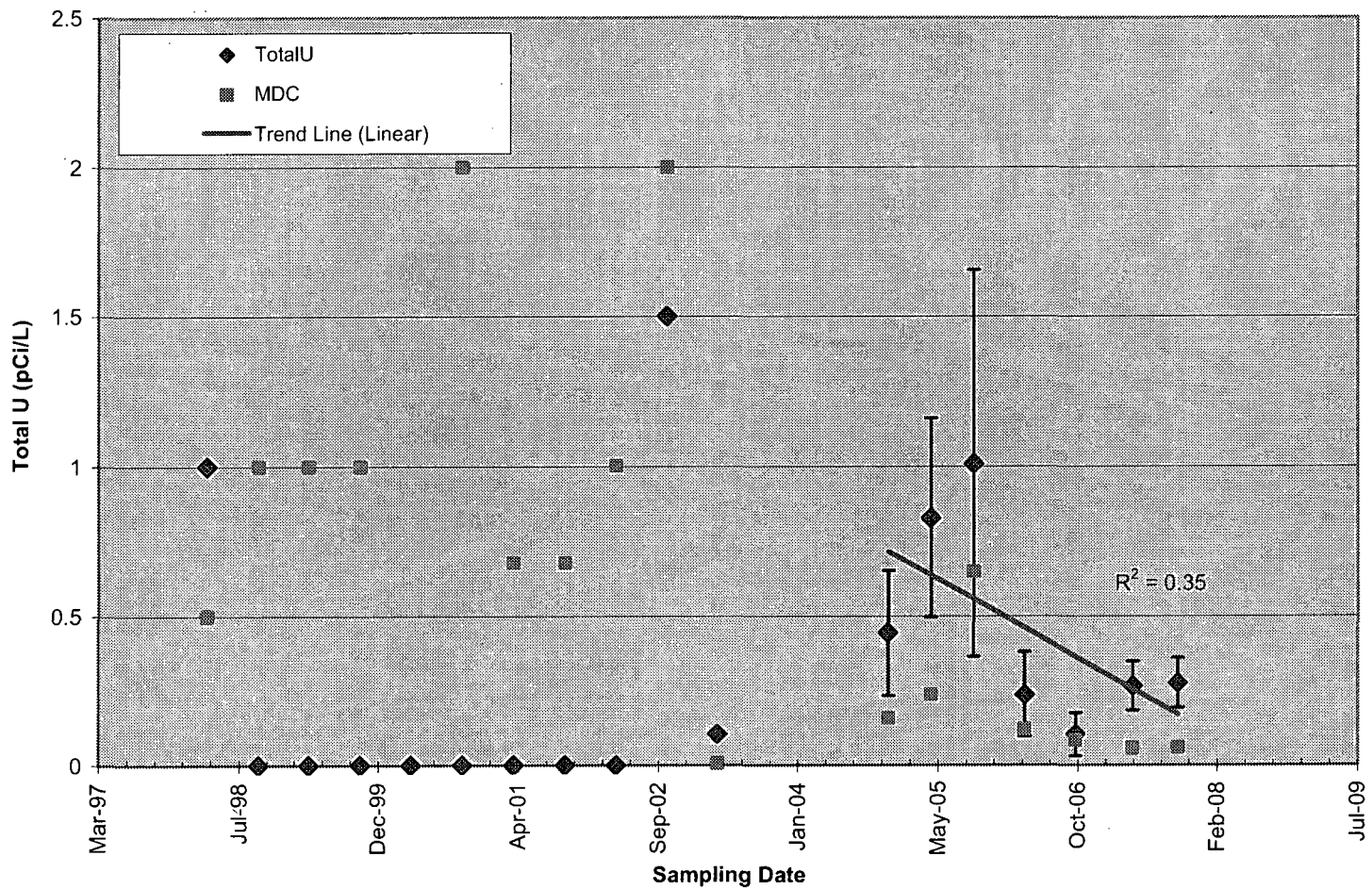
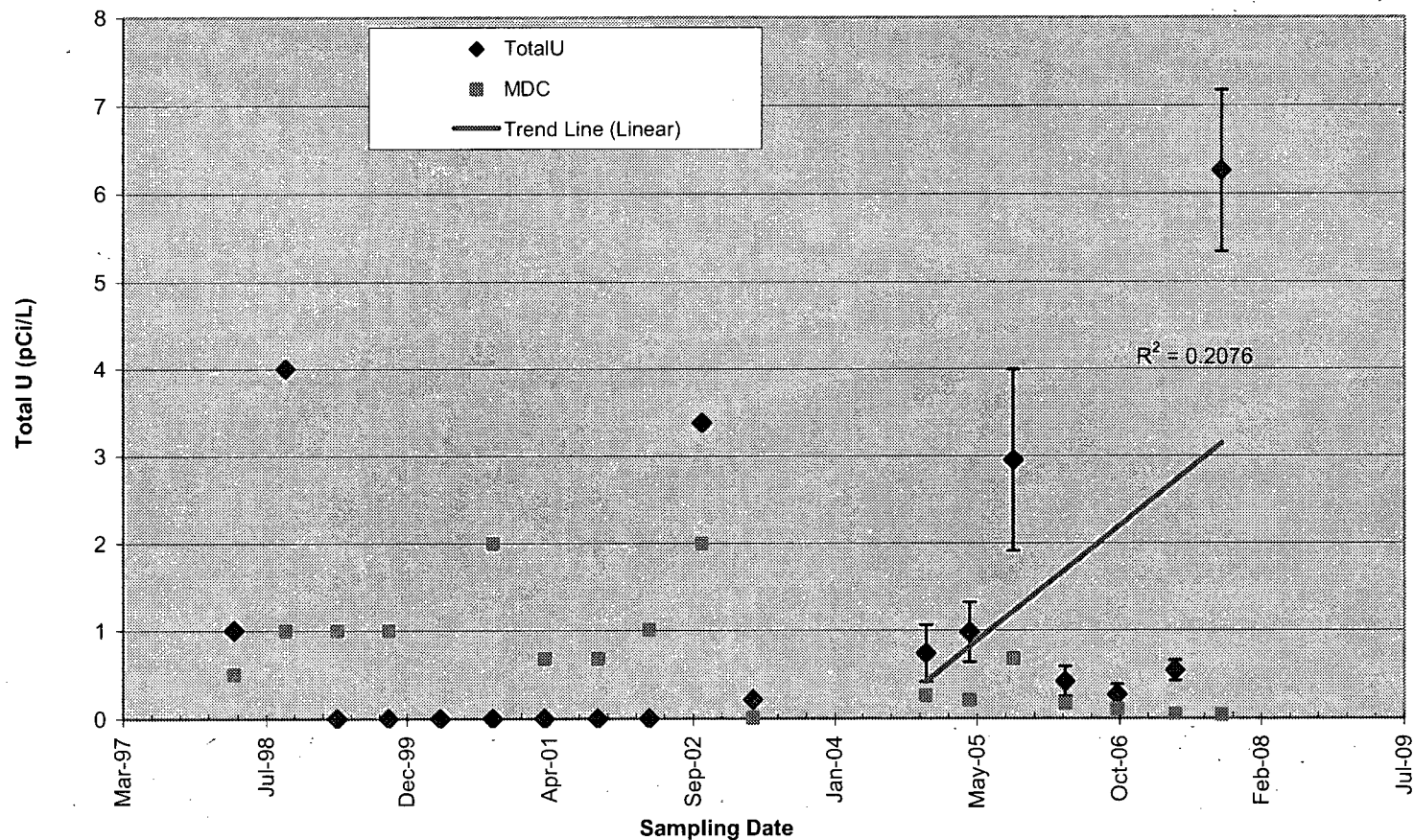


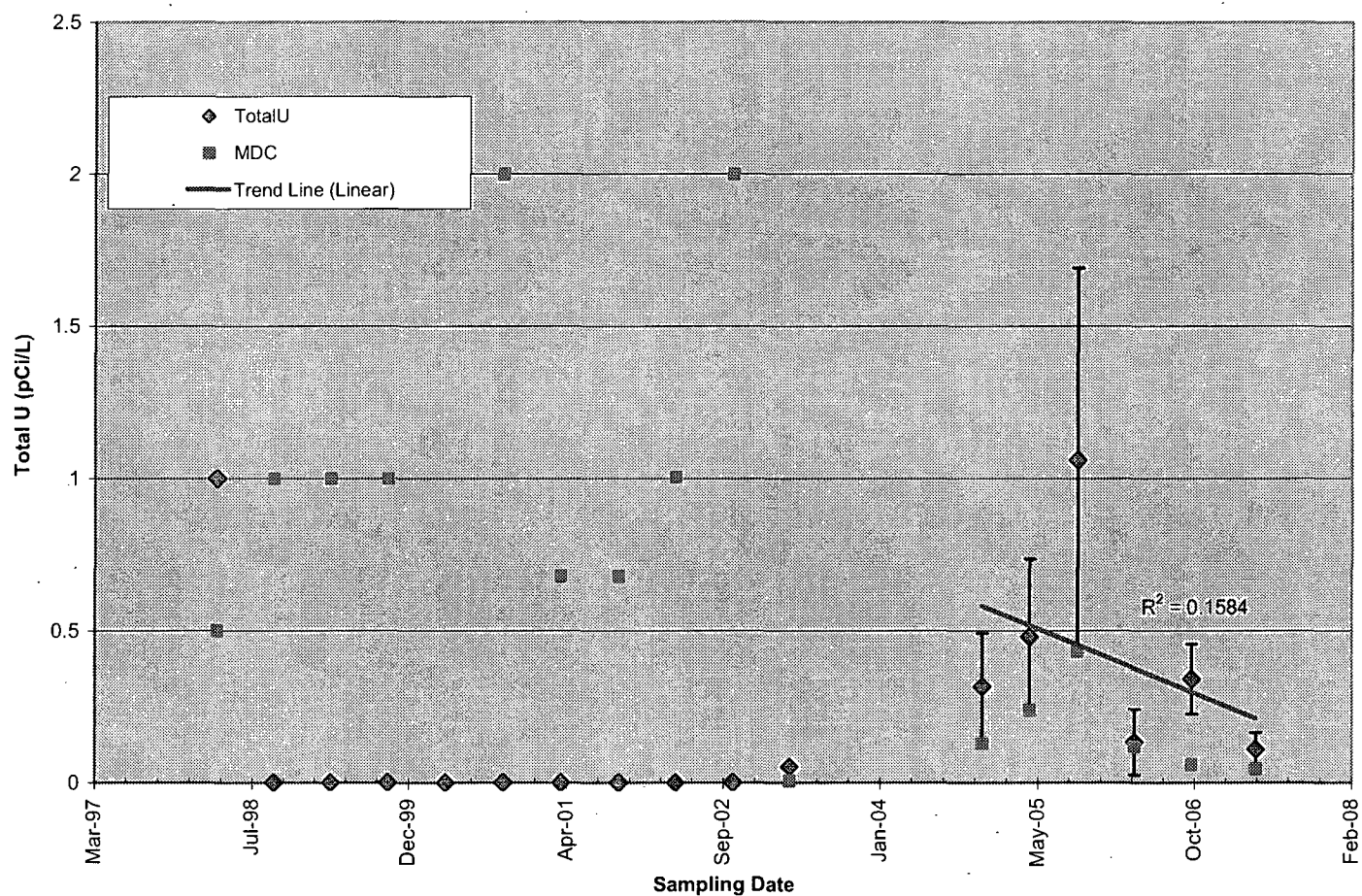
Figure 4-17. Total Uranium in SW-DU-004 (1998-2007)



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 (1998-2007)





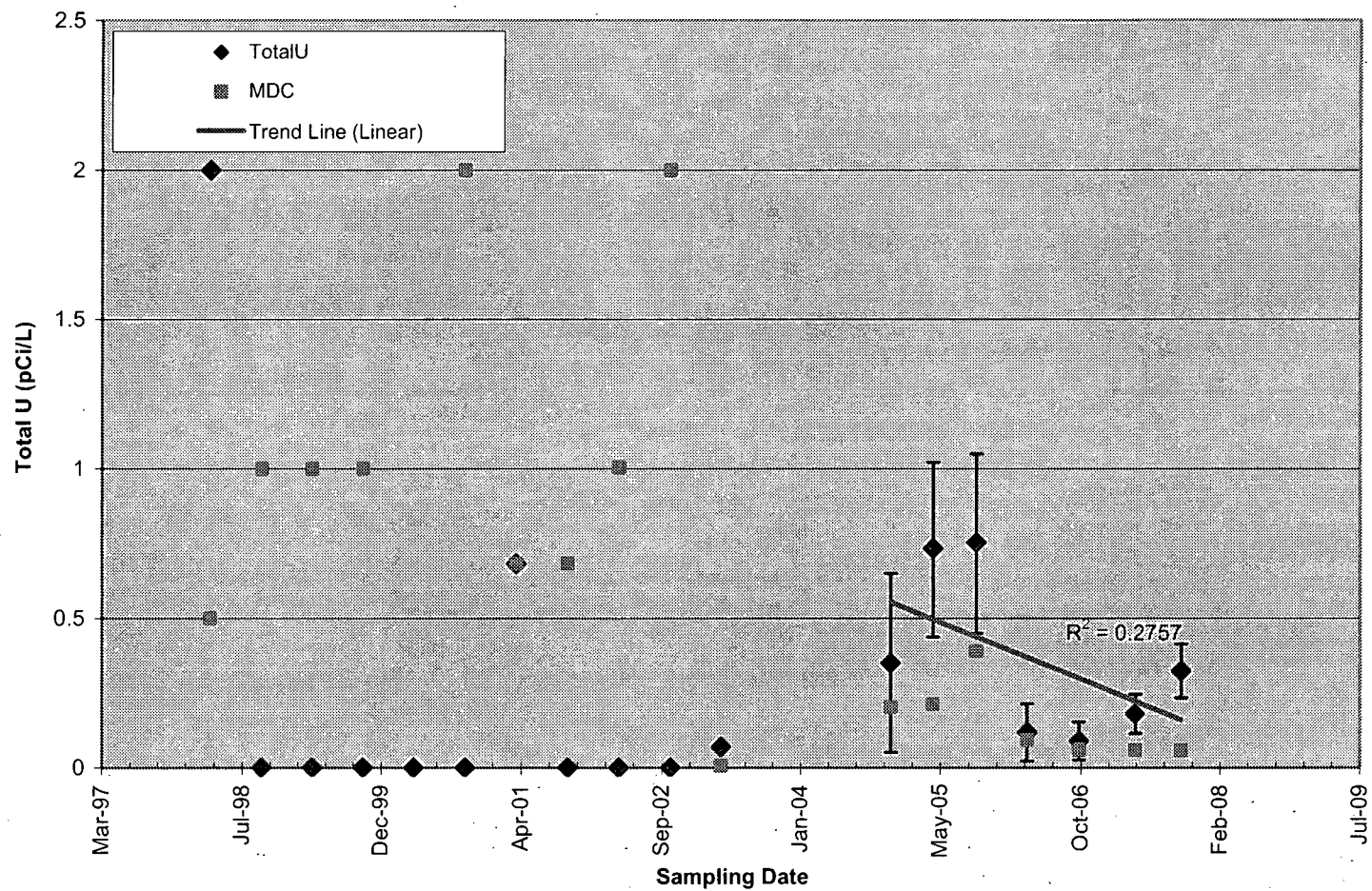


Figure 4-20. Total Uranium in SW-DU-007 (1998-2007)

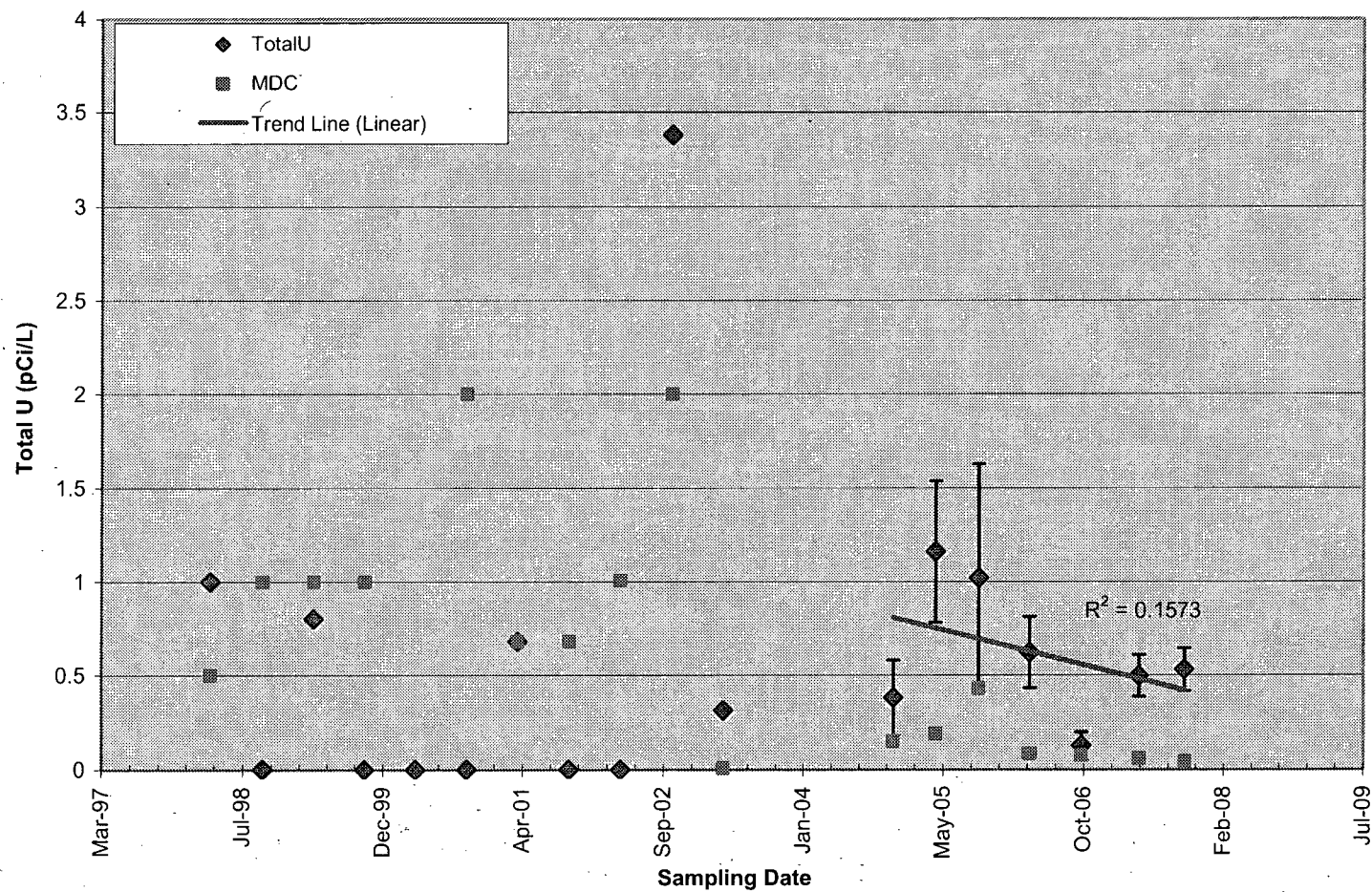


Figure 4-21. Total Uranium in SW-DU-008 (1998-2007)

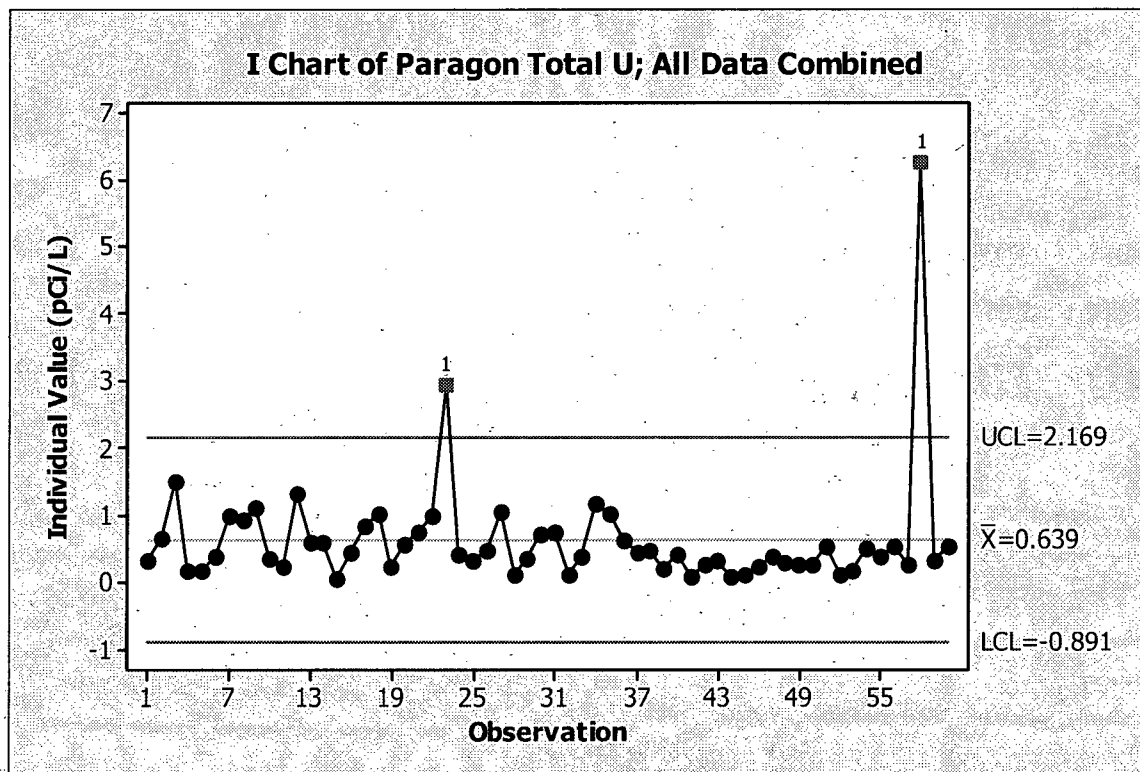


Figure 4-22. Control Chart for All Surface Water Data (2004-2007)

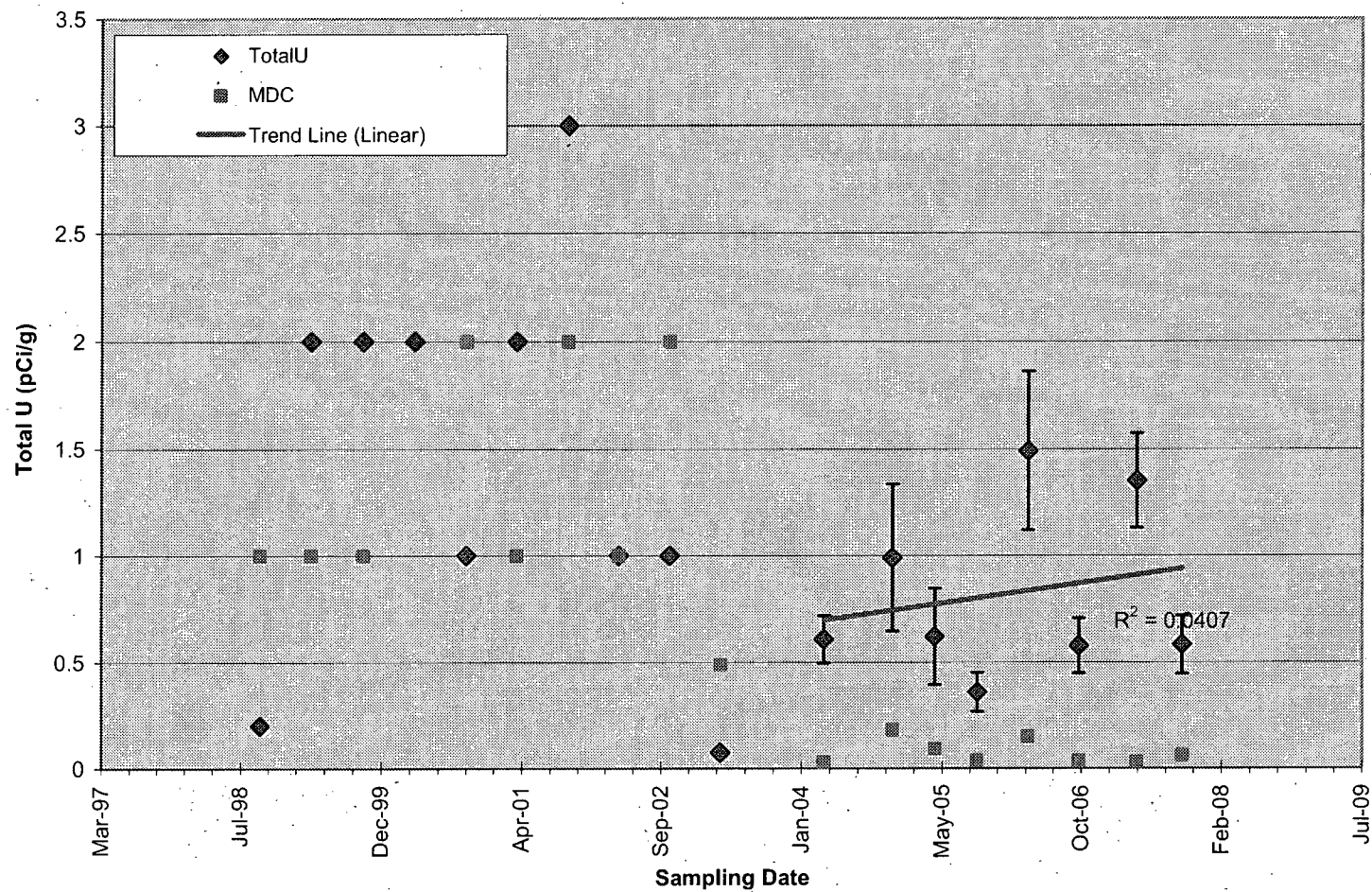


Figure 4-23. Total Uranium in SD-DU-001 (1998-2007)



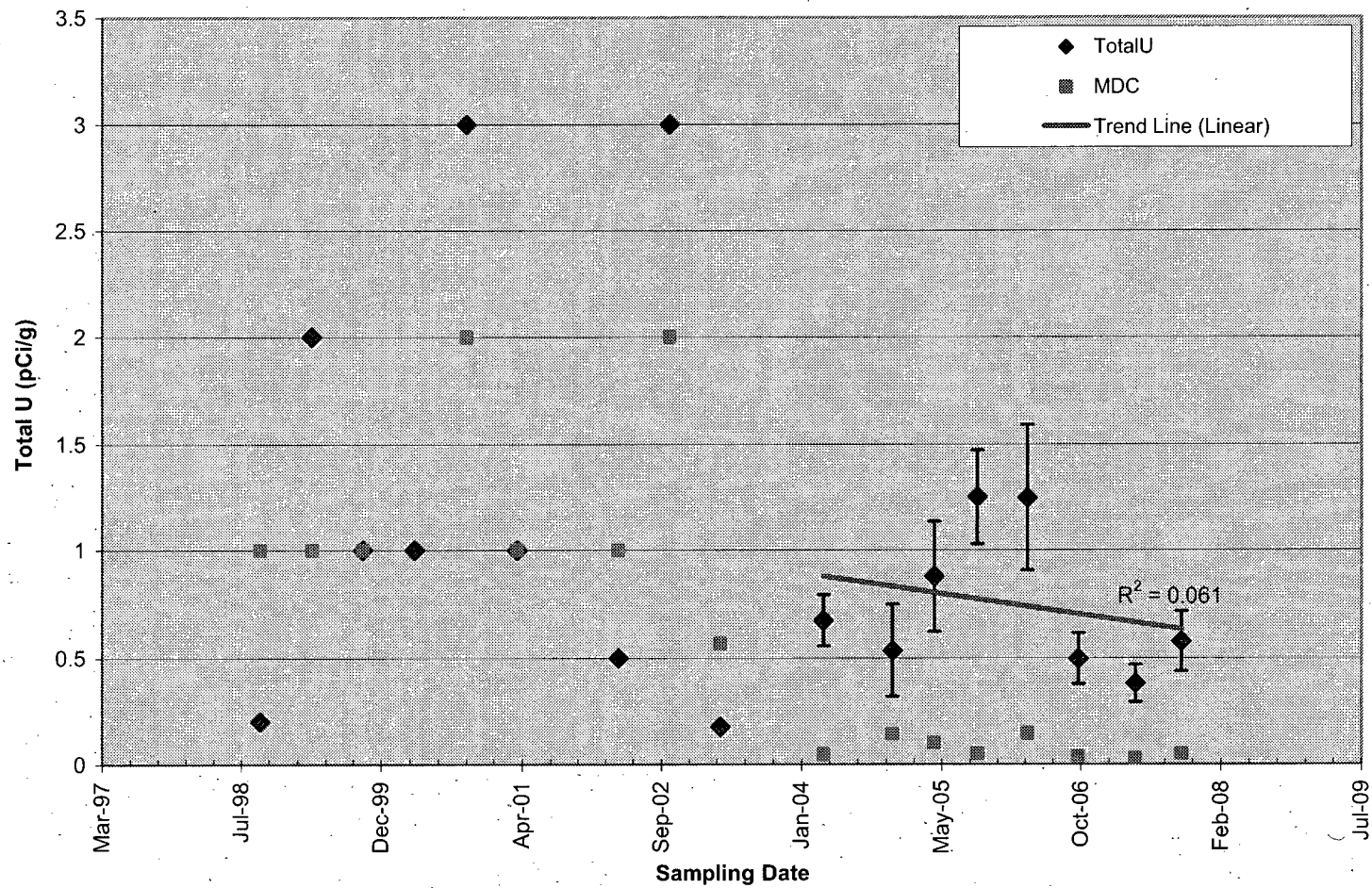


Figure 4-24. Total Uranium in SD-DU-002 (1998-2007)

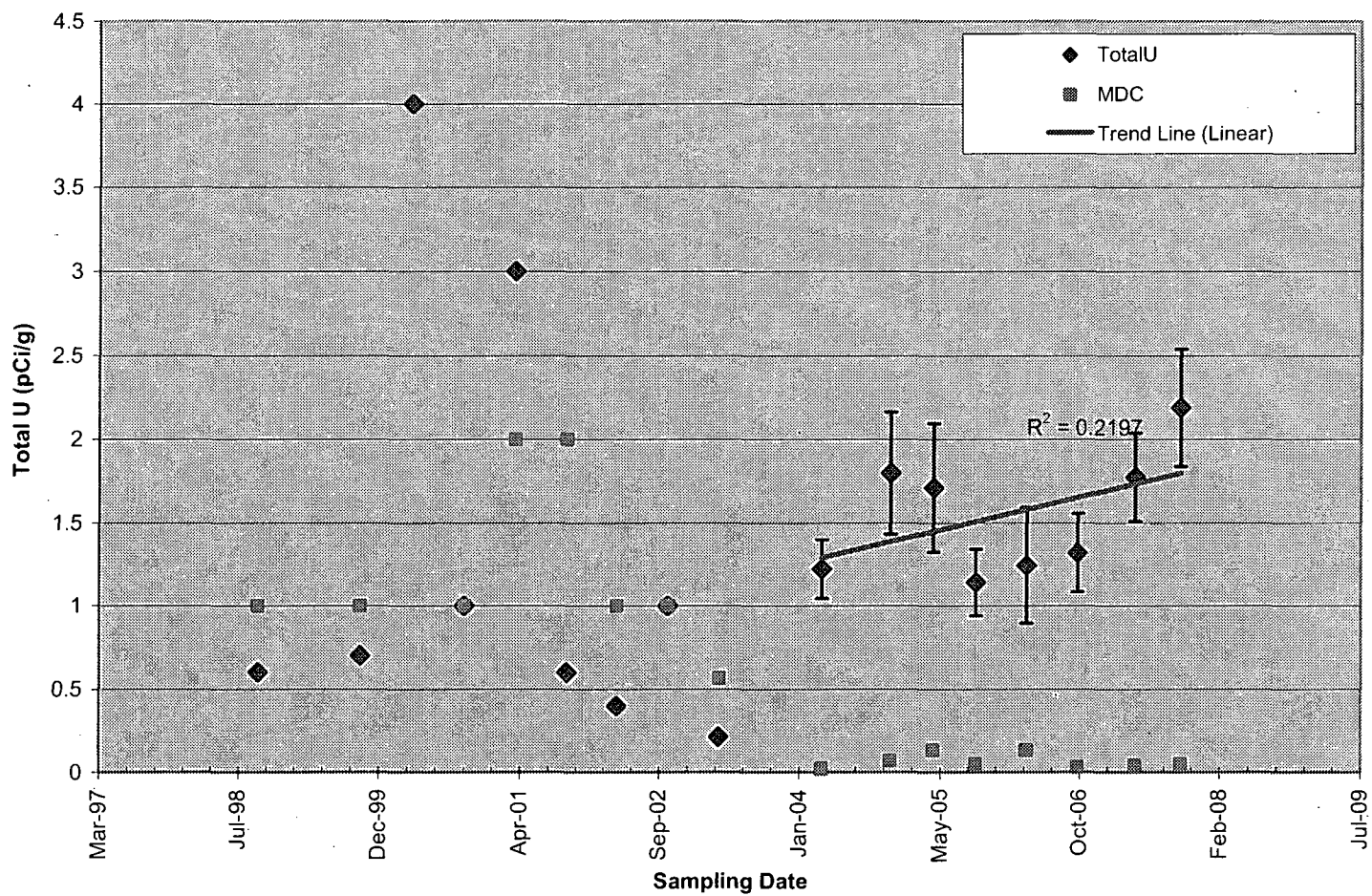


Figure 4-25. Total Uranium in SD-DU-003 (1998-2007)

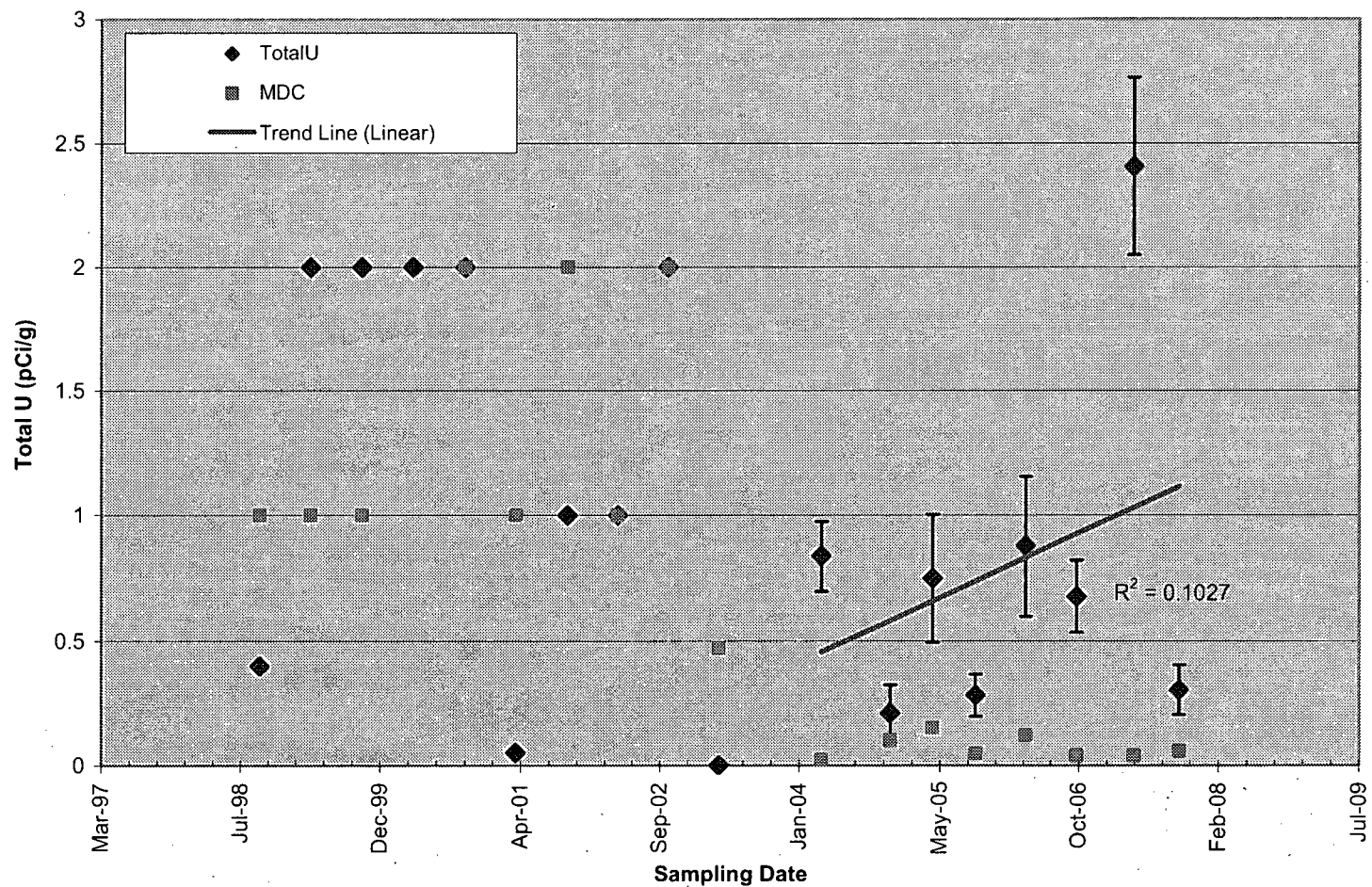


Figure 4-26. Total Uranium in SD-DU-004 (1998-2007)



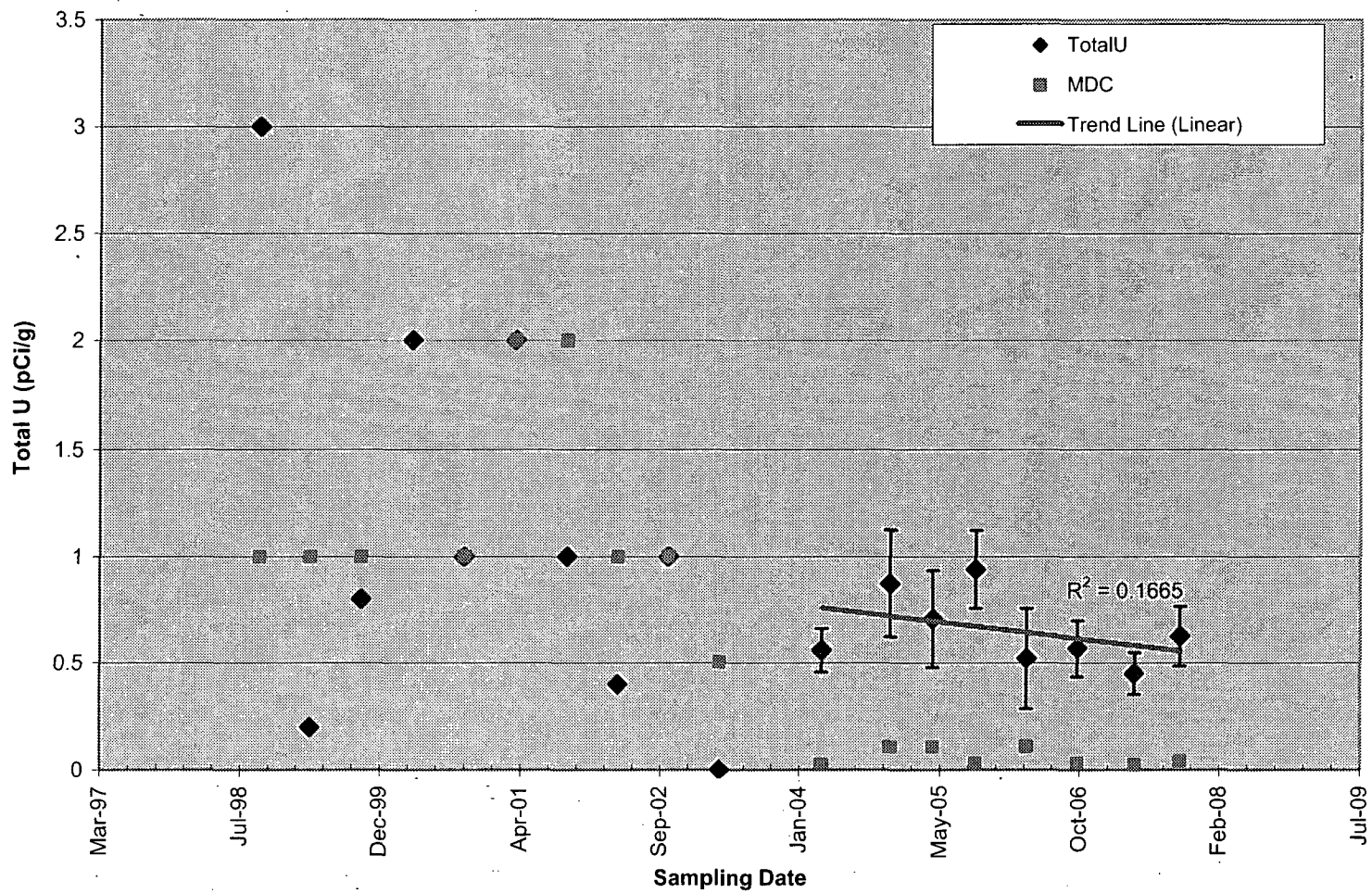


Figure 4-27. Total Uranium in SD-DU-005 (1998-2007)

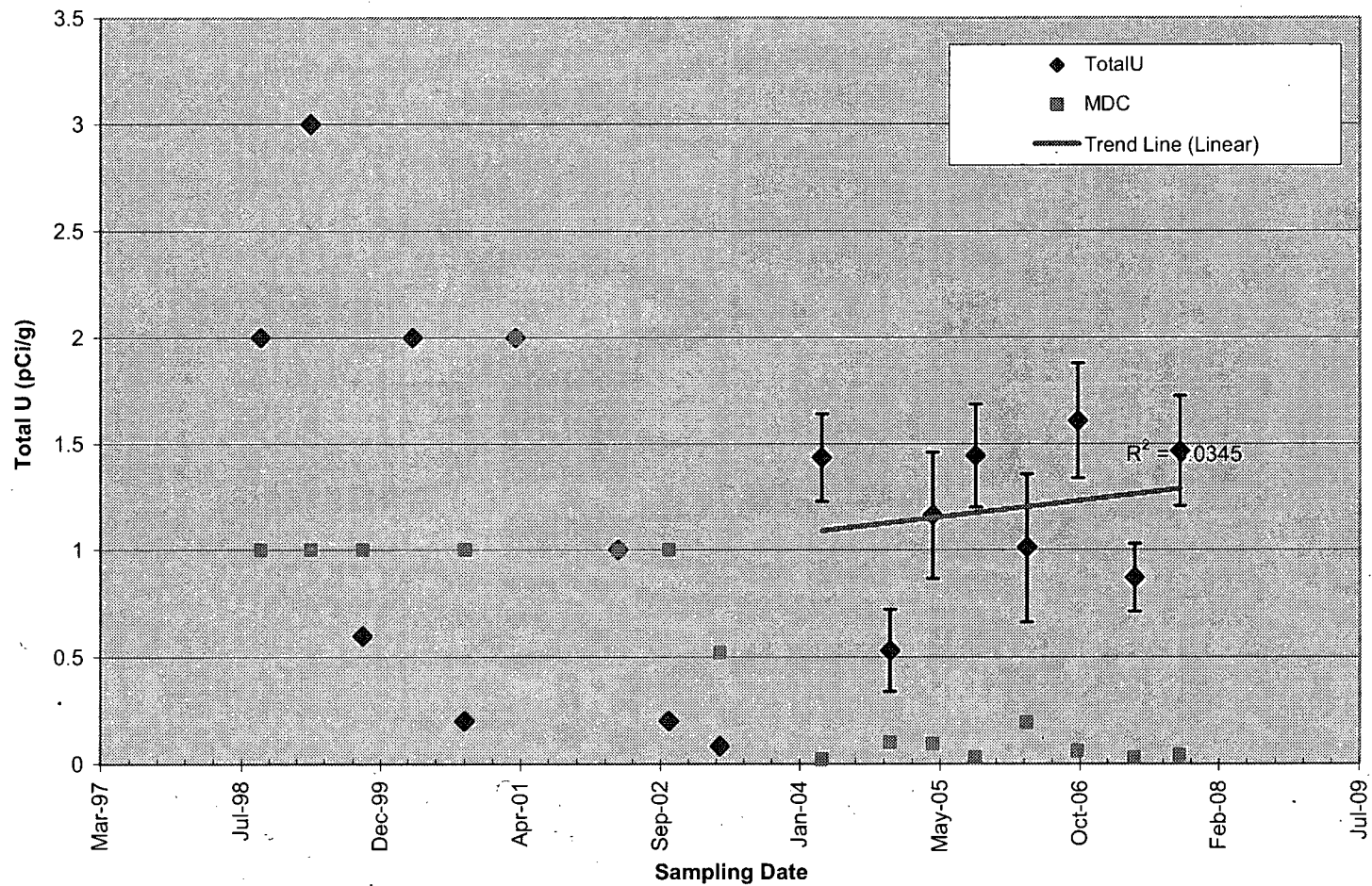


Figure 4-28. Total Uranium in SD-DU-006 (1998-2007)

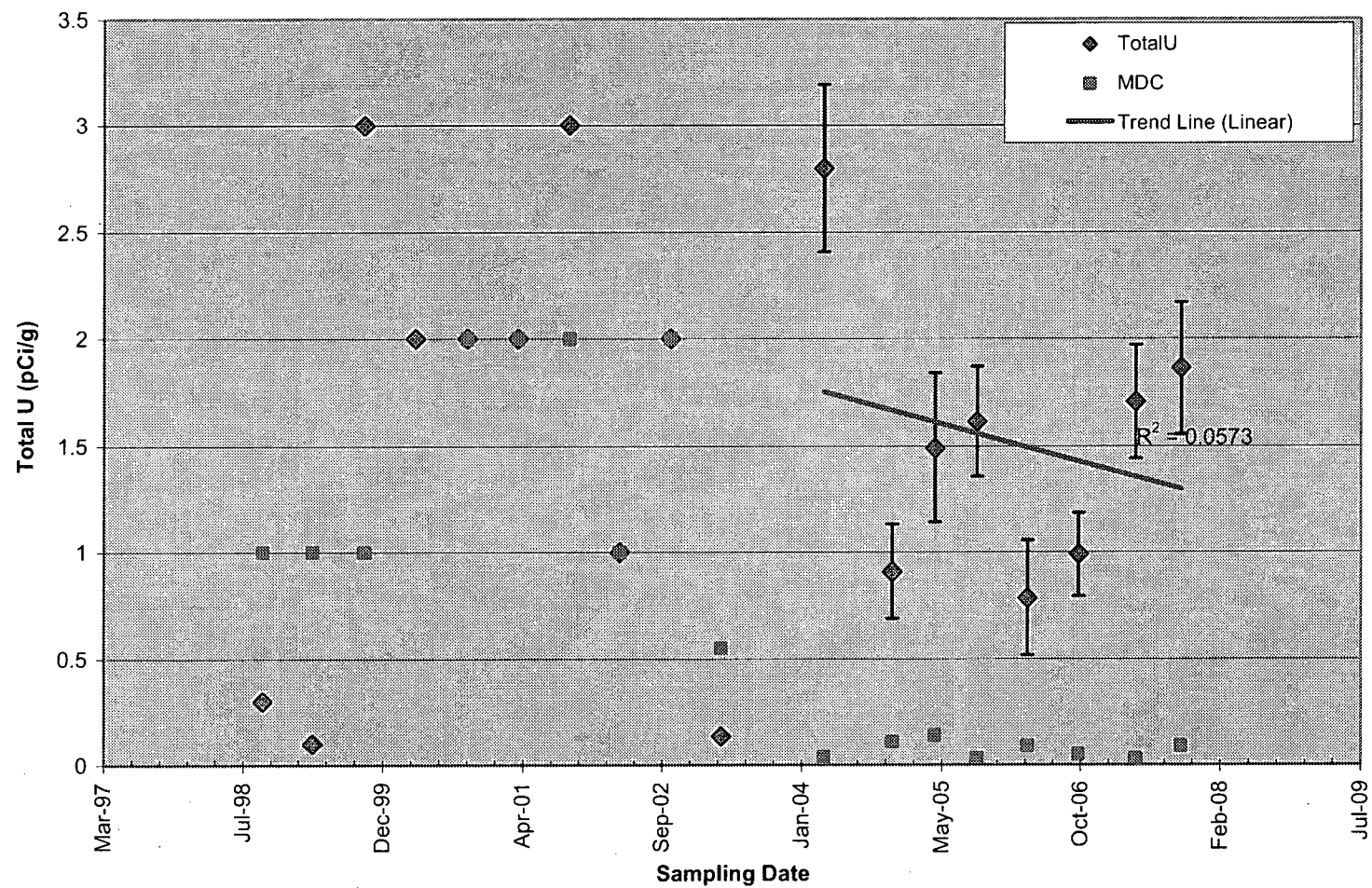


Figure 4-29. Total Uranium in SD-DU-007 (1998-2007)

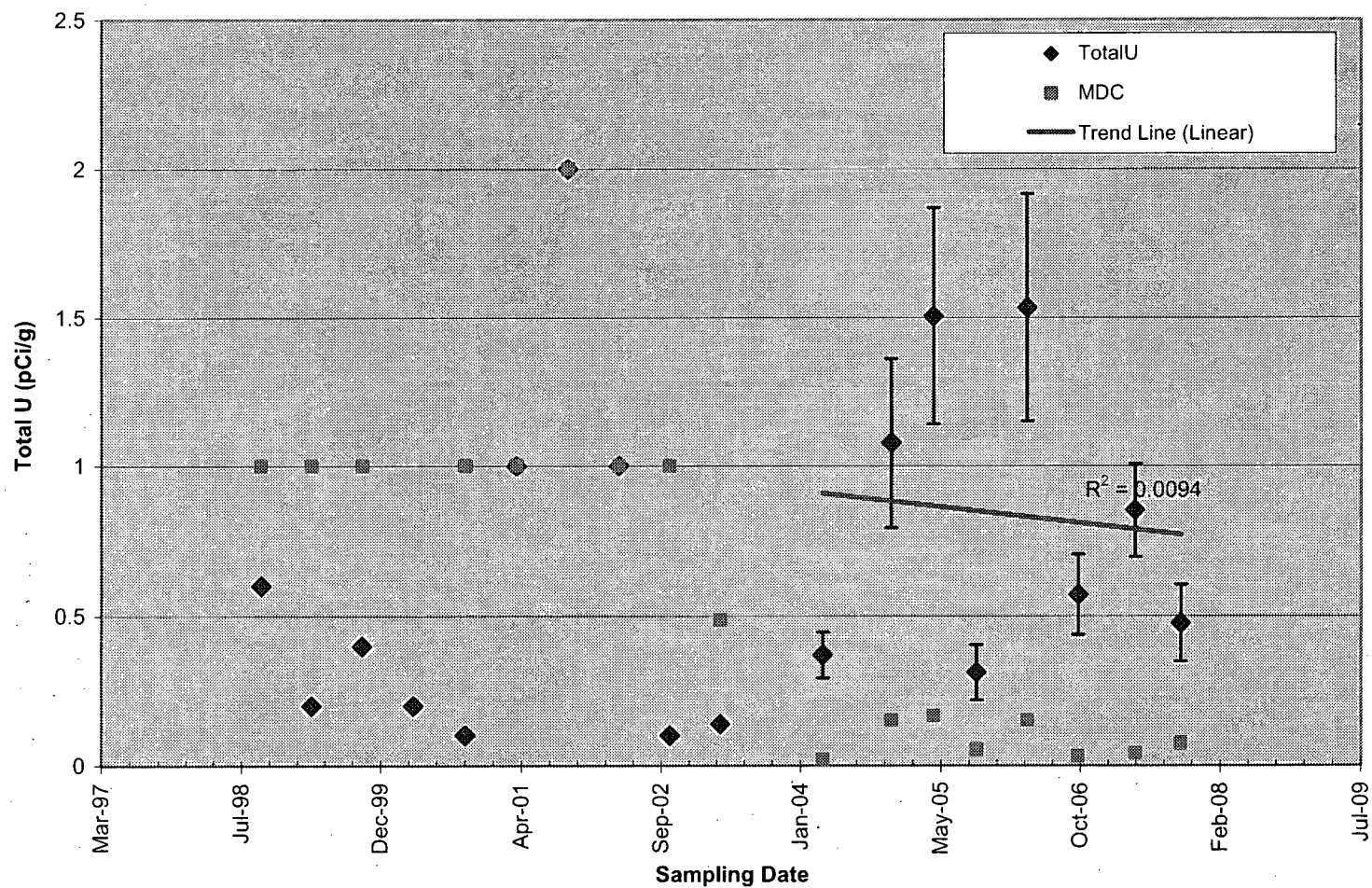


Figure 4-30. Total Uranium in SD-DU-008 (1998-2007)

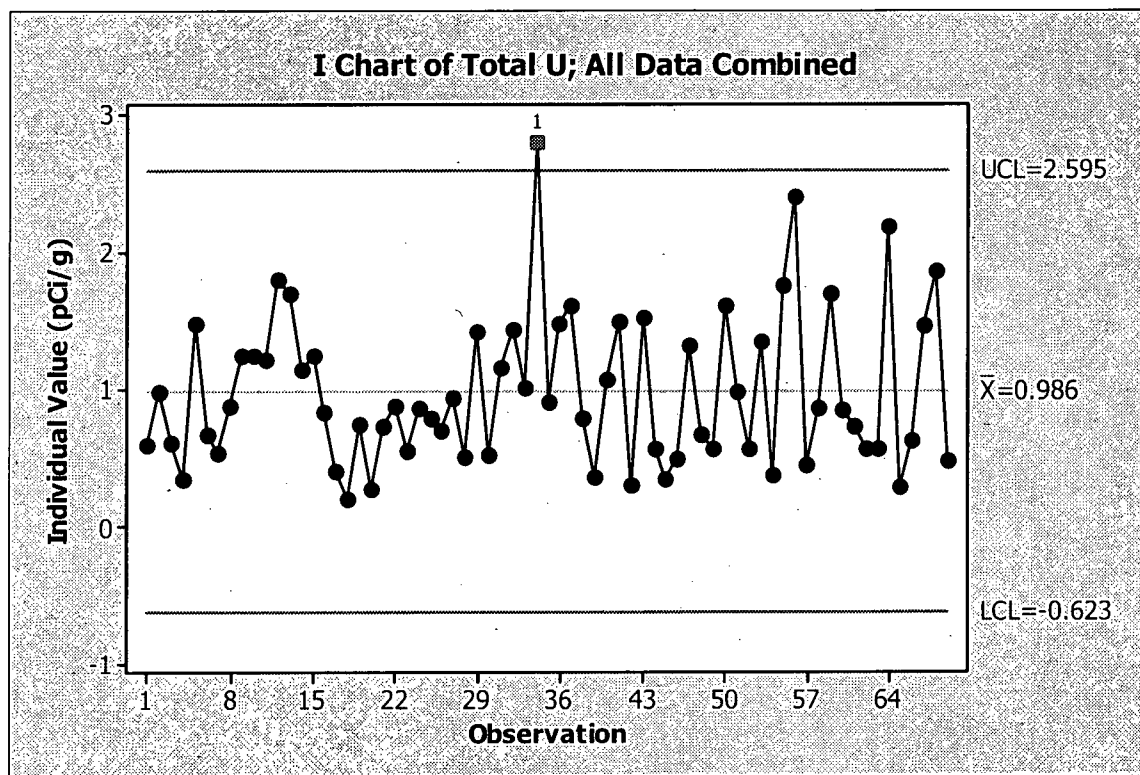


Figure 4-31. Control Chart for All Sediment Data (2004-2007)



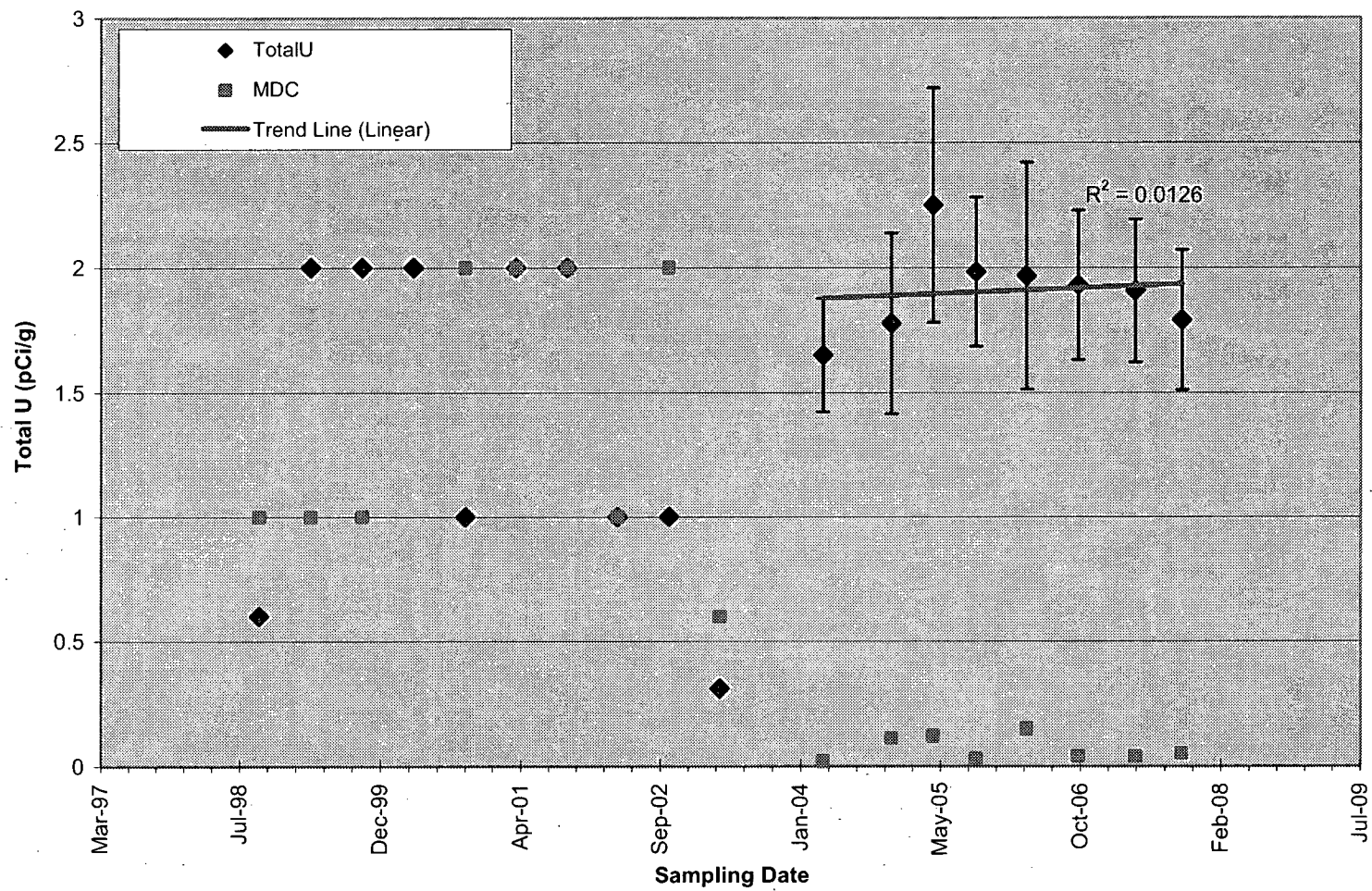
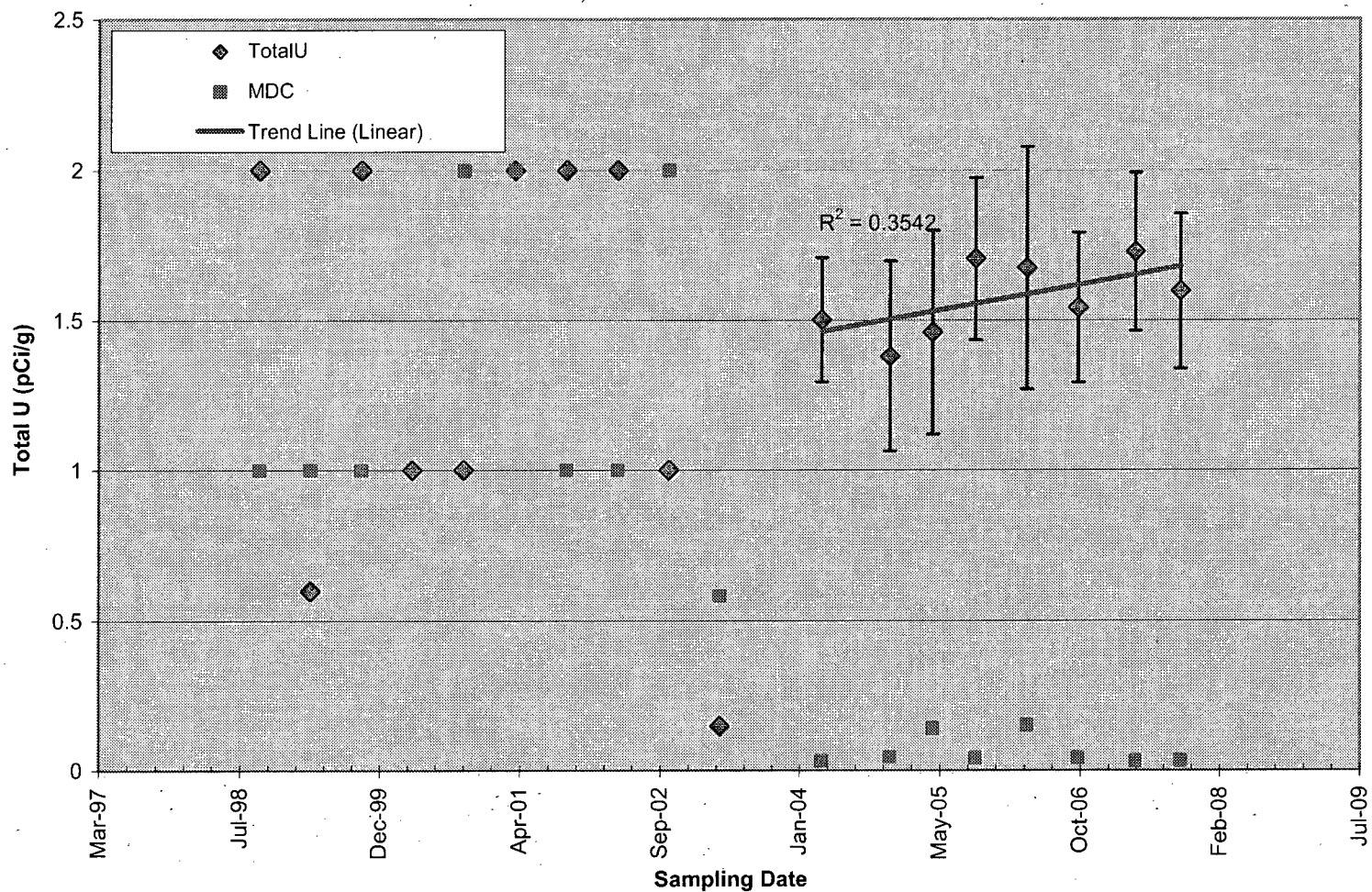


Figure 4-32. Total Uranium in SS-DU-001 (1998-2007)



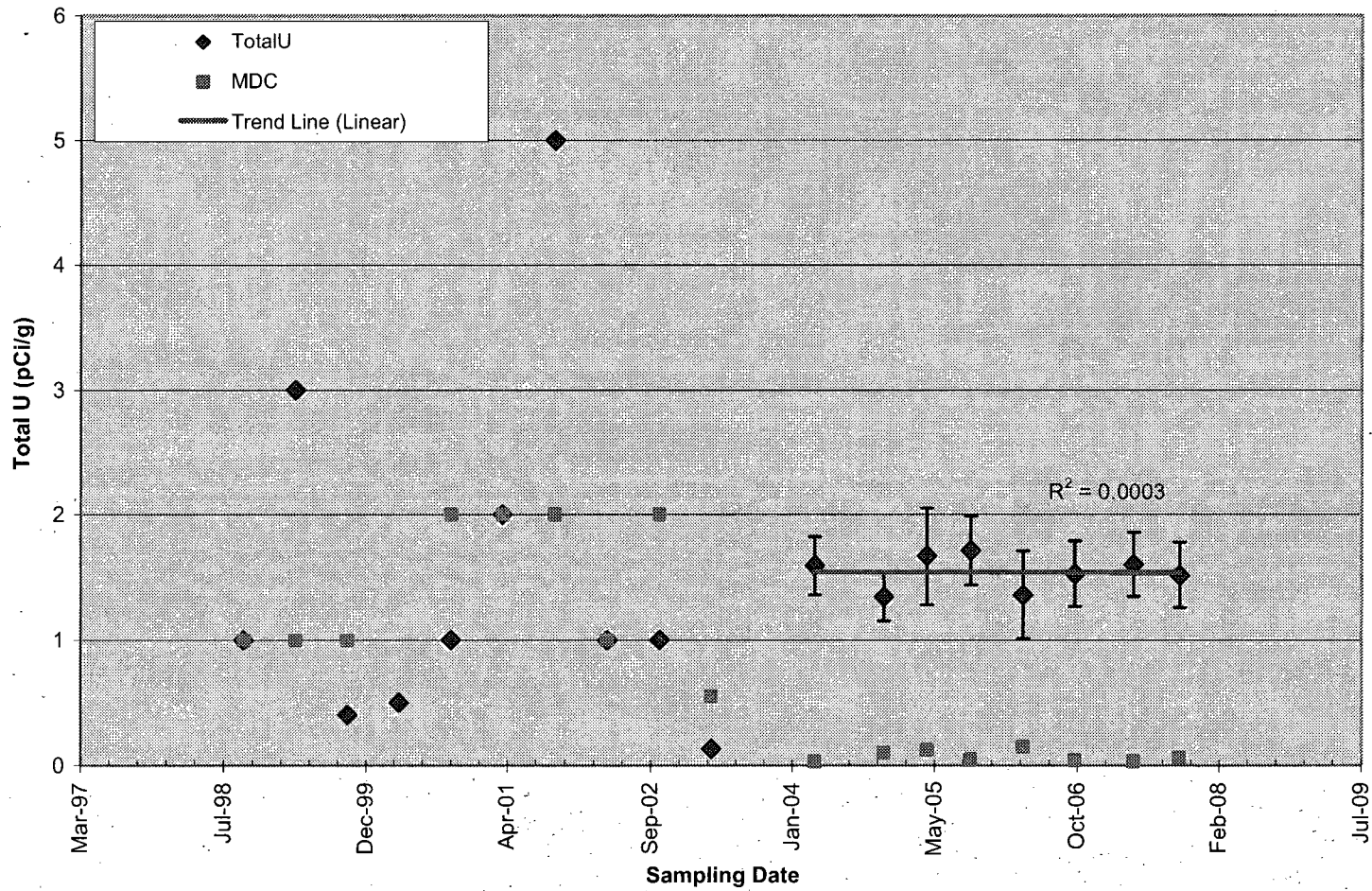


Figure 4-34. Total Uranium in SS-DU-003 (1998-2007)



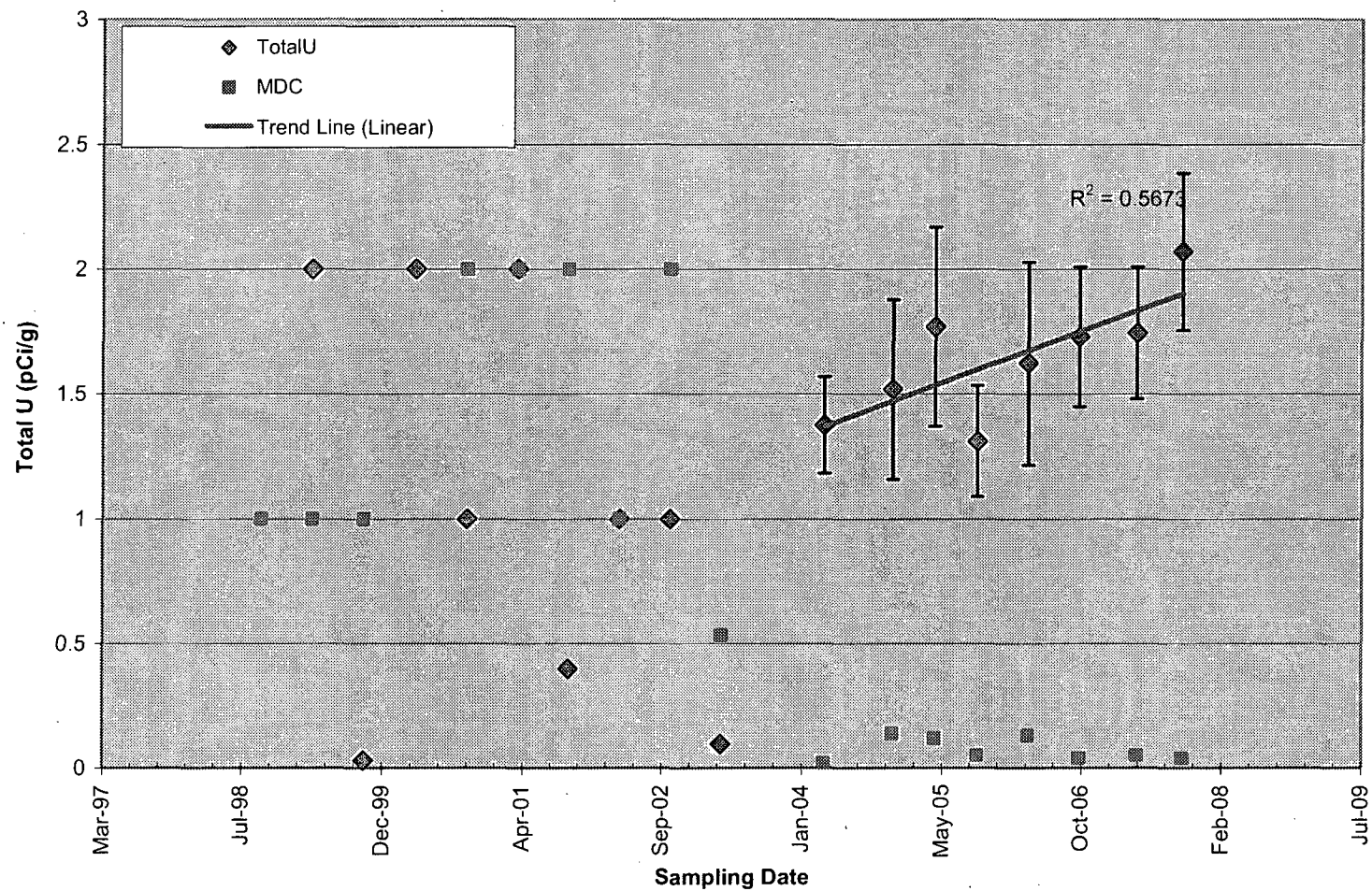


Figure 4-35. Total Uranium in SS-DU-004 (1998-2007)

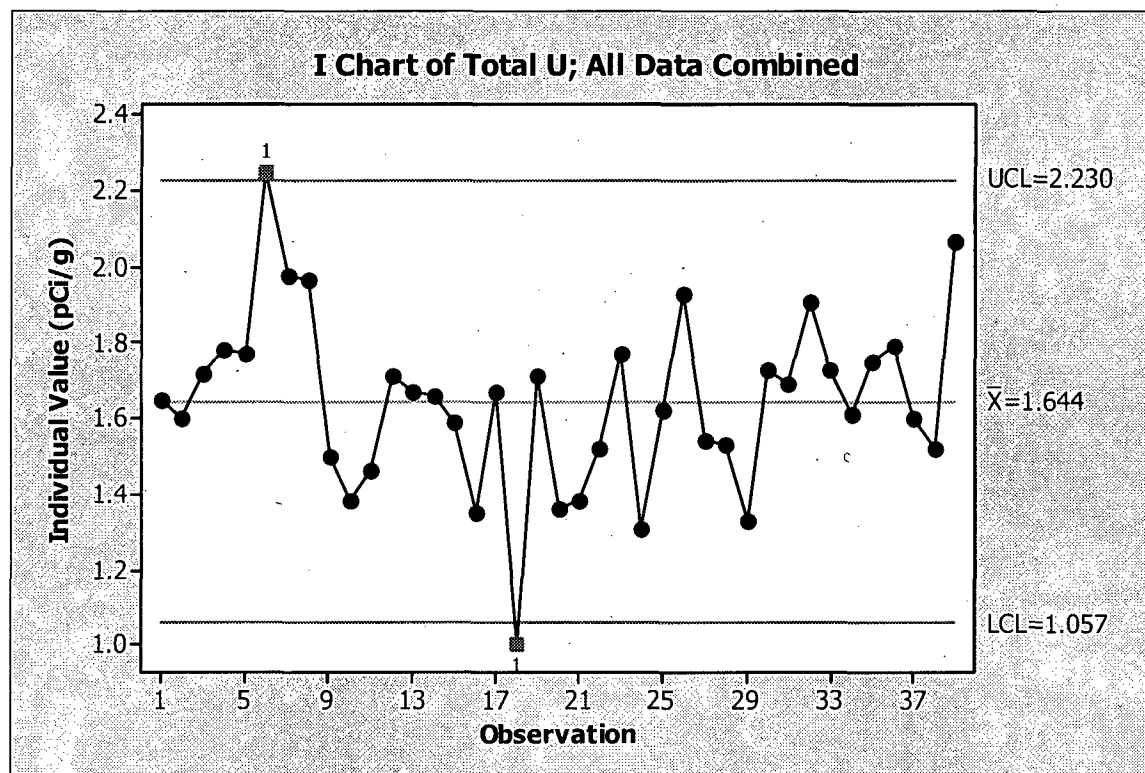


Figure 4-36. Control Chart for All Surface Soil Data (2004-2007)

## 5. CONCLUSIONS AND RECOMMENDATIONS

The October 2007 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 are investigated further to validate if the sample is representative of DU or natural uranium. The only case where a ratio exceeded 3 was for surface water sample SWS05, which exhibited a U-238/U-234 ratio exceeding 3 and thus was subject to additional investigation. This investigation included re-collection of the sample, results of which were compliant with action levels. Other than this aberration, there was no indication of DU in any of the environmental media sampled, and trend analysis completed did not provide evidence of any notable increasing or decreasing trends in the environmental media sampled. Furthermore, no action levels defined in the Army's license were exceeded. Future environmental monitoring will continue to be completed in accordance with the SOP until it is superseded by a revised ERMP Plan.

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## 6. REFERENCES

- CHPPM (U.S. Army Center for Health Promotion and Preventative Medicine). 2000. *Standard Operating Procedure, Depleted Uranium Sampling Program, Environmental Radiation Monitoring Program*. SOP No. OHP 40-2. 10 March.
- CHPPM. 2003. Training Range Site Characterization and Risk Screening – Regional Range Study, Jefferson Proving Ground, Madison, Indiana. Prepared by the U.S. Army Center for Health Promotion and Preventive Medicine. August.
- CFR (Code of Federal Regulations). 2004. 10 CFR 40.4. Energy. Nuclear Regulatory Commission. Domestic Licensing of Source Material. Definitions.
- CFR. 2004. 10 CFR 20. Energy. Nuclear Regulatory Commission. Standards for Protection Against Radiation.
- NRC (Nuclear Regulatory Commission). 1988. License Number SUB-1435 and Subsequent Amendments, Jefferson Proving Ground, Madison, Indiana. U.S. Army, TECOM, Aberdeen Proving Ground, Maryland. 8 May.
- 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. 2000. *Standing Operating Procedure, Depleted Uranium Sampling Program, Environmental Radiation Monitoring Program, Jefferson Proving Ground, Madison, Indiana*. MCHB-TS-OH. SOP No. OHP 40-2. Effective date, 10 March 2000.
- 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.

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**APPENDIX A**  
**STANDARD OPERATING PROCEDURE**

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**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

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**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.

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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

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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, Annex 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.

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3) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Soil Sample Collection Worksheet (Annex B).

c. Surface Water Samples. A total of 8 sample locations have been identified for the collection of water sample from the two creeks that run through the DU impact area (figure 3, Annex C).

1) Sample will be collected using the grab method. Sample container will be positioned pointing upstream and below the surface of the water.

2) A sample quantity of 1 US gallon will be collected.

3) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Surface Water Sample Worksheet (Annex B).

4) Water sample will not be filtered or preserved in the field.

d. Sediment Sample. A total of 8 sample locations have been identified for the collection of sediment samples from the two creeks that run through the DU impact area. Sediment samples will be collected at the sites selected for surface water collection (figure 3, Annex C).

1) Sample will be collected using a new or properly cleaned scoop, trowel, or other suitable tool. Sample will be placed in a glass sample jar.

2) Sediment sample will be collected only after the water sample has been collected.

3) While a sediment sample is usually considered a solid sample matrix, a certain amount of water is expected in the sample. The sample should not be drained of water that is collected as part of the sample.

4) Radiation dose rate measurements will be taken at 1 meter above the sample location and recorded on the Sediment Sample Worksheet (Annex B).

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9. **Sample Management.** Since sample collected are in support of NRC License commitments, chain-of-custody procedures will be followed.

a. Samples will be secured from unauthorized access during the period of sampling.

b. Prior to shipment of samples to USACHPPM, a properly completed CHPPM Form 235-R-E, Chain of Custody Record (Annex B), will be placed in each shipping container. Survey personnel will maintain a copy of the Chain of Custody Record for verification of sample transport.

c. Water samples must reach RCCCD no later than 4 days from the time of sampling. To ensure this time frame is met and that the laboratory has time to filter and preserve the sample if necessary, water samples should be collected on the first day of the sampling trip and shipped the following day. It is not necessary to ship the water, sediments, and soils together.

10. **Sample Analysis.** Sample analysis of all environmental samples will be performed through the USACHPPM RCCCD.

a. Samples will be analyzed in accordance with RCCCD established protocols and procedures. All environmental samples will be coordinated with the SBCCOM RPO for disposal instructions.

1) Water samples will be analyzed fluorometrically for dissolved total uranium.

2) Soil and sediment samples will be analyzed using gamma spectroscopy, keying on the isotopic peaks of the Thorium-234. The thorium is the daughter of U-238 and is considered to be in equilibrium therefore the activity would be equal.

b. The QC for laboratory instruments will be performed by RCCCD.

c. Reports of analysis will be forwarded to the USACHPPM project officer responsible for requesting the sampling. Electronic as well as hard copy reports will be requested.

11. **Action Levels.** Every effort will be made to maintain radiation exposures and releases of radioactive and non-radioactive toxic metals to unrestricted areas as low as is reasonable achievable (ALARA).

a. The following criteria for the restricted area will be used to limit DU exposure. (Limits were established in the NRC Approved ERM)

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SOIL:

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

WATER:

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

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

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



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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.

g. **Duplicate Samples:** Samples collected simultaneously from the same source, under identical conditions, into separate containers.

h. **Ground Water Sample:** A sample of water taken from an established monitoring well.

i. **Preservation:** Techniques which retard physical and/or chemical changes in a sample after it has been collected.

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i. **Quality Assurance:** A monitoring program which ensures the production of quality data and identifies and quantifies all sources of error associated with each step of the sampling and analytical effort.

j. **Sample:** A part or selection from a medium located in a survey area that represents the quality or quantity of a given parameter or nature of the whole area.

k. **Sediment:** A sample of the mineral and/or organic matter deposited by surface waters.

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                                 |

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- 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

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ANNEX B

FORMS, LABELS AND WORKSHEETS

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## Request for Laboratory Services

Page 1 of 2

**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

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#### 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:

<input checked="" type="checkbox"/>	CHAIN-OF-CUSTODY (COC)
<input type="checkbox"/>	SAFETY CONSIDERATION/HAZARDOUS MATERIALS (Specify):

☒ 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):

SAMPLE COLLECTION KIT:  
DATE REQUIRED: 07/04/2000

CHECK PREFERENCE:

1. TO BE PICKED UP AT DLS BY PROJECT OFFICER

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

## **PART 5: SAMPLE ANALYSIS INFORMATION**

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

Figure B-1b

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### 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 \_\_\_\_\_  
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**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)			



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**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 _____			

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**JEFFERSON PROVING GROUND**  
DU SAMPLING PROGRAM  
PROJECT NUMBER: 26-MA-R\_-8260-\_\_

SOIL SAMPLES				
Sample ID	Sample Date	Exposure Reading ( $\mu$ R/hr)	Sample Locations	JPG ID Code
SOS1			Vicinity at intersection of C-Road and Wonju Road)	(S44)
SOS2			Vicinity at intersection of E-Road and Morgan Road	(S48)
SOS3			0.5 miles east of intersection at C-Road & East Recovery Road	(S43)
SOS4			Corner of Morgan Road and C-Road	(S47)
SOS5			Duplicate or Split of	
SOS6			Well on south perimeter road along south border of JPG	B-1
SOS7			West Perimeter Road at Fork Creek	B-3
SOS8			South Perimeter Road of JPG	B-5
SOS9			Well on SW Corner of JPG	B-6

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

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**JEFFERSON PROVING GROUND**  
 DU SAMPLING PROGRAM  
 PROJECT NUMBER: 26-MA-R\_-8260-\_\_

<b>SURFACE WATER SAMPLES</b>				
<b>Sample ID</b>	<b>Sample Date</b>	<b>Exposure Reading (μR/hr)</b>	<b>Sample Locations</b>	<b>JPG ID Code</b>
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)

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**JEFFERSON PROVING GROUND**  
 DU SAMPLING PROGRAM  
 PROJECT NUMBER: 26-MA-R\_-8260-\_\_

<b>SEDIMENT SAMPLES</b>				
<b>Sample ID</b>	<b>Sample Date</b>	<b>Exposure Reading (μR/hr)</b>	<b>Sample Locations</b>	<b>JPG ID Code</b>
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)

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ANNEX C  
SAMPLE LOCATION MAPS

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**Jefferson Proving Ground: DU Sampling  
GROUNDWATER MONITORING WELLS**



Figure 1: Groundwater samples (Sept. 1997)

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**Jefferson Proving Ground: DU Sampling  
SOIL SAMPLES**

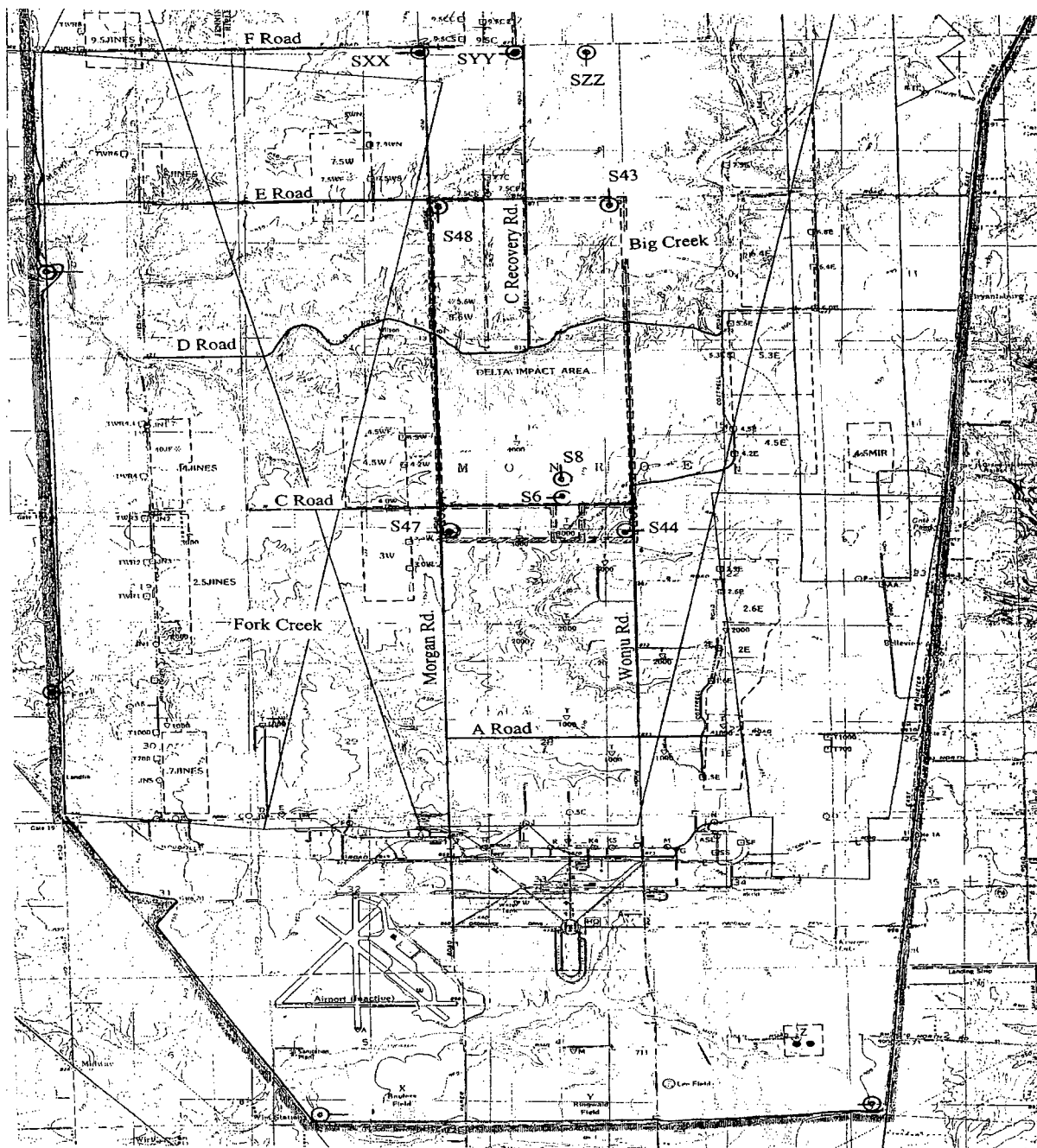


Figure 2: Soil Samples (Sept. 1997)

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**Jefferson Proving Ground: DU Sampling  
SURFACEWATER & SEDIMENT SAMPLES**

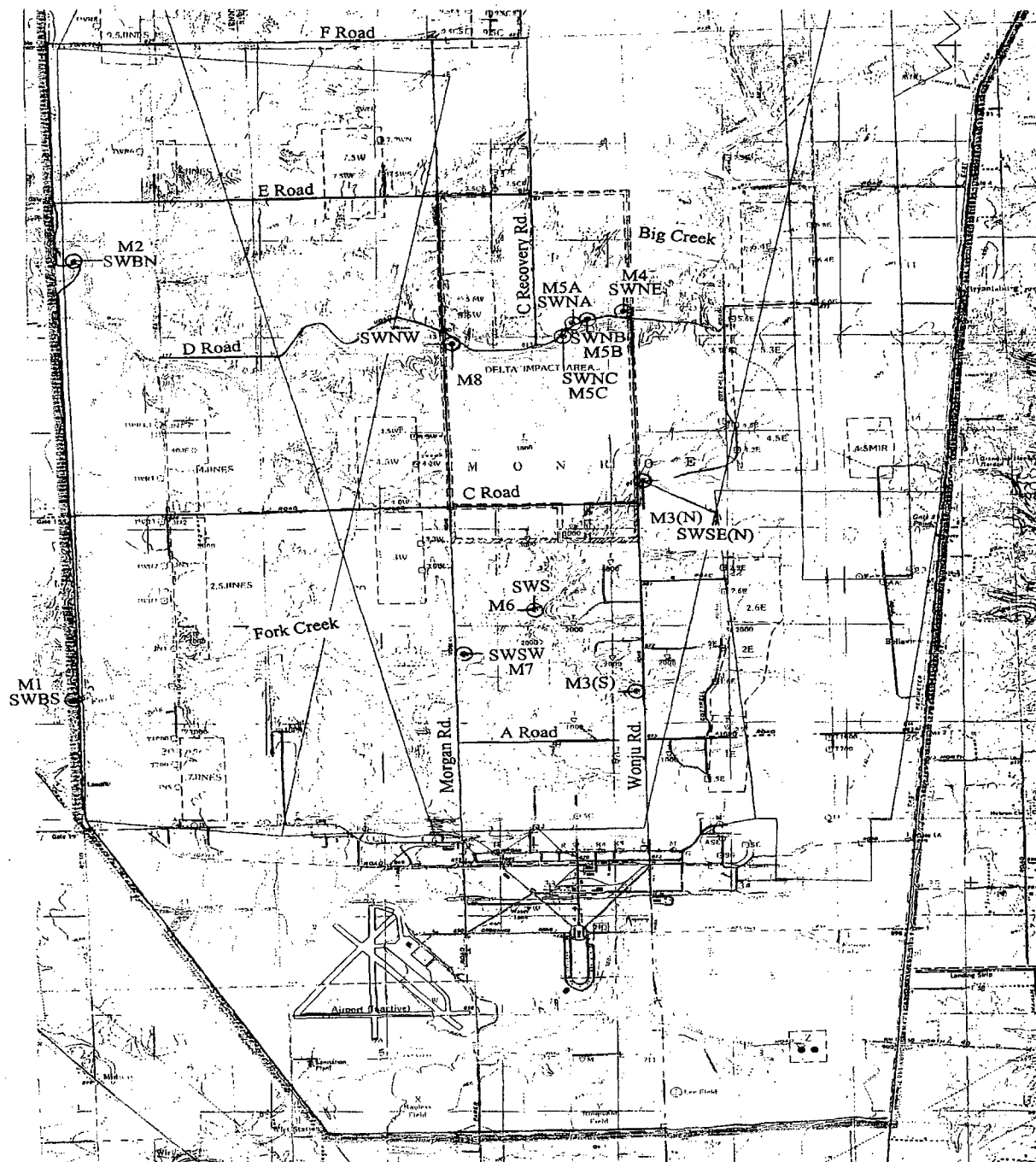


Figure 3: Surfacewater & Sediment Samples (Sept. 1997)



**APPENDIX B**  
**FIELD LOGBOOK**

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Location JPG Madison IN Date 4/19/07

Project / Client Louisville Army COE

## Preliminary Estimated Plan Only

Location	DATE	TIME	Est hrs	Est time
MW-DU-001	4/19/07	8:05	19	8921
MW-DU-002	4/19/07	0850	9	9857
MW-DU-003	4/19/07	0915	24	0945
MW-DU-004	4/20/07	0905	40	0942
MW-DU-005	4/19/07	12:40	10	1250
MW-DU-006	4/19/07	12:47	13	1218
MW-DU-007	4/19/07	0940	40	1012
MW-DU-008	4/20/07	0955	11	1016
MW-DU-009	4/19/07	1732	19	1858
MW-DU-010	4/19/07	1702	40	1737
MW-DU-011	4/19/07	1258	24	125

Completed by Ken Knott Site Manager

Army COE

Army will keep remaining rounds

in baghouse

Barter - 1/2 for barter

4/19/07

4/19/07

Location JPG Madison IN

Date 10/15/07

Project / Client Louisville Army COE

- 0700 Arrive at JPG Field Office  
Sampling Crew - SATC  
William Wilkinson  
Clark Evers  
Conduct H/S Tailgate (SEE Page 95)  
Signatures: *William Wilkinson*  
*Clark Evers*
- 0830 Conduct Equipment Calibration  
All Equipment / Instruments  
working properly  
Stock vehicle with supplies
- 0910 Go to surface water location  
SW-DU-001 to collect surface  
water and sediment sample
- 0930 Collect SW-DU-001 & SW-DU-001  
collect water quality parameters.  
All samples cooled to 4°C  
PPE - Latex gloves  
SEE PAGE 96 for Tasks  
Will not collect additional samples  
At MW-DU-006 this round
- 1025 Collect SD-DU-002, (SARC 08)  
1 for AMBER
- 1734 Collect SW-DU-002 (SARC 08)  
4/19/07

Location JPG Madison IN Date 10/3/07  
 Project / Client Louisville Army COE

# Field Equipment Calibration

## RAD INSTRUMENT CHECK-IN

**43-89**

METER # 202405

MODEL # 2360

DETECTOR # 207683

Calibration Due 5/31/08

**44-9**

METER # 197790

MODEL # 212132 <sup>will</sup> <sub>10/13/08</sub> 2221

DETECTOR # 212132

Calibration Due 4/16/08

**NR**

METER # 205706

MODEL # 19

DETECTOR # N/A

Calibration Due 8/16/08

0838 Harrison 4-16

0838

Cal observed 4.6 pH 4.44 COND

Actual 3.98 pH 4.44 COND

Calibration completed - Auto Cal

on 00/08/07

Location JPG Madison IN Date 10/3/07  
 Project / Client Louisville Army COE

DATE	TIME	LOCATION	SITE #	RAD MODEL NO.	COND
10/4/07	0800	50-DU-001	50-DU-001	50-DU-001	5
10/3/07	1635	50-DU-002	50-DU-002	50-DU-002	5
10/4/07	1650	50-DU-003	50-DU-003	50-DU-003	5
10/4/07	1830	50-DU-004	50-DU-004	50-DU-004	5
10/3/07	0800	50-DU-005	50-DU-005	50-DU-005	5
10/3/07	0930	50-DU-006	50-DU-006	50-DU-006	5
10/4/07	1625	50-DU-007	50-DU-007	50-DU-007	5
10/4/07	0800	50-DU-008	50-DU-008	50-DU-008	5
10/4/07	0800	50-DU-009	50-DU-009	50-DU-009	5
10/4/07	0800	50-DU-010	50-DU-010	50-DU-010	5
10/4/07	0800	50-DU-011	50-DU-011	50-DU-011	5
10/4/07	0800	50-DU-012	50-DU-012	50-DU-012	5
10/4/07	0800	50-DU-013	50-DU-013	50-DU-013	5
10/4/07	0800	50-DU-014	50-DU-014	50-DU-014	5
10/4/07	0800	50-DU-015	50-DU-015	50-DU-015	5
10/4/07	0800	50-DU-016	50-DU-016	50-DU-016	5
10/4/07	0800	50-DU-017	50-DU-017	50-DU-017	5
10/4/07	0800	50-DU-018	50-DU-018	50-DU-018	5
10/4/07	0800	50-DU-019	50-DU-019	50-DU-019	5
10/4/07	0800	50-DU-020	50-DU-020	50-DU-020	5
10/4/07	0800	50-DU-021	50-DU-021	50-DU-021	5
10/4/07	0800	50-DU-022	50-DU-022	50-DU-022	5
10/4/07	0800	50-DU-023	50-DU-023	50-DU-023	5
10/4/07	0800	50-DU-024	50-DU-024	50-DU-024	5
10/4/07	0800	50-DU-025	50-DU-025	50-DU-025	5
10/4/07	0800	50-DU-026	50-DU-026	50-DU-026	5
10/4/07	0800	50-DU-027	50-DU-027	50-DU-027	5
10/4/07	0800	50-DU-028	50-DU-028	50-DU-028	5
10/4/07	0800	50-DU-029	50-DU-029	50-DU-029	5
10/4/07	0800	50-DU-030	50-DU-030	50-DU-030	5
10/4/07	0800	50-DU-031	50-DU-031	50-DU-031	5
10/4/07	0800	50-DU-032	50-DU-032	50-DU-032	5
10/4/07	0800	50-DU-033	50-DU-033	50-DU-033	5
10/4/07	0800	50-DU-034	50-DU-034	50-DU-034	5
10/4/07	0800	50-DU-035	50-DU-035	50-DU-035	5
10/4/07	0800	50-DU-036	50-DU-036	50-DU-036	5
10/4/07	0800	50-DU-037	50-DU-037	50-DU-037	5
10/4/07	0800	50-DU-038	50-DU-038	50-DU-038	5
10/4/07	0800	50-DU-039	50-DU-039	50-DU-039	5
10/4/07	0800	50-DU-040	50-DU-040	50-DU-040	5
10/4/07	0800	50-DU-041	50-DU-041	50-DU-041	5
10/4/07	0800	50-DU-042	50-DU-042	50-DU-042	5
10/4/07	0800	50-DU-043	50-DU-043	50-DU-043	5
10/4/07	0800	50-DU-044	50-DU-044	50-DU-044	5
10/4/07	0800	50-DU-045	50-DU-045	50-DU-045	5
10/4/07	0800	50-DU-046	50-DU-046	50-DU-046	5
10/4/07	0800	50-DU-047	50-DU-047	50-DU-047	5
10/4/07	0800	50-DU-048	50-DU-048	50-DU-048	5
10/4/07	0800	50-DU-049	50-DU-049	50-DU-049	5
10/4/07	0800	50-DU-050	50-DU-050	50-DU-050	5
10/4/07	0800	50-DU-051	50-DU-051	50-DU-051	5
10/4/07	0800	50-DU-052	50-DU-052	50-DU-052	5
10/4/07	0800	50-DU-053	50-DU-053	50-DU-053	5
10/4/07	0800	50-DU-054	50-DU-054	50-DU-054	5
10/4/07	0800	50-DU-055	50-DU-055	50-DU-055	5
10/4/07	0800	50-DU-056	50-DU-056	50-DU-056	5
10/4/07	0800	50-DU-057	50-DU-057	50-DU-057	5
10/4/07	0800	50-DU-058	50-DU-058	50-DU-058	5
10/4/07	0800	50-DU-059	50-DU-059	50-DU-059	5
10/4/07	0800	50-DU-060	50-DU-060	50-DU-060	5
10/4/07	0800	50-DU-061	50-DU-061	50-DU-061	5
10/4/07	0800	50-DU-062	50-DU-062	50-DU-062	5
10/4/07	0800	50-DU-063	50-DU-063	50-DU-063	5
10/4/07	0800	50-DU-064	50-DU-064	50-DU-064	5
10/4/07	0800	50-DU-065	50-DU-065	50-DU-065	5
10/4/07	0800	50-DU-066	50-DU-066	50-DU-066	5
10/4/07	0800	50-DU-067	50-DU-067	50-DU-067	5
10/4/07	0800	50-DU-068	50-DU-068	50-DU-068	5
10/4/07	0800	50-DU-069	50-DU-069	50-DU-069	5
10/4/07	0800	50-DU-070	50-DU-070	50-DU-070	5
10/4/07	0800	50-DU-071	50-DU-071	50-DU-071	5
10/4/07	0800	50-DU-072	50-DU-072	50-DU-072	5
10/4/07	0800	50-DU-073	50-DU-073	50-DU-073	5
10/4/07	0800	50-DU-074	50-DU-074	50-DU-074	5
10/4/07	0800	50-DU-075	50-DU-075	50-DU-075	5
10/4/07	0800	50-DU-076	50-DU-076	50-DU-076	5
10/4/07	0800	50-DU-077	50-DU-077	50-DU-077	5
10/4/07	0800	50-DU-078	50-DU-078	50-DU-078	5
10/4/07	0800	50-DU-079	50-DU-079	50-DU-079	5
10/4/07	0800	50-DU-080	50-DU-080	50-DU-080	5
10/4/07	0800	50-DU-081	50-DU-081	50-DU-081	5
10/4/07	0800	50-DU-082	50-DU-082	50-DU-082	5
10/4/07	0800	50-DU-083	50-DU-083	50-DU-083	5
10/4/07	0800	50-DU-084	50-DU-084	50-DU-084	5
10/4/07	0800	50-DU-085	50-DU-085	50-DU-085	5
10/4/07	0800	50-DU-086	50-DU-086	50-DU-086	5
10/4/07	0800	50-DU-087	50-DU-087	50-DU-087	5
10/4/07	0800	50-DU-088	50-DU-088	50-DU-088	5
10/4/07	0800	50-DU-089	50-DU-089	50-DU-089	5
10/4/07	0800	50-DU-090	50-DU-090	50-DU-090	5
10/4/07	0800	50-DU-091	50-DU-091	50-DU-091	5
10/4/07	0800	50-DU-092	50-DU-092	50-DU-092	5
10/4/07	0800	50-DU-093	50-DU-093	50-DU-093	5
10/4/07	0800	50-DU-094	50-DU-094	50-DU-094	5
10/4/07	0800	50-DU-095	50-DU-095	50-DU-095	5
10/4/07	0800	50-DU-096	50-DU-096	50-DU-096	5
10/4/07	0800	50-DU-097	50-DU-097	50-DU-097	5
10/4/07	0800	50-DU-098	50-DU-098	50-DU-098	5
10/4/07	0800	50-DU-099	50-DU-099	50-DU-099	5
10/4/07	0800	50-DU-100	50-DU-100	50-DU-100	5

Location - JPB Madison, IN Date 10/3/07

Project/Client - Louisville Army COE

10:30 cont. Samples cooled to 4°C. SEE TABLES (Page 123, 127) for sample info.

Samples collected:

SW-DU-002 1 liter Poly

SD-DU-002 8 oz Amber

10:50 Arrive at surface water location SW-DU-008 to collect sediment and surface water sample. Also, MW-DU-005 will be collected.

NOTE: Stream level low, hardly any flow currently. (Very dry conditions)

11:00 Collect SD-DU-008 (SWC 08)

1. 8 oz Amber, cool to 4°C

Samples collected downstream at surface water sample location

11:05 Collect surface water sample location SW-DU-008 (SWC 08)

1. 1 liter poly, cool 4°C

11:35 Arrive at MW-DU-010 to collect groundwater sample.

Water level @ 11:35 15.75 ft.

11:46 Collect MW-DU-010 (SWC 08)

cool to 4°C. W. 10/10/07

Location JPB Madison, IN

Date 10/3/07

Project/Client Louisville Army COE

# Water Levels - Monitoring Wells

WELL ID	DATE	TIME	WATER LEVEL (FT. BGC)
MW-DU-001	10/3/07	14:40	14.42
MW-DU-002	10/10/07	08:25	14.48
MW-DU-003	10/04/07	09:20	14.15
MW-DU-004	10/04/07	13:00	14.62
MW-DU-005	10/3/07	14:10	18.33
MW-DU-006	10/4/07	10:18	38.42
MW-DU-007	10/3/07	09:45	13.44
MW-DU-008	10/4/07	12:25	23.75
MW-DU-009	10/3/07	12:00	37.30
MW-DU-010	10/3/07	11:46	11.08
MW-DU-011	10/3/07	12:45	34.38

W. 10/10/07

Location: JPG Madison IN Date: 10/3/07  
 Project / Client: Louisville Army COR

- 11:50 Go to MW-DU-009 to  
 Collect Groundwater Sample
- 12:00 Water Level = 37.30 FTISTOC  
 Water Level Probe wiped with  
 DI Water before entering well.
- 12:05 Collect MW-DU-009 (SAC 08)  
 1 L. 1 Ltr Poly collected  
 Cool to 4°C
- 12:20 Arrive at SW-DU-005 &  
 SW-DU-005 to collect  
 Samples
- 12:40 Collect SW-DU-005 & SW-DU-005  
 Cool Samples to 4°C  
 Sediment Samples collected  
 with dedicated stainless steel  
 Spoon (decon in field office)  
 Collect:  
 1 L. 1 Ltr Poly - water  
 1 8 oz Amber - Sed
- 12:45 Arrive at ~~SW-DU-005~~ <sup>SW-DU-011</sup>  
 MW-DU-011 to collect groundwater  
 Sample. Water level = 34.381  
 Below top of casing (13.70C)  
 w.w. 10/10/07

Location: JPG Madison IN Date: 10/3/07  
 Project / Client: Louisville Army COR

LOCATION	DATE	TIME	SAC #	PIT	COND	TEMP	PH	DO	ORP	RED
MW-DU-001	10/3/07	14:45	SAC 08	7.60	0.524	05	12.69	18.3	6	6
MW-DU-002	10/4/07	08:30	SAC 08	6.44	0.533	152	11.06	16.1	5	5
MW-DU-003	10/4/07	09:20	SAC 08	6.69	0.513	146	10.55	16.7	5	5
MW-DU-004	10/4/07	13:15	SAC 08	7.16	0.593	144	10.06	23.8	5.5	5.5
MW-DU-005	10/3/07	14:15	SAC 07	7.30	4.18	171	12.58	12.4	5	5
MW-DU-006	10/4/07	10:15	SAC 08	7.20	0.563	144	11.36	16.1	5	5
MW-DU-007	10/4/07	09:40	SAC 08	7.18	0.356	144	10.08	17.8	6	6
MW-DU-008	10/4/07	12:25	SAC 08	7.49	0.517	147	12.02	17.1	6	6
MW-DU-009	10/3/07	12:05	SAC 08	7.27	1.16	187	12.96	15.5	5	5
MW-DU-010	10/3/07	11:40	SAC 08	6.96	0.505	183	10.79	18.7	5	5
MW-DU-011	10/3/07	12:50	SAC 08	7.48	1.82	143	12.62	15.9	6	6



Location JPG Madison IN Date 10/3/07

Project / Client Lawrence Army COE

1250 Collect groundwater  
Sample from mw-DU-011  
(SADC 07). Sample collected  
w/ the dedicated trailer &  
bailer rope (Disposable trailer).  
Sample cooled to 4°C.  
Collect 1-1 liter Poly

1305 Go to office for well KEY  
And to make phone calls

1350 Go back to DU AREA to  
continue sampling. Talked to  
Paul Glad on 10/2/07. They  
will not be burning brush  
in DU Area today. Okay to  
sample.

1410 Contact water level = 18.33 BFOC  
for well mw-DU-005

1420 Sample mw-DU-005 (SADC 07)  
Collect 1-1 liter <sup>14/10/07</sup> ~~Antibiotic~~ Poly  
Cool to 4°C.  
Sample collected w/ dedicated trailer &  
bailer rope.

W.C. 10/10/07

Location JPG Madison IN Date 10/3/07

Project / Client Lawrence Army COE

Surface water samples - water quality parameters									
Date	Time	Location	SADC	PH	COND	TEMP	DO	TEMP	BAR
10/3/07	0930	mw-DU-001	07	5.98	0.307	0.0	2.10	11.9	16
10/3/07	1025	mw-DU-002	08	6.13	0.244	7	5.02	18.4	5
		mw-DU-003		stream	Dry				1
10/03/07	1510	mw-DU-004		1.80	0.249	5	5.02	18.6	5
10/3/07	1230	mw-DU-005	08	7.84	0.233	2	5.08	11.4	6
10/4/07	-	mw-DU-006		stream	Dry	-	-	-	1
10/4/07	1740	mw-DU-007		7.81	0.257	10	1.12	23.3	5
10/3/07	11:05	mw-DU-008	08	6.91	0.251	0.0	1.95	18.4	5

W.C. 10/10/07

Location JPG - Madison IN Date 10/13/07  
 Project / Client Louisville COE

1445 Collect MW-DU-001 (SATC 08)  
 1-1 liter poly collected  
 Sample collected with  
 dedicated bucket (Precleaned)  
 and Rope.  
 Cooled to 4°C

15:10 Collect SW-DU-004, 004D  
 SD-DU-004  
 Duplicate Sample collected - SW  
 Cool to 4°C  
 Dedicated stainless steel spoon  
 & tubing used to collect  
 samples

1635 Collect SS-DU-002 (SATC 08)  
 Sample collected with  
 Dedicated stainless steel spoon  
 (Decorated at Field Office)  
 1 002 Amber collected  
 Cool 4°C

17:15 BACK AT Field Office to  
 unload & get ready for  
 sampling tomorrow

17:25 Clark Rivers OFFSITE

17:40 W. Ulman OFFSITE

W. Ulman 10/13/07

Location JPG - Madison IN Date 10/14/07  
 Project / Client Louisville COE

0700 Arrive AT Field Office  
 Personnel Onsite:

William Wilkinson - SNEC

Charles Powers - SNEC

All Personnel in level D PPR

Tasks for the Day:

1. Collect GSW Samples
2. Collect SW Samples
3. Collect SED Samples
4. Radio locate the wells
5. Sample Management

0800 Cars to AT SW-DU-003 and  
 SW-DU-007 to collect sampling  
 Creek Bed is Dry.

Conduct H/C tailgate

Level D PPR, DU

Barriers in DU Area

Setting - Leave DU Area

Insects

Drying in Road, Deer, Spill

W. Ulman

NOTE: SLTTR was in a controlled  
 burn - 2 days ago - Soil/SED

May be effected by this event

W. Ulman AT SW-DU-003. Creek Dry.  
 10/14/07



Location JPG Madison IN Date 10/14/07Project / Client Louisville COE

- #825 Arrive at  
 MW-DU-002 Collect  
 Water sample.  
 Water level = 14.48 FTBTOC  
 #830 Collect 1-2 liter Poly-DU  
 Sample collected with dedicated  
 bucket and rope.  
 Cool to 4°C  
 Sample 20 = MW-DU-002 (SASC02)

NOTE: HORIBA CONDUCTIVITY

AT #730 TODAY

Auto Calibration Solution

PH 4.000 0.0 mS 4.49 mS/cm

Expiration 12/29/08

Auto Cal = V Successful

Actual = 3.98 PH 9.49 mS/cm

Turbidity = 0.3 NTU'S - Try to clean

clean - 0.2 NTU'S - NOT SOLVING

appears to be functioning

Auto Cal read OK!

- #850 Arrive at Gravel Area  
 Above / near SW-DU-006 &  
 SD-DU-006  
 W.W. 10/10/07

Location JPG Madison IN Date 10/14/07 127Project / Client Louisville COE

- #885 Collect SD-DU-006 (SASC08)  
 Creek Bed Dry  
 1 8oz Amber collected  
 Sample collected with  
 dedicated stainless steel  
 Spoon - (Decanned w/  
 Ficus OFFICE w/alkalox  
 Potable Rinse, DE Rinse)

- #920 Arrive AT MW-DU-003  
 to collect groundwater sample  
 Water Level = 14.15 FTBTOC  
 collect water quality parameters  
 (Page 121)  
 1-1 liter Poly collected  
 Cool Sample to 4°C  
 Sample collected with dedicated  
 bucket & rope

- #940 Arrive AT MW-DU-007 (SASC08)  
 to collect water sample  
 Water level = 13.44 FTBTOC  
 Sample collected with dedicated  
 bucket & rope. Cooled to 4°C

W.W. 10/10/07

Location JPO Madison IN Date 10/4/07  
Project / Client Louisville COE

10:00 Arrive at SW-DU-007 &  
SD-DU-007 to collect  
SAMPLES. Creek is dry  
ABOVE & Below the Bridge  
(Upstream & Downstream of Bridge)  
Standing water (Groundwater?)  
Most likely. Collect sediment  
SAMPLE. Don't can do  
about this location.

SAMPLE COLLECTED WITH  
dedicated stainless steel Spoon.

10:15 Arrive at MW-DU-006 to  
Collect groundwater SAMPLE  
SAMPLE I.D. MW-DU-006 (JACO8)  
(SEE TABLE PREVIOUS)  
Water level = 38.42' BTOL  
Collect 1-1 Liter Poly  
Cool to 4°C

SAMPLE collected with dedicated  
bailer (ROPE (Treated Bailer).

10:25 Collect SAMPLE

10:30 Collect soil SAMPLE SC-DU-003  
& SS-DU-003 D. Cool to 4°C  
Dedicated stainless steel Spoon  
w.w. 10/10/07

Location JPO Madison IN Date 10/4/07  
Project / Client Louisville COE

10:50 Collect SS-DU-004 (JACO8)  
Sample collected with  
dedicated stainless steel  
Spoon, cooled to 4°C  
1 oz Amber collected

11:30 Arrive at Field Office

Go to town to get  
Something to drink

12:10 Back at Field Office

12:25 Arrive at MW-DU-008 (JACO8)

Water Level = 33.75' BTOL  
Collect water SAMPLE with  
dedicated bailer & bailer rope  
1-1 Liter Poly collected  
Cool 4°C

(SEE TABLE FOR PAGE 121 FOR  
WATER QUALITY PARAMETERS)

13:15 Arrive at MW-DU-004 to  
Collect Groundwater Sample.

Water Level = 14.42' BTOL

SAMPLE collected with dedicated  
bailer & rope  
Cool 4°C

Water Quality Parameters Page 121

w.w. 10/10/07

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Location JRG Madison IN Date 10/4/07

Project / Client LOUISVILLE COR

14:00 Go to get gas. First samples  
left to collect:

SS-DU-001 (8000 ft)

SW-DU-007 (8000 ft)

14:30 Talk to Paul & Paul Clark  
Burning in Dr Area started at  
wood. Talk to Joe (Eugene  
Wright) on phone. (Clark spoke  
with him). We can get an  
escort north 5-5:30 to  
get remaining samples. Fires  
must be burning actively.

Start sample management

17:05 Go where with Dr. Joe  
to collect samples.

Notes: Paul & Ken gave us  
escort to collect samples.

17:45 Collect SW-DU-007. Start 08  
Go back to find OFFICE  
to pump samples.

18:35 Go to Hotel to check  
internet & Do COLs.

w.w. 10/10/07

131

Location JRG Madison IN Date 10/5/07

Project / Client LOUISVILLE COR.

1600 Package samples for  
delivery to lab.  
Fed X Airbill # 829287950052  
Fed X Airbill # 829287950041  
Re-Test samples for  
Saturday shipment  
Samples HAVE:

Cushy Seals

Ziplock BAGS

Cooler - lined with Tinfoil

BAG Sediment Samples Separate

Cooling -

Cushy Seals

Dont type in Pigeon

Strapping tape

3 Coolers ship

1 - sed &amp; soils

2 with GW &amp; SW samples

Airbills - Saturday delivery

w.w. 10/10/07

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**APPENDIX C**  
**DATA VALIDATION SUMMARY**

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## C. DATA VALIDATION SUMMARY

### C.1 PARAGON ANALYTICS SDG 07-10-061

This report contains the results from the data validation technical review for the Jefferson Proving Ground (JPG) 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 0, 2/2004). 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 SDGs. 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	33
Total Number of Data Points	99
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 (American Society for Testing and Materials [ASTM] D3972-90M).
- Groundwater, surface water, and sediment/soil samples were analyzed in SDG 07-10-061.

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).

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.

- **Blank Contamination**—Uranium-234 was present in the associated water method blank at  $0.046 \pm 0.029$  picocuries per liter (pCi/L). This may indicate that contamination could have been introduced during the laboratory preparation. Those samples where the normalized absolute difference (NAD) between the sample and the method blank was less than 2.58 were qualified as estimated, *J*, with a reason code 6 for the Uranium-234 results via alpha spectroscopy. Although the blank contamination required qualification of associated sample data, the contamination was well below the requested MDC of 0.1 pCi/L.
- **Requested Minimum Detectable Concentration (MDC)**—The requested MDC of 0.1 pCi/L was not met for U-234 in sample MW-DU-004 SAIC08D. The reported activity for this sample is greater than the achieved MDC. No action is required.

3. Additional comments:

- The case narrative reports that the analytical method quantifies U-235 alpha activity in a specific region of interest corresponding to emission energies between those of U-234 and U-238. A potential limitation of this method is that measurable amounts of U-234 in the sample may cause a small amount of characteristic activity in the U-235 region of interest due to poorly resolved alpha activity at the boundary between the two regions. To minimize the potential for a high bias in the U-235 analytical results, the U-235 region of interest has been narrowed and limited to a lower energy region. An 85.1 percent abundance correction has been made to the final U-235 results. No action was taken during validation.

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



# SAMPLE INDEX

Laboratory:

Paragon Analytics

SDG #:

07-10-061

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
MW-DU-001 SAIC08	0710061-1	03-Oct-07	Isotopic Uranium
MW-DU-002 SAIC08	0710061-2	04-Oct-07	Isotopic Uranium
MW-DU-003 SAIC08	0710061-3	04-Oct-07	Isotopic Uranium
MW-DU-004 SAIC08	0710061-4	04-Oct-07	Isotopic Uranium
MW-DU-004 SAIC08D	0710061-5	04-Oct-07	Isotopic Uranium
MW-DU-005 SAIC08	0710061-6	03-Oct-07	Isotopic Uranium
MW-DU-006 SAIC08	0710061-7	04-Oct-07	Isotopic Uranium
MW-DU-007 SAIC08	0710061-8	04-Oct-07	Isotopic Uranium
MW-DU-008 SAIC08	0710061-9	04-Oct-07	Isotopic Uranium
MW-DU-009 SAIC08	0710061-10	03-Oct-07	Isotopic Uranium
MW-DU-010 SAIC08	0710061-11	03-Oct-07	Isotopic Uranium
MW-DU-011 SAIC08	0710061-12	03-Oct-07	Isotopic Uranium
SW-DU-001 SAIC08	0710061-13	03-Oct-07	Isotopic Uranium
SW-DU-002 SAIC08	0710061-14	03-Oct-07	Isotopic Uranium
SW-DU-004 SAIC08	0710061-15	03-Oct-07	Isotopic Uranium
SW-DU-004 SAIC08D	0710061-16	03-Oct-07	Isotopic Uranium
SW-DU-005 SAIC08	0710061-17	03-Oct-07	Isotopic Uranium
SW-DU-007 SAIC08	0710061-18	04-Oct-07	Isotopic Uranium
SW-DU-008 SAIC08	0710061-19	03-Oct-07	Isotopic Uranium
SS-DU-001 SAIC08	0710061-20	04-Oct-07	Isotopic Uranium
SS-DU-002 SAIC08	0710061-21	03-Oct-07	Isotopic Uranium
SS-DU-003 SAIC08D	0710061-22	04-Oct-07	Isotopic Uranium
SS-DU-003 SAIC08	0710061-23	04-Oct-07	Isotopic Uranium
SS-DU-004 SAIC08	0710061-24	04-Oct-07	Isotopic Uranium
SD-DU-001 SAIC08	0710061-25	03-Oct-07	Isotopic Uranium
SD-DU-002 SAIC08	0710061-26	03-Oct-07	Isotopic Uranium
SD-DU-003 SAIC08	0710061-27	04-Oct-07	Isotopic Uranium
SD-DU-003 SAIC08D	0710061-28	04-Oct-07	Isotopic Uranium
SD-DU-004 SAIC08	0710061-29	03-Oct-07	Isotopic Uranium
SD-DU-005 SAIC08	0710061-30	03-Oct-07	Isotopic Uranium
SD-DU-006 SAIC08	0710061-31	04-Oct-07	Isotopic Uranium
SD-DU-007 SAIC08	0710061-32	04-Oct-07	Isotopic Uranium
SD-DU-008 SAIC08	0710061-33	03-Oct-07	Isotopic Uranium

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**ATTACHMENT**

**JEFFERSON PROVING GROUND  
SAMPLE DATA SUMMARY SHEETS**

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SAMPLE DATA SUMMARY – SOILS							
Laboratory: Paragon Analytics					SDG #: 07-10-061		

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SS-DU-001 SAIC08	U-234	0.82	0.19	0.05	pCi/g		
SS-DU-001 SAIC08	U-235	0.090	0.052	0.019	pCi/g	J	37
SS-DU-001 SAIC08	U-238	0.88	0.20	0.03	pCi/g		
SS-DU-002 SAIC08	U-234	0.87	0.20	0.03	pCi/g		
SS-DU-002 SAIC08	U-235	0.047	0.036	0.033	pCi/g	J	37
SS-DU-002 SAIC08	U-238	0.68	0.16	0.03	pCi/g		
SS-DU-003 SAIC08D	U-234	0.68	0.16	0.02	pCi/g		
SS-DU-003 SAIC08D	U-235	0.046	0.036	0.018	pCi/g	J	37
SS-DU-003 SAIC08D	U-238	0.74	0.18	0.02	pCi/g		
SS-DU-003 SAIC08	U-234	0.66	0.17	0.06	pCi/g		
SS-DU-003 SAIC08	U-235	0.029	0.031	0.043	pCi/g	U	
SS-DU-003 SAIC08	U-238	0.83	0.19	0.04	pCi/g		
SS-DU-004 SAIC08	U-234	1.07	0.23	0.04	pCi/g		
SS-DU-004 SAIC08	U-235	0.070	0.044	0.017	pCi/g	J	37
SS-DU-004 SAIC08	U-238	0.93	0.21	0.03	pCi/g		
SD-DU-001 SAIC08	U-234	0.31	0.10	0.06	pCi/g		
SD-DU-001 SAIC08	U-235	0.028	0.033	0.051	pCi/g	U	
SD-DU-001 SAIC08	U-238	0.244	0.087	0.044	pCi/g		
SD-DU-002 SAIC08	U-234	0.257	0.093	0.047	pCi/g		
SD-DU-002 SAIC08	U-235	0.033	0.035	0.049	pCi/g	U	
SD-DU-002 SAIC08	U-238	0.289	0.099	0.017	pCi/g		
SD-DU-003 SAIC08	U-234	1.20	0.27	0.05	pCi/g		
SD-DU-003 SAIC08	U-235	0.048	0.042	0.049	pCi/g	U	
SD-DU-003 SAIC08	U-238	0.94	0.22	0.05	pCi/g		
SD-DU-003 SAIC08D	U-234	1.03	0.23	0.05	pCi/g		
SD-DU-003 SAIC08D	U-235	0.025	0.028	0.037	pCi/g	U	
SD-DU-003 SAIC08D	U-238	0.90	0.21	0.04	pCi/g		
SD-DU-004 SAIC08	U-234	0.138	0.066	0.058	pCi/g		

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SD-DU-004 SAIC08	U-235	0.005	0.027	0.040	pCi/g	U	
SD-DU-004 SAIC08	U-238	0.161	0.071	0.050	pCi/g		
SD-DU-005 SAIC08	U-234	0.277	0.094	0.043	pCi/g		
SD-DU-005 SAIC08	U-235	0.028	0.028	0.019	pCi/g	J	37
SD-DU-005 SAIC08	U-238	0.32	0.10	0.04	pCi/g		
SD-DU-006 SAIC08	U-234	0.79	0.2	0.04	pCi/g		
SD-DU-006 SAIC08	U-235	0.046	0.039	0.021	pCi/g	J	37
SD-DU-006 SAIC08	U-238	0.63	0.16	0.04	pCi/g		
SD-DU-007 SAIC08	U-234	0.98	0.23	0.09	pCi/g		
SD-DU-007 SAIC08	U-235	0.062	0.044	0.038	pCi/g	J	37
SD-DU-007 SAIC08	U-238	0.82	0.20	0.06	pCi/g		
SD-DU-008 SAIC08	U-234	0.261	0.094	0.074	pCi/g		
SD-DU-008 SAIC08	U-235	0.009	0.026	0.046	pCi/g	U	
SD-DU-008 SAIC08	U-238	0.207	0.081	0.058	pCi/g		

SAMPLE DATA SUMMARY – WATERS							
Laboratory: Paragon Analytics					SDG #: 07-10-061		

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
MW-DU-001 SAIC08	U-234	0.237	0.074	0.036	pCi/L	J	6
MW-DU-001 SAIC08	U-235	-0.008	0.022	0.049	pCi/L	U	
MW-DU-001 SAIC08	U-238	0.152	0.055	0.011	pCi/L		
MW-DU-002 SAIC08	U-234	0.82	0.19	0.06	pCi/L		
MW-DU-002 SAIC08	U-235	0.024	0.028	0.041	pCi/L	U	
MW-DU-002 SAIC08	U-238	0.39	0.11	0.04	pCi/L		
MW-DU-003 SAIC08	U-234	0.55	0.15	0.06	pCi/L		
MW-DU-003 SAIC08	U-235	0.059	0.058	0.084	pCi/L	U	
MW-DU-003 SAIC08	U-238	0.33	0.12	0.08	pCi/L		
MW-DU-004 SAIC08	U-234	1.48	0.29	0.07	pCi/L		
MW-DU-004 SAIC08	U-235	0.084	0.053	0.064	pCi/L	J	37
MW-DU-004 SAIC08	U-238	1.27	0.25	0.06	pCi/L		
MW-DU-004 SAIC08D	U-234	1.52	0.34	0.10	pCi/L		
MW-DU-004 SAIC08D	U-235	0.082	0.056	0.025	pCi/L	J	37
MW-DU-004 SAIC08D	U-238	1.36	0.31	0.09	pCi/L		
MW-DU-005 SAIC08	U-234	0.222	0.070	0.029	pCi/L	J	6
MW-DU-005 SAIC08	U-235	0.029	0.030	0.042	pCi/L	U	
MW-DU-005 SAIC08	U-238	0.106	0.048	0.042	pCi/L		
MW-DU-006 SAIC08	U-234	2.35	0.42	0.03	pCi/L		
MW-DU-006 SAIC08	U-235	0.131	0.055	0.014	pCi/L		
MW-DU-006 SAIC08	U-238	2.00	0.37	0.04	pCi/L		
MW-DU-007 SAIC08	U-234	1.18	0.24	0.03	pCi/L		
MW-DU-007 SAIC08	U-235	0.070	0.046	0.051	pCi/L	J	37
MW-DU-007 SAIC08	U-238	0.71	0.17	0.05	pCi/L		
MW-DU-008 SAIC08	U-234	0.313	0.089	0.042	pCi/L		
MW-DU-008 SAIC08	U-235	0.029	0.027	0.034	pCi/L	U	
MW-DU-008 SAIC08	U-238	0.220	0.072	0.042	pCi/L		
MW-DU-009 SAIC08	U-234	1.15	0.23	0.03	pCi/L		
MW-DU-009 SAIC08	U-235	0.026	0.027	0.036	pCi/L	U	
MW-DU-009 SAIC08	U-238	0.332	0.094	0.039	pCi/L		
MW-DU-010 SAIC08	U-234	1.71	0.32	0.03	pCi/L		
MW-DU-010 SAIC08	U-235	0.081	0.041	0.013	pCi/L	J	37

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
MW-DU-010 SAIC08	U-238	0.76	0.16	0.03	pCi/L		
MW-DU-011 SAIC08	U-234	0.133	0.054	0.037	pCi/L	J	6
MW-DU-011 SAIC08	U-235	-0.025	0.031	0.078	pCi/L	U	
MW-DU-011 SAIC08	U-238	0.052	0.040	0.056	pCi/L	U	
SW-DU-001 SAIC08	U-234	0.197	0.094	0.089	pCi/L	J	6
SW-DU-001 SAIC08	U-235	0.010	0.043	0.065	pCi/L	U	
SW-DU-001 SAIC08	U-238	0.195	0.089	0.069	pCi/L		
SW-DU-002 SAIC08	U-234	0.206	0.069	.038	pCi/L	J	6
SW-DU-002 SAIC08	U-235	0.026	0.027	.036	pCi/L	U	
SW-DU-002 SAIC08	U-238	0.295	0.087	.038	pCi/L		
SW-DU-004 SAIC08	U-234	0.102	0.052	0.059	pCi/L	J	6
SW-DU-004 SAIC08	U-235	0.025	0.026	0.034	pCi/L	U	
SW-DU-004 SAIC08	U-238	0.151	0.061	0.056	pCi/L		
SW-DU-004 SAIC08D	U-234	0.107	0.050	0.034	pCi/L	J	6
SW-DU-004 SAIC08D	U-235	0.011	0.027	0.015	pCi/L	U	
SW-DU-004 SAIC08D	U-238	0.181	0.069	0.050	pCi/L		
SW-DU-005 SAIC08	U-234	0.85	0.18	0.04	pCi/L		
SW-DU-005 SAIC08	U-235	0.059	0.037	0.035	pCi/L	J	37
SW-DU-005 SAIC08	U-238	5.35	0.90	0.04	pCi/L		
SW-DU-007 SAIC08	U-234	0.176	0.067	0.047	pCi/L	J	6
SW-DU-007 SAIC08	U-235	0.023	0.033	0.056	pCi/L	U	
SW-DU-007 SAIC08	U-238	0.124	0.052	0.012	pCi/L		
SW-DU-008 SAIC08	U-234	0.158	0.058	0.030	pCi/L	J	6
SW-DU-008 SAIC08	U-235	0.029	0.024	0.013	pCi/L	J	37
SW-DU-008 SAIC08	U-238	0.342	0.095	0.043	pCi/L		



## KEY TO THE DATA VALIDATION QUALIFIERS

QUALIFIERS	
U	Indicates that the data met all quality assurance/quality control (QA/QC) requirements, and that the radionuclide was analyzed for but was not detected above the reported sample quantitation limit.
J	Indicates that the radionuclide was positively identified; the associated numerical value is the approximate concentration of the radionuclide in the sample.
UJ	Indicates that the radionuclide was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
N	The analysis indicates the presence of a radionuclide for which there is presumptive evidence to make a "tentative identification."
R	Indicates that the sample results for the radionuclide are rejected or unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the radionuclide cannot be verified.

### Data Validation Reason Code

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

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