Data Validation Package

July 2009
Groundwater Sampling at the Shirley Basin South, Wyoming, Disposal Site

October 2009

U.S. DEPARTMENT OF ENERGY

Legacy Management

Contents

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Sampling Event Summary

Site: Shirley Basin South, Wyoming, Disposal Site

Sampling Period: July 22-23, 2009

The 2004 *Long-Term Surveillance Plan for the U. S. Department of Energy Shirley Basin South (UMTRCA Title II) Disposal Site, Carbon County, Wyoming,* requires annual monitoring to verify continued compliance with the pertinent alternate concentration limits (ACLs) and Wyoming Class III (livestock use) groundwater protection standards. Point-of-compliance (POC) wells 5-SC, 5-DC, and 19-DC, and monitor wells 40-SC, 54-SC, 10-DC, and K.G.S. #3 were sampled as specified in the plan; POC well 51-SC was dry at the time of sampling. Sampling and analysis were conducted in accordance with *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351, continually updated). Also sampled were five newer monitor wells installed downgradient of the disposal cell in 2008 (100-SC, 102-SC, 110-DC, 112-DC, and 113-DC); new well 101-SC was dry at the time of sampling. The water level was measured at each sampled well.

Monitor wells with an "SC" suffix are completed in the upper sand aquifer of the Wind River Formation. Wells with a "DC" suffix are completed in the main sand aquifer. It has been determined using a downhole video camera that well 54-SC is continuously screened through both the upper sand and main sand aquifers; this well is scheduled for decommissioning in 2010 to avoid potential cross-contamination of the aquifers. Well K.G.S. #3 is completed in the lower sand aquifer, which is hydraulically separated from the overlying main sand and upper sand aquifers.

ACLs are approved for cadmium, chromium, lead, nickel, radium-226, radium-228, selenium, thorium-230, and uranium in site groundwater. As shown on Table 1, radium-228 concentrations remain above the ACL in wells 5-DC and 54-SC. Radium-228 concentrations apparently are related to naturally occurring thorium ore in the main sand unit (the primary ore body at the site). Radium-226 exceeded the ACL in downgradient well 110-DC. The cause for this result is not known; confirmatory sampling is scheduled for fall 2009. No other ACLs were exceeded.

Table 1. Wells with Results Exceeding an ACL

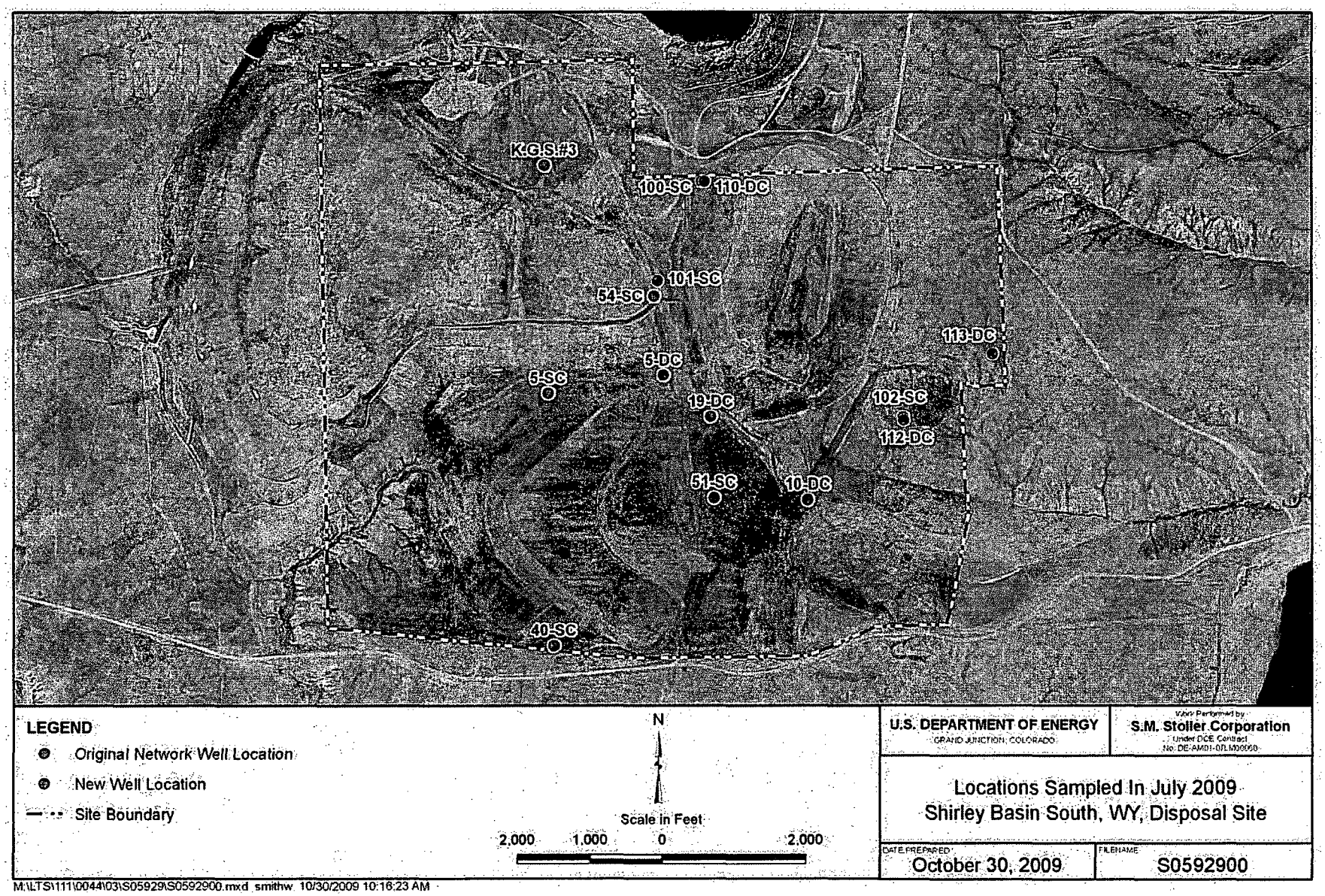
Analyte	ACL	110-DC	5-DC	54-SC
Radium-226	91.3 pCi/L	172 pCi/L		
Radium-228	25.7 pCi/L		33.0 pCi/L	93.4 pCi/L

Key: ACL = alternate concentration limit; pCi/L = picocuries per liter

Concentrations of sulfate and total dissolved solids continue to exceed their respective Wyoming Class III groundwater protection standards for livestock use in wells 5-DC, 5-SC, and 54-SC as they have done throughout the sampling history; however, there is no livestock use of the water from these aquifers at the site.

Richard K. Johnson
Site Lead, S.M. Stoller

10/30/09
Date



Shirley Basin South, Wyoming, Disposal Site Sample Location Map

Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	Shirley Basin South, Wyoming	**Date(s) of Water Sampling**	July 22-23, 2009
Date(s) of Verification	October 2, 2009	**Name of Verifier**	Steve Donivan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
List other documents, SOPs, instructions.		Work Order Letter dated June 15, 2009.
2. Were the sampling locations specified in the planning documents sampled?	No	Well 101-SC was dry. Well 51-SC was pumped dry during development on July 21 and did not recover by July 23.
3. Was a pre-trip calibration conducted as specified in the above-named documents?	Yes	Pre-trip calibration was performed on July 17 and 20, 2009.
4. Was an operational check of the field equipment conducted daily?	Yes	
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	Yes	
6. Was the category of the well documented?	Yes	
7. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged prior to sampling?	Yes	
Did the water level stabilize prior to sampling?	Yes	
Did pH, specific conductance, and turbidity measurements stabilize prior to sampling?	No	The pH did not meet stability criteria at well 113-DC.
Was the flow rate less than 500 mL/min?	No	The flow rate exceeded 500 mL/min in wells 10-DC, 19-DC, 112-DC, and 113-DC.
If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	NA	

Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected from well 19-DC.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with nondedicated equipment?	NA	
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were QC samples assigned a fictitious site identification number?	Yes	Location ID 2940 was used for the duplicate sample.
Was the true identity of the samples recorded on the Quality Assurance Sample Log or in the Field Data Collection System (FDCS) report?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	Yes	
16. Were chain of custody records completed and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members (hardcopies) or are dates present for the "Date Signed" fields (FDCS)?	Yes	
18. Was all other pertinent information documented on the field data sheets?	Yes	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	Yes	

Laboratory Performance Assessment

General Information

Report Number (RIN):	09072450
Sample Event:	July 22-23, 2009
Site(s):	Shirley Basin South, Wyoming
Laboratory:	ALS Laboratory Group, Fort Collins, Colorado
Work Order No.:	0907273
Analysis:	Metals, Inorganic, and Radiochemistry
Validator:	Steve Donivan
Review Date:	October 1, 2009

This validation was performed according to the *Environmental Procedures Catalog* (LMS/PRO/S04325, continually updated), "Standard Practice for Validation of Laboratory Data," GT-9(P). The procedure was applied at Level 3, Data Validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 2.

Table 2. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Cadmium, Lead, Selenium, Uranium	LMM-02	SW-846 3005A	SW-846 6020A
Chloride	MIS-A-039	SW-846 9056	SW-846 9056
Chromium, Nickel	LMM-01	SW-846 3005A	SW-846 6010B
Nitrate + Nitrite as N	WCH-A-022	MCAWW 353.2	MCAWW 353.2
Radium-226	GPC-A-018	SOP712R14	SOP724R10
Radium-228	GPC-A-020	SW-846 9320	SW-846 9320
Sulfate	MIS-A-044	SW-846 9056	SW-846 9056
Thorium Isotopes	ASP-A-008	SOP776R11	SOP714R11
Total Dissolved Solids	WCH-A-033	MCAWW 160.1	MCAWW 160.1

Data Qualifier Summary

Analytical results were qualified as listed in Table 3. Refer to the sections below for an explanation of the data qualifiers applied.

Table 3. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
0907273-1	100-SC	Chromium	U	Less than 5 times the method blank
0907273-1	100-SC	Thorium-232	J	Less than 3 times the MDC
0907273-2	102-SC	Chromium	U	Less than 5 times the method blank
0907273-3	10-DC	Cadmium	U	Less than 5 times the calibration blank
0907273-3	10-DC	Chromium	U	Less than 5 times the method blank
0907273-4	110-DC	Chromium	U	Less than 5 times the method blank
0907273-4	110-DC	Thorium-228	J	Less than 3 times the MDC
0907273-4	110-DC	Thorium-232	J	Less than 3 times the MDC
0907273-5	112-DC	Cadmium	U	Less than 5 times the calibration blank
0907273-5	112-DC	Chromium	U	Less than 5 times the method blank
0907273-6	113-DC	Cadmium	U	Less than 5 times the calibration blank
0907273-6	113-DC	Chromium	U	Less than 5 times the method blank
0907273-7	19-DC	Thorium-232	J	Less than 3 times the MDC
0907273-7	19-DC	Chromium	U	Less than 5 times the method blank
0907273-8	19-DC Duplicate	Cadmium	U	Less than 5 times the calibration blank
0907273-8	19-DC Duplicate	Chromium	U	Less than 5 times the method blank
0907273-8	19-DC Duplicate	Lead	U	Less than 5 times the calibration blank
0907273-8	19-DC Duplicate	Thorium-232	U	Less than the TPU
0907273-9	40-SC	Chromium	U	Less than 5 times the method blank
0907273-9	40-SC	Lead	U	Less than 5 times the calibration blank
0907273-10	54-SC	Radium-228	J	Yield adjusted by laboratory
0907273-11	5-DC	Chromium	U	Less than 5 times the method blank
0907273-12	5-SC	Radium-228	J	Less than 3 times the MDC
0907273-13	K.G.S.#3	Cadmium	U	Less than 5 times the calibration blank
0907273-13	K.G.S.#3	Chromium	U	Less than 5 times the method blank
0907273-13	K.G.S.#3	Nickel	U	Less than 5 times the calibration blank
0907273-13	K.G.S.#3	Thorium-232	U	Less than the TPU
0907273-13	K.G.S.#3	Radium-226	J	Less than 3 times the MDC
0907273-13	K.G.S.#3	Uranium	U	Less than 5 times the calibration blank

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received 13 water samples on July 24, 2009, accompanied by a Chain of Custody (COC) form. Copies of the three air bills were included in the receiving documentation. The COC form was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The COC form was complete with no errors or omissions, with the following exception. An incorrect sample date was written on the COC form for location 10-DC. The error was rectified when the data were loaded into the SEEPro database.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 2.8 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses, with the following exception. For location 5-SC, the laboratory noted that the aliquots for total dissolved solids and anions, which are not supposed to be acidified, were received with a pH of 4 or lower. This is typical for samples from this location; these pH values do not indicate a field preservation error. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for all analytes. Initial calibration demonstrates that the instrument is capable of acceptable performance in the beginning of the analytical run and of producing a linear curve. Compliance requirements for continuing calibration checks are established to ensure that the instrument continues to be capable of producing acceptable qualitative and quantitative data. All laboratory instrument calibrations were performed correctly in accordance with the cited methods.

Method MCAWW 160.1, Total Dissolved Solids

There is no initial or continuing calibration requirement associated with the determination of total dissolved solids.

Method MCAWW 353.2, Nitrate + Nitrite as N

Calibrations were performed on July 30, 2009, using seven calibration standards. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the method detection limit (MDL). Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification checks were made at the required frequency resulting in four verification checks. All calibration checks met the acceptance criteria.

Method SW-846 6010B, Chromium and Nickel

Single point calibrations were performed for chromium and nickel on August 4, 2009. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the practical quantitation limit (PQL) and all results were within the acceptance range.

Method SW-846 6020A, Cadmium, Lead, Selenium, and Uranium

Calibrations for cadmium, lead, and uranium were performed on August 6, 2009; and for selenium on August 10, 2009, using eight calibration standards. The calibration curve correlation

coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification (CCV) checks were made at the required frequency resulting in 15 verification checks. All calibration checks met the acceptance criteria with the exception of CCV10 for uranium. There were no sample results associated with this CCV. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL and all results were within the acceptance range. Mass calibration and resolution verifications were performed at the beginning of each analytical run in accordance with the analytical procedure. Internal standard recoveries associated with requested analytes were stable and within acceptable ranges.

Method SW-846 9056, Chloride and Sulfate

Calibrations were performed on July 16, 2009, using five calibration standards. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification checks were made at the required frequency resulting in six verification checks. All calibration checks met the acceptance criteria.

Radiochemical Analysis

All radiochemical results reported included the calculated two-sigma total propagated uncertainty (TPU) and minimum detectable concentration (MDC). Radiochemical results are qualified with a "J" flag (estimated) when the result is greater than the MDC, but less than 3 times the MDC. Radiochemical results are qualified with a "U" flag (not detected) when the result is greater than the MDC but less than the two-sigma TPU.

Radium-226

Samples were screened for radium-226 by gas flow proportional counting. Plateau voltage determinations were performed in July and September 2008. Efficiency calibrations were performed October through November of 2008. Daily instrument checks met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Radium–228

Plateau voltage determinations and detector efficiency calibrations were performed in November 2008. Daily instrument checks performed on August 13, 2009, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples. Chemical recoveries for several of the samples were adjusted by the laboratory to minimize possible low biases. The results for these samples are qualified with a "J" flag (estimated).

Thorium Isotopes

Alpha spectrometry calibrations were performed on August 5, 2009. Instrument background was determined on August 5, 2009. The tracer recoveries met the acceptance criteria of 30 to

110 percent for all samples. The full width at half maximum (FWHM) was reviewed to evaluate the spectral resolution. For several samples, the tracer FWHM exceeded 100 kilo electron volts, which is expected for isotopes such as thorium-229 with alpha emissions at multiple energies. These tracer peaks did not appear to compromise the data by contributing significantly to the thorium-230 region of interest. The laboratory noted that the thorium-230 results were corrected for thorium-229 contribution based on historical method blank data. All internal standard peaks were within 50 kilo electron volts of the expected position. The regions of interest for analyte peaks were reviewed. No manual integrations were performed and all regions of interest were satisfactory.

Method and Calibration Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis.

Metals and Wet Chemistry

All method blank and calibration blank results associated with the samples were below the PQLs for all analytes with the exception of CCB10 calibration blank for uranium. There were no sample results associated with this blank. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a "U" flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration.

Radiochemistry

All radiochemical method blank results were below the MDC with the exception of thorium-232. Thorium-232 sample results that are greater than the MDC but less than 5 times the blank concentration are qualified with a "J" flag as estimated values.

Inductively Coupled Plasma (ICP) Interference Check Sample (ICS) Analysis

ICP interference check samples ICSA and ICSAB were analyzed at the required frequency to verify the instrumental interelement and background correction factors. All check sample results met the acceptance criteria.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix for the metals and wet chemistry analyses. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The spikes met the recovery and precision criteria for all analytes evaluated.

Laboratory Replicate Analysis

Laboratory replicate sample results demonstrate acceptable laboratory precision. The relative percent difference values for the non-radiochemical sample replicates and matrix spike replicates

were less than 20 percent for results that are greater than 5 times the PQL, indicating acceptable precision.

The radiochemical relative error ratio (calculated using the one-sigma TPU) for the sample replicates and laboratory control sample replicates was less than three, indicating acceptable precision.

Laboratory Control Sample

Laboratory control samples were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. All control sample results were acceptable.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for the metals analyses to monitor chemical or physical interferences in the sample matrix. Serial dilution data are evaluated when the concentration of the undiluted sample is greater than 100 times the PQL for ICP-MS or greater than 50 times the PQL for ICP. All evaluated serial dilution data were acceptable.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The required detection limits were met for all metals and wet chemistry analytes.

All radiochemical MDCs were calculated using the following equation as specified in *Quality Systems for Analytical Services*.

$$MDC = \frac{4.65 \times \sqrt{\frac{b}{T}}}{K} + \frac{3}{K \times T}$$

Where:
b = background count rate (counts per minute)
K = Efficiency factor
T = Count time in minutes

The calculation of the MDCs using the equation above was verified. All reported MDCs were less than the required MDCs with the exception of four radium-228 and two thorium isotope MDCs. The associated sample results were greater than the reported detection limit.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The analytical report included the MDL (MDC for radiochemistry) and PQL for all analytes and all required supporting documentation.

Chromatography Peak Integration

The integration of analyte peaks was reviewed for all ion chromatography data. All peak integrations, including manual integrations, were satisfactory.

Electronic Data Deliverable (EDD) File

The EDD file arrived on August 20, 2009. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 09072450 Lab Code: PAR Validator: Steve Donivan Validation Date: 10/1/2009

Project: Shirley Basin South Analysis Type: ☑ Metals ☑ General Chem ☑ Rad ☐ Organics

# of Samples: 13 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

☑ Holding Times	All analyses were completed within the applicable holding times.
☑ Detection Limits	There are 0 detection limit failures.
☐ Field/Trip Blanks	
☑ Field Duplicates	There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 09072450 **Lab Code:** PAR **Date Due:** 8/21/2009

Matrix: Water **Site Code:** SBS **Date Completed:** 8/21/2009

Analyte	Date Analyzed	CALIBRATION						Method	LCS	MS	MSD	Dup.	ICSAB	Serial Dil.	CRI
		Int.	R^2	ICV	CCV	ICB	CCB	Blank	%R	%R	%R	RPD	%R	%R	%R
CADMIUM	08/06/2009	0.0000	1.0000	OK	OK	OK	OK	OK	99.0	97.0	98.0	1.0	96.0	23.0	106.0
CHROMIUM	08/04/2009			OK	OK	OK	OK	OK	104.0	97.0	94.0	3.0	96.0		107.0
CHROMIUM	08/04/2009												93.0		110.0
LEAD	08/06/2009	0.0000	1.0000	OK	OK	OK	OK	OK	97.0	104.0	104.0	0.0	104.0	2.0	98.0
NICKEL	08/04/2009			OK	OK	OK	OK	OK	105.0	88.0	87.0	2.0	91.0		105.0
NICKEL	08/04/2009												92.0		106.0
SELENIUM	08/10/2009	0.0000	1.0000	OK	OK	OK	OK	OK	81.0	120.0	122.0	2.0	96.0		102.0
URANIUM	08/06/2009	0.0000	1.0000	OK	OK	OK	OK	OK	104.0	120.0	120.0	0.0	113.0	6.0	103.0

SAMPLE MANAGEMENT SYSTEM

Wet Chemistry Data Validation Worksheet

RIN: 09072450 **Lab Code:** PAR **Date Due:** 8/21/2009

Matrix: Water **Site Code:** SBS **Date Completed:** 8/21/2009

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB	Blank					
CHLORIDE	07/27/2009	0.000	1.0000	OK	OK	OK	OK	OK	90.00	96.0	95.0	0	
NITRATE/NITRITE AS N	07/30/2009	0.000	1.0000	OK	OK	OK	OK	OK	101.00	106.0	102.0	4.00	
SULFATE	07/27/2009	0.000	1.0000	OK	OK	OK	OK	OK	92.00	96.0	96.0	0	
TOTAL DISSOLVED SOLIDS	07/28/2009							OK	101.00			0	

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 09072450 **Lab Code:** PAR **Date Due:** 8/21/2009

Matrix: Water **Site Code:** SBS **Date Completed:** 8/21/2009

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
40-SC	Radium-226	08/12/2009			92.8			
5-SC	Radium-226	08/12/2009			87.4			
54-SC	Radium-226	08/12/2009			91.7			
10-DC	Radium-226	08/12/2009			88.9			
5-DC	Radium-226	08/12/2009			90.9			
19-DC	Radium-226	08/12/2009			94.5			
110-DC	Radium-226	08/12/2009			95.1			
2940	Radium-226	08/12/2009			92.2			
112-DC	Radium-226	08/12/2009			93.6			
113-DC	Radium-226	08/12/2009			97.9			
100-SC	Radium-226	08/12/2009			91.8			
102-SC	Radium-226	08/12/2009			94.5			
K.G.S.#3	Radium-226	08/12/2009			93.9			
Blank_Spike	Radium-226	08/12/2009			92.7	116.0		
Blank_Spike_Du	Radium-226	08/12/2009			92.5	113.0		0.18
Blank	Radium-226	08/12/2009	0.0171	U	94.3			
40-SC	Radium-228	08/13/2009			57.0			
5-SC	Radium-228	08/13/2009			54.2			
54-SC	Radium-228	08/13/2009			52.4			
10-DC	Radium-228	08/13/2009			53.0			
5-DC	Radium-228	08/13/2009			58.7			
19-DC	Radium-228	08/13/2009			49.1			
110-DC	Radium-228	08/13/2009			52.5			
2940	Radium-228	08/13/2009			50.1			
112-DC	Radium-228	08/13/2009			54.2			
113-DC	Radium-228	08/13/2009			55.8			
100-SC	Radium-228	08/13/2009			61.0			
102-SC	Radium-228	08/13/2009			52.4			
K.G.S.#3	Radium-228	08/13/2009			54.3			
Blank_Spike	Radium-228	08/13/2009			55.2	110.0		
Blank_Spike_Du	Radium-228	08/13/2009			58.9	101.0		0.38
Blank	Radium-228	08/13/2009	0.0526	U	54.7			

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 09072450 **Lab Code:** PAR **Date Due:** 8/21/2009

Matrix: Water **Site Code:** SBS **Date Completed:** 8/21/2009

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
10-DC	Thorium-228	08/07/2009			80.8			
19-DC	Thorium-228	08/07/2009			84.1			
110-DC	Thorium-228	08/07/2009			79.3			
112-DC	Thorium-228	08/07/2009			80.5			
113-DC	Thorium-228	08/07/2009			72.1			
100-SC	Thorium-228	08/07/2009			82.8			
102-SC	Thorium-228	08/07/2009			81.8			
100-SC	Thorium-228	08/07/2009			82.0			0.70
40-SC	Thorium-228	08/10/2009			79.3			
5-SC	Thorium-228	08/10/2009			78.5			
54-SC	Thorium-228	08/10/2009			75.9			
5-DC	Thorium-228	08/10/2009			83.1			
2940	Thorium-228	08/10/2009			78.8			
K.G.S.#3	Thorium-228	08/10/2009			73.0			
Blank	Thorium-228	08/10/2009	0.0165	U	74.1			
100-SC	Thorium-230	08/07/2009						1.41
Blank_Spike	Thorium-230	08/10/2009			80.0	94.2		
Blank	Thorium-230	08/10/2009	-0.0915	U				
Blank	Thorium-230	08/10/2009	0.1060					
100-SC	Thorium-232	08/07/2009						2.03

Sampling Quality Control Assessment

The following information summarizes and assesses quality control for this sampling event.

Sampling Protocol

Sample results for all monitor wells were qualified with an "F" flag in the database, indicating the wells were purged and sampled using the low-flow sampling method. All wells met the Category I criteria with the following exceptions:

- Well 100-SC was classified as Category II.
- Well 102-SC was classified as Category III.
- The change in pH exceeded the Category I criterion for well 113-DC.
- The flow rate exceeded the 500 mL/min Category I criteria when sampling wells 10-DC, 19-DC, 112-DC, and 113-DC

The sample results for these wells were qualified with a "Q" flag, indicating the data are qualitative because of the sampling technique.

Equipment Blank Assessment

An equipment blank was not required because samples were collected using dedicated equipment.

Field Duplicate Assessment

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from well 19-DC. The non-radiochemical duplicate results were acceptable, meeting the Environmental Protection Agency recommended laboratory duplicate criteria of less than 20 percent relative difference for results that are greater than 5 times the PQL. The radiochemical duplicate results were acceptable with relative error ratios (calculated using the one-sigma TPU) of less than three.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 09072450 Lab Code: PAR Project: Shirley Basin South Validation Date: 10/1/2009

Duplicate: 2940 Sample: 19-DC

Analyte	Sample Result	Sample Flag	Sample Error	Duplicate Result	Duplicate Flag	Duplicate Error	RPD	RER	Units
CADMIUM	0.33			0.28	B		16.39		UG/L
CHLORIDE	54			57			5.41		MG/L
CHROMIUM	1.8	B		2.3	B				UG/L
LEAD	0.11	B		0.061	B				UG/L
NICKEL	120			120			0		UG/L
NITRATE/NITRITE AS N	0.013			0.014					MG/L
Radium-226	10.7		2.84	10.6		2.82	0.94	0	pCi/L
Radium-228	7.63		2.39	7.13		2.24	6.78	0.3	pCi/L
SELENIUM	0.11			0.11					UG/L
SULFATE	1500			1600			6.45		MG/L
Thorium-228	0.343	U	0.245	0.0478	U	0.247		1.7	pCi/L
Thorium-230	0.156	U	0.354	-0.242	U	0.302		1.7	pCi/L
Thorium-232	0.176		0.139	0.0989		0.1		0.9	pCi/L
TOTAL DISSOLVED SOLIDS	2600			2500			3.92		MG/L
URANIUM	2.6			2.6			0		UG/L

Certification

All laboratory analytical quality control criteria were met except as qualified in this report. The data qualifiers listed on the SEEPro database reports are defined on the last page of each report. All data in this package are considered validated and available for use.

Laboratory Coordinator: Steve Donivan — Steve Donivan — 10-12-2009 — Date

Data Validation Lead: Steve Donivan — Steve Donivan — 10-12-2009 — Date

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Attachment 1
Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

Potential outliers are measurements that are extremely large or small relative to the rest of the data and, therefore, are suspected of misrepresenting the population from which they were collected. Potential outliers may result from transcription errors, data-coding errors, or measurement system problems. However, outliers may also represent true extreme values of a distribution and indicate more variability in the population than was expected.

Statistical outlier tests give probabilistic evidence that an extreme value does not "fit" with the distribution of the remainder of the data and is therefore a statistical outlier. These tests should only be used to identify data points that require further investigation. The tests alone cannot determine whether a statistical outlier should be discarded or corrected within a data set.

There are three steps involved in identifying extreme values or outliers:

1. Identify extreme values that may be potential outliers by generating the Outliers Report using the Sample Management System from data in the SEEPro database. The application compares the new data set with historical data and lists the new data that fall outside the historical data range. A determination is also made if the data are normally distributed using the Shapiro-Wilk Test.
2. Apply the appropriate statistical test. Dixon's Extreme Value test is used to test for statistical outliers when the sample size is less than or equal to 25. This test considers both extreme values that are much smaller than the rest of the data (case 1) and extreme values that are much larger than the rest of the data (case 2). This test is valid only if the data without the suspected outlier are normally distributed. Rosner's Test is a parametric test that is used to detect outliers for sample sizes of 25 or more. This test also assumes that the data without the suspected outliers are normally distributed.
3. Scientifically review statistical outliers and decide on their disposition.

There were no potential outliers identified, and the data for this event are acceptable as qualified.

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Attachment 2
Data Presentation

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Groundwater Quality Data

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Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 10-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	180.8	-	220.8	0.00017	B	UFQ	#	0.000013	
Chloride	mg/L	07/22/2009	N001	180.8	-	220.8	53		FQ	#	4	
Chromium	mg/L	07/22/2009	N001	180.8	-	220.8	0.0013	B	UFQ	#	0.00071	
Lead	mg/L	07/22/2009	N001	180.8	-	220.8	0.0031		FQ	#	0.000014	
Nickel	mg/L	07/22/2009	N001	180.8	-	220.8	0.0014	B	FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	180.8	-	220.8	0.01	U	FQ	#	0.01	
Oxidation Reduction Potential	mV	07/22/2009	N001	180.8	-	220.8	17.3		FQ	#		
pH	s.u.	07/22/2009	N001	180.8	-	220.8	6.53		FQ	#		
Radium-226	pCi/L	07/22/2009	N001	180.8	-	220.8	20.4		FQ	#	0.19	5.28
Radium-228	pCi/L	07/22/2009	N001	180.8	-	220.8	4.47		FQ	#	1.1	1.49
Selenium	mg/L	07/22/2009	N001	180.8	-	220.8	0.000076	B	FQ	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	180.8	-	220.8	2003		FQ	#		
Sulfate	mg/L	07/22/2009	N001	180.8	-	220.8	980		FQ	#	10	
Temperature	C	07/22/2009	N001	180.8	-	220.8	10.81		FQ	#		
Thorium-228	pCi/L	07/22/2009	N001	180.8	-	220.8	0.23	U	FQ	#	0.23	0.155
Thorium-230	pCi/L	07/22/2009	N001	180.8	-	220.8	0.75	U	FQ	#	0.75	0.346
Thorium-232	pCi/L	07/22/2009	N001	180.8	-	220.8	0.19	U	FQ	#	0.19	0.124
Total Dissolved Solids	mg/L	07/22/2009	N001	180.8	-	220.8	1800		FQ	#	40	
Turbidity	NTU	07/22/2009	N001	180.8	-	220.8	5.2		FQ	#		
Uranium	mg/L	07/22/2009	N001	180.8	-	220.8	0.014		FQ	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 100-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	210	-	225	0.0018		FQ	#	0.000013	
Chloride	mg/L	07/22/2009	N001	210	-	225	150		FQ	#	10	
Chromium	mg/L	07/22/2009	N001	210	-	225	0.0013	B	UFQ	#	0.00071	
Lead	mg/L	07/22/2009	N001	210	-	225	0.00027	B	FQ	#	0.000014	
Nickel	mg/L	07/22/2009	N001	210	-	225	0.0071	B	FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	210	-	225	0.01	U	FQ	#	0.01	
Oxidation Reduction Potential	mV	07/22/2009	N001	210	-	225	185.8		FQ	#		
pH	s.u.	07/22/2009	N001	210	-	225	7.5		FQ	#		
Radium-226	pCi/L	07/22/2009	N001	210	-	225	6.72		FQ	#	0.18	1.85
Radium-228	pCi/L	07/22/2009	N001	210	-	225	8.19		FQ	#	0.95	2.53
Selenium	mg/L	07/22/2009	N001	210	-	225	0.00041		FQ	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	210	-	225	2363		FQ	#		
Sulfate	mg/L	07/22/2009	N001	210	-	225	920		FQ	#	25	
Temperature	C	07/22/2009	N001	210	-	225	14.55		FQ	#		
Thorium-228	pCi/L	07/22/2009	N001	210	-	225	0.5	U	FQ	#	0.5	0.255
Thorium-230	pCi/L	07/22/2009	N001	210	-	225	0.77	U	FQ	#	0.77	0.383
Thorium-232	pCi/L	07/22/2009	N001	210	-	225	0.35		FQJ	#	0.13	0.2
Total Dissolved Solids	mg/L	07/22/2009	N001	210	-	225	2000		FQ	#	40	
Turbidity	NTU	07/22/2009	N001	210	-	225	9.23		FQ	#		
Uranium	mg/L	07/22/2009	N001	210	-	225	0.015		FQ	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 102-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/23/2009	0001	168.5	-	183.5	0.00039		FQ	#	0.000013	
Chloride	mg/L	07/23/2009	0001	168.5	-	183.5	250		FQ	#	4	
Chromium	mg/L	07/23/2009	0001	168.5	-	183.5	0.0011	B	UFQ	#	0.00071	
Lead	mg/L	07/23/2009	0001	168.5	-	183.5	0.00022	B	FQ	#	0.000014	
Nickel	mg/L	07/23/2009	0001	168.5	-	183.5	0.0012	B	FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/23/2009	0001	168.5	-	183.5	0.15		FQ	#	0.01	
Oxidation Reduction Potential	mV	07/23/2009	N001	168.5	-	183.5	-31		FQ	#		
pH	s.u.	07/23/2009	N001	168.5	-	183.5	7.4		FQ	#		
Radium-226	pCi/L	07/23/2009	0001	168.5	-	183.5	5.67		FQ	#	0.2	1.58
Radium-228	pCi/L	07/23/2009	0001	168.5	-	183.5	5.62		FQ	#	1	1.8
Selenium	mg/L	07/23/2009	0001	168.5	-	183.5	0.00013		FQ	#	0.000032	
Specific Conductance	umhos /cm	07/23/2009	N001	168.5	-	183.5	1772		FQ	#		
Sulfate	mg/L	07/23/2009	0001	168.5	-	183.5	470		FQ	#	10	
Temperature	C	07/23/2009	N001	168.5	-	183.5	11		FQ	#		
Thorium-228	pCi/L	07/23/2009	0001	168.5	-	183.5	0.58	U	FQ	#	0.58	0.289
Thorium-230	pCi/L	07/23/2009	0001	168.5	-	183.5	0.75	U	FQ	#	0.75	0.316
Thorium-232	pCi/L	07/23/2009	0001	168.5	-	183.5	0.25	U	FQ	#	0.25	0.0901
Total Dissolved Solids	mg/L	07/23/2009	0001	168.5	-	183.5	1400		FQ	#	40	
Turbidity	NTU	07/23/2009	N001	168.5	-	183.5	601		FQ	#		
Uranium	mg/L	07/23/2009	0001	168.5	-	183.5	0.00059		FQ	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 110-DC WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	255	-	305	0.0013	E	F	#	0.000013	
Chloride	mg/L	07/22/2009	N001	255	-	305	200		F	#	10	
Chromium	mg/L	07/22/2009	N001	255	-	305	0.0011	B	UF	#	0.00071	
Lead	mg/L	07/22/2009	N001	255	-	305	0.0044		F	#	0.000014	
Nickel	mg/L	07/22/2009	N001	255	-	305	0.0022	B	F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	255	-	305	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	07/22/2009	N001	255	-	305	121.1		F	#		
pH	s.u.	07/22/2009	N001	255	-	305	6.84		F	#		
Radium-226	pCi/L	07/22/2009	N001	255	-	305	172		F	#	0.21	43.1
Radium-228	pCi/L	07/22/2009	N001	255	-	305	5.05		F	#	1.2	1.66
Selenium	mg/L	07/22/2009	N001	255	-	305	0.0001		F	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	255	-	305	3595		F	#		
Sulfate	mg/L	07/22/2009	N001	255	-	305	1800		F	#	25	
Temperature	C	07/22/2009	N001	255	-	305	18.62		F	#		
Thorium-228	pCi/L	07/22/2009	N001	255	-	305	0.159		FJ	#	0.16	0.135
Thorium-230	pCi/L	07/22/2009	N001	255	-	305	0.75	U	F	#	0.75	0.334
Thorium-232	pCi/L	07/22/2009	N001	255	-	305	0.181		FJ	#	0.15	0.143
Total Dissolved Solids	mg/L	07/22/2009	N001	255	-	305	3800		F	#	80	
Turbidity	NTU	07/22/2009	N001	255	-	305	5.43		F	#		
Uranium	mg/L	07/22/2009	N001	255	-	305	0.013		F	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 112-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/23/2009	N001	203	-	253	0.00007	B	UFQ	#	0.000013	
Chloride	mg/L	07/23/2009	N001	203	-	253	49		FQ	#	4	
Chromium	mg/L	07/23/2009	N001	203	-	253	0.003	B	UFQ	#	0.00071	
Lead	mg/L	07/23/2009	N001	203	-	253	0.00052		FQ	#	0.000014	
Nickel	mg/L	07/23/2009	N001	203	-	253	0.0016	B	FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/23/2009	N001	203	-	253	0.01	U	FQ	#	0.01	
Oxidation Reduction Potential	mV	07/23/2009	N001	203	-	253	-54.7		FQ	#		
pH	s.u.	07/23/2009	N001	203	-	253	7.21		FQ	#		
Radium-226	pCi/L	07/23/2009	N001	203	-	253	29.1		FQ	#	0.2	7.47
Radium-228	pCi/L	07/23/2009	N001	203	-	253	6.9		FQ	#	0.97	2.16
Selenium	mg/L	07/23/2009	N001	203	-	253	0.00016		FQ	#	0.000032	
Specific Conductance	umhos /cm	07/23/2009	N001	203	-	253	2031		FQ	#		
Sulfate	mg/L	07/23/2009	N001	203	-	253	1000		FQ	#	10	
Temperature	C	07/23/2009	N001	203	-	253	11.02		FQ	#		
Thorium-228	pCi/L	07/23/2009	N001	203	-	253	0.46	U	FQ	#	0.46	0.249
Thorium-230	pCi/L	07/23/2009	N001	203	-	253	0.76	U	FQ	#	0.76	0.388
Thorium-232	pCi/L	07/23/2009	N001	203	-	253	0.23	U	FQ	#	0.23	0.151
Total Dissolved Solids	mg/L	07/23/2009	N001	203	-	253	1900		FQ	#	40	
Turbidity	NTU	07/23/2009	N001	203	-	253	4.13		FQ	#		
Uranium	mg/L	07/23/2009	N001	203	-	253	0.12		FQ	#	0.0000087	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 113-DC WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/23/2009	N001	235	-	285	0.000067	B	UFQ	#	0.000013	
Chloride	mg/L	07/23/2009	N001	235	-	285	6.9		FQ	#	1	
Chromium	mg/L	07/23/2009	N001	235	-	285	0.0014	B	UFQ	#	0.00071	
Lead	mg/L	07/23/2009	N001	235	-	285	0.00017	B	FQ	#	0.000014	
Nickel	mg/L	07/23/2009	N001	235	-	285	0.0016	B	FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/23/2009	N001	235	-	285	0.01	U	FQ	#	0.01	
Oxidation Reduction Potential	mV	07/23/2009	N001	235	-	285	237.5		FQ	#		
pH	s.u.	07/23/2009	N001	235	-	285	7.61		FQ	#		
Radium-226	pCi/L	07/23/2009	N001	235	-	285	4.87		FQ	#	0.16	1.36
Radium-228	pCi/L	07/23/2009	N001	235	-	285	3.45		FQ	#	0.89	1.16
Selenium	mg/L	07/23/2009	N001	235	-	285	0.000079	B	FQ	#	0.000032	
Specific Conductance	umhos /cm	07/23/2009	N001	235	-	285	1567		FQ	#		
Sulfate	mg/L	07/23/2009	N001	235	-	285	590		FQ	#	10	
Temperature	C	07/23/2009	N001	235	-	285	11.71		FQ	#		
Thorium-228	pCi/L	07/23/2009	N001	235	-	285	0.51	U	FQ	#	0.51	0.199
Thorium-230	pCi/L	07/23/2009	N001	235	-	285	0.79	U	FQ	#	0.79	0.331
Thorium-232	pCi/L	07/23/2009	N001	235	-	285	0.19	U	FQ	#	0.19	0.145
Total Dissolved Solids	mg/L	07/23/2009	N001	235	-	285	1100		FQ	#	40	
Turbidity	NTU	07/23/2009	N001	235	-	285	3.41		FQ	#		
Uranium	mg/L	07/23/2009	N001	235	-	285	0.0017		FQ	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 19-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	177	-	237	0.00033		FQ	#	0.000013	
Cadmium	mg/L	07/22/2009	N002	177	-	237	0.00028	B	UFQ	#	0.000013	
Chloride	mg/L	07/22/2009	N001	177	-	237	54		FQ	#	4	
Chloride	mg/L	07/22/2009	N002	177	-	237	57		FQ	#	4	
Chromium	mg/L	07/22/2009	N001	177	-	237	0.0018	B	UFQ	#	0.00071	
Chromium	mg/L	07/22/2009	N002	177	-	237	0.0023	B	UFQ	#	0.00071	
Lead	mg/L	07/22/2009	N001	177	-	237	0.00011	B	FQ	#	0.000014	
Lead	mg/L	07/22/2009	N002	177	-	237	0.000061	B	UFQ	#	0.000014	
Nickel	mg/L	07/22/2009	N001	177	-	237	0.12		FQ	#	0.001	
Nickel	mg/L	07/22/2009	N002	177	-	237	0.12		FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	177	-	237	0.013		FQ	#	0.01	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N002	177	-	237	0.014		FQ	#	0.01	
Oxidation Reduction Potential	mV	07/22/2009	N001	177	-	237	-77		FQ	#		
pH	s.u.	07/22/2009	N001	177	-	237	6.63		FQ	#		
Radium-226	pCi/L	07/22/2009	N001	177	-	237	10.7		FQ	#	0.19	2.84
Radium-226	pCi/L	07/22/2009	N002	177	-	237	10.6		FQ	#	0.18	2.82
Radium-228	pCi/L	07/22/2009	N001	177	-	237	7.63		FQ	#	1.1	2.39
Radium-228	pCi/L	07/22/2009	N002	177	-	237	7.13		FQ	#	1.1	2.24
Selenium	mg/L	07/22/2009	N001	177	-	237	0.00011		FQ	#	0.000032	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 19-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Selenium	mg/L	07/22/2009	N002	177	-	237	0.00011		FQ	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	177	-	237	2600		FQ	#		
Sulfate	mg/L	07/22/2009	N001	177	-	237	1500		FQ	#	10	
Sulfate	mg/L	07/22/2009	N002	177	-	237	1600		FQ	#	10	
Temperature	C	07/22/2009	N001	177	-	237	9.7		FQ	#		
Thorium-228	pCi/L	07/22/2009	N001	177	-	237	0.38	U	FQ	#	0.38	0.245
Thorium-228	pCi/L	07/22/2009	N002	177	-	237	0.55	U	FQ	#	0.55	0.247
Thorium-230	pCi/L	07/22/2009	N001	177	-	237	0.74	U	FQ	#	0.74	0.354
Thorium-230	pCi/L	07/22/2009	N002	177	-	237	0.75	U	FQ	#	0.75	0.302
Thorium-232	pCi/L	07/22/2009	N001	177	-	237	0.176		FQJ	#	0.15	0.139
Thorium-232	pCi/L	07/22/2009	N002	177	-	237	0.0989		UFQ	#	0.067	0.1
Total Dissolved Solids	mg/L	07/22/2009	N001	177	-	237	2600		FQ	#	40	
Total Dissolved Solids	mg/L	07/22/2009	N002	177	-	237	2500		FQ	#	40	
Turbidity	NTU	07/22/2009	N001	177	-	237	3.18		FQ	#		
Uranium	mg/L	07/22/2009	N001	177	-	237	0.0026		FQ	#	0.0000017	
Uranium	mg/L	07/22/2009	N002	177	-	237	0.0026		FQ	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 40-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft.BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/23/2009	N001	-	0.00045		F	#	0.000013	
Chloride	mg/L	07/23/2009	N001	-	50		F	#	4	
Chromium	mg/L	07/23/2009	N001	-	0.001	B	UF	#	0.00071	
Lead	mg/L	07/23/2009	N001	-	0.000025	B	UF	#	0.000014	
Nickel	mg/L	07/23/2009	N001	-	0.015	B	F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/23/2009	N001	-	1.2		F	#	0.01	
Oxidation Reduction Potential	mV	07/23/2009	N001	-	105.7		F	#		
pH	s.u.	07/23/2009	N001	-	6.62		F	#		
Radium-226	pCi/L	07/23/2009	N001	-	0.2	U	F	#	0.2	0.117
Radium-228	pCi/L	07/23/2009	N001	-	0.84	U	F	#	0.84	0.451
Selenium	mg/L	07/23/2009	N001	-	0.0048		F	#	0.000032	
Specific Conductance	umhos /cm	07/23/2009	N001	-	3127		F	#		
Sulfate	mg/L	07/23/2009	N001	-	1800		F	#	10	
Temperature	C	07/23/2009	N001	-	8.13		F	#		
Thorium-228	pCi/L	07/23/2009	N001	-	0.38	U	F	#	0.38	0.171
Thorium-230	pCi/L	07/23/2009	N001	-	0.75	U	F	#	0.75	0.319
Thorium-232	pCi/L	07/23/2009	N001	-	0.13	U	F	#	0.13	0.0868
Total Dissolved Solids	mg/L	07/23/2009	N001	-	3000		F	#	40	
Turbidity	NTU	07/23/2009	N001	-	3.38		F	#		
Uranium	mg/L	07/23/2009	N001	-	0.00051		F	#	0.0000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 5-DC WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Data	QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	-	0.00046		F	#	0.000013	
Chloride	mg/L	07/22/2009	N001	-	150		F	#	20	
Chromium	mg/L	07/22/2009	N001	-	0.018	B	UF	#	0.0035	
Lead	mg/L	07/22/2009	N001	-	0.0011		F	#	0.000014	
Nickel	mg/L	07/22/2009	N001	-	1.1		F	#	0.0052	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	-	1	U	F	#	1	
Oxidation Reduction Potential	mV	07/22/2009	N001	-	186.4		F	#		
pH	s.u.	07/22/2009	N001	-	4.68		F	#		
Radium-226	pCi/L	07/22/2009	N001	-	12.8		F	#	0.22	3.38
Radium-228	pCi/L	07/22/2009	N001	-	33		F	#	0.78	9.87
Selenium	mg/L	07/22/2009	N001	-	0.00065		F	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	-	7033		F	#		
Sulfate	mg/L	07/22/2009	N001	-	5700		F	#	50	
Temperature	C	07/22/2009	N001	-	12.33		F	#		
Thorium-228	pCi/L	07/22/2009	N001	-	2.56		F	#	0.33	0.657
Thorium-230	pCi/L	07/22/2009	N001	-	0.75	U	F	#	0.75	0.421
Thorium-232	pCi/L	07/22/2009	N001	-	0.596		F	#	0.15	0.262
Total Dissolved Solids	mg/L	07/22/2009	N001	-	9200		F	#	200	
Turbidity	NTU	07/22/2009	N001	-	9.56		F	#		
Uranium	mg/L	07/22/2009	N001	-	0.06		F	#	0.000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 5-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/23/2009	N001	49.3	-	57.7	0.037		F	#	0.000013	
Chloride	mg/L	07/23/2009	N001	49.3	-	57.7	270		F	#	20	
Chromium	mg/L	07/23/2009	N001	49.3	-	57.7	0.36		F	#	0.0035	
Lead	mg/L	07/23/2009	N001	49.3	-	57.7	0.00049	B	F	#	0.000014	
Nickel	mg/L	07/23/2009	N001	49.3	-	57.7	3.1		F	#	0.0052	
Nitrate + Nitrite as Nitrogen	mg/L	07/23/2009	N001	49.3	-	57.7	1	U	F	#	1	
Oxidation Reduction Potential	mV	07/23/2009	N001	49.3	-	57.7	211		F	#		
pH	s.u.	07/23/2009	N001	49.3	-	57.7	3.67		F	#		
Radium-226	pCi/L	07/23/2009	N001	49.3	-	57.7	5.55		F	#	0.19	1.56
Radium-228	pCi/L	07/23/2009	N001	49.3	-	57.7	1.31		FJ	#	0.86	0.601
Selenium	mg/L	07/23/2009	N001	49.3	-	57.7	0.019		F	#	0.00016	
Specific Conductance	umhos /cm	07/23/2009	N001	49.3	-	57.7	11591		F	#		
Sulfate	mg/L	07/23/2009	N001	49.3	-	57.7	13000		F	#	100	
Temperature	C	07/23/2009	N001	49.3	-	57.7	9.89		F	#		
Thorium-228	pCi/L	07/23/2009	N001	49.3	-	57.7	54.4		F	#	1.3	9.98
Thorium-230	pCi/L	07/23/2009	N001	49.3	-	57.7	479		F	#	3.7	76.6
Thorium-232	pCi/L	07/23/2009	N001	49.3	-	57.7	13.8		F	#	0.63	3.36
Total Dissolved Solids	mg/L	07/23/2009	N001	49.3	-	57.7	19000		F	#	200	
Turbidity	NTU	07/23/2009	N001	49.3	-	57.7	5.94		F	#		
Uranium	mg/L	07/23/2009	N001	49.3	-	57.7	3.8		F	#	0.00017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: 54-SC WELL

Parameter	Units	Sample Date	ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Data	QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	0001	-	0.0013		F	#	0.000013	
Chloride	mg/L	07/22/2009	0001	-	330		F	#	20	
Chromium	mg/L	07/22/2009	0001	-	0.29		F	#	0.0035	
Lead	mg/L	07/22/2009	0001	-	0.00049	B	F	#	0.000014	
Nickel	mg/L	07/22/2009	0001	-	2.7		F	#	0.0052	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	0001	-	1	U	F	#	1	
Oxidation Reduction Potential	mV	07/22/2009	N001	-	298.2		F	#		
pH	s.u.	07/22/2009	N001	-	3.94		F	#		
Radium-226	pCi/L	07/22/2009	0001	-	23.3		F	#	0.19	6.01
Radium-228	pCi/L	07/22/2009	0001	-	93.4		FJ	#	0.85	27.8
Selenium	mg/L	07/22/2009	0001	-	0.0006	*	F	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	-	8577		F	#		
Sulfate	mg/L	07/22/2009	0001	-	8400		F	#	50	
Temperature	C	07/22/2009	N001	-	17.58		F	#		
Thorium-228	pCi/L	07/22/2009	0001	-	10.4		F	#	0.39	1.94
Thorium-230	pCi/L	07/22/2009	0001	-	5.97		F	#	0.78	1.26
Thorium-232	pCi/L	07/22/2009	0001	-	8.23		F	#	0.13	1.58
Total Dissolved Solids	mg/L	07/22/2009	0001	-	13000		F	#	200	
Turbidity	NTU	07/22/2009	N001	-	19.8		F	#		
Uranium	mg/L	07/22/2009	0001	-	0.044		F	#	0.000017	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009
Location: K.G.S.#3 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/22/2009	N001	420	-	450	0.000032	B	UF	#	0.000013	
Chloride	mg/L	07/22/2009	N001	420	-	450	19		F	#	2	
Chromium	mg/L	07/22/2009	N001	420	-	450	0.0012	B	UF	#	0.00071	
Lead	mg/L	07/22/2009	N001	420	-	450	0.00018	B	F	#	0.000014	
Nickel	mg/L	07/22/2009	N001	420	-	450	0.0011	B	UF	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	07/22/2009	N001	420	-	450	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	07/22/2009	N001	420	-	450	-117.6		F	#		
pH	s.u.	07/22/2009	N001	420	-	450	9.35		F	#		
Radium-226	pCi/L	07/22/2009	N001	420	-	450	0.447		FJ	#	0.16	0.224
Radium-228	pCi/L	07/22/2009	N001	420	-	450	0.86	U	F	#	0.86	0.48
Selenium	mg/L	07/22/2009	N001	420	-	450	0.00014		F	#	0.000032	
Specific Conductance	umhos /cm	07/22/2009	N001	420	-	450	731		F	#		
Sulfate	mg/L	07/22/2009	N001	420	-	450	240		F	#	5	
Temperature	C	07/22/2009	N001	420	-	450	17.46		F	#		
Thorium-228	pCi/L	07/22/2009	N001	420	-	450	0.44	U	F	#	0.44	0.159
Thorium-230	pCi/L	07/22/2009	N001	420	-	450	0.78	U	F	#	0.78	0.345
Thorium-232	pCi/L	07/22/2009	N001	420	-	450	0.107		FJ	#	0.072	0.108
Total Dissolved Solids	mg/L	07/22/2009	N001	420	-	450	470		F	#	20	
Turbidity	NTU	07/22/2009	N001	420	-	450	7.47		F	#		
Uranium	mg/L	07/22/2009	N001	420	-	450	0.000035	B	F	#	0.0000017	

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:
- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.

D	Analyte determined in diluted sample.
E	Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
H	Holding time expired, value suspect.
I	Increased detection limit due to required dilution.
J	Estimated
N	Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
P	> 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
U	Analytical result below detection limit.
W	Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
X,Y,Z	Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

F	Low flow sampling method used.	G	Possible grout contamination, pH > 9.	J	Estimated value.
L	Less than 3 bore volumes purged prior to sampling.	Q	Qualitative result due to sampling technique.	R	Unusable result.
U	Parameter analyzed for but was not detected.	X	Location is undefined.		

QA QUALIFIER:

#	Validated according to quality assurance guidelines.

Static Water Level Data

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STATIC WATER LEVELS (USEE700) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/2/2009

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)	Water Level Flag
10-DC		7113.02	07/22/2009	14:50:02	171.11	6941.91	
100-SC		7154.11	07/22/2009	11:10:40	218.8	6935.31	
101-SC		7168.86	07/23/2009	12:43:00	190.4	6978.46	
102-SC		7126.59	07/23/2009	08:40:51	184.61	6941.98	
110-DC		7154.43	07/22/2009	11:25:18	112.65	7041.78	
112-DC		7125.59	07/23/2009	11:10:40	183.38	6942.21	
113-DC		7135.76	07/23/2009	14:00:27	191.68	6944.08	
19-DC		7112.04	07/22/2009	11:30:30	170.31	6941.73	
40-SC		7058.48	07/23/2009	08:55:27	9.26	7049.22	
5-DC		7119.84	07/22/2009	17:30:44	178.5	6941.34	
5-SC		7056.45	07/23/2009	10:00:37	56.85	6999.6	
51-SC		7091.68	07/23/2009	12:16:00	102	6989.68	
54-SC		7158.78	07/22/2009	16:00:07	208.4	6950.38	
K.G.S.#3		7171.03	07/22/2009	14:00:41	224	6947.03	

FLOW CODES: B BACKGROUND C CROSS GRADIENT D DOWN GRADIENT F OFF SITE
N UNKNOWN O ON SITE U UPGRADIENT

WATER LEVEL FLAGS: D Dry F FLOWING

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Time-Concentration Graphs

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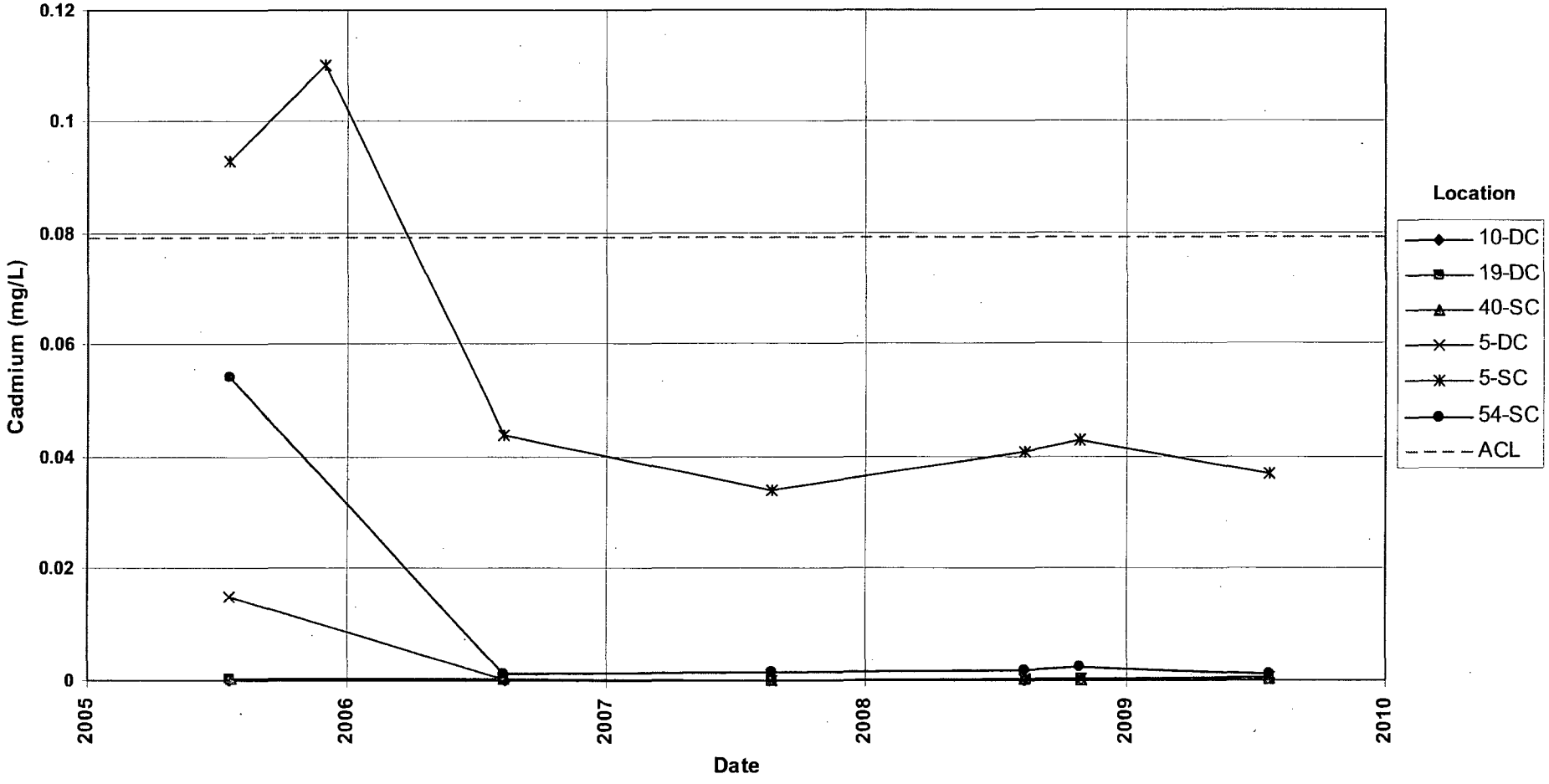
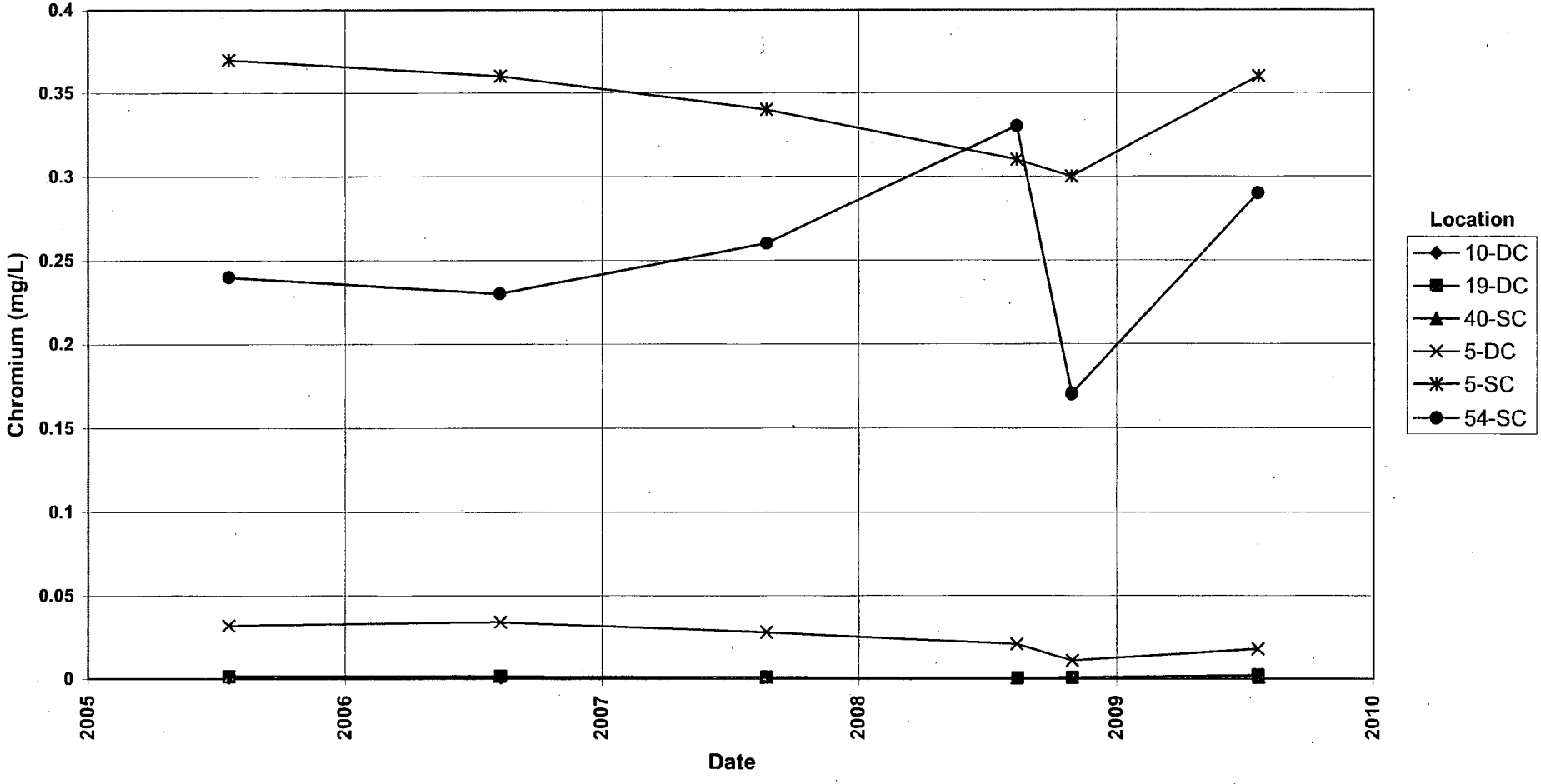
Shirley Basin South Disposal Site
Cadmium Concentration
Alternate Concentration Limit (ACL) = 0.079 ml/L

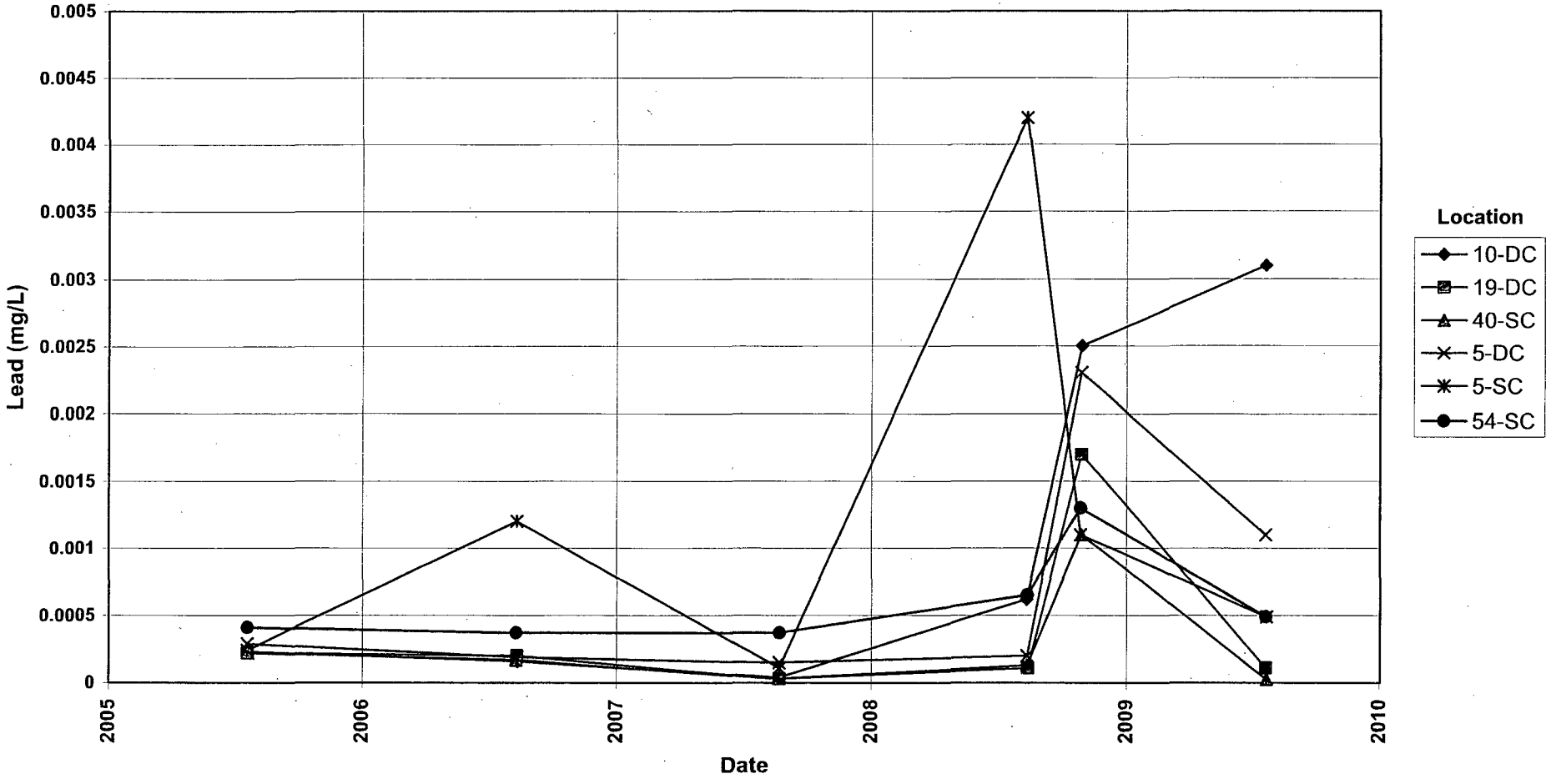


Shirley Basin South Disposal Site
Chromium Concentration
Alternate Concentration Limit (ACL) = 1.83 mg/L

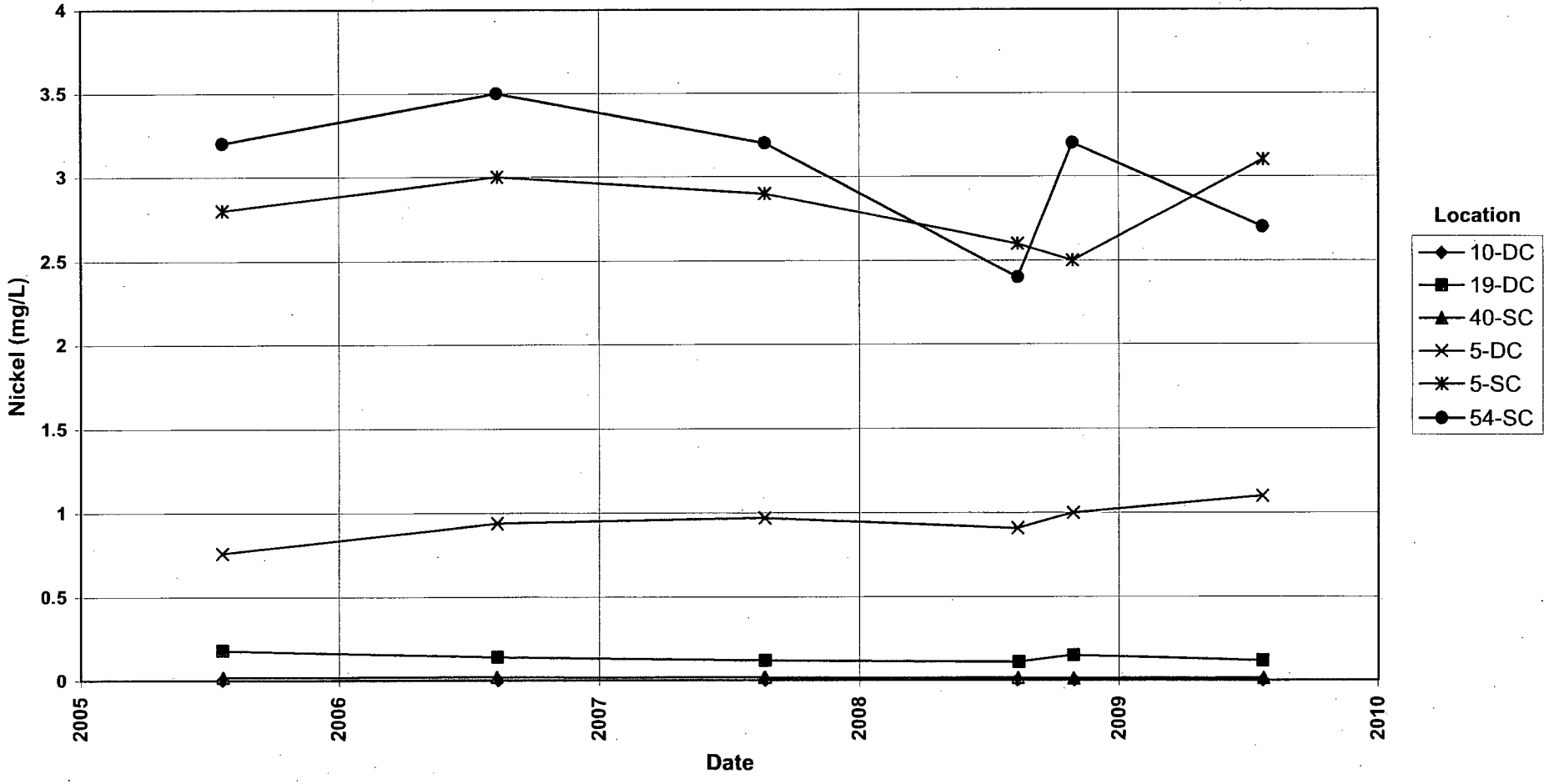


Shirley Basin South Disposal Site
Lead Concentration

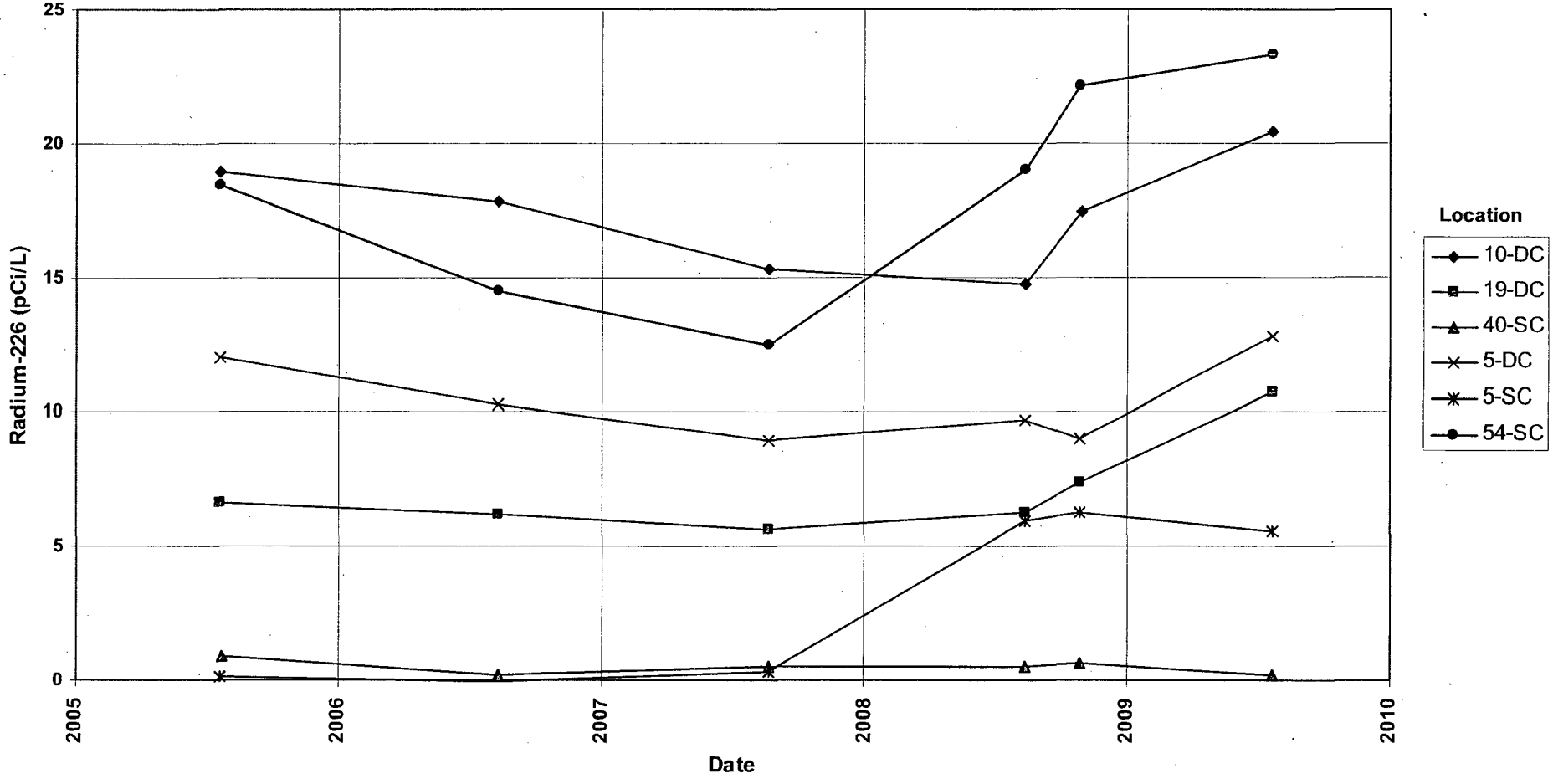
Alternate Concentration Limit (ACL) = 0.05 mg/L



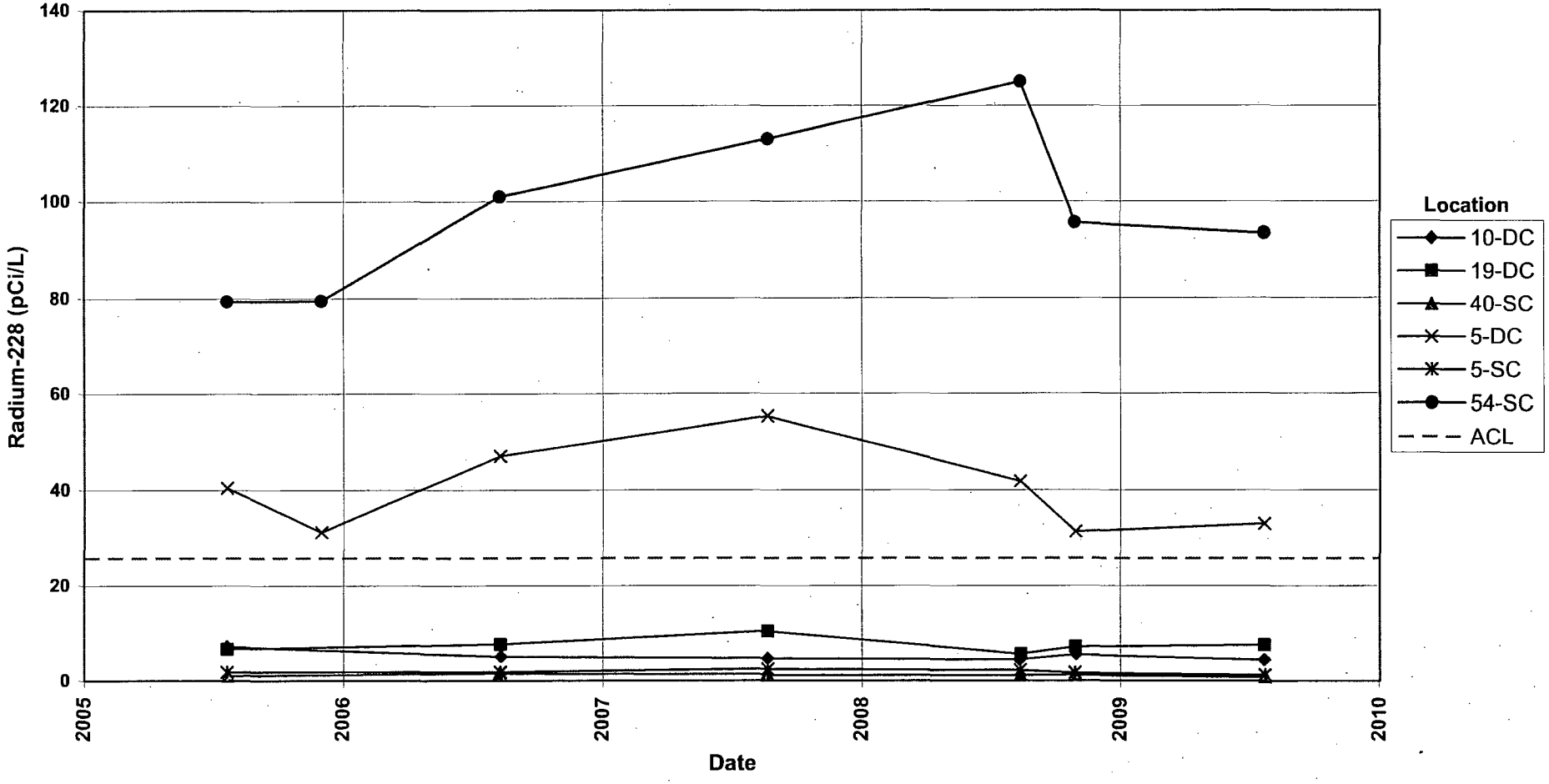
Shirley Basin South Disposal Site
Nickel Concentration
Alternate Concentration Limit (ACL) = 6.15 mg/L



Shirley Basin South Disposal Site
Radium-226 Concentration
Alternate Concentration Limit (ACL) = 91.3 pCi/L

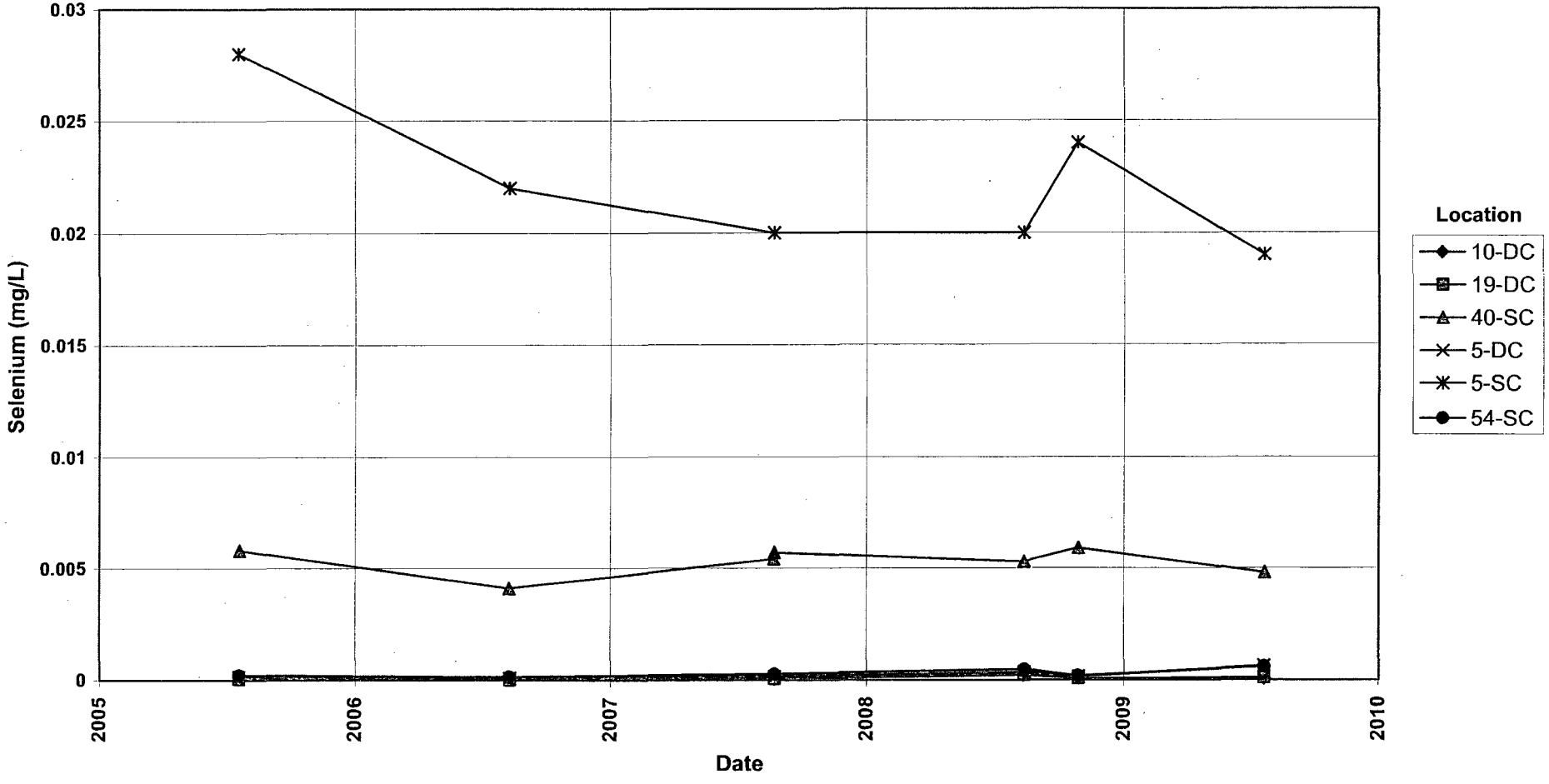


Shirley Basin South Disposal Site
Radium-228 Concentration
Alternate Concentration Limit (ACL) = 25.7 pCi/L

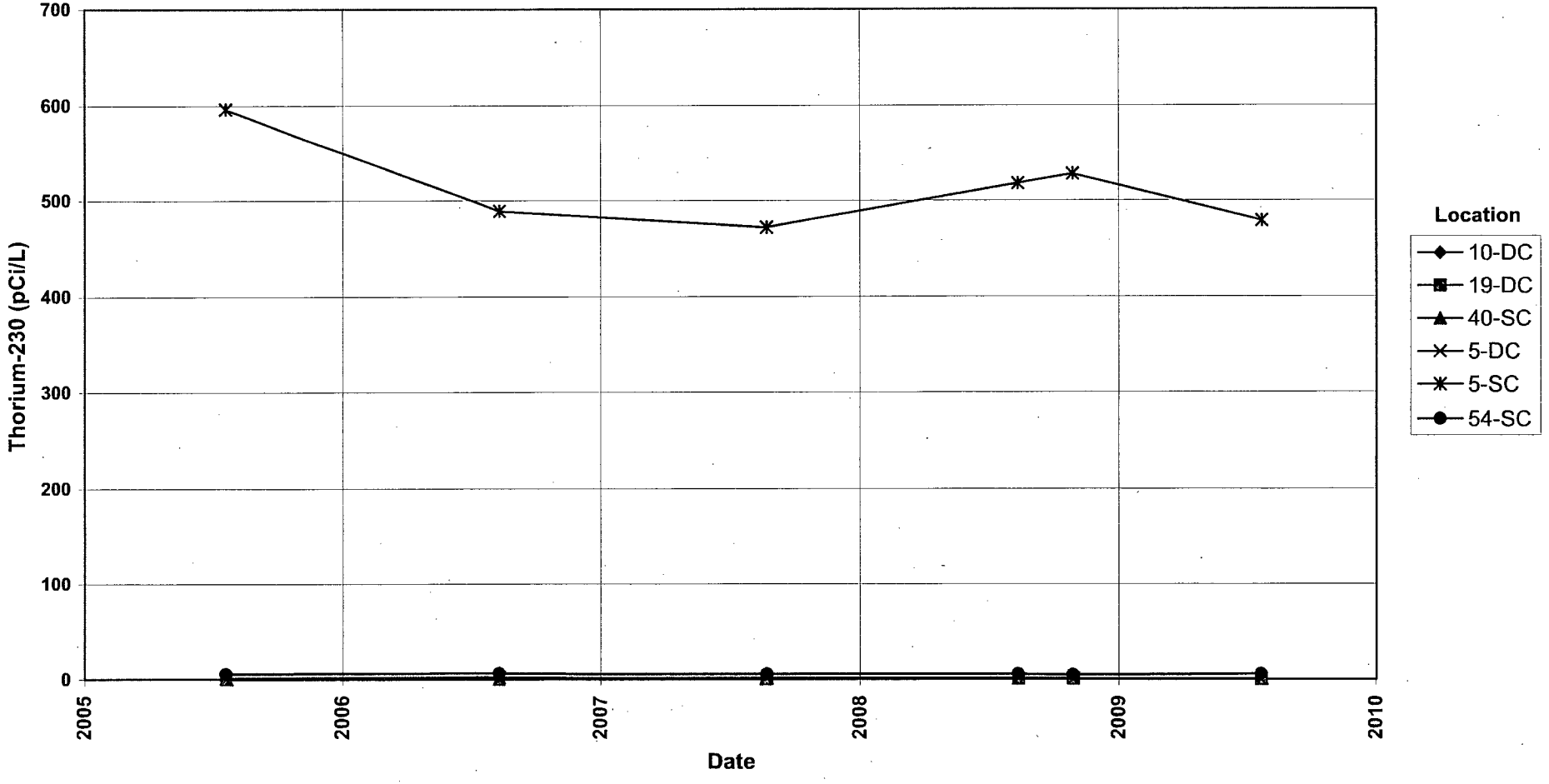


Shirley Basin South Disposal Site
Selenium Concentration

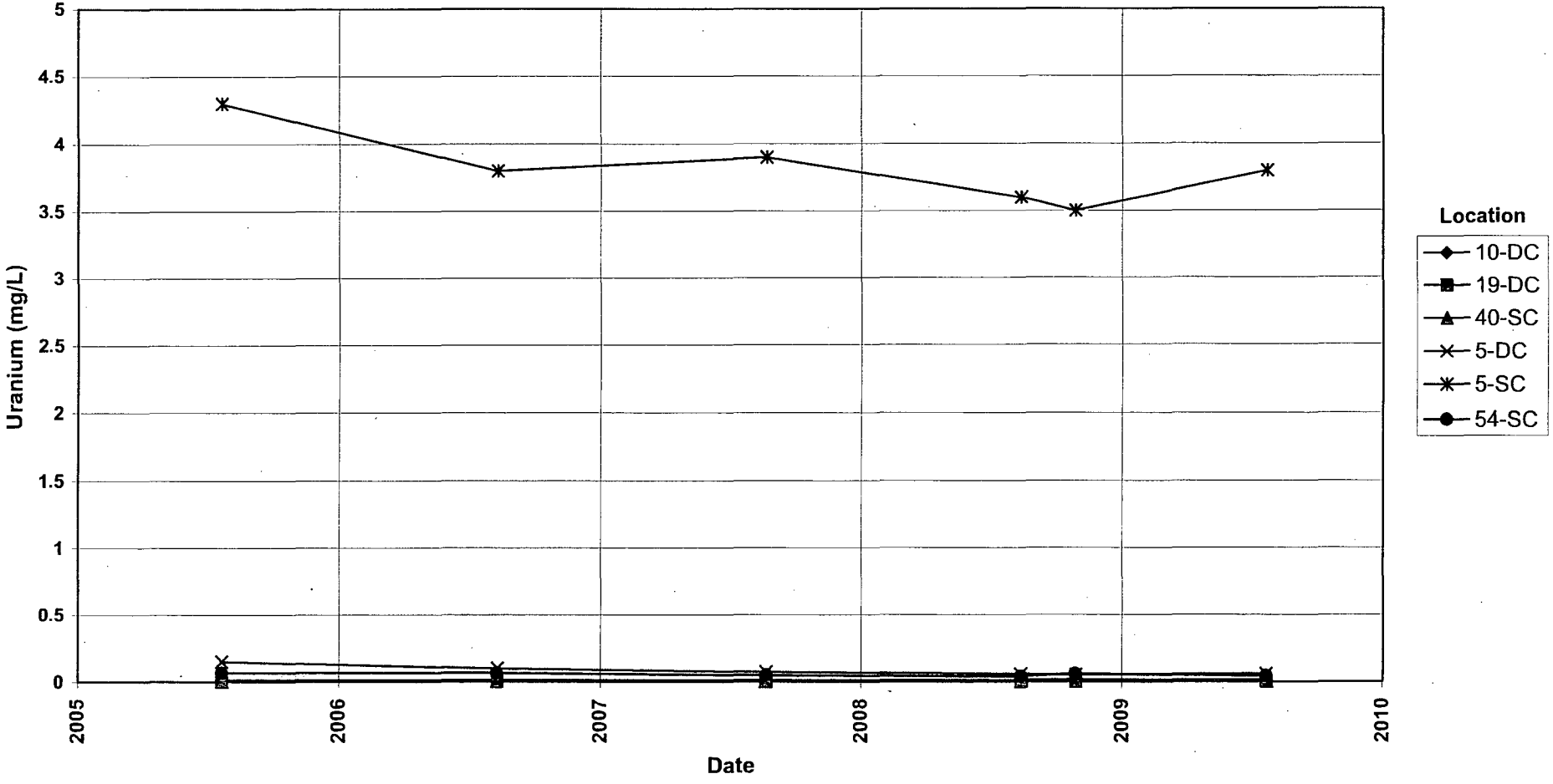
Alternate Concentration Limit (ACL) = 0.12 mg/L



Shirley Basin South Disposal Site
Thorium-230 Concentration
Alternate Concentration Limit (ACL) = 2409 pCi/L



Shirley Basin South Disposal Site
Uranium Concentration
Alternate Concentration Limit (ACL) = 9.2 mg/L



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Attachment 3
Sampling and Analysis Work Order

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Stoller established 1959

Task Order LM00-501
Control Number 09-0820

June 15, 2009

U.S. Department of Energy
Office of Legacy Management
ATTN: Scott Surovchak
Site Manager
11025 Dover St, Suite 1000
Westminster, CO 80021-5573

SUBJECT: Contract No. DE-AM01-07LM00060, Stoller
July 2009 Environmental Sampling at Shirley Basin South, Wyoming

REFERENCE: Task Order LM00-501-03-223-402, Shirley Basin South, WY, Disposal Site

Dear Mr. Surovchak:

The purpose of this letter is to inform you of the upcoming sampling event at Shirley Basin South, Wyoming. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the Shirley Basin South Disposal site. Water quality data will be collected from monitor wells at this site as part of the routine environmental sampling currently scheduled to begin the week of July 20, 2009.

The following list shows the monitor wells scheduled to be sampled during this event.

Monitor Wells*

40-SC	51-SC	10-DC	5-DC	9-DC	5-SC	54-SC
100-SC	101-SC	102-SC	110-DC	112-DC	113-DC	K.G.S.#3

*NOTE: SC wells are completed in the upper sand aquifer of the Wind River Formation; DC wells are completed in the main sand aquifer of the Wind River Formation.

All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. Access agreements are being reviewed and are expected to be complete by the beginning of fieldwork.

Please call me at (970) 248-6022 if you have questions.

Sincerely,

Richard K. Johnson
Site Lead

RKJ/lcg/LB

Enclosures (3)

cc: (electronic)
Cheri Bahrke, Stoller
Steve Donivan, Stoller
Bev Gallagher, Stoller
Lauren Goodknight, Stoller
Dick Johnson, Stoller
EDD Delivery
rc-grand.junction

Constituent Sampling Breakdown

Site	Shirley Basin South				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Approx. No. Samples/yr	8	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Cadmium	X		0.001	SW-846 6020	LMM-02
Calcium					
Chloride	X		0.5	SW-846 9056	MIS-A-039
Chromium	X		0.005	SW-846 6010	LMM-01
Gross Alpha					
Gross Beta					
Iron					
Lead	X		0.002	SW-846 6020	LMM-02
Magnesium					
Manganese					
Molybdenum					
Nickel	X		0.02	SW-846 6010	LMM-01
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N	X		0.05	EPA 353.1	WCH-A-022
Potassium					
Radium-226	X		1 pCi/L	Gas Proportional Counter	GPC-A-018
Radium-228	X		1 pCi/L	Gas Proportional Counter	GPC-A-020
Selenium	X		0.0001	SW-846 6020	LMM-02
Silica					
Sodium					
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Thorium-230	X		1 pCi/L	Alpha Spectrometry	ASP-A-008
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	0			

Note: All analyte samples are considered unfiltered unless stated otherwise. All private well samples are to be unfiltered. The total number of analytes does not include field parameters.

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Attachment 4
Trip Report

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Stoller established 1959
Grand Junction Office

Memorandum

Control Number N/A

DATE: July 28, 2009

TO: Dick Johnson

FROM: Jeff Price

SUBJECT: Trip Report

Site: Shirley Basin South, Wyoming, Disposal Site

Dates of Sampling Event: July 20 - 24, 2009.

Team Members: Dan Sellers, Joe Trevino, David Atkinson, and Jeff Price.

Number of Locations Sampled: 12 wells were sampled for metals (Cd, Cr, Pb, Ni, Se, U), Th-230, Ra-226/228, TDS, nitrites/nitrates, and anions (Cl, SO4). In addition, one duplicate sample was collected for QA/QC purposes.

Locations Not Sampled/Reason: Well 101-SC was dry; well 51-SC was pumped dry during development on July 21 and did not recover by July 23.

Well Development Information: All wells, except for 101-SC (dry), 40-SC (sampled prior to development), and K.G.S. #3 (private submersible pump blocking access), were developed by first surging and then purging with a pump until the turbidity was acceptable. Well 51-SC, which was purged dry during the initial bailing, is a very slow recovering well and did not recover prior to the conclusion of the trip. Because this type of low yielding well is very difficult to develop, it is unlikely that well 51-SC will never be developed properly.

Field Variance: None.

Location Specific Information: There were black specks and the water smelled of sulfur in well K.G.S. #3.

Quality Control Sample Cross Reference: The following is the false identification assigned to the quality control sample:

False Id	True Id	Sample Type	Associated Matrix	Ticket Number
2940	19-DC	Duplicate	Groundwater	HIV 545

Requisition Numbers Assigned: All samples were assigned to RIN 09072450.

Sample Shipment: Samples were shipped to ALS Laboratory Group on July 23, 2009.

Water Level Measurements: Water levels were measured at all wells.

Well Inspection Summary: All wells were in good condition and properly labeled.

Equipment: All equipment functioned properly.

Institutional Controls: All gates were closed and locked during the sampling event.

Fences, Gates, Locks: OK.
Signs: No missing or vandalized signs were observed.
Trespassing/Site Disturbances: N/A.

Site Issues

Disposal Cell/Drainage Structure Integrity: No problems observed.
Vegetation/Noxious Weed Concerns: Canada thistle was noted at several locations across the site. The revegetation work on the access roads and the disturbed areas around the newer well pads appears to be a success.
Maintenance Requirements: None observed.
Safety Issues: None.

Corrective Action Taken: None.

JEP/lcg

cc: (electronic)
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EDD Delivery