DEPARTMENT OF THE ARMY
INSTALLATION MANAGEMENT AGENCY
HEADQUARTERS, UNITED STATES ARMY GARRISON-ROCK ISLAND ARSENAL
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REPLY TO
ATTENTION OF:

02 MAR 2007

Office of the Garrison Manager

Dr. Thomas McLaughlin
Office of Federal and State Materials and
Environmental Management Programs (FSME)
Division of Waste Management and
Environmental Protection (DWMEP)
Decommissioning and Uranium Recovery
Licensing Directorate (DURLD)
Materials Decommissioning Branch (MDB)
Mail Stop T-7E18
U.S Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Dr. McLaughlin:

In accordance with the US Army's Jefferson Proving Ground License SUB-1435 requirements, enclosed are electronic and hard copies of the Final, Radiation Monitoring Report for License SUB-1435 Jefferson Proving Ground, Summary of Results for September 27 – October 5, 2006 Sampling Event.

Please contact Mr. Paul Cloud at (410) 436-2381, E-mail address paul.d.cloud@us.army.mil, or Mr. John J. Welling at (309) 782-8433, E-mail address john.j.welling@us.army.mil, if you have any questions.

Sincerely,

Alan G. Wilson
Garrison Manager

Enclosure

Copy Furnished:
Paul Cloud
Brooks Evens

RADIATION MONITORING REPORT
FOR LICENSE SUB-1435
JEFFERSON PROVING GROUND

Summary of Results for
September 27 – October 5, 2006 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

March 2007

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LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	Micrograms per Liter
µR/hr	Micro-Roentgens/Hour
ASTM	American Society for Testing and Materials
CHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
CFR	Code of Federal Regulations
DO	Dissolved Oxygen
DQO	Data Quality Objective
DU	Depleted Uranium
ERM	Environmental Radiation Monitoring
ERMP	Environmental Radiation Monitoring Program
I.D.	Identification
JPG	Jefferson Proving Ground
LCL	Lower Control Limit
MDC	Maximum Detectable Concentration
NCR	Nonconformance Report
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 (ERM) Program, 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 ERM Program 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 2006 sampling event, which is the second of two sampling events in 2006 for this biannual program. The sampling requirements and methodology are presented in Section 2. The results of the multimedia sampling event are presented and discussed in Section 3. Historical data from the ERM Program 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 Environmental Radiation Monitoring Program (ERMP) (U.S. Army 2000) approved by the NRC and the SOP, provided in Appendix A, specifies the Army's (i.e., 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. Science Applications International Corporation (SAIC) implemented this procedure to fulfill the Army's responsibilities for monitoring under NRC Radioactive Material License SUB-1435.

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3. RESULTS

The three-person SAIC field crew prepared for and conducted field sampling at JPG from September 27 through 29, 2006. Additional samples were collected on October 4 and 5, 2006, as described in Section 3.3. Appendix B contains the field logbook documenting field activities during both sampling efforts. No unusual or abnormal conditions (e.g., soil or water discoloration, odd odors, or elevated radiation levels) were observed during the sampling efforts. One water conductivity reading was 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 (see 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 0.15 picocuries per liter (pCi/L) to 3.93 pCi/L, with an average concentration of 1.27 pCi/L. In addition to the individual isotopic concentrations, Table 3-1 also presents the U-238/U-234 ratios for each sample, which ranged from 0.23 ± 0.10 to 1.07 ± 0.57.

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.

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.

A groundwater sample could not be collected from monitoring well MW005 because the well was dry. No results are reported for this well in either Table 3-1 or Table 3-2.

The groundwater sample from monitoring well MW009 (sample MW-DU-009) exhibited a conductivity value well in excess of all other water samples. Historically, the conductivity values have been the highest in this well and have ranged from 7.0 to 11.3 microSiemens/cm, but the measurements are generally low as compared to the conductivities measured in other JPG wells (e.g., the Range Study, 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 0.09 to 0.48 pCi/L, with an average concentration of 0.30 pCi/L. The U-238/U-234 ratio for each sample ranged from 0.76 ± 0.45 to 2.65 ± 2.02.

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 water samples. A U-238/U-234 ratio was not calculated for samples at three surface water locations (SWS05, SWS06, and SWS07), since U-238 was not detected in these samples.

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 0.35 to 1.61 picocuries per gram (pCi/g), with an average concentration of 0.79 pCi/g. The U-238/U-234 ratio for each sample ranged from 0.67 ± 0.40 to 1.33 ± 0.64.

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.

Samples SD-DU-001, SD-DU-002, SD-DU-002D (duplicate), and SD-DU-008 had broken container lids upon arrival at the analytical laboratory. The SAIC Project Manager was immediately notified and replacement samples were collected on October 4 and October 5, 2006. SAIC staff were present on the JPG site for the collection of stream gauging data and were able to collect replacement samples expeditiously. Only the replacement samples were analyzed because ice water appears to have intruded into the broken containers, so the laboratory was concerned about the possibility of potential cross-contamination adversely impacting the results.

The suspected cause of the broken lids is that sample bottles were inadvertently placed in the cooler without bubble wrap. The corrective actions include an action for the Field Manager to check all packing before bottles are placed in coolers for shipment and the development of a nonconformance report (NCR).

3.4 SOIL

The concentrations of total uranium in surface soil at four surface soil sample locations plus 1 duplicate sample are presented in Table 3-6. Total uranium concentrations ranged from 1.33 to 1.93 pCi/g, with an average concentration of 1.61 pCi/g. The U-238/U-234 ratios ranged from 0.95 ± 0.31 to 1.13 ± 0.39.

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.

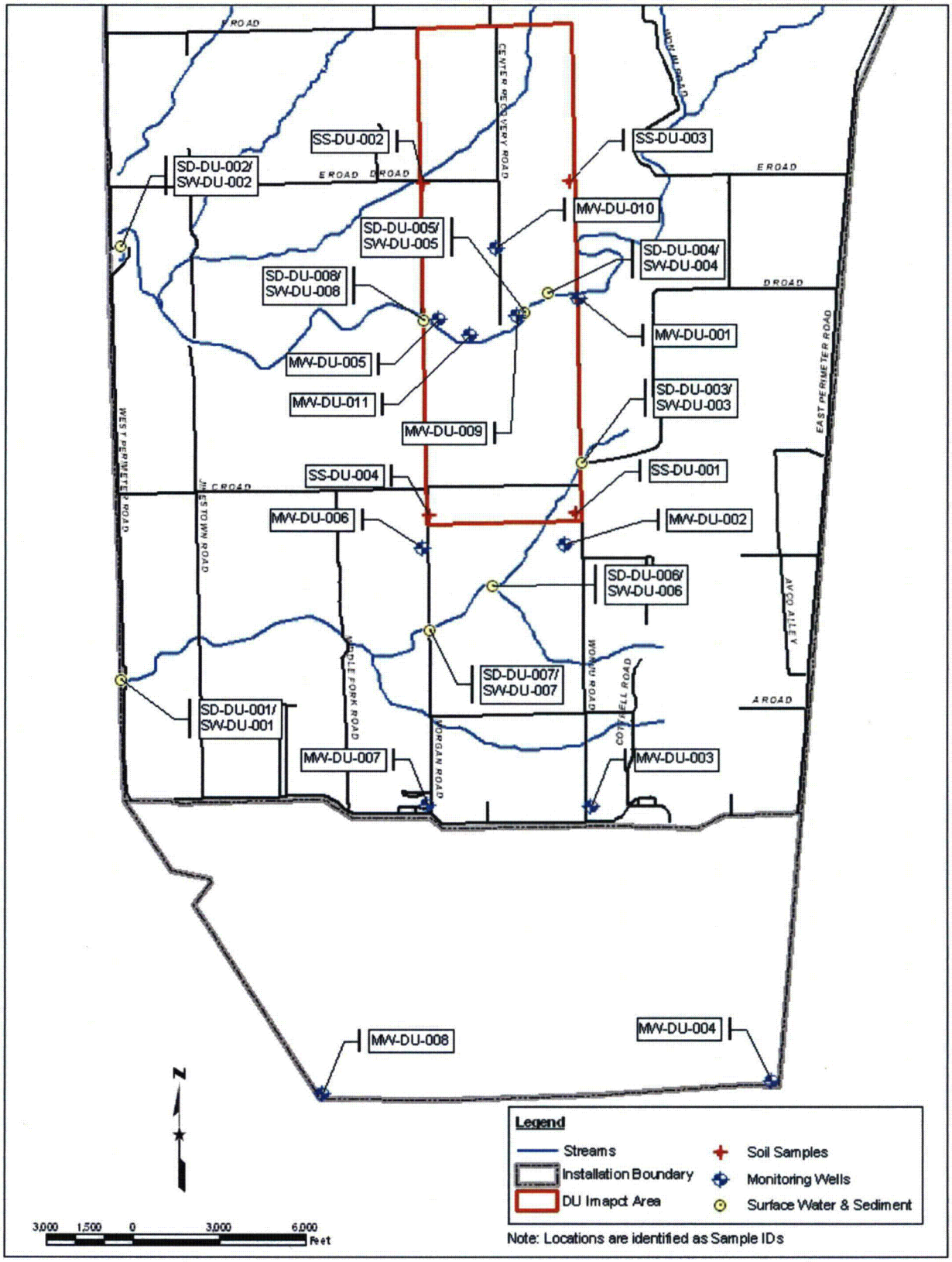

Figure 3-1. Sampling Locations for the JPG ERM Program

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

JPG Sample Designation[a]	Sample I.D.	Analyte	Result (pCi/L)
MW01	MW-DU-001	U-234	0.255 J
MW01	MW-DU-001	U-235	0.022 U
MW01	MW-DU-001	U-238	0.141
		Total Uranium	**0.42**
		U-238/U-234 Ratio[b]	0.55
MW02	MW-DU-002	U-234	0.86
MW02	MW-DU-002	U-235	0.02 U
MW02	MW-DU-002	U-238	0.46
		Total Uranium	**1.34**
		U-238/U-234 Ratio[b]	0.53
MW03	MW-DU-003	U-234	0.35 J
MW03	MW-DU-003	U-235	0.013 U
MW03	MW-DU-003	U-238	0.159
		Total Uranium	**0.52**
		U-238/U-234 Ratio[b]	0.45
MW04	MW-DU-004	U-234	0.36 J
MW04	MW-DU-004	U-235	0.0 U
MW04	MW-DU-004	U-238	0.238
		Total Uranium	**0.60**
		U-238/U-234 Ratio[b]	0.66
MW04	MW-DU-004D	U-234	0.33 J
MW04	MW-DU-004D	U-235	0.03 J
MW04	MW-DU-004D	U-238	0.261
		Total Uranium	**0.62**
		U-238/U-234 Ratio[b]	0.79
MW05	MW-DU-005	U-234	No Sample
MW05	MW-DU-005	U-235	No Sample
MW05	MW-DU-005	U-238	No Sample
		Total Uranium	**-----**
		U-238/U-234 Ratio[b]	-----
MW06	MW-DU-006	U-234	2.11
MW06	MW-DU-006	U-235	0.089 J
MW06	MW-DU-006	U-238	1.73
		Total Uranium	**3.93**
		U-238/U-234 Ratio[b]	0.82
MW07	MW-DU-007	U-234	1.19
MW07	MW-DU-007	U-235	0.052 J
MW07	MW-DU-007	U-238	0.71
		Total Uranium	**1.95**
		U-238/U-234 Ratio[b]	0.60

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

JPG Sample Designation[a]	Sample I.D.	Analyte	Result (pCi/L)
MW08	MW-DU-008	U-234	0.232 J
MW08	MW-DU-008	U-235	0.009 U
MW08	MW-DU-008	U-238	0.248
		Total Uranium	**0.49**
		U-238/U-234 Ratio[b]	1.07
MW09	MW-DU-009	U-234	1
MW09	MW-DU-009	U-235	0.031 J
MW09	MW-DU-009	U-238	0.228
		Total Uranium	**1.26**
		U-238/U-234 Ratio[b]	0.23
MW010	MW-DU-010	U-234	1.82
MW010	MW-DU-010	U-235	0.084 J
MW010	MW-DU-010	U-238	0.78
		Total Uranium	**2.68**
		U-238/U-234 Ratio[b]	0.43
MW011	MW-DU-011	U-234	0.128 J
MW011	MW-DU-011	U-235	0.011 U
MW011	MW-DU-011	U-238	0.013 U
		Total Uranium	**0.15**
		U-238/U-234 Ratio[b]	ND

[a] Represents sample designation developed in previous sampling programs.
[b] 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 conducted.
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 3-2. Groundwater Water Quality Parameters and Exposure Readings
Jefferson Proving Ground, Madison, Indiana

JPG Designation*	Sample I.D.	pH	Temp (°C)	Conductivity (microSiemens/cm)	Dissolved Oxygen (mg/L)	Rad (μR/hr)
MW01	MW-DU-001	7.41	15.6	0.471	9.86	5
MW02	MW-DU-002	7.45	15.9	0.502	9.55	5
MW03	MW-DU-003	7.38	16.8	0.603	9.00	6
MW04	MW-DU-004	7.52	17.6	0.483	9.05	5
MW05	MW-DU-005	No Sample				
MW06	MW-DU-006	7.54	17.2	0.598	16.69	6
MW07	MW-DU-007	7.55	17.4	0.585	8.78	5
MW08	MW-DU-008	7.52	13.9	0.391	10.72	6
MW09	MW-DU-009	7.42	15.2	7.73	12.10	5
MW10	MW-DU-0010	7.49	20.0	0.600	9.63	6
MW11	MW-DU-0011	7.65	19.5	0.346	10.31	5

* Represents sample designation developed in previous sampling programs.

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

JPG Sample Designation[a]	Sample I.D.	Analyte	Result (pCi/g)
SWS01	SW-DU-001	U-234	0.233 J
SWS01	SW-DU-001	U-235	0.031 U
SWS01	SW-DU-001	U-238	0.178
		Total Uranium	**0.44**
		U-238/U-234 Ratio[b]	0.76
SWS01	SW-DU-001D	U-234	0.149 J
SWS01	SW-DU-001D	U-235	0.036 U
SWS01	SW-DU-001D	U-238	0.29
		Total Uranium	**0.48**
		U-238/U-234 Ratio[b]	1.95
SWS02	SW-DU-002	U-234	0.121 J
SWS02	SW-DU-002	U-235	0.001 U
SWS02	SW-DU-002	U-238	0.101 J
		Total Uranium	**0.22**
		U-238/U-234 Ratio[b]	0.83
SWS03	SW-DU-003	U-234	0.165 J
SWS03	SW-DU-003	U-235	0.009 U
SWS03	SW-DU-003	U-238	0.237
		Total Uranium	**0.41**
		U-238/U-234 Ratio[b]	1.44
SWS04	SW-DU-004	U-234	0.042 U
SWS04	SW-DU-004	U-235	0.04 U
SWS04	SW-DU-004	U-238	0.022 U
		Total Uranium	**ND**
		U-238/U-234 Ratio[b]	ND
SWS05	SW-DU-005	U-234	0.17 J
SWS05	SW-DU-005	U-235	0.036 U
SWS05	SW-DU-005	U-238	0.064 U
		Total Uranium	**0.27**
		U-238/U-234 Ratio[b]	ND
SWS06	SW-DU-006	U-234	0.088 J
SWS06	SW-DU-006	U-235	0.021 U
SWS06	SW-DU-006	U-238	0.233
		Total Uranium	**0.34**
		U-238/U-234 Ratio[b]	2.65
SWS07	SW-DU-007	U-234	0.055 J
SWS07	SW-DU-007	U-235	0.012 U
SWS07	SW-DU-007	U-238	0.021 U
		Total Uranium	**0.09**
		U-238/U-234 Ratio[b]	ND
SWS08	SW-DU-008	U-234	0.087 J
SWS08	SW-DU-008	U-235	0.014 U
SWS08	SW-DU-008	U-238	0.023 U
		Total Uranium	**0.12**
		U-238/U-234 Ratio[b]	ND

[a] Represents sample designation developed in previous sampling programs.
[b] 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 conducted.
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[a]	Sample I.D.	pH	Temp (°C)	Conductivity (microSiemens/cm)	Dissolved Oxygen (mg/L)	Rad (μR/hr)
SWS01	SW-DU-001	7.57	15.2	0.222	9.05	5
SWS02	SW-DU-002	7.50	15.9	0.191	8.64	5
SWS03	SW-DU-003	7.75	16.1	0.132	5.36	5
SWS04	SW-DU-004	8.06	16.1	0.213	6.91	5
SWS05	SW-DU-005	7.45	17.1	0.282	7.54	5
SWS06	SW-DU-006	8.05	16.2	0.136	7.64	—[b]
SWS07	SW-DU-007	8.28	18.7	0.142	9.62	—[b]
SWS08	SW-DU-008	7.73	16.2	0.218	7.48	—[b]

[a] Represents sample designation developed in previous sampling programs.
[b] Readings taken, but not recorded. This was an oversight. The corrective action that will be taken to prevent reoccurrence is for the Field Manager to review logbooks to ensure completeness in recorded data before leaving the site after completing sampling activities.

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

JPG Sample Designation[a]	Sample I.D.	Analyte	Result (pCi/g)
SES01	SD-DU-001	U-234	0.329
SES01	SD-DU-001	U-235	0.01 U
SES01	SD-DU-001	U-238	0.239
		Total Uranium	**0.58**
		U-238/U-234 Ratio[b]	0.73
SES02	SD-DU-002	U-234	0.19
SES02	SD-DU-002	U-235	0.027 J
SES02	SD-DU-002	U-238	0.128
		Total Uranium	**0.35**
		U-238/U-234 Ratio[b]	0.67
SES02	SD-DU-002D	U-234	0.234
SES02	SD-DU-002D	U-235	0.02 J
SES02	SD-DU-002D	U-238	0.243
		Total Uranium	**0.50**
		U-238/U-234 Ratio[b]	1.04
SES03	SD-DU-003	U-234	0.67
SES03	SD-DU-003	U-235	0.05 J
SES03	SD-DU-003	U-238	0.6
		Total Uranium	**1.32**
		U-238/U-234 Ratio[b]	0.90
SES04	SD-DU-004	U-234	0.314
SES04	SD-DU-004	U-235	0.023 U
SES04	SD-DU-004	U-238	0.34
		Total Uranium	**0.68**
		U-238/U-234 Ratio[b]	1.08
SES05	SD-DU-005	U-234	0.232
SES05	SD-DU-005	U-235	0.026 U
SES05	SD-DU-005	U-238	0.309
		Total Uranium	**0.57**
		U-238/U-234 Ratio[b]	1.33

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

JPG Sample Designation[a]	Sample I.D.	Analyte	Result (pCi/g)
SES06	SD-DU-006	U-234	0.84
SES06	SD-DU-006	U-235	0.018 U
SES06	SD-DU-006	U-238	0.75
		Total Uranium	**1.61**
		U-238/U-234 Ratio[b]	0.89
SES07	SD-DU-007	U-234	0.52
SES07	SD-DU-007	U-235	0.029 U
SES07	SD-DU-007	U-238	0.44
		Total Uranium	**0.99**
		U-238/U-234 Ratio[b]	0.85
SES08	SD-DU-008	U-234	0.294
SES08	SD-DU-008	U-235	0.005 U
SES08	SD-DU-008	U-238	0.272
		Total Uranium	**0.57**
		U-238/U-234 Ratio[b]	0.93

[a] Represents sample designation developed in previous sampling programs.
[b] 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 conducted.
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 Designation[a]	Sample I.D.	Analyte	Result (pCi/g)
SOS01	SS-DU-001	U-234	0.93
SOS01	SS-DU-001	U-235	0.05 J
SOS01	SS-DU-001	U-238	0.95
		Total Uranium	**1.93**
		U-238/U-234 Ratio[b]	1.02
SOS02	SS-DU-002	U-234	0.77
SOS02	SS-DU-002	U-235	0.042 J
SOS02	SS-DU-002	U-238	0.73
		Total Uranium	**1.54**
		U-238/U-234 Ratio[b]	0.95
SOS03	SS-DU-003	U-234	0.75
SOS03	SS-DU-003	U-235	0.02 J
SOS03	SS-DU-003	U-238	0.76
		Total Uranium	**1.53**
		U-238/U-234 Ratio[b]	1.01
SOS03	SS-DU-003D	U-234	0.61
SOS03	SS-DU-003D	U-235	0.03 U
SOS03	SS-DU-003D	U-238	0.69
		Total Uranium	**1.33**
		U-238/U-234 Ratio[b]	1.13
SOS04	SS-DU-004	U-234	0.81
SOS04	SS-DU-004	U-235	0.069 J
SOS04	SS-DU-004	U-238	0.85
		Total Uranium	**1.73**
		U-238/U-234 Ratio[b]	1.05

[a] Represents sample designation developed in previous sampling programs.
[b] 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 conducted.
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.

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4. HISTORICAL DATA ASSESSMENT AND TREND ANALYSIS

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

Table 4-1. Action Levels and Corrective Actions for Total Uranium in Environmental Media Jefferson Proving Ground, Madison, Indiana

Medium	Total Uranium Action Level	Corrective Action
Groundwater and Surface Water	≥ 150 pCi/L*	Resample. If activity verified, notify NRC and assess results. The findings and recommended corrective actions will be documented for the Army's Radiation Control Committee. The Committee will provide recommendations to the Commander based on its evaluation.
	Less than 150 pCi/L	No action.
Soil and Sediment:		
Perimeter and Background Samples	≥ 35 pCi/g	Collect five additional samples in a 1-meter grid. If average activity exceeds 35 pCi/g, decontaminate to 35 pCi/g.
	Less than 35 pCi/g	No corrective action.
Samples Along the Firing Line	100 – 300 pCi/g	Collect five additional samples in a 1-meter grid. If average activity exceeds 100 pCi/g, investigate and determine reason for high level. If > 300 pCi/g verified, investigate to determine cause and contact NRC.
	Less than 100 pCi/g	No corrective action.

* Effluent concentration limit for uranium is 300 pCi/L in 10 CFR 20, Appendix B, Table 2, Column 2.
Source: Appendix A, pages A-6 and A-7.

An assessment of historical trends for ERM program 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.[1] 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 (μg/L) rather than pCi/L.

As noted above, the April 2006 Radiation Monitoring Report (SAIC 2006) provided detailed information about the trending methods employed and why certain data were or were not included in the initial trend analysis. To avoid confusion, that information is not repeated in this report. This report section re-examines the ERM program data for historical trends following the addition of the ERM program data collected during the September – October 2006 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 59 discrete samples available from 11 monitoring wells (MW01 to MW11) during the period of 2004 through 2006, the average total uranium activity-concentration is 1.50 pCi/L, the standard deviation

[1] 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.

is 1.17 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.

Inspection of the figures for all 11 individual monitoring wells indicates no significant trends. Only samples from wells MW-DU-006, MW-DU-008, and MW-DU-009 exhibited trend lines with R^2 values greater than 0.5 (i.e., somewhat significant) and, in each instance, 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. 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 five points that lie above the UCL. All five points are for MW-DU-006. Clearly, this well has exhibited and continues to exhibit total uranium results in excess of the other wells. The boring logs for this well indicate that this well was not screened in bedrock. The U-238/U-234 ratio for all five of these samples was approximately 1.0, eliminating DU as a likely cause. This well will continue to be monitored closely.

4.2 SURFACE WATER

For 45 discrete samples available from 8 surface water sampling locations (SW01 to SW08) during the period of 2004 through 2006, the average total uranium activity-concentration is 0.60 pCi/L, the standard deviation is 0.51 pCi/L, and the maximum detected activity-concentration is 2.95 pCi/L. The activity-concentrations at each well 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.

Inspection of the figures for all eight individual surface water sampling locations indicates 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 no new points above the UCL or below the LCL. All of the surface water results for the October sampling event fall below the mean, suggesting a general decrease in the overall uranium concentrations. These data should be monitored to determine if there is a repeating cycle. 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 2006 results for SW-DU-005 are at levels consistent with previous years and well below the elevated level in October 2005 (2.95 pCi/L).

4.3 SEDIMENT

For 52 discrete samples available from 8 sediment sampling locations (SD01 to SD08) during the period of 2004 through 2006, the average total uranium activity-concentration is 0.95 pCi/g, the standard deviation is 0.50 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.

Inspection of the figures for all eight individual sediment sampling locations indicates no significant trends. Only sample SD-DU-007 exhibited a trend line with an R^2 values greater than 0.5 (i.e., somewhat significant), and that trend was in the decreasing direction. The potential increasing trend at SD-DU-002 noted in the April 2006 report (SAIC 2006) has not continued.

The eight sediment sampling locations also were examined in aggregate to determine if some locations or particular sampling events were distinctive. A simple individual control chart was created using the pooled data for all sediment sampling locations and all data collected after December 2004 (Figure 4-31).

Figure 4-31 indicates no new points above the UCL or below the LCL. The October 2006 sediment sampling results vary around the mean, as expected.

4.4 SOILS

For 30 discrete samples available from 4 surface soil sampling locations (SS01 to SS04) during the period of 2004 through 2006, the average total uranium activity-concentration is 1.61 pCi/g, the standard deviation is 0.25 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.

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.

Inspection of the figures for all four individual surface soil sampling locations indicates no significant trends. None of the samples exhibited trend lines with R^2 values greater than 0.5 (i.e., somewhat significant).

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).

Figure 4-36 indicates no new points above the UCL or below the LCL. The October 2006 surface soil sampling results vary around the mean, as expected.

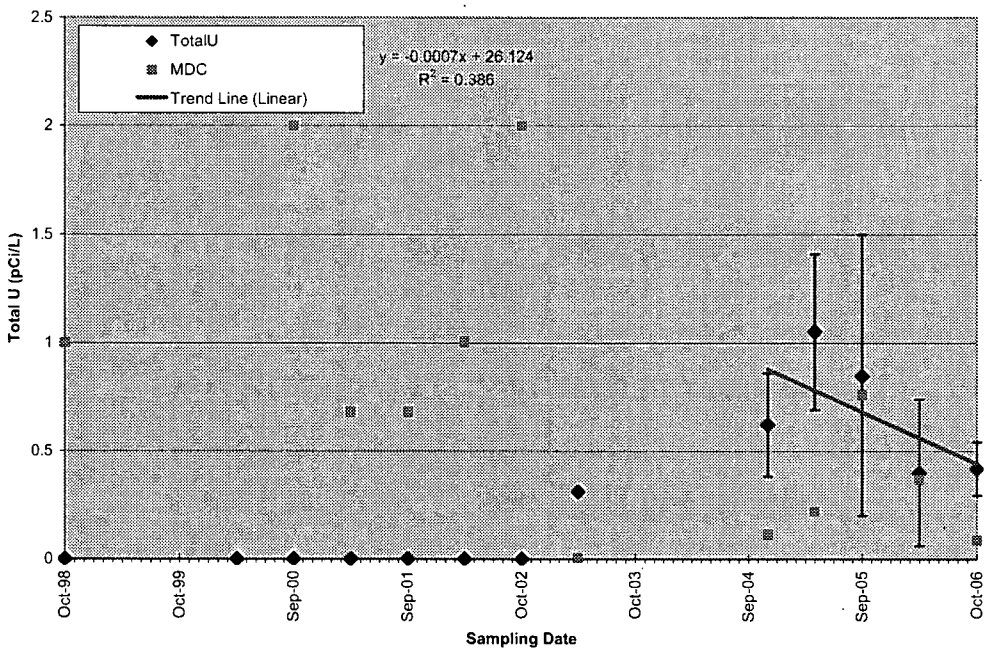

Figure 4-1. Total Uranium in MW-DU-001 (1998-2006)

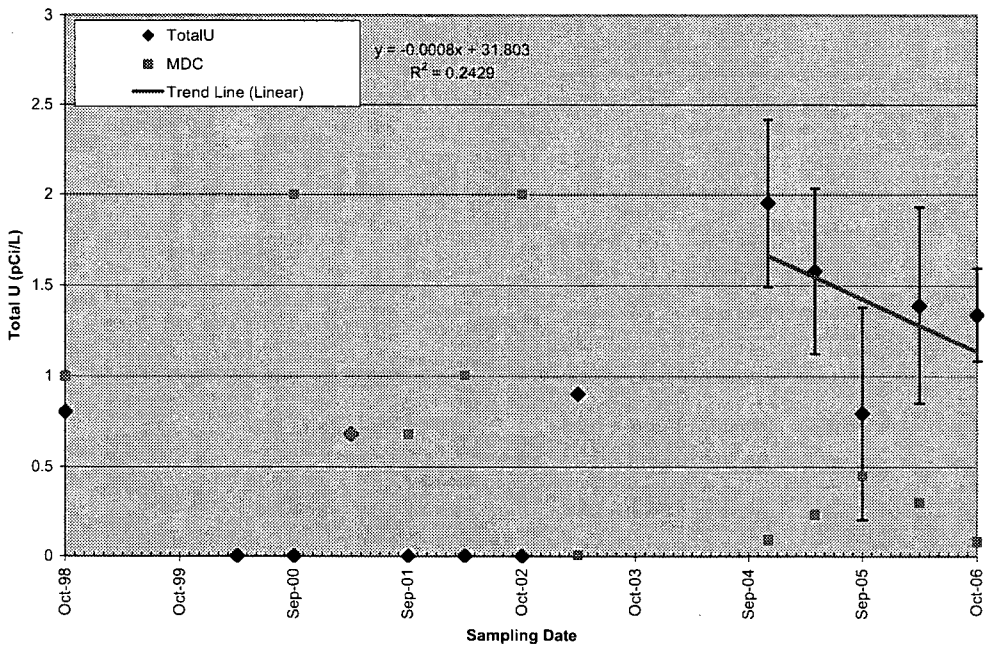

Figure 4-2. Total Uranium in MW-DU-002 (1998-2006)

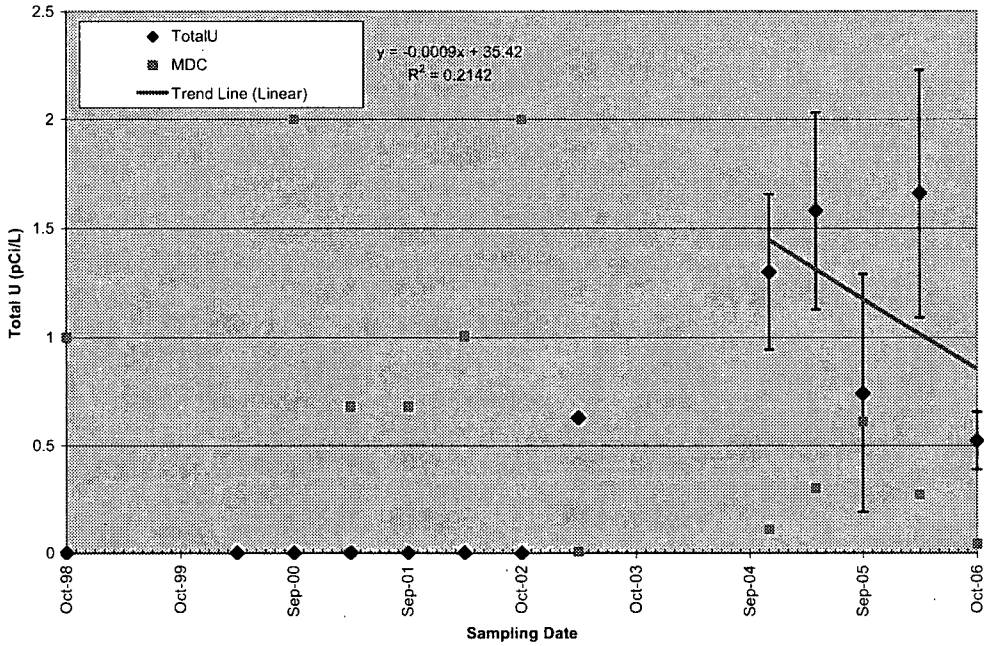

Figure 4-3. Total Uranium in MW-DU-003 (1998-2006)

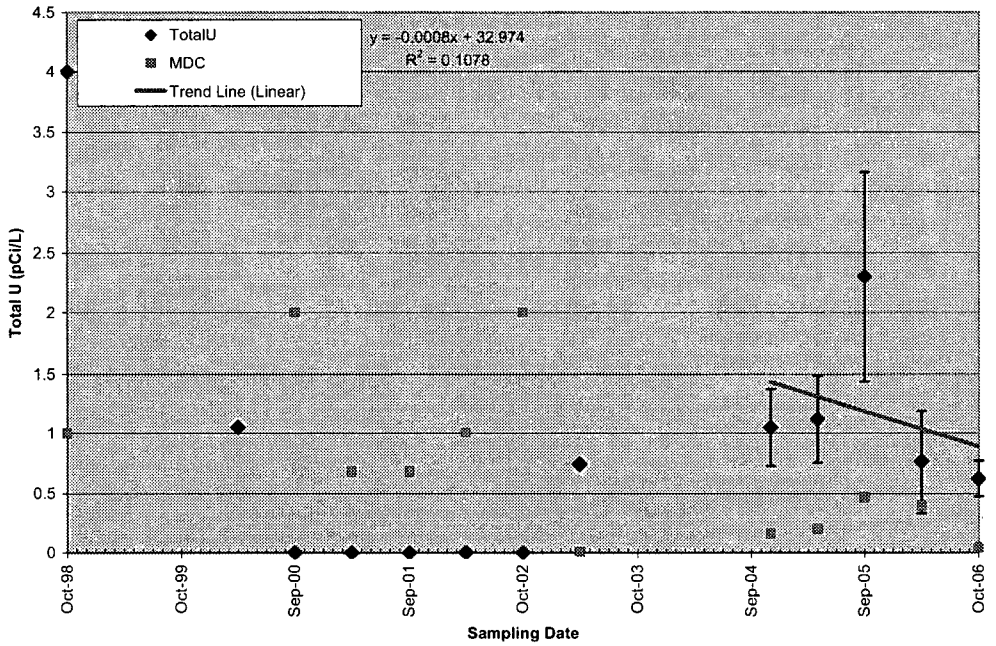

Figure 4-4. Total Uranium in MW-DU-004 (1998-2006)

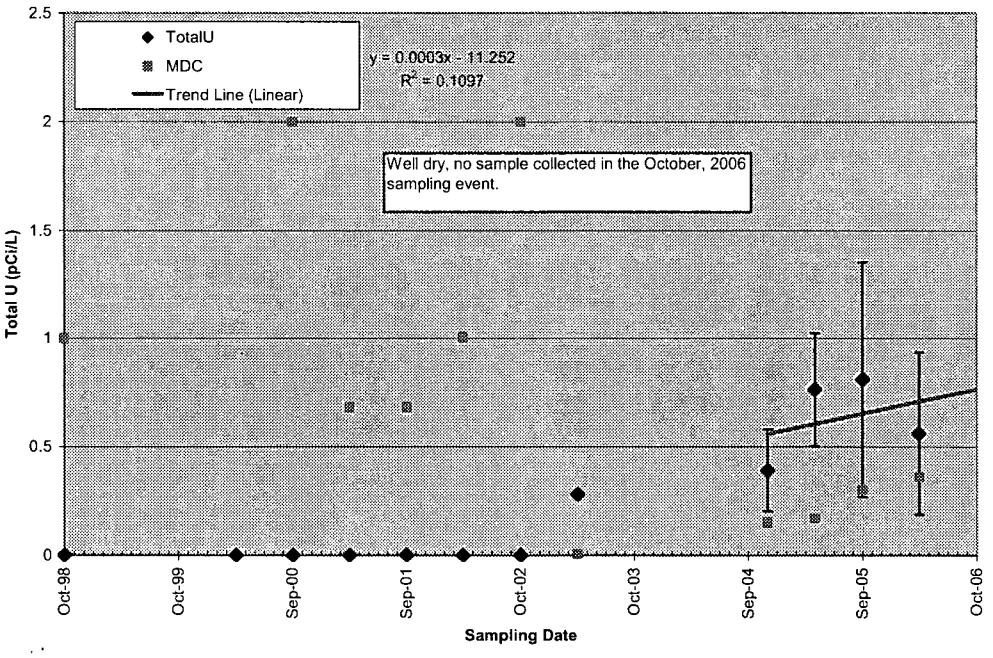

Figure 4-5. Total Uranium in MW-DU-005 (1998-2006)

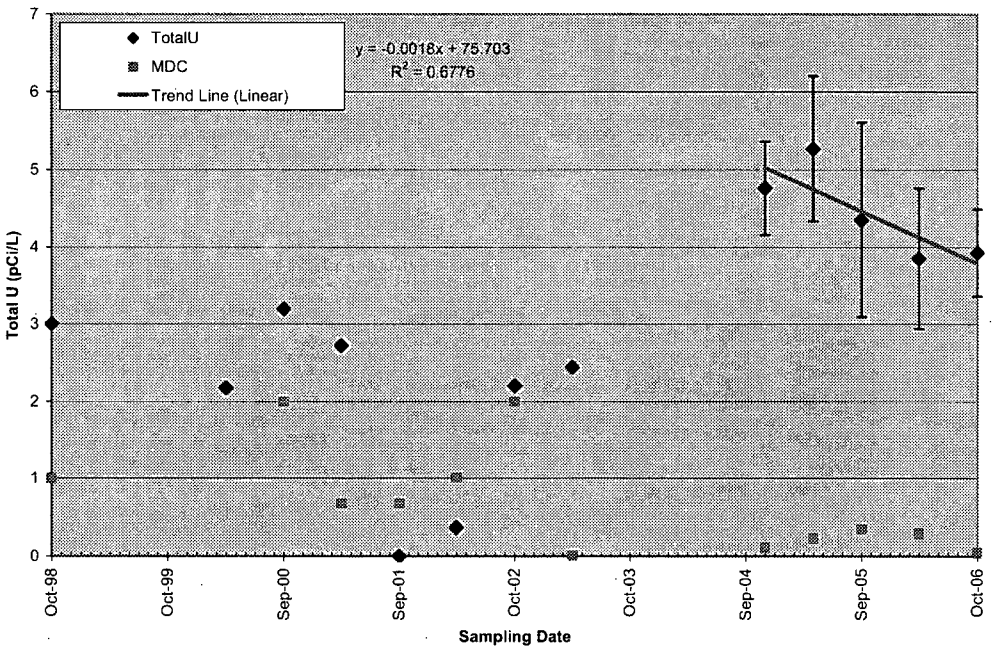

Figure 4-6. Total Uranium in MW-DU-006 (1998-2006)

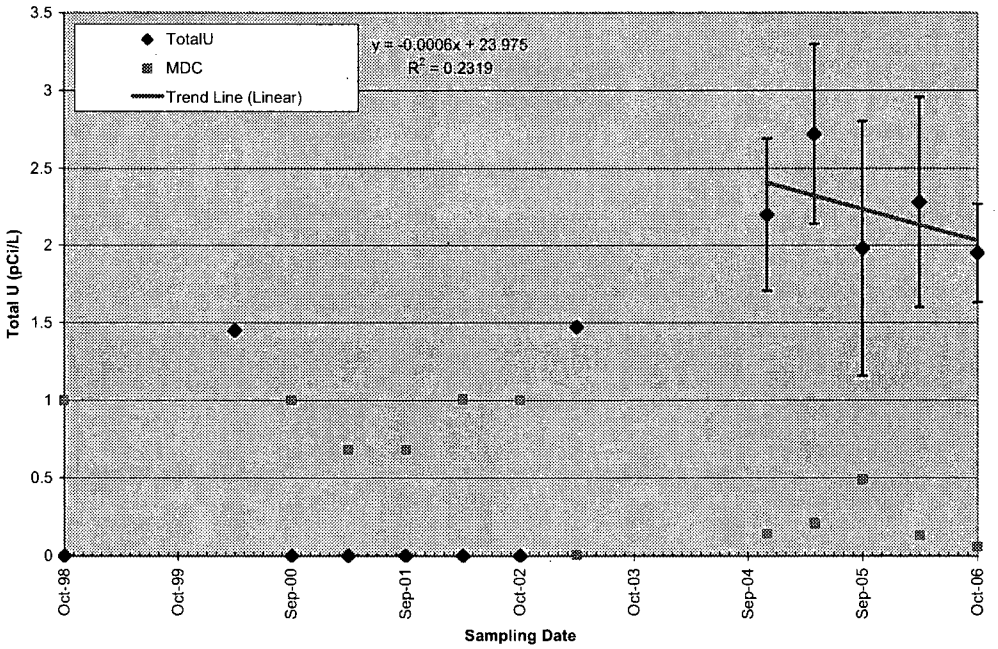

Figure 4-7. Total Uranium in MW-DU-007 (1998-2006)

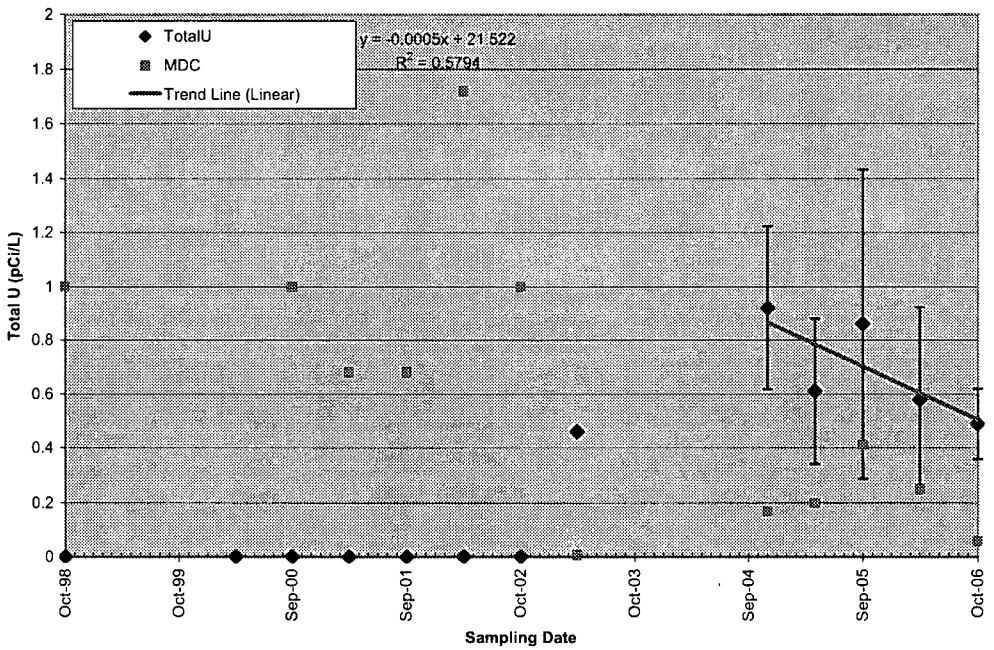

Figure 4-8. Total Uranium in MW-DU-008 (1998-2006)

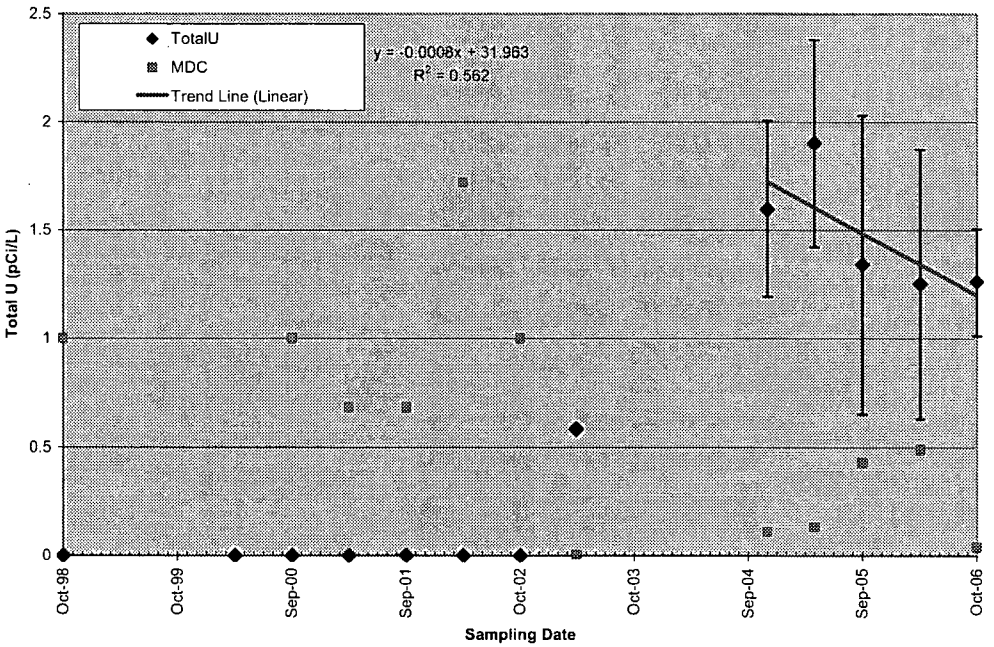

Figure 4-9. Total Uranium in MW-DU-009 (1998-2006)

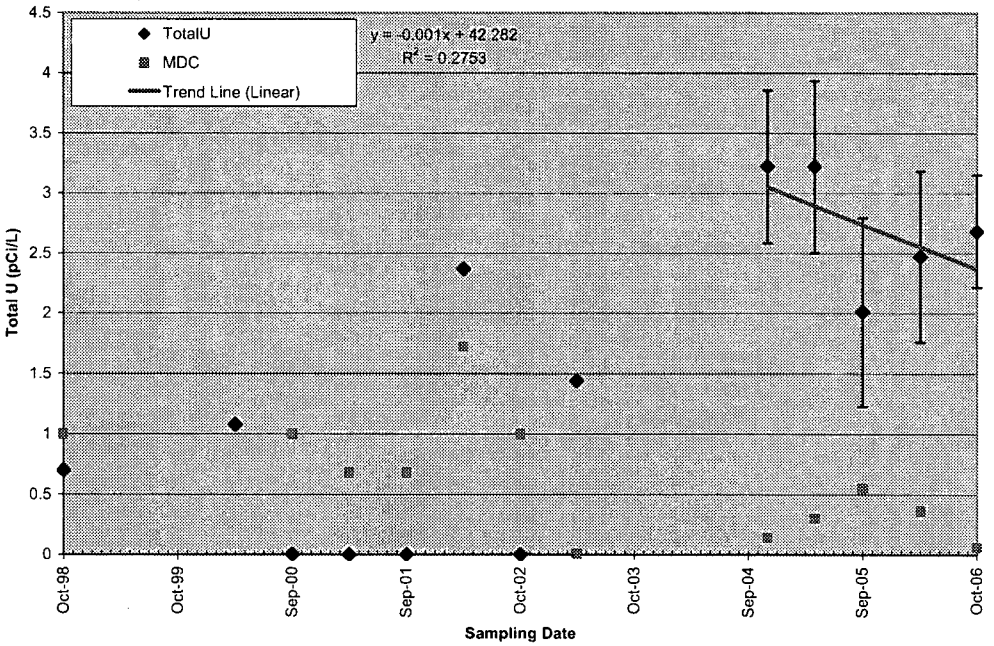

Figure 4-10. Total Uranium in MW-DU-010 (1998-2006)

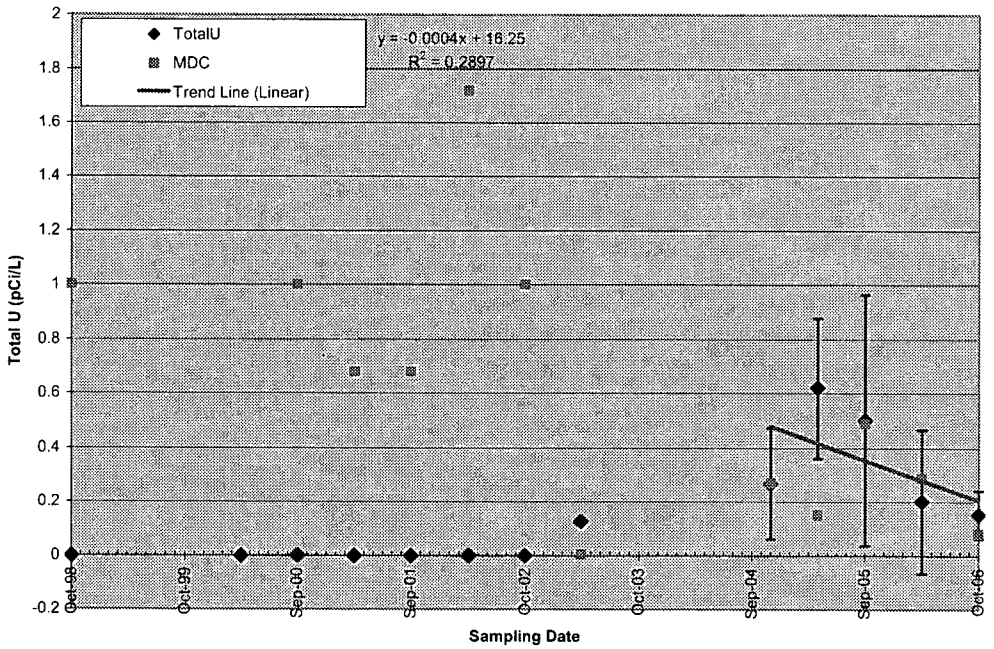

Figure 4-11. Total Uranium in MW-DU-011 (1998-2006)

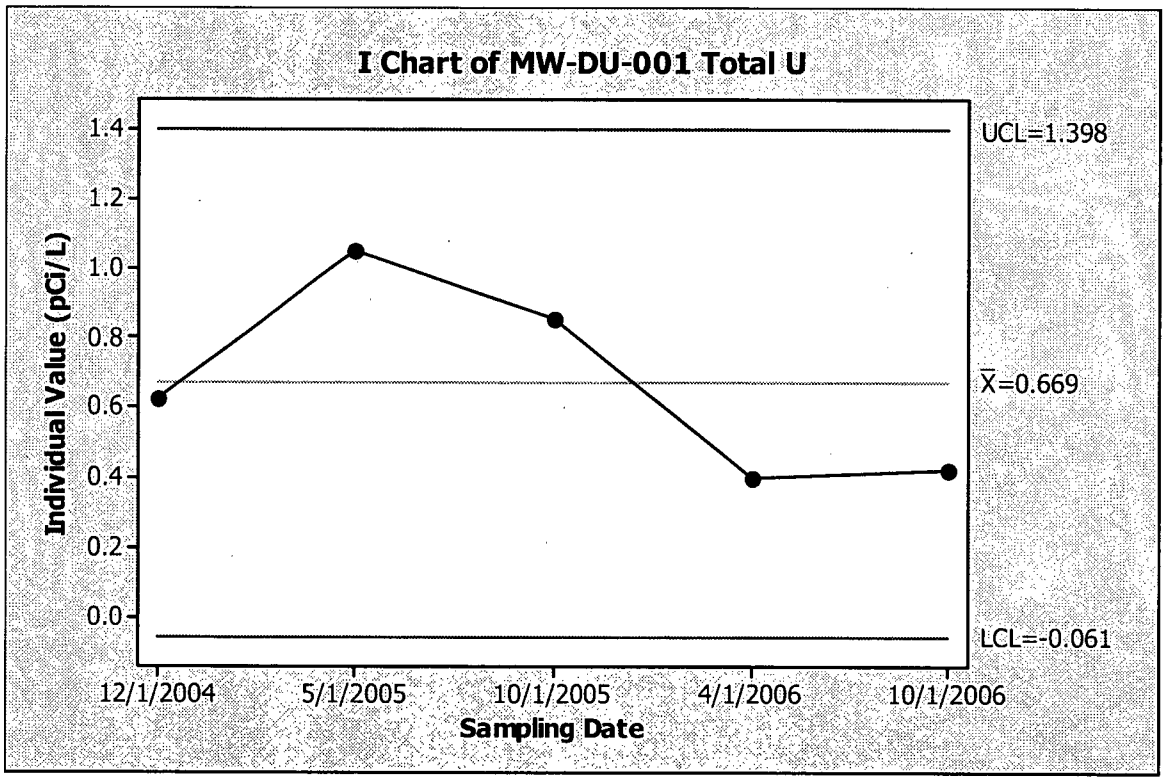

Figure 4-12. Variable Control Chart for Total Uranium in MW-DU-001 (2004-2006)

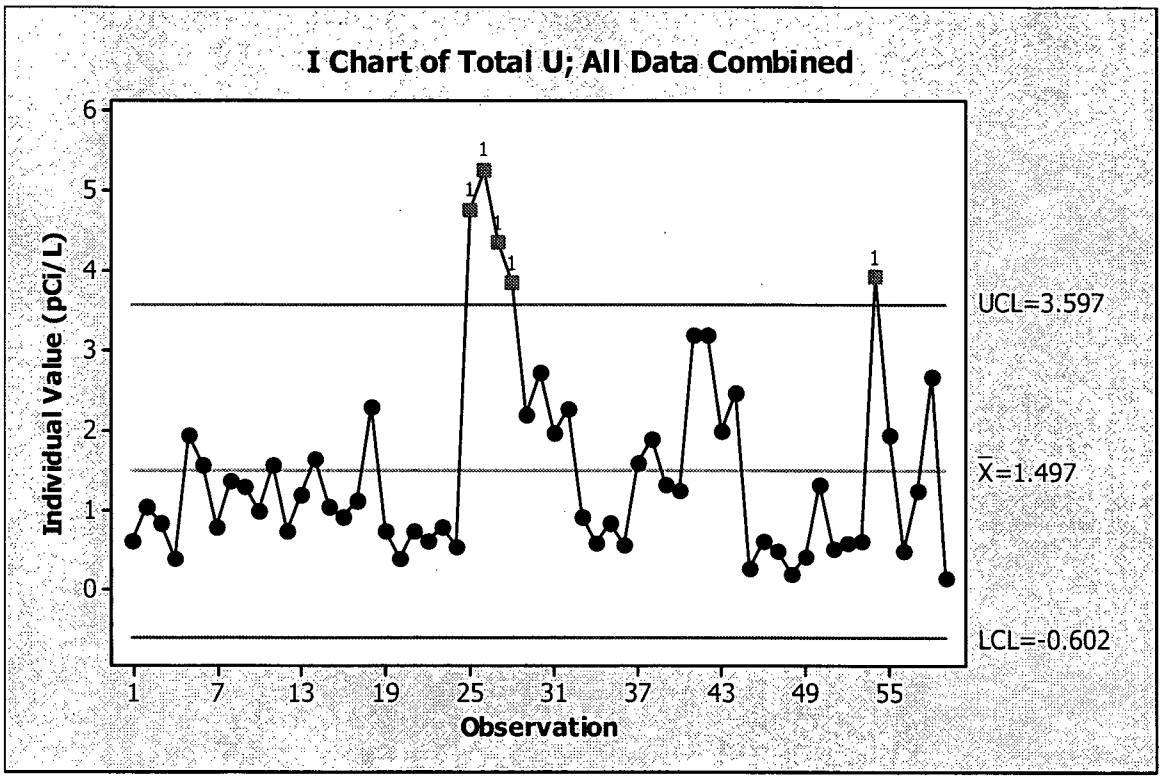

Figure 4-13. Control Chart for All Monitoring Well Data (2004-2006)

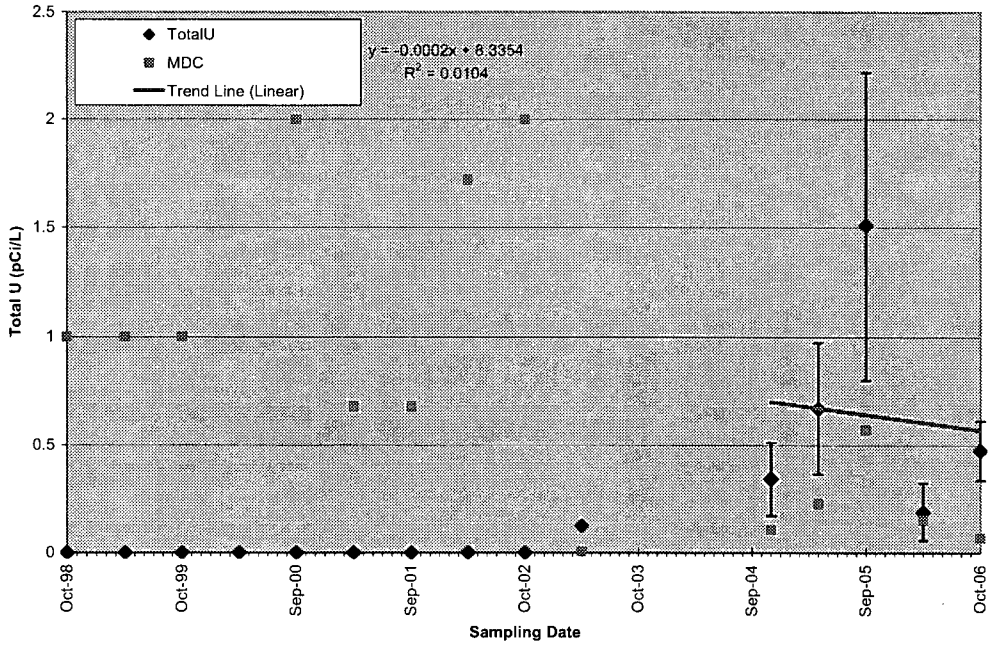

Figure 4-14. Total Uranium in SW-DU-001 (1998-2006)

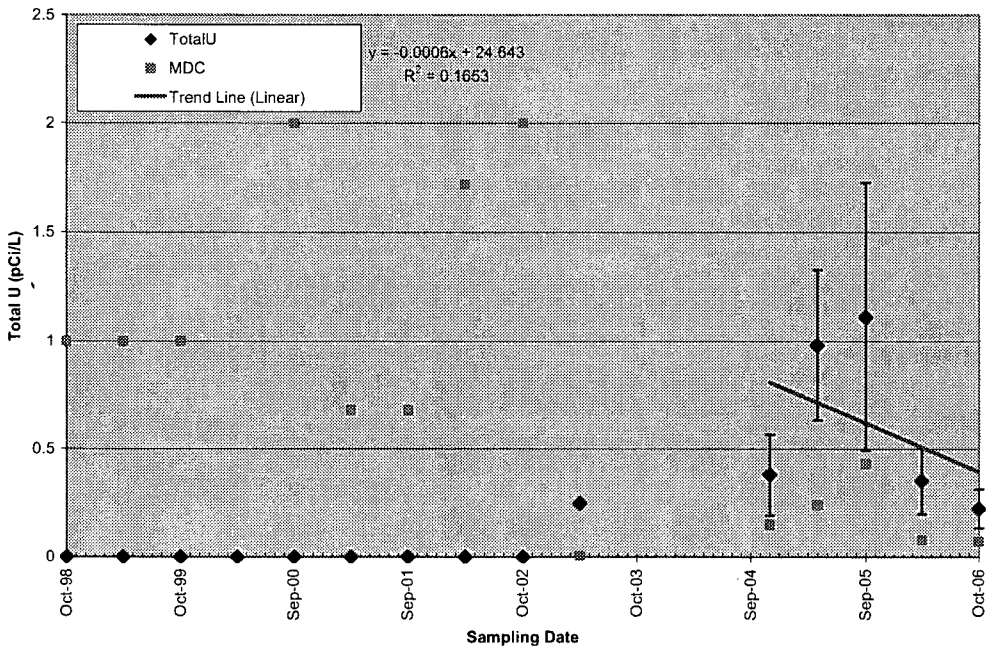

Figure 4-15. Total Uranium in SW-DU-002 (1998-2006)

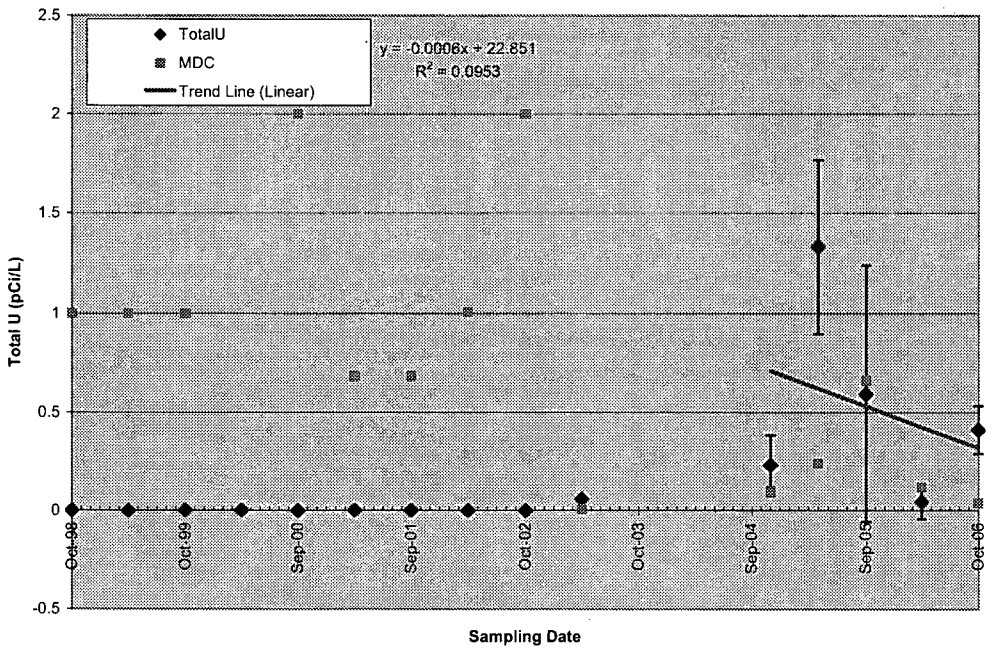

Figure 4-16. Total Uranium in SW-DU-003 (1998-2006)

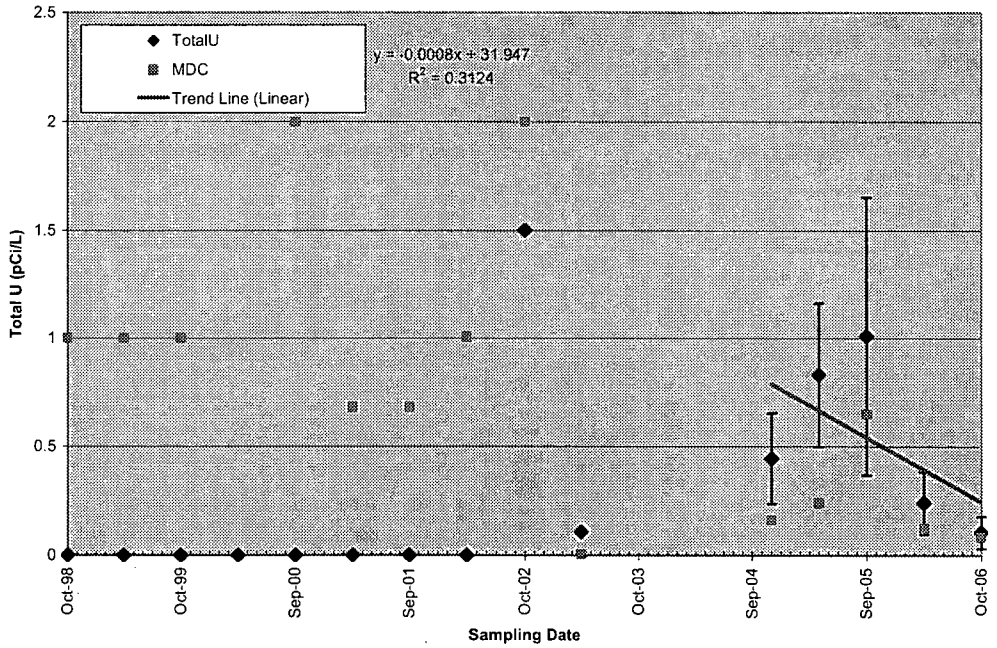

Figure 4-17. Total Uranium in SW-DU-004 (1998-2006)

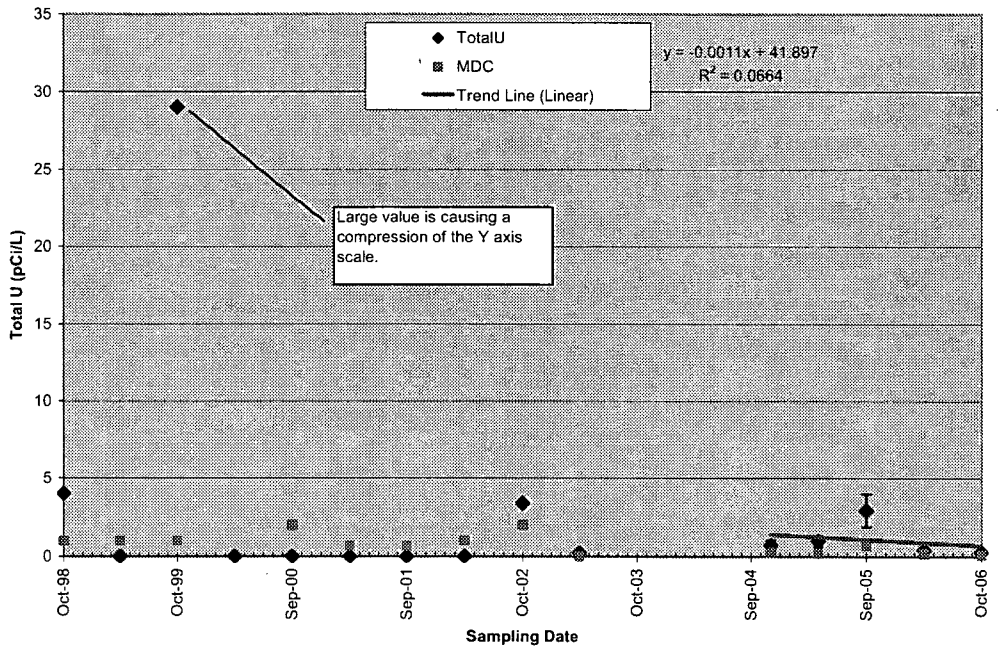

Figure 4-18. Total Uranium in SW-DU-005 (1998-2006)

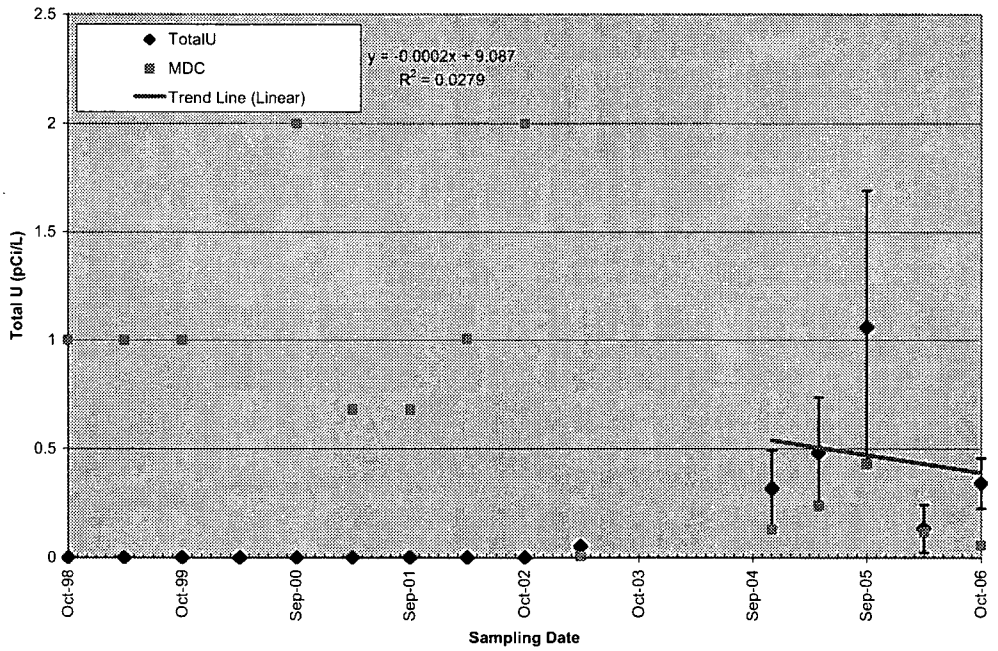

Figure 4-19. Total Uranium in SW-DU-006 (1998-2006)

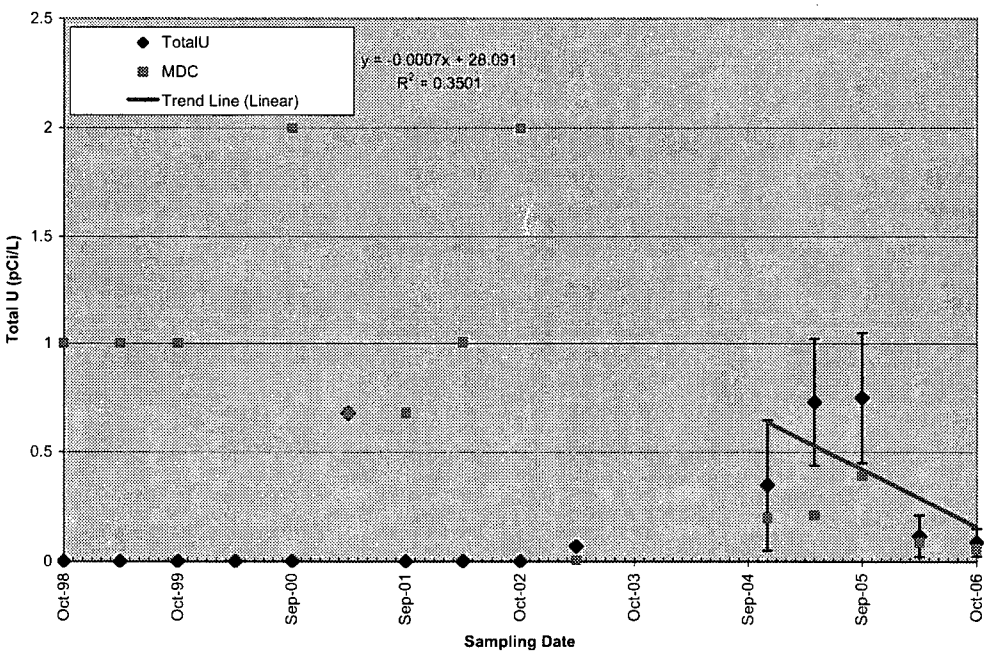

Figure 4-20. Total Uranium in SW-DU-007 (1998-2006)

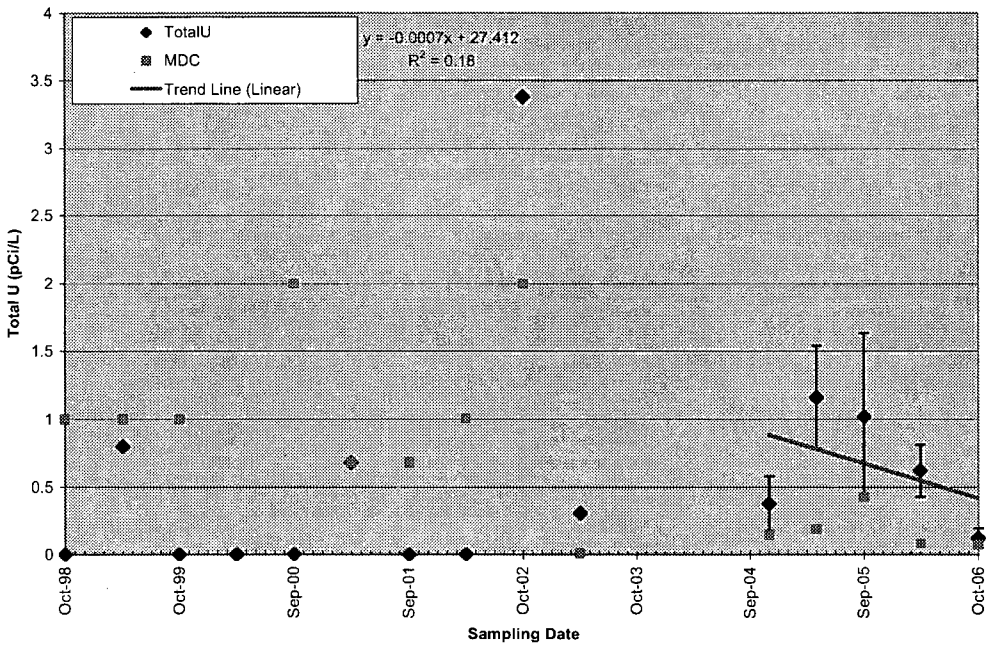

Figure 4-21. Total Uranium in SW-DU-008 (1998-2006)

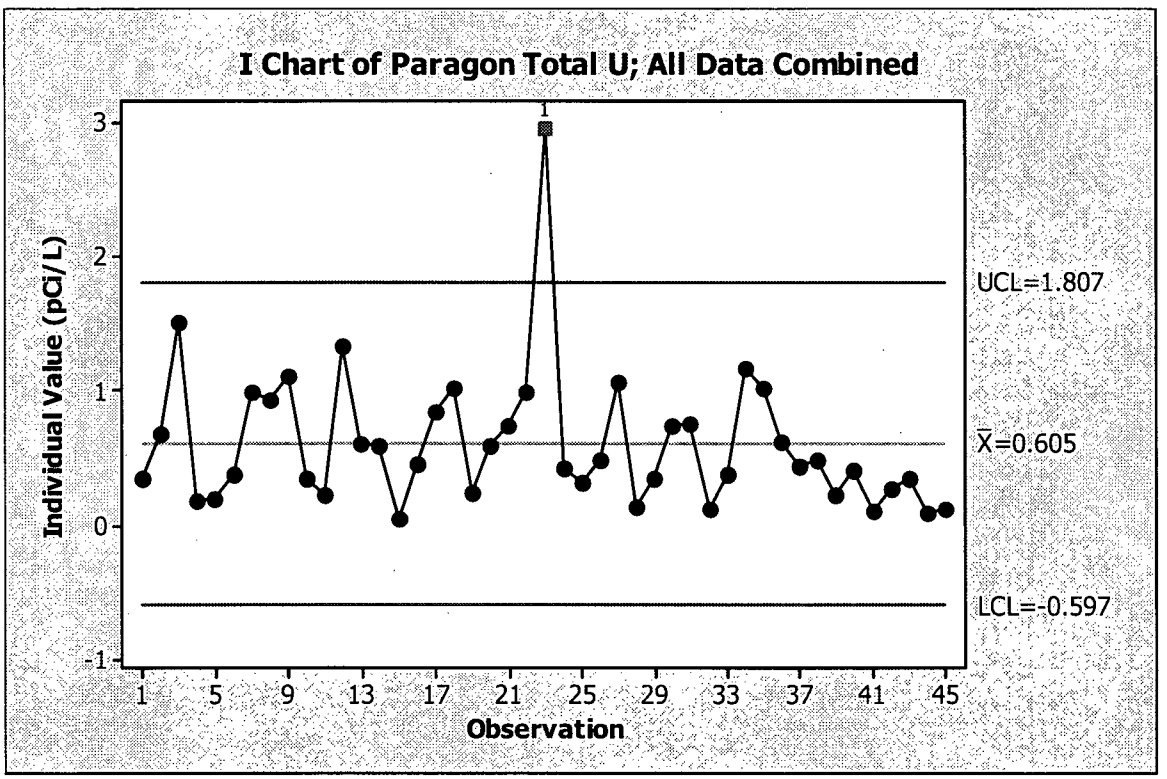

Figure 4-22. Control Chart for All Surface Water Data (2004-2006)

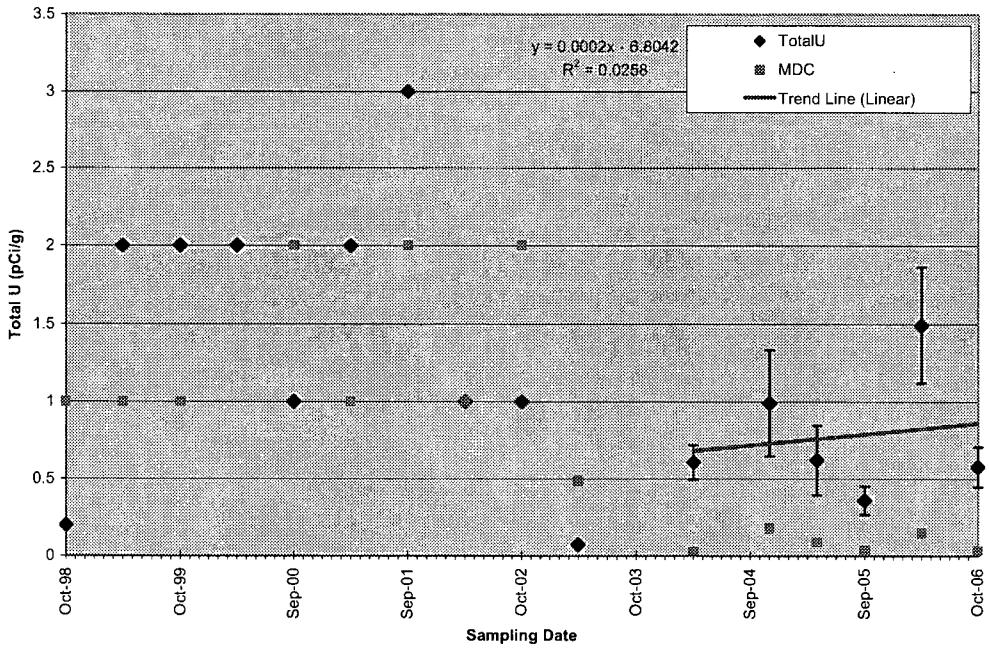

Figure 4-23. Total Uranium in SD-DU-001 (1998-2006)

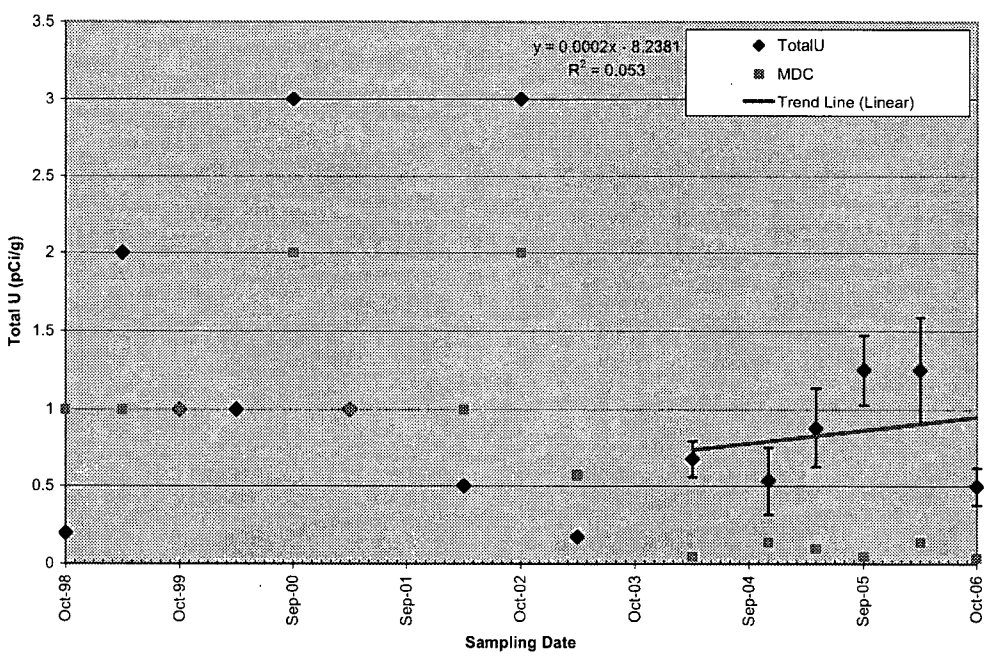

Figure 4-24. Total Uranium in SD-DU-002 (1998-2006)

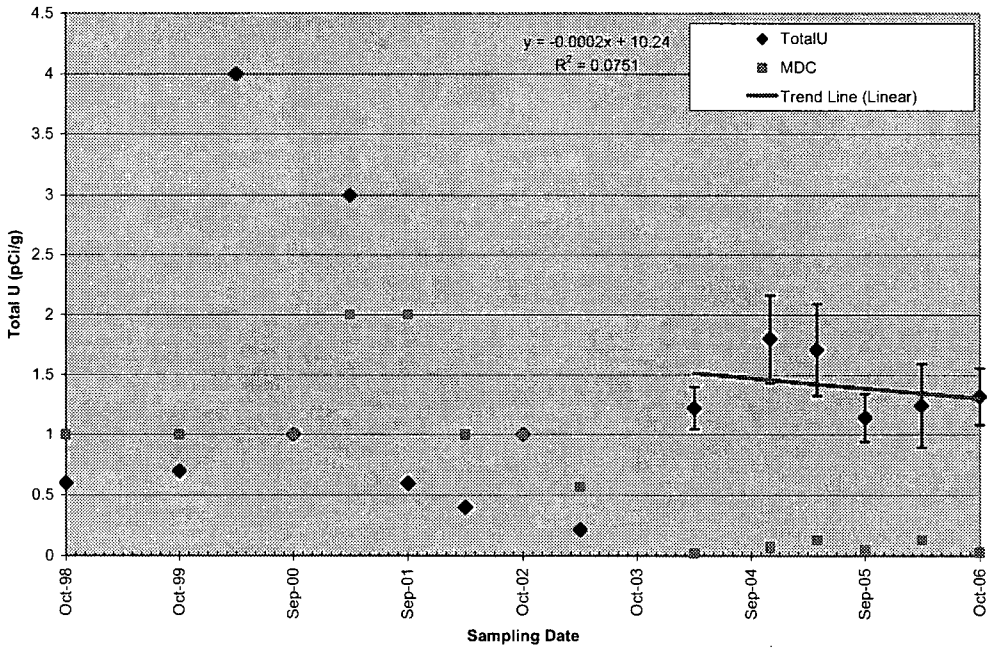

Figure 4-25. Total Uranium in SD-DU-003 (1998-2006)

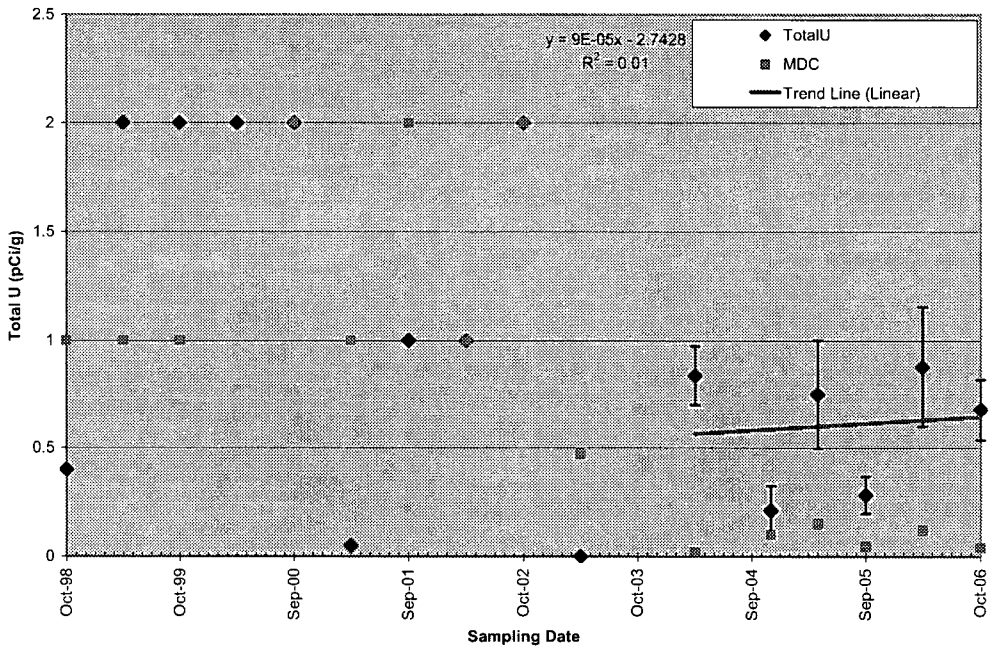

Figure 4-26. Total Uranium in SD-DU-004 (1998-2006)

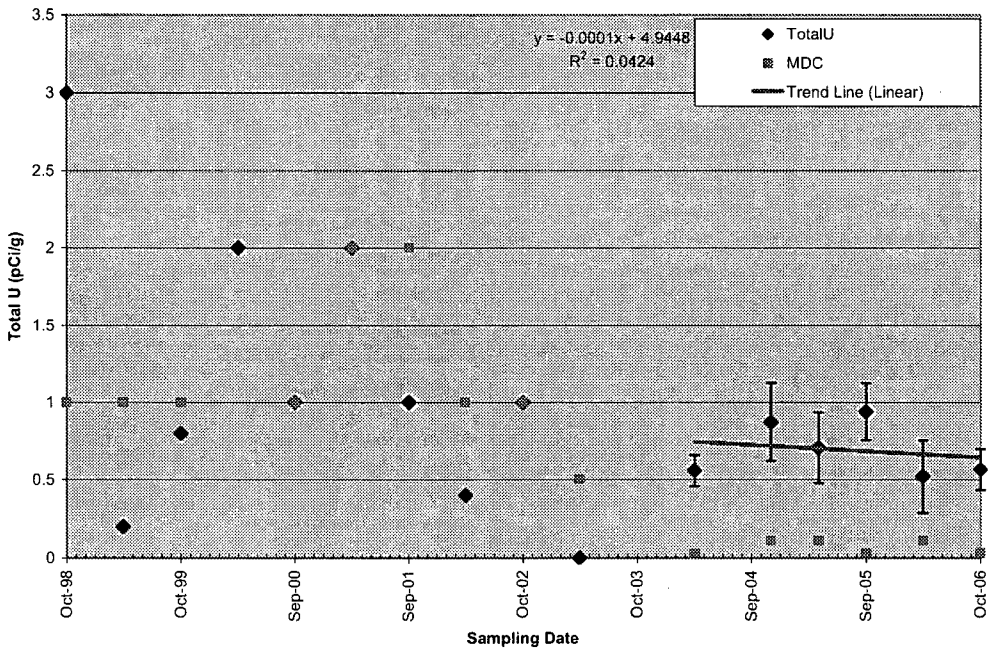

Figure 4-27. Total Uranium in SD-DU-005 (1998-2006)

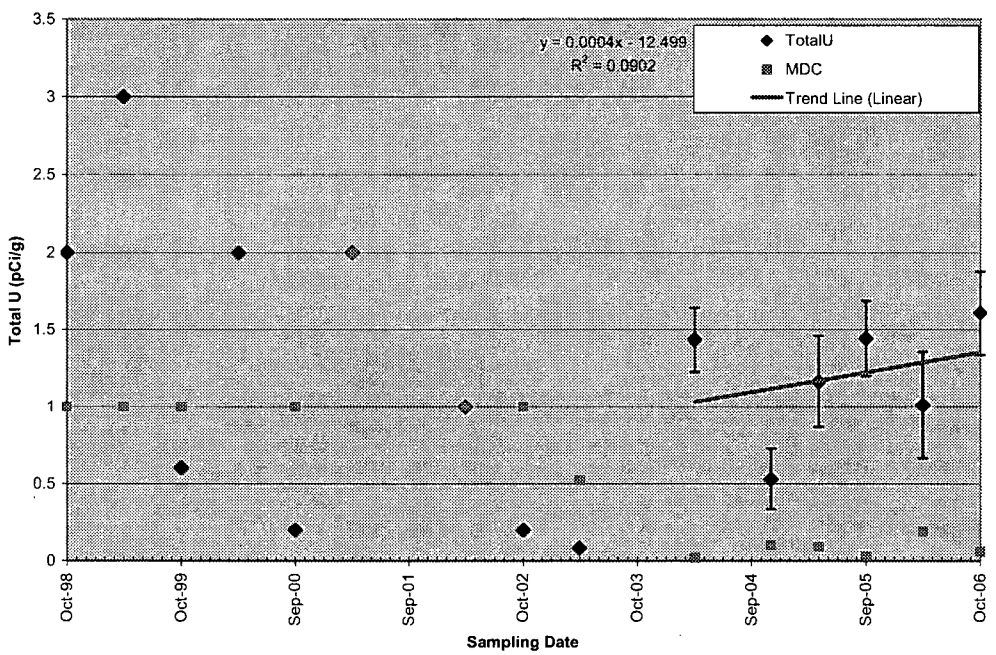

Figure 4-28. Total Uranium in SD-DU-006 (1998-2006)

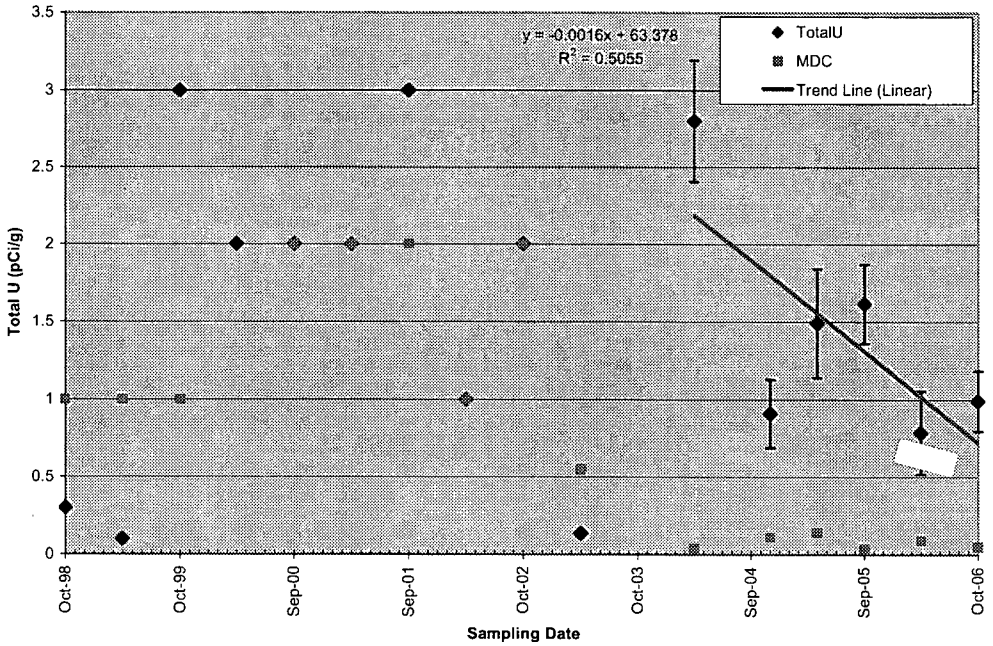

Figure 4-29. Total Uranium in SD-DU-007 (1998-2006)

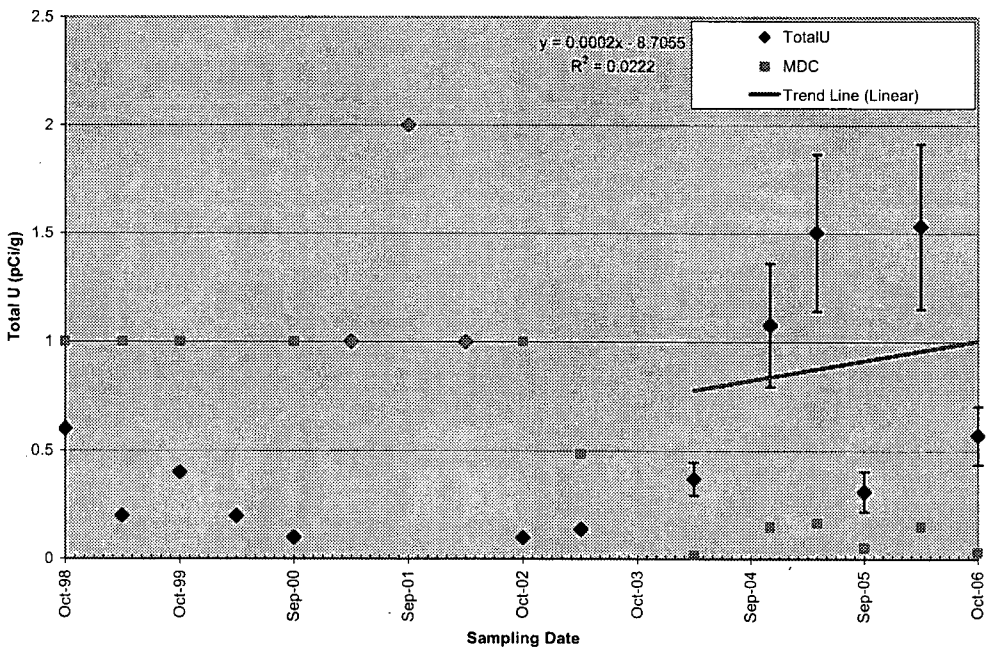

Figure 4-30. Total Uranium in SD-DU-008 (1998-2006)

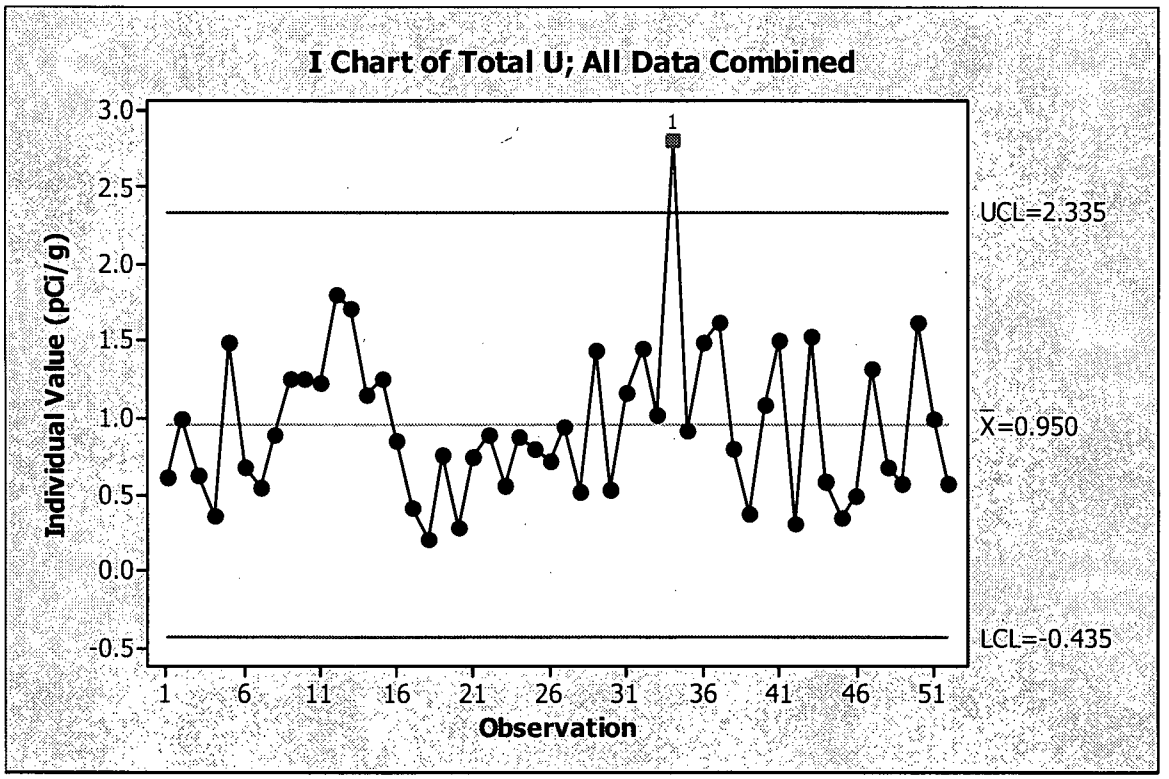

Figure 4-31. Control Chart for All Sediment Data (2004-2006)

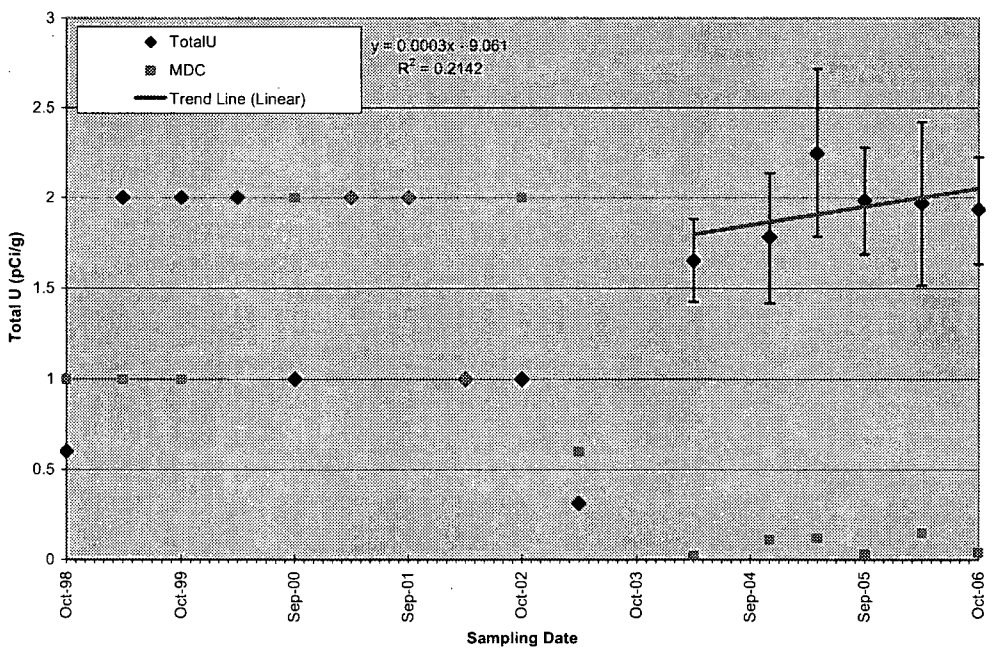

Figure 4-32. Total Uranium in SS-DU-001 (1998-2006)

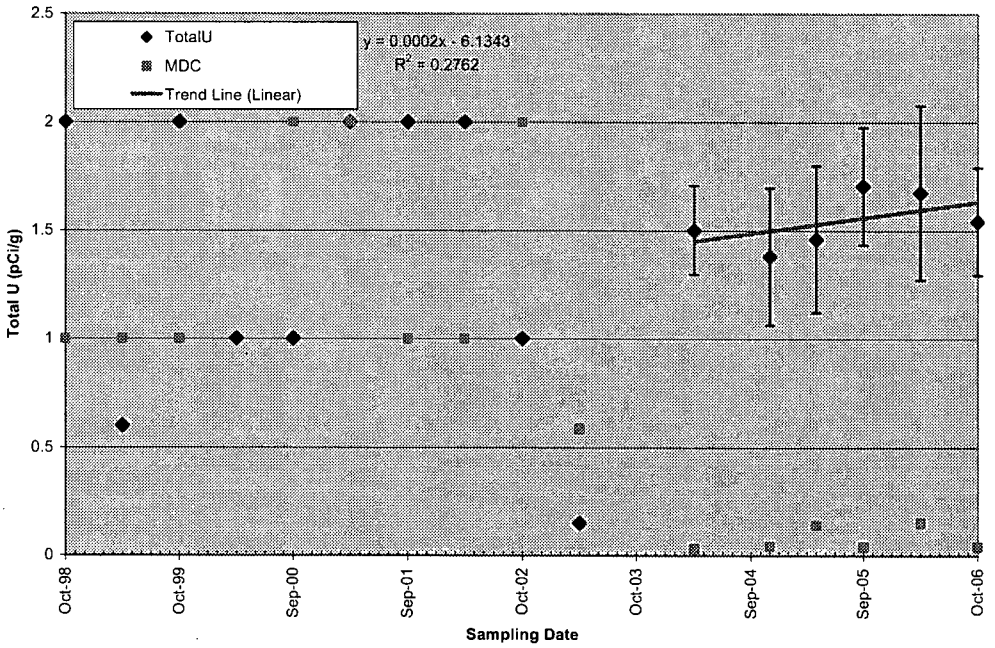

Figure 4-33. Total Uranium in SS-DU-002 (1998-2006)

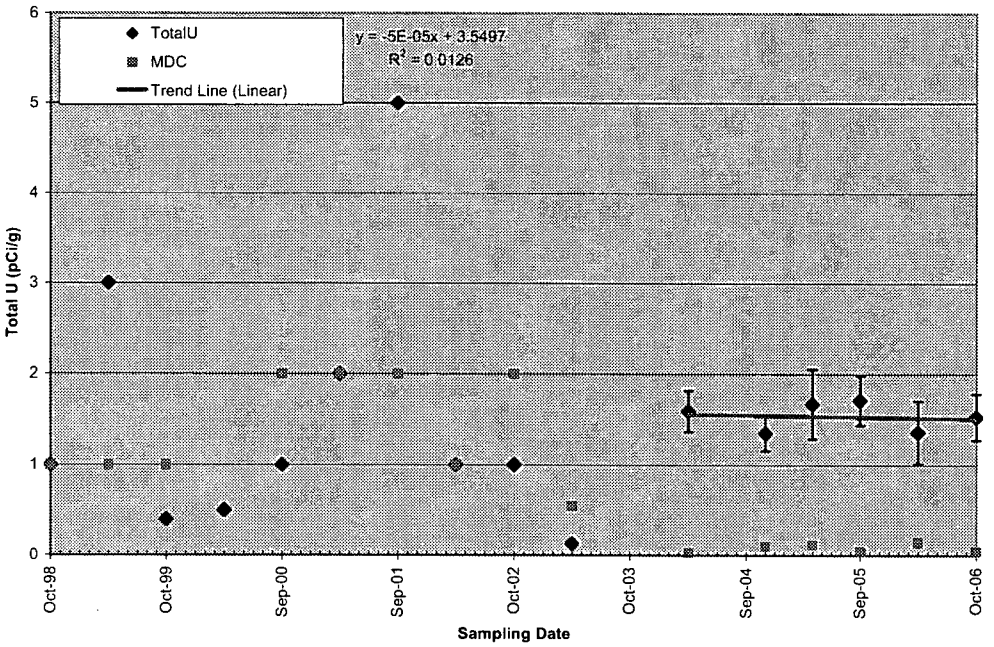

Figure 4-34. Total Uranium in SS-DU-003 (1998-2006)

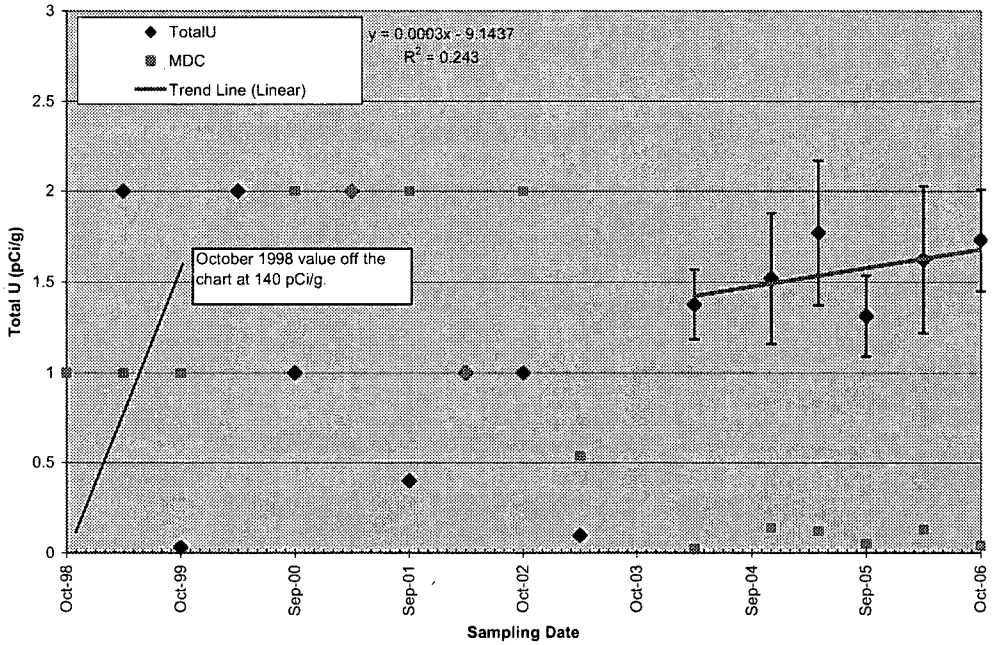

Figure 4-35. Total Uranium in SS-DU-004 (1998-2006)

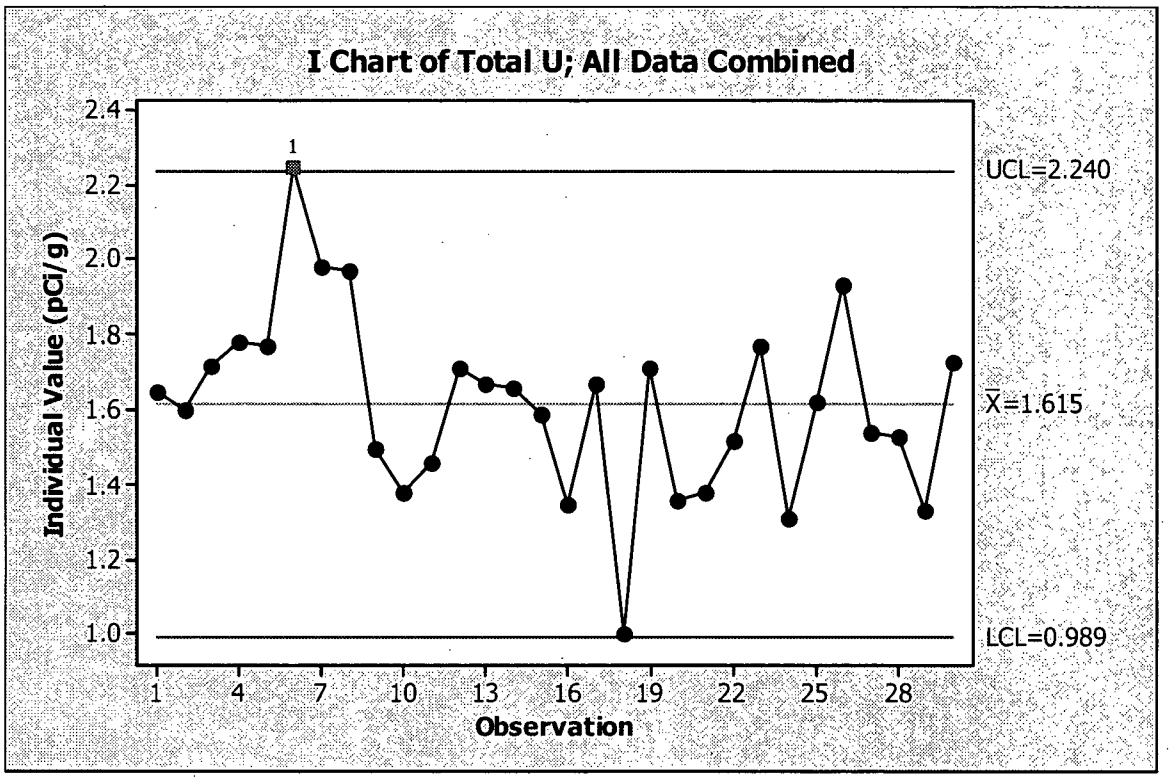

Figure 4-36. Control Chart for All Surface Soil Data (2004-2006)

5. CONCLUSIONS AND RECOMMENDATIONS

The April 2006 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 a small fraction of the action levels (see Table 4-1) established in the SOP, and no action levels were exceeded. There was no indication of DU in any of the environmental media sampled and the trend analysis completed did not provide evidence of any notable increasing or decreasing trends in the environmental media sampled. Future environmental monitoring will continue to be completed in accordance with the SOP until it is superseded by a revised ERM Program 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. March 10.

CHPPM (U.S. Army Center for Health Promotion and Preventive Medicine). 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. May 8.

SAIC (Science Applications International Corporation). 2006. *Radiation Monitoring Report for License SUB-1435 Jefferson Proving Ground, Summary of Results for April 10-13, 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, March 10, 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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SOP No. OHP 40-2

Effective Date 10 Mar 00
Date Removed from Service _____

STANDING OPERATING PROCEDURE

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

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

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

2. **Authority.**

a. US Nuclear Regulatory Commission License No. SUB-1435.

b. Program Services Meeting, 14 September 1999, between SBCCOM and HPP, USACHPPM.

3. **Scope.** This SOP applies to Health Physics Program personnel performing the collection of environmental samples in support of the ERM.

4. **Definitions, Abbreviations.** A list of terms and abbreviations used in this SOP can be found in Annex A.

5. **Forms, Labels, and Worksheets.** A sample of all forms, sample labels, and sample collection worksheets can be found in Annex B.

6. **Point(s) of Contact for Program Coordination:**

a. **Soldier and Biological Chemical Command**
Ms. Joyce Kuykendall, SBCCOM Health Physicist
Comm: 410-436-7118
DSN : 584-7118
email: joyce.kuykendall@sbccom.apgea.army.mil

b. **US Army Center for Health Promotion and Preventive Medicine**
Health Physics Program (Pgm 26)
Comm: 410-436-3502
DSN : 584-3502
fax : 410-436-8261/8263

Radiologic, Classic and Clinical Chemistry Division (RCCCD)
Comm: 410-436-3983/8235
DSN: 584-8235

c. **Jefferson Proving Ground**
Mr. Ken Knouf, Site Manager
Mr. Phil Mann
Ms. Yvette Hayes
Comm: 812-273-2551/2522/6075

7. **Survey Coordination.**

a. Pre-Survey Coordination: 60 days prior to scheduled sample date.

1) Initial Coordination: - made through the SBCCOM Health Physicist. Close coordination with the site management team at JPG will be required to ensure support will be onsite at the time of sampling.

2) USACHPPM HPP Program Assistant, (410) 436-1303,(if call from the Edgewood Arsenal: 5-1303) will be contacted to initiate travel orders. Due to the nature of the sampling program, a four-wheel drive vehicle is required to perform this project. The project and associated report number will be 26-MA-8260-R#-YY. The R# will be a "1" for the October and "2" for the April survey, and the YY will be the current fiscal year.

3) Prepare CHPPM Form 330-R-E (Request for Laboratory Services. (See Annex B) This form can be found on the USACHPPM Web Site or through intranet FormFlow program. Current DLS Test Codes being used are as follows:

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

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

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

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

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

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

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

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

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

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

b. Field instrument quality control. Upon receipt of field instruments from the HPP Instrument Coordinator and the Surface Water and Waste Water Program, appropriate instrument quality control checks will be conducted to ensure proper operation prior to departure.

1) Radiation detection instrumentation will be checked for response against a radiation check source. This check source should also be shipped to the survey site for instrument verification on

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

2) Water quality instruments should also be verified using guidance provided by water program personnel. At a minimum, verify the accuracy of the pH meter using the certified pH solution packets.

8. **Sample Collection.** Four separate sample matrixes will be collected in support of the ERM. Methodologies for sampling can be found in US Army Environmental Hygiene Agency (the predecessor to USACHPPM) Technical Guide 155, Environmental Sampling Guide, February 1993.

a. Ground Water Samples. A total of 11 monitoring wells have been established to be used for the Environmental Monitoring Program. Wells are indicated on the ground water sample map (figure 1, Anne C) using an alphanumeric code containing the letters MW and a two digit sample number (01-11).

1) Sample will be collected using a new hand bailer for each sample. Care will be taken when lowering the bailer into the well to prevent unnecessary aeration or contamination of the sample.

2) A total quantity to be collected will be 1 US gallon.

3) A portion of the first bailer full of water will be placed into a clean beaker, or other suitable container, and an evaluation of radiation level, temperature, pH and conductivity will be conducted and recorded.

4) Sample information will be recorded on the Ground Water Sample Collection Worksheet. (Annex B)

5) Samples will not be filtered or persevered in the field.

b. Soil Samples. A total of 4 soil samples will be collected, one from each corner of the trapezoidal impact area. Sample locations are indicated on the soil sample map (figure 2, Annex C).

1) Sample will be collected using a new or properly cleaned scoop, trowel, or other suitable tool. Sample will be placed in a self sealing (Ziploc®) bag.

2) A sample quantity of approximately 1000 grams will be collected.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SOIL:

- Perimeter and background samples:

  ≤ 35 pCi/g - no corrective action.

  > 35 pCi/g - collect 5 additional samples in a 1 meter square grid. If average > 35 pCi/g is confirmed, recommendation to decontaminate soil to ≤ 35 pCi/g will be made to the SBCCOM RPO.

- Sample locations along the lines of fire:

  < 100 pCi/g - no corrective action

  100-300 pCi/g - collect 5 additional samples in a 1 meter square grid. If average > 100 pCi/g is confirmed, investigate to determine reason for the high level.

  > 300 pCi/g - collect 5 additional samples in a 1 meter square grid. If average > 300 pCi/g is confirmed, investigate to determine reason for the high level and immediately notify the SBCCOM RPO to initiate notification to the NRC.

WATER:

- Uranium limit established in 10 CFR 2, Annex B is 3.0×10^{-1} pCi/ml

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

  > 1.5×10^{-1} pCi/ml - resample; if results above 1.5×10^{-1} pCi/ml is confirmed, investigate to determine reason for the high level and immediately notify the SBCCOM RPO to initiate notification to the NRC.

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

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

ANNEX A

DEFINITIONS AND ABBREVIATION

1. **Definitions**:

a. **Action Level**: The numerical value that will cause the decision maker to choose one of the alternative actions. The action level may be a regulatory standard or may be a level set to ensure that corrective action is initiated before regulatory standards are met.

b. **Area**: A general term referring to any portion of a site, up to and including the entire site.

c. **Background Sample**: A sample collected from an area similar to the one being studied, but in an area thought to be free of contaminant of concern.

d. **Calibration**: Comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

e. **Chain-of-Custody**: Documentation of the possession and handling of a sample from the time it is collected to the final disposition.

f. **Detection Limit**: The lowest concentration at which given analytical procedures can identify.

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

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

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

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

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

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

l. **Soil Sample:** A sample of the soil taken from the first 15 centimeters (6 inches) of surface soil.

m. **Split Sample:** A sample, which has been portioned into two or more containers from a single sample container.

n. **Surface Water:** Water found above the surface of the soil, particularly water contained in creeks and streams.

2. **Abbreviations:**

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

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

ANNEX B

FORMS, LABELS AND WORKSHEETS

Request for Laboratory Services

Directorate of Laboratory Sciences
REQUEST FOR LABORATORY SERVICES

PLEASE PRINT OR TYPE ALL REQUESTED INFORMATION

For DLS Use Only
LIMS JOB# _____
Date Received _____

PART 1: PROJECT INFORMATION

1. DATE OF REQUEST: 08/03/2000
2. PROJECT #: (CHPPM only) 26 MA 8260 XO# _____
3. FUND SOURCE: ☐ P84 ☐ DERA ☐ OTHER Supplemental *(Specify)* _____
4. DIVISION/PROGRAM: Health Physics Program
5. INSTALLATION: Jefferson Proving Ground
6. STATE WHERE SAMPLES TO BE COLLECTED: Indiana
7. NAME OF PROJECT OFFICER(s): Mr. David Collins
   TELEPHONE: (410) 436-3502 FAX# (410) 436-8261
   E-MAIL: david.collins@apg.amedd.army.mil
8. NAME OF SAMPLE COLLECTOR: Mr David Collins
9. PROJECT DESCRIPTION/OBJECTIVE *(Screen, Monitoring, Regulatory or Health Concern, Etc.)*:
   Sampling required as part of the Environmental Radiation Monitoring Plan
10. SAMPLE OR SITE HISTORY (High Toxicity, Etc):
    DU Firing Range
11. PROJECT COORDINATOR/DLS TECHNICAL CONSULTANT - Was project coordinated with DLS? ☒ YES ☐ NO
    Name of Person in DLS: Mr. Gary Wright ext. 8235

PART 2: TURNAROUND TIME REQUESTED

1. DATE RESULTS REQUIRED: _____
2. INDICATE THE APPROPRIATE SAMPLE OR PROJECT DESIGNATION:
   ☒ STANDARD
   (Note: All samples are routinely processed as Standard Analyses Unless Arrangements Have Been Made with DLS for High-Priority or Top-Priority Analyses.)
   ☐ HIGH-PRIORITY ☐ TOP-PRIORITY
   (Note: High-Priority and Top-Priority Requests should be Coordinated with DLS and are Subject to Cost Surcharges.)

PART 3: REPORT DISTRIBUTION OPTIONS

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

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

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

Figure B-1a

PART 4: PROJECT COORDINATION INFORMATION

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

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

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

2. SPECIAL HANDLING REQUIREMENTS:

[x] CHAIN-OF-CUSTODY (COC)

[ ] SAFETY CONSIDERATION/HAZARDOUS MATERIALS (Specify):

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

[ ] OTHER (Specify):

3. SAMPLE COLLECTION KIT:

DATE REQUIRED: 07/04/2000

CHECK PREFERENCE:

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

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

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

PART 5: SAMPLE ANALYSIS INFORMATION

DLS TEST CODE	PROCEDURE DESCRIPTION	STD METHOD	MATRIX	NUMBER OF SAMPLES	SPECIAL REQUIREMENTS/COMMENTS (REQUESTS FOR EXTRA BLANKS OR
803	Uranium in Soil	G-002	Soil	5	Soil
586	Uranium in Water	U-002	Water	9	Surface Water (1 gal Cubitainer)
803	Uranium in Soil	G-002	Soil	9	Sediment
586	Uranium in Water	U-002	Water	12	Ground Water (1 gal Cubitainer)

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

Figure B-1b

Sample Labels

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

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

Figure B-2

Effective Date _____
Date Removed from Service _____

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

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

Effective Date _____
Date Removed from Service _____

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

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

Effective Date _____
Date Removed from Service _____

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

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

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

Effective Date _____
Date Removed from Service _____

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

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

SOP No. OHP 40-2

Effective Date _____
Date Removed from Service _____

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

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

ANNEX C

SAMPLE LOCATION MAPS

Jefferson Proving Ground: DU Sampling
GROUNDWATER MONITORING WELLS

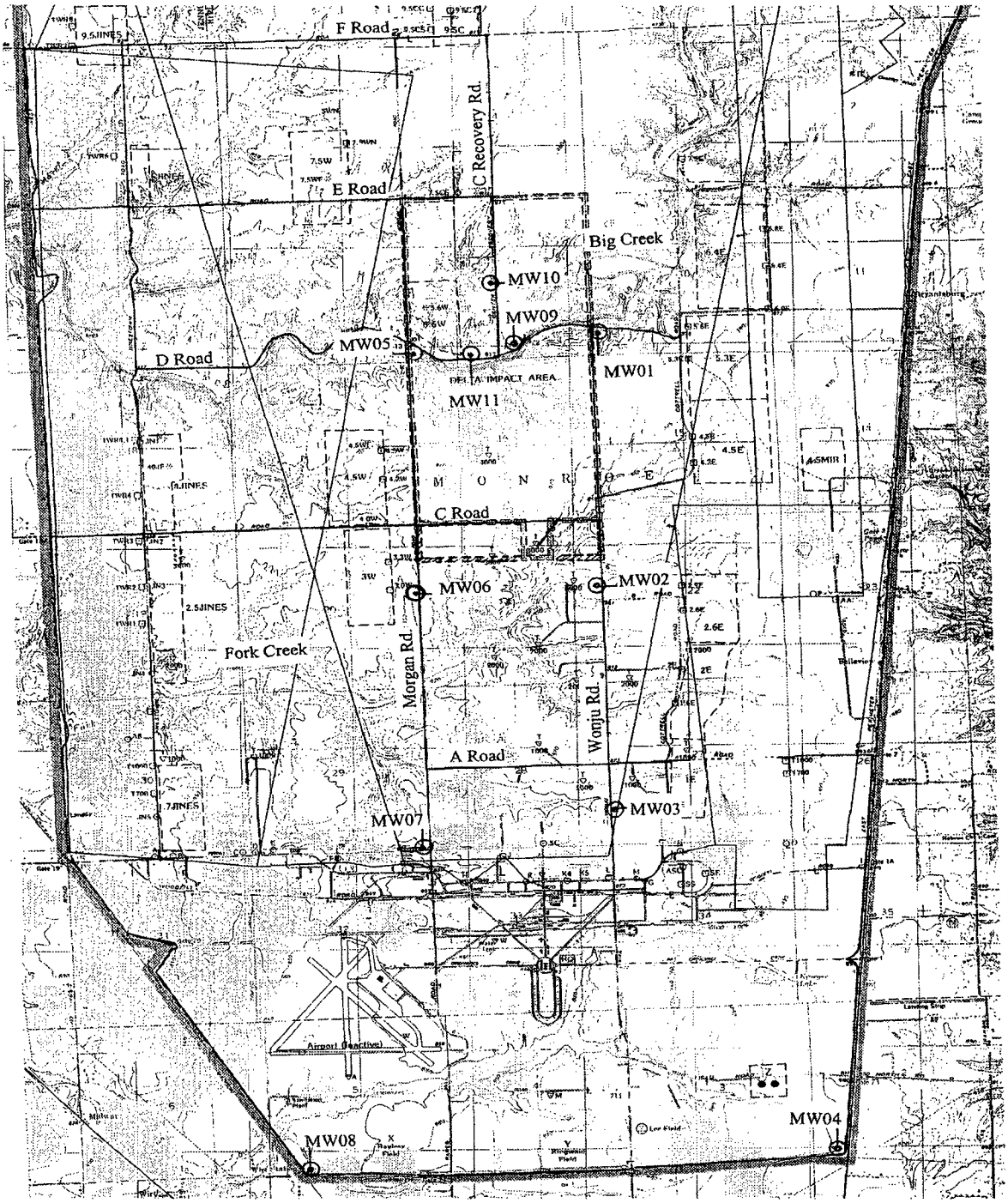

Figure 1: Groundwater samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SOIL SAMPLES

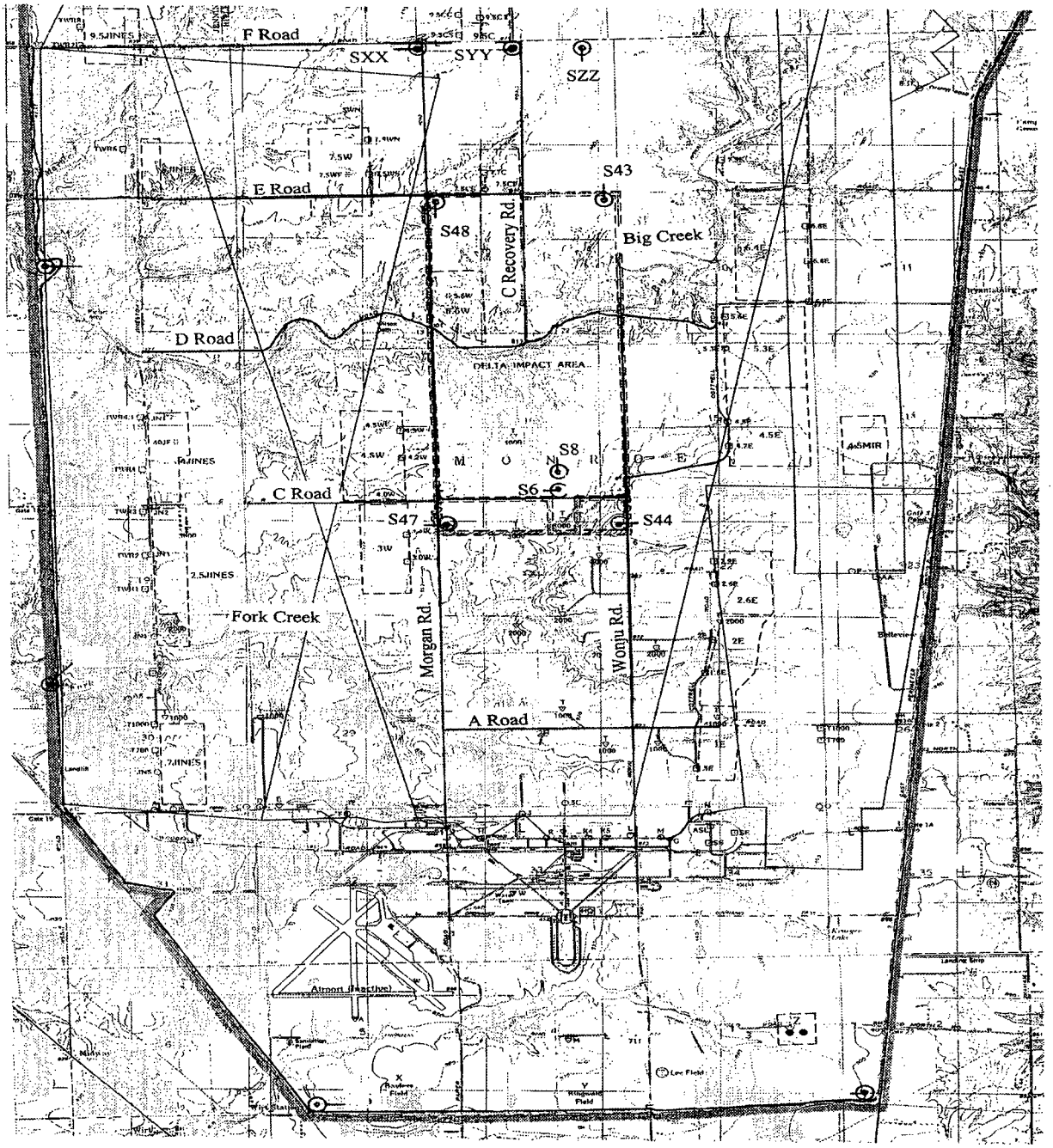

Figure 2: Soil Samples (Sept. 1997)

Jefferson Proving Ground: DU Sampling
SURFACEWATER & SEDIMENT SAMPLES

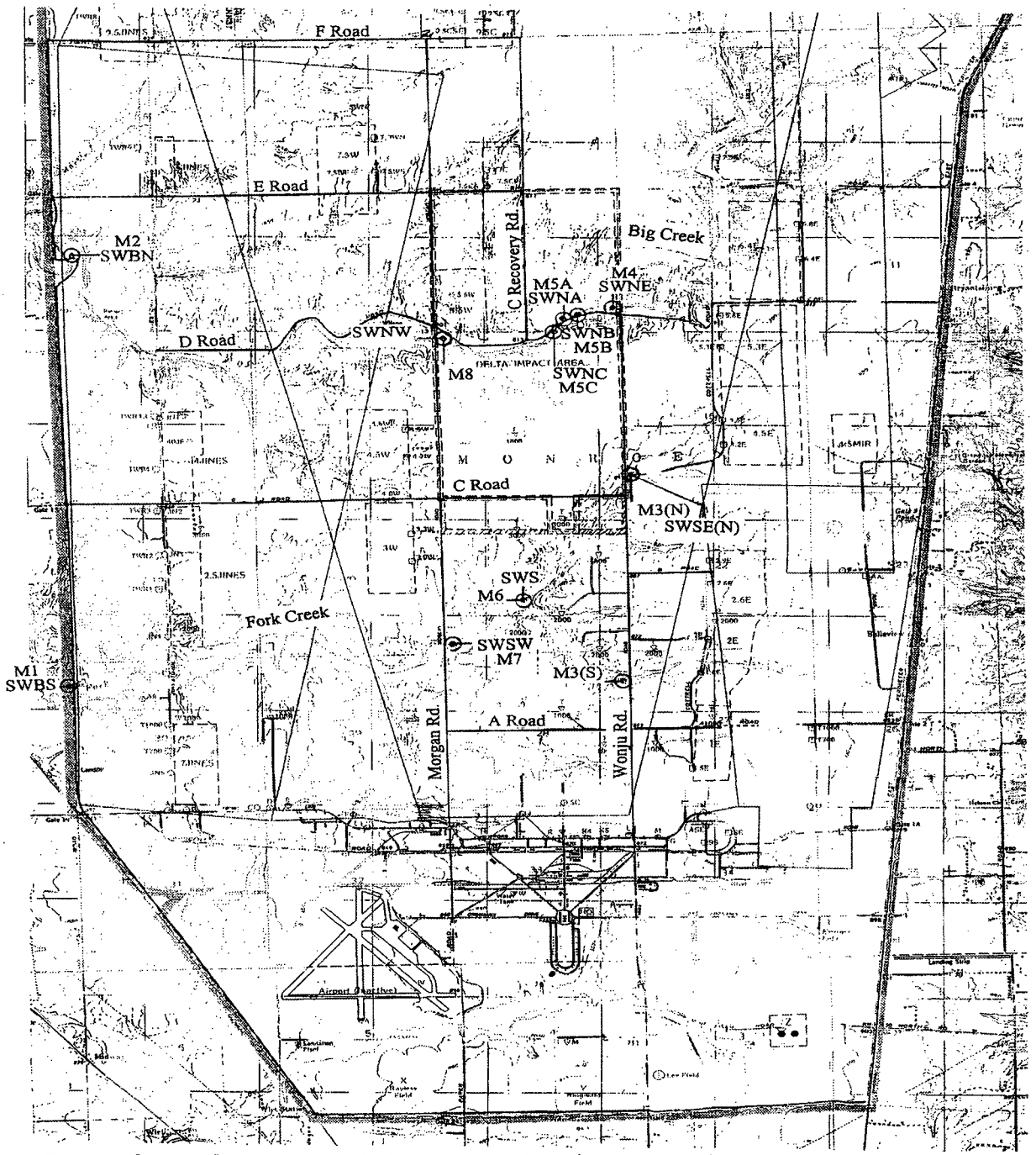

Figure 3: Surfacewater & Sediment Samples (Sept. 1997)

APPENDIX B
FIELD LOGBOOK

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Location JPG Madison IN Date 9/26/06 77

Project / Client Army COE Louisville

13:00 Arrive at JPG to meet Seth Stevenson to clear areas for UXO where sampling occurs
WW 9/26/06

15:00 Back at FIELD OFFICE
Check Supplies & Equipment for sampling
Charge batteries & take Inventory

17:00 Go to Hotel

WW 9/26/06

WW. 9/26/06

Location JPG Madison IN Date 9/27/96
Project / Client Army COE, Louisville

0630 Arrive at Field office,
SWJC crew:
Clark Evers - Physicist
William Wilkinson - Field Manager
Army COE Phil Mann, Ken Knoff
0700 Conduct H/S Tailgate meeting
(See Page 526 for additional H/S Discussions).
1. Personel will be frisked upon entrance & exit to Sites
2. Wear PPE, steel toe shoes, safety glasses, gloves
3. Do not handle UXO or disturb soil at the surface
4. Due - Lowering Red sound, See Page 3.
5. Obey speed limits and watch for animals/deer in road
6. Equipment calibrated daily
7. Samples screened w/ rad equipment after sampling
8. All samples filtered & cooled to 4°C, Preserved w HNO3 Chemille w/ gloves & safety glasses
[illegible] 9/27/96

Location JPG Madison IN Date 9/27/96
Project / Client Army COE, Louisville

Field Sampling Tasks to be Completed:
8 SW & SED Samples
1 SED & SW Duplicate
11 GW Samples & 1 DUP
4 Surface Soil Samples & 1 Duplicate
0730 Calibrate Equipment
Horiba
RAD monitoring Equipment
0830 Get Vehicle packed & Ready for Field Sampling

HORIBA CALIBRATION INFO:
Calibration solution Standards
Are pH 4.000 NTU 0.0,
Cond 4.49 mScm
Expiration Part #
Horiba Calibrated
pH 3.99
Cond 4.49
NW
[illegible] 9/27/96

80

Location JPG Madison IN Date 9-27-06

Project / Client Army COE Louisville

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Rad Instrument Check IN

43-89 'H'

METER # 202427

Model # 2360

Detector # 212727

Cal Due 1/9/07

UR - 'N'

Meter # 209715

Model # 19

Cal Due: 1/23/07

44-9

Meter # 211665

Model # 3

Detector # 222376

Cal Due 12/6/06

44-10

Meter # 202337

Model # ~~208816~~ WCC 1/22/06 2221

Detector #: 208816

Cal Due: 11/30/06

Wallmuller 9/27/06

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Location JPG Madison, IN Date 9/27/06

Project / Client Army COE - Louisville

Soil & Sediment Samples

Date	Time	Location	Sample	RAD Instrument (CPM)
9/27/06	1400	SS-01-0001	06	5 (BKG)
9/27/06	1400	SS-01-0002	06	6
9/27/06	1400	SS-01-0003	06	7
9/27/06	1400	SS-01-0004	06	5
9/27/06	1400	SS-01-0005	06	5
9/27/06	1400	SD-01-0001	06	5
9/27/06	1400	SD-01-0002	06	6
9/27/06	1400	SD-01-0003	06	5
9/27/06	1400	SD-01-0004	06	5
9/27/06	1400	SD-01-0005	06	5
9/27/06	1400	SD-01-0006	06	5
9/27/06	1400	SD-01-0007	06	5
9/27/06	1400	SD-01-0008	06	5
9/27/06	1400	SD-01-0009	06	5
9/27/06	1400	SD-01-0010	06	5

Wallmuller 9/27/06

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Location JPG - Madison IN Date 9-27-06

Project / Client Army COE - Louisville

WATER LEVEL MEASUREMENTS (FEET)

Location	Date	Time	Water Level
MW-DU-001	9/28/06	08:35	15.66
MW-DU-002	09/28/06	09:40	10.34
MW-DU-003	09/28/06	10:05	9.64
MW-DU-004	09/28/06	11:20	6.82
MW-DU-005	09/27/06	13:25	32.80 Dry
MW-DU-006	09/27/06	15:34	25.54
MW-DU-007	09/28/06	10:40	9.98
MW-DU-008	09/28/06	11:20	23.57
MW-DU-009	09/27/06	13:40	33.22'
MW-DU-010	09/27/06	14:15	2.18
MW-DU-011	09/27/06	1500	6.49

W.W. 9/27/06

W. Miller 9/27/06

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Location JPG - Madison IN Date 9-27-06

Project / Client Army COE - Louisville

Groundwater Sampling - Low Flow (Micropurge) Method

Date	Time	Location	Sample	pH	Cond	Temp	D.O.	Turbid	Water
9/28/06	0838	MW-DU-001	06	7.41	0.471	2	9.16	15.6	5
9/28/06	0940	MW-DU-002	06	7.45	0.552	15	9.55	15.9	5
9/28/06	1005	MW-DU-003	06	7.38	0.603	20.4	9.00	16.8	5
09/28/06	11:20	MW-DU-004	06	7.52	0.483	18.2	9.05	17.6	5
09/27/06	11:30	MW-DU-005	06	Dry Well					
9/27/06	1530	MW-DU-006	06	7.54	0.398	8	11.69	17.2	5
9/28/06	1040	MW-DU-007	06	7.55	0.535	20.4	8.78	17.4	5
9/28/06	11:20	MW-DU-008	06	7.52	0.391	20.2	10.72	13.9	5
9/27/06	1345	MW-DU-009	06	7.42	7.73	19.5	12.10	15.2	5
09/27/06	1415	MW-DU-010	06	7.49	0.480	8	9.63	20.0	5
9/27/06	1500	MW-DU-011	06	7.65	0.346	5	10.31	19.5	5
9/28/06	11:22	MW-DU-004D	Same as 004						

W. Miller 9/27/06

Location JPG Madison IN Date 9/27/06

Project / Client Army COE Louisville

0900 Go to SW & SD-DU-001 to collect SW & SEDIMENT SAMPLE

0915 Collect SAMPLE. SAMPLE Filtered with 0.45 Micro Filter all SAMPLE Supplies, to bing dedicated to each location. Cool SAMPLES to 4°C after SAMPLING. Water SAMPLE Bottles Preserved with HNO_3. SEDIMENT SAMPLE Collected with Stainless Steel Spoon (dedicated) & Gloves.

0945 Go to SW & SD-DU-002 to collect surface water & Sediment SAMPLES

1010 collect SW DU-002 & SD-DU-002 SAME Procedure AS ABOVE.

10:40 Go to ~~DU-SS~~ SS-DU-004 to collect Surface Soil SAMPLE (dedicated, decomed stainless Steel Spoon & Amber Jar)

11:15 Collect SS-DU-004

11:25 Go to SW & SD DU-008.

W.W. 9/27/06

Location JPG Madison IN Date 9/27/06

Project / Client Army COE, Louisville

Surface Water Sample Quality Measurements

Date	Time	Location	DO	Cond (mS)	pH	Temp (°C)
9/27/06	0915	SW-DU-001	8.0	1.577	0.222	5
9/27/06	1000	SW-DU-002	8.0	1.54	0.191	7.4
9/27/06	0920	SW-DU-003	8.0	2.15	0.132	8
9/27/06	0915	SW-DU-004	8.0	5.04	1.213	9
9/27/06	1400	SW-DU-005	8.0	7.45	0.282	5
9/27/06	1530	SW-DU-006	8.0	8.05	0.136	5
9/27/06	1530	SW-DU-007	8.0	9.28	1.142	7
9/27/06	11:35	SW-DU-008	8.0	7.73	0.249	8
9/27/06	0915	SW-DU-010	8.0	SEE ABOVE		

9/27/06

W.W. 9/27/06

Location JPG Madison IN Date 9-27-06
Project / Client Army COE Louisville

11:35 collect surface soil & sediment at SW-DU-008 & SD-DU-008
11:50 Walk to MW-DU-005, well Locked, Go to OFFICE to Get Phil Mann & take Lunch.
12:30 Back From lunch Pick up Phil Mann with well key. Go Back to MW DU-005. ~~well T~~ w.m. 9/27/06
13:00 Well Tagged at 32.50' Feet Phil Bailed Well on Monday morning. Says well always recharged/had recovery Well is Dry.
13:30 Go to MW-DU-009
13:45 collect MW-DU-009 with bailer & Peristaltic Pump, water filtered with 0.45 micron filter & dedicated, precleaned (lab grade) tubing Samples Bottles Preprescrved w.m. 9/27/06

Location JPG Madison IN Date 9-27-06
Project / Client Army COE Louisville

13:45 Cont. with HNO_3 & cooled to 4°C. w.m.
14:00 Arrive at SW-DU-005 & SD-DU-005 to collect SW & SED SAMPLE. Samples collect with Peristaltic Pump & dedicated tubing. Water sample Bottles preprescrved with HNO_3 & cooled to 4°C In line filter (0.45 micron) used to collect Sample.
14:15 Arrive at MW-DU-010 to collect GW SAMPLE. Samples collected with Peristaltic Pump, dedicated tubing & IN LINE filter. Bailer used to retrieve sample from well.
14:30 Go to SS-DU-001 & SS-DU-002.
w.m. 9/27/06

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Location: JPG Madison IN Date: 9-27-06

Project / Client: Army COE Louisville

1455 Arrive at SS-DU-001
Collect Surface Soil Sample
with Stainless Steel Spoon
1443 Arrive at SS-DU-002
collect Surface Soil Sample
with Stainless Steel Spoon
All Samples cooled to
4°C.
15:30 Go to field office to
Prep Samples &
Prepare for tommorow.
17:30 Leave field office.

9/27/06
W.W.

W. Allen 9/27/06

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Location: JPG Madison IN Date: 9-28-06

Project / Client: Army COE Louisville

0630 Arrive at field office
Calibrate Equipment
Horiba & RAD Equipment
Prep for Sampling.
0700 Conduct H/S tail gate
Meeting
0740 Leave field office
to collect Samples.
0815 Arrive at SW-DU-004
& SD-DU-004. Samples
collected, Bottles Preprepared
& filtered with 0.45 micron
filter.
0850 Collect MW-DU-01
with Peristaltic Pump,
dedicated tubing,
Preprepared Bottles (HNO_3)
All Samples Cooled to 4°C.
0920 Collect SW-DU-003
& SD-DU-003, Surface
Seds collected with
Stainless Steel Spoon.
Water Sample Procedure Same
as above/previous.

W. Allen 9/28/06

Location JPG Madison IN Date 09/25/06

Project / Client Army COE Louisville

0940 collect MW-DU-002 water level measurements in table on Page 82. Sample procedures same as documented previously.

10:05 collect MW-DU-003 Samples preprescrved & cooled 4°C

10:40 collect MW-DU-007 Samples Preprescrved & cooled to 4°C. Procedurs same as previously documented

11:20 collect MW-DU-004 & 004D (Duplicate Sample).

13:50 Go to SS-DU-003 to collect Final SS Sample

14:00 collect SS-DU-003 with Stainless Steel Spoon

14:30 Back at field OFFICE to request that access/clearing be completed to SAMPLE SW-DU-006/SD-DU-006

W. W. 9/25/06

Location JPG Madison IN Date 09/25/06

Project / Client Army COE Louisville

15:45 Go to SW-DU-006 & SD-DU-006 to collect Surface Water & sediment SAMPLE

16:00 collect SW-DU-006 & SD-DU-006

All samples (water) Preprescrved with HNO_3 & filter with 0.45 micron filter.

17:00 Back at field OFFICE to Prep Samples

19:00 Leave site for the day.

W. W. 9/25/06

W. W. 9/25/06

92 Location JPG Madison IN Date 09/29/06
Project / Client Army COE Louisville

0700 Prep Samples & cooler, Bag ICE, Fill out Fed-X Air bills Demob, & ETC.
Dup Samples collected This Event
SW-DU-000 D
SD-DU-002 D
MW-DU-004 D
SS-DU-003 D
10:00 Bottle count okay, custody seals, Bag ICE, Sample management tasks
13:00 ~~Head~~ 3/29/06
Box up Equipment to Ship to Rental Vendor.
13:30 Leave Madison, will Ship samples tomorrow to avoid Saturday delivery.

9/29/06

9/29/06

Location JPG Madison IN Date 09/30/06
Project / Client Army COE Louisville

11:00 Re-Pack / ICE Samples
11:30 Ship to LAB FWSA COCs for Shipment.

9/30/06

9/30/06

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APPENDIX C
DATA VALIDATION SUMMARY

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C. DATA VALIDATION SUMMARY

C.1 PARAGON ANALYTICS SDGs 06-04-128, 06-04-129, AND 06-04-130

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) numbers. 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 code used in the validation of the data.

Report Summary	
Total Number of Samples	35
Total Number of Data Points	105
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 samples were analyzed in SDG 06-04-130, surface water samples were analyzed in SDG 06-04-129, and sediment/soil samples were analyzed in SDG 06-04-128.

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.

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 #:* **06-04-128, 06-04-129, 06-04-130**

Client Sample I.D.	Laboratory Sample I.D.	Date Collected	Analyses Performed
SS-DU-001 SAIC05	0604128-1	12-Apr-06	Isotopic Uranium
SS-DU-002 SAIC05	0604128-2	12-Apr-06	Isotopic Uranium
SS-DU-003 SAIC05	0604128-3	12-Apr-06	Isotopic Uranium
SS-DU-004 SAIC05	0604128-4	12-Apr-06	Isotopic Uranium
SS-DU- SAIC05D	0604128-5	12-Apr-06	Isotopic Uranium
SD-DU-001 SAIC05	0604128-6	11-Apr-06	Isotopic Uranium
SD-DU-002 SAIC05	0604128-7	11-Apr-06	Isotopic Uranium
SD-DU-003 SAIC05	0604128-8	12-Apr-06	Isotopic Uranium
SD-DU-004 SAIC05	0604128-9	12-Apr-06	Isotopic Uranium
SD-DU-005 SAIC05	0604128-10	12-Apr-06	Isotopic Uranium
SD-DU-006 SAIC05	0604128-11	12-Apr-06	Isotopic Uranium
SD-DU-007 SAIC05	0604128-12	12-Apr-06	Isotopic Uranium
SD-DU-008 SAIC05	0604128-13	12-Apr-06	Isotopic Uranium
SD-DU-004 SAIC05D	0604128-14	12-Apr-06	Isotopic Uranium
MW-DU-001 SAIC05	0604130-1	12-Apr-06	Isotopic Uranium
MW-DU-002 SAIC05	0604130-2	12-Apr-06	Isotopic Uranium
MW-DU-003 SAIC05	0604130-3	11-Apr-06	Isotopic Uranium
MW-DU-004 SAIC05	0604130-4	11-Apr-06	Isotopic Uranium
MW-DU-005 SAIC05	0604130-5	12-Apr-06	Isotopic Uranium
MW-DU-006 SAIC05	0604130-6	11-Apr-06	Isotopic Uranium
MW-DU-007 SAIC05	0604130-7	11-Apr-06	Isotopic Uranium
MW-DU-008 SAIC05	0604130-8	11-Apr-06	Isotopic Uranium
MW-DU-009 SAIC05	0604130-9	12-Apr-06	Isotopic Uranium
MW-DU-010 SAIC05	0604130-10	12-Apr-06	Isotopic Uranium
MW-DU-011 SAIC05	0604130-11	12-Apr-06	Isotopic Uranium
MW-DU-003 SAIC05D	0604130-12	11-Apr-06	Isotopic Uranium
SW-DU-001 SAIC05	0604129-1	11-Apr-06	Isotopic Uranium
SW-DU-002 SAIC05	0604129-2	11-Apr-06	Isotopic Uranium
SW-DU-003 SAIC05	0604129-3	12-Apr-06	Isotopic Uranium
SW-DU-004 SAIC05	0604129-4	12-Apr-06	Isotopic Uranium
SW-DU-005 SAIC05	0604129-5	12-Apr-06	Isotopic Uranium
SW-DU-006 SAIC05	0604129-6	12-Apr-06	Isotopic Uranium
SW-DU-007 SAIC05	0604129-7	12-Apr-06	Isotopic Uranium
SW-DU-008 SAIC05	0604129-8	12-Apr-06	Isotopic Uranium
SW-DU-001 SAIC05D	0604129-9	12-Apr-06	Isotopic Uranium

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ATTACHMENT

JEFFERSON PROVING GROUND
SAMPLE DATA SUMMARY SHEETS

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SAMPLE DATA SUMMARY – SOILS	
Laboratory:	*SDG #:*
Paragon Analytics	**06-04-128**

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	**Analyte**	**Result**	**Error**	**MDC**	**Units**	**Qualifier**	**Reason Code**
SS-DU-001 SAIC05	U-234	0.87	0.30	0.15	pCi/g		
SS-DU-001 SAIC05	U-235	0.037	0.079	0.124	pCi/g	U	
SS-DU-001 SAIC05	U-238	1.06	0.33	0.12	pCi/g		
SS-DU-002 SAIC05	U-234	0.76	0.27	0.15	pCi/g		
SS-DU-002 SAIC05	U-235	0.054	0.077	0.134	pCi/g	U	
SS-DU-002 SAIC05	U-238	0.86	0.29	0.13	pCi/g		
SS-DU-003 SAIC05	U-234	0.58	0.22	0.13	pCi/g		
SS-DU-003 SAIC05	U-235	0.042	0.072	0.143	pCi/g	U	
SS-DU-003 SAIC05	U-238	0.74	0.26	0.12	pCi/g		
SS-DU-004 SAIC05	U-234	0.83	.29	0.13	pCi/g		
SS-DU-004 SAIC05	U-235	0.063	0.085	0.132	pCi/g	U	
SS-DU-004 SAIC05	U-238	0.73	0.27	0.11	pCi/g		
SS-DU-002 SAIC05D	U-234	0.84	0.28	0.12	pCi/g		
SS-DU-002 SAIC05D	U-235	0.010	0.075	0.130	pCi/g	U	
SS-DU-002 SAIC05D	U-238	0.81	0.28	0.05	pCi/g		
SD-DU-001 SAIC05	U-234	0.77	0.27	0.13	pCi/g		
SD-DU-001 SAIC05	U-235	0.12	0.11	0.12	pCi/g	J	37
SD-DU-001 SAIC05	U-238	0.60	0.23	0.15	pCi/g		
SD-DU-002 SAIC05	U-234	0.55	0.22	0.13	pCi/g		
SD-DU-002 SAIC05	U-235	0.028	0.076	0.144	pCi/g	U	
SD-DU-002 SAIC05	U-238	0.67	0.25	0.13	pCi/g		
SD-DU-003 SAIC05	U-234	0.66	0.25	0.09	pCi/g		
SD-DU-003 SAIC05	U-235	0.015	0.081	0.127	pCi/g	U	
SD-DU-003 SAIC05	U-238	0.57	0.23	0.13	pCi/g		
SD-DU-004 SAIC05	U-234	0.38	0.18	0.05	pCi/g		
SD-DU-004 SAIC05	U-235	0	0.079	0.06	pCi/g	U	
SD-DU-004 SAIC05	U-238	0.36	0.18	0.05	pCi/g		
SD-DU-005 SAIC05	U-234	0.28	0.16	0.10	pCi/g	J	37
SD-DU-005 SAIC05	U-235	-0.004	0.084	0.112	pCi/g	U	

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
SD-DU-005 SAIC05	U-238	0.24	0.15	0.10	pCi/g	J	37
SD-DU-006 SAIC05	U-234	0.46	0.23	0.19	pCi/g		
SD-DU-006 SAIC05	U-235	0.05	0.10	0.14	pCi/g	U	
SD-DU-006 SAIC05	U-238	0.50	0.24	0.16	pCi/g		
SD-DU-007 SAIC05	U-234	0.45	0.20	0.09	pCi/g		
SD-DU-007 SAIC05	U-235	0.046	0.081	0.062	pCi/g	U	
SD-DU-007 SAIC05	U-238	0.29	0.16	0.09	pCi/g	J	37
SD-DU-008 SAIC05	U-234	0.71	0.26	0.15	pCi/g		
SD-DU-008 SAIC05	U-235	0.053	0.076	0.132	pCi/g	U	
SD-DU-008 SAIC05	U-238	0.77	0.27	0.13	pCi/g		
SD-DU-004 SAIC05D	U-234	0.44	0.19	0.12	pCi/g		
SD-DU-004 SAIC05D	U-235	0.017	0.074	0.099	pCi/g	U	
SD-DU-004 SAIC05D	U-238	0.42	0.19	0.10	pCi/g		

SAMPLE DATA SUMMARY – WATERS	
Laboratory:	*SDG #:*
Paragon Analytics	**06-04-130, 06-04-129**

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	**Analyte**	**Result**	**Error**	**MDC**	**Units**	**Qualifier**	**Reason Code**
MW-DU-001 SAIC05	U-234	0.38	0.27	0.33	pCi/L	J	37
MW-DU-001 SAIC05	U-235	-0.02	0.16	0.37	pCi/L	U	
MW-DU-001 SAIC05	U-238	0.02	0.13	0.31	pCi/L	U	
MW-DU-002 SAIC05	U-234	0.86	0.41	0.29	pCi/L		
MW-DU-002 SAIC05	U-235	0.02	0.17	0.30	pCi/L	U	
MW-DU-002 SAIC05	U-238	0.51	0.31	0.26	pCi/L	J	37
MW-DU-003 SAIC05	U-234	0.69	0.36	0.30	pCi/L	J	37
MW-DU-003 SAIC05	U-235	0.05	0.17	0.33	pCi/L	U	
MW-DU-003 SAIC05	U-238	0.47	0.28	0.11	pCi/L	J	37
MW-DU-004 SAIC05	U-234	0.54	0.33	0.36	pCi/L	J	37
MW-DU-004 SAIC05	U-235	0.07	0.17	0.30	pCi/L	U	
MW-DU-004 SAIC05	U-238	0.15	0.21	0.40	pCi/L	U	
MW-DU-005 SAIC05	U-234	0.30	0.25	0.33	pCi/L	U	
MW-DU-005 SAIC05	U-235	0.04	0.17	0.36	pCi/L	U	
MW-DU-005 SAIC05	U-238	0.22	0.22	0.33	pCi/L	U	
MW-DU-006 SAIC05	U-234	2.55	0.75	0.20	pCi/L		
MW-DU-006 SAIC05	U-235	0.02	0.16	0.28	pCi/L	U	
MW-DU-006 SAIC05	U-238	1.28	0.49	0.29	pCi/L		
MW-DU-007 SAIC05	U-234	1.32	0.51	0.11	pCi/L		
MW-DU-007 SAIC05	U-235	0.05	0.18	0.13	pCi/L	U	
MW-DU-007 SAIC05	U-238	0.91	0.41	0.11	pCi/L		
MW-DU-008 SAIC05	U-234	0.27	0.22	0.21	pCi/L	J	37
MW-DU-008 SAIC05	U-235	0.08	0.17	0.25	pCi/L	U	
MW-DU-008 SAIC05	U-238	0.23	0.20	0.21	pCi/L	J	37
MW-DU-009 SAIC05	U-234	1.15	0.55	0.49	pCi/L		
MW-DU-009 SAIC05	U-235	0.10	0.22	0.32	pCi/L	U	
MW-DU-009 SAIC05	U-238	-0.01	0.19	0.41	pCi/L	U	
MW-DU-010 SAIC05	U-234	1.68	0.58	0.36	pCi/L		
MW-DU-010 SAIC05	U-235	-0.04	0.16	0.31	pCi/L	U	
MW-DU-010 SAIC05	U-238	0.79	0.38	0.31	pCi/L		
MW-DU-011 SAIC05	U-234	0.03	0.14	0.29	pCi/L	U	
MW-DU-011 SAIC05	U-235	0.04	0.16	0.12	pCi/L	U	

Isotopic Uranium ASTM D3972-90M							
Sample I.D.	Analyte	Result	Error	MDC	Units	Qualifier	Reason Code
MW-DU-011 SAIC05	U-238	0.13	0.16	0.24	pCi/L	U	
MW-DU-003 SAIC05D	U-234	0.72	0.36	0.27	pCi/L		
MW-DU-003 SAIC05D	U-235	0.03	0.16	0.23	pCi/L	U	
MW-DU-003 SAIC05D	U-238	0.91	0.41	0.27	pCi/L		
SW-DU-001 SAIC05	U-234	0.098	0.092	0.155	pCi/L	U	
SW-DU-001 SAIC05	U-235	0.036	0.049	0.071	pCi/L	U	
SW-DU-001 SAIC05	U-238	0.046	0.065	0.123	pCi/L	U	
SW-DU-002 SAIC05	U-234	0.072	0.063	0.066	pCi/L	J	37
SW-DU-002 SAIC05	U-235	0.010	0.054	0.078	pCi/L	U	
SW-DU-002 SAIC05	U-238	0.27	0.13	0.07	pCi/L		
SW-DU-003 SAIC05	U-234	-0.001	0.046	0.119	pCi/L	U	
SW-DU-003 SAIC05	U-235	0.010	0.054	0.078	pCi/L	U	
SW-DU-003 SAIC05	U-238	0.035	0.053	0.098	pCi/L	U	
SW-DU-004 SAIC05	U-234	0.123	0.096	0.122	pCi/L	J	37
SW-DU-004 SAIC05	U-235	0.017	0.062	0.046	pCi/L	U	
SW-DU-004 SAIC05	U-238	0.099	0.086	0.113	pCi/L	U	
SW-DU-005 SAIC05	U-234	0.20	0.12	0.17	pCi/L	J	37
SW-DU-005 SAIC05	U-235	-0.017	0.051	0.110	pCi/L	U	
SW-DU-005 SAIC05	U-238	0.22	0.11	0.09	pCi/L		
SW-DU-006 SAIC05	U-234	0.067	0.071	0.118	pCi/L	U	
SW-DU-006 SAIC05	U-235	0.001	0.051	0.100	pCi/L	U	
SW-DU-006 SAIC05	U-238	0.066	0.066	0.100	pCi/L	U	
SW-DU-007 SAIC05	U-234	0.021	0.043	0.091	pCi/L	U	
SW-DU-007 SAIC05	U-235	0.010	0.050	0.072	pCi/L	U	
SW-DU-007 SAIC05	U-238	0.086	0.068	0.074	pCi/L	J	37
SW-DU-008 SAIC05	U-234	0.143	0.089	0.084	pCi/L	J	37
SW-DU-008 SAIC05	U-235	0.038	0.051	0.073	pCi/L	U	
SW-DU-008 SAIC05	U-238	0.44	0.16	0.08	pCi/L		
SW-DU-001 SAIC05D	U-234	0.104	0.095	0.154	pCi/L	U	
SW-DU-001 SAIC05D	U-235	-0.022	0.052	0.121	pCi/L	U	
SW-DU-001 SAIC05D	U-238	0.088	0.077	0.110	pCi/L	U	

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

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

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