

Data Validation Package

June 2011

**Water Sampling at the Shirley Basin
South, Wyoming, Disposal Site**

September 2011



**U.S. DEPARTMENT OF
ENERGY**

Legacy
Management

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Sampling Event Summary

Site: Shirley Basin South, Wyoming, Disposal Site

Sampling Period: June 28–29, 2011

The 2004 *Long-Term Surveillance Plan for the 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 19-DC, 5-DC, and 5-SC, and monitoring wells 10-DC, 40-SC, and 54-SC were sampled as specified in the plan. POC well 51-SC was dry at the time of sampling and monitoring well K.G.S. #3 could not be sampled, although field measurements were collected. Also sampled were four of the six newer monitoring wells installed downgradient of the disposal cell in 2008 (100-SC, 110-DC, 112-DC, and 113-DC); downgradient wells 101-SC and 102-SC were dry at the time of sampling. The water level was measured at each sampled well. Sampling and analysis were conducted in accordance with the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites (LMS/PLN/S04351, continually updated)*.

Monitoring 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. The upper and main sandstone units vary in thickness and lateral extent, and coalesce into one unit under the northern portion of the disposal cell and near the former open pit mine northeast of the disposal cell. 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. The only ACLs that were exceeded were for radium-226 and radium-228.

As shown on Table 1, radium-228 concentrations remain above the ACL in wells 5-DC and 54-SC, with no apparent trend over the last seven sampling events (see page 58). The former licensee attributed elevated radium-228 at the site to natural thorium in the uranium ore. Consequently, the elevated concentrations in the wells may represent the reestablishment of equilibrium of groundwater with naturally occurring constituents in the sand units.

Table 1. Wells with Results Exceeding an ACL

Analyte	ACL	110-DC	5-DC	54-SC
Radium-226	91.3 pCi/L	149 pCi/L		
Radium-228	25.7 pCi/L		50.5 pCi/L	103 pCi/L

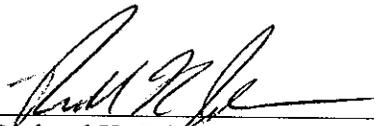
Key:

ACL = alternate concentration limit

pCi/L = picocuries per liter

Radium-226 continues to exceed the ACL in downgradient well 110-DC (Table 1), with no apparent trend during the last five sampling events (see page 57). There are insufficient data to definitively determine why radium-226 is elevated at well 110-DC. The highest radium-226 concentration for all other wells for this sampling event was 19.5 picocuries per liter (pCi/L) in well 54-SC, and for POC wells was 12.0 pCi/L in well 5-DC. This information, combined with low concentrations of sulfate and uranium at the well, suggests that the elevated radium-226 concentrations at well 110-DC do not represent a contaminant plume migrating off site; rather, they more likely represent natural conditions within the ore-bearing sand unit as aquifer recovery continues.

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 and no constituent concentrations exceed groundwater protection standards at the wells near the site boundary.


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

10/25/11
Date



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Shirley Basin South, Wyoming, Disposal Site Sample Location Map

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Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	<u>Shirley Basin South, Wyoming</u>	Date(s) of Water Sampling	<u>June 28–29, 2011</u>
Date(s) of Verification	<u>September 1, 2011</u>	Name of Verifier	<u>Gretchen Baer</u>

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures? List other documents, SOPs, instructions.	<u>Yes</u>	<u>Work Order letter date May 25, 2011.</u>
2. Were the sampling locations specified in the planning documents sampled?	<u>No</u>	<u>Wells 51-SC, 101-SC, and 102-SC were dry. Well K.G.S. #3 could not be sampled because of a plugged screen.</u>
3. Was a pre-trip calibration conducted as specified in the above-named documents?	<u>Yes</u>	<u>Pre-trip calibration was performed on June 27, 2011.</u>
4. Was an operational check of the field equipment conducted daily? Did the operational checks meet criteria?	<u>Yes</u> <u>Yes</u>	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	<u>Yes</u>	
6. Was the category of the well documented?	<u>Yes</u>	
7. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged prior to sampling? Did the water level stabilize prior to sampling? Did pH, specific conductance, and turbidity measurements stabilize prior to sampling? Was the flow rate less than 500 mL/min? If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	<u>Yes</u> <u>Yes</u> <u>Yes</u> <u>Yes</u> <u>NA</u>	

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 40-SC.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with nondedicated equipment?	NA	Dedicated equipment was used at all locations.
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 2174 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): 11063905
Sample Event: June 28-29, 2011
Site(s): Shirley Basin South, Wyoming
Laboratory: ALS Laboratory Group, Fort Collins, Colorado
Work Order No.: 1106401
Analysis: Metals, Inorganic, and Radiochemistry
Validator: Gretchen Baer
Review Date: August 30, 2011

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/PRO/S04325, continually updated) “Standard Practice for Validation of Laboratory Data.” The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and 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	SOP712R15	SOP724R11
Radium-228	GPC-A-020	SOP746R9	SOP724R11
Sulfate	MIS-A-044	SW-846 9056	SW-846 9056
Thorium Isotopes	ASP-A-008	SOP776R12	SOP714R12
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
1106401-1	100-SC	Cadmium	J	Reporting limit verification failure
1106401-1	100-SC	Lead	J	Negative blank
1106401-1	100-SC	Nickel	J	Negative blank
1106401-1	100-SC	Nitrate + Nitrite as N	J	Replicate failure
1106401-1	100-SC	Selenium	J	Reporting limit verification failure
1106401-2	10-DC	Cadmium	J	Reporting limit verification failure
1106401-2	10-DC	Lead	J	Negative blank
1106401-2	10-DC	Nickel	J	Negative blank
1106401-2	10-DC	Selenium	J	Reporting limit verification failure
1106401-3	110-DC	Cadmium	J	Reporting limit verification failure
1106401-3	110-DC	Nickel	J	Negative blank
1106401-3	110-DC	Selenium	J	Reporting limit verification failure
1106401-4	112-DC	Cadmium	J	Reporting limit verification failure
1106401-4	112-DC	Lead	J	Negative blank
1106401-4	112-DC	Nickel	J	Negative blank
1106401-4	112-DC	Selenium	J	Reporting limit verification failure
1106401-5	113-DC	Cadmium	J	Reporting limit verification failure
1106401-5	113-DC	Lead	J	Negative blank
1106401-5	113-DC	Nickel	J	Negative blank
1106401-5	113-DC	Selenium	J	Reporting limit verification failure
1106401-6	19-DC	Cadmium	J	Reporting limit verification failure
1106401-6	19-DC	Lead	J	Negative blank
1106401-6	19-DC	Selenium	J	Reporting limit verification failure
1106401-7	40-SC Dup, 2174	Cadmium	J	Reporting limit verification failure
1106401-7	40-SC Dup, 2174	Lead	J	Negative blank
1106401-7	40-SC Dup, 2174	Radium-226	U	Less than the Decision Level Concentration
1106401-8	40-SC	Cadmium	J	Reporting limit verification failure
1106401-8	40-SC	Lead	J	Negative blank
1106401-8	40-SC	Radium-226	J	Less than the Determination Limit
1106401-10	5-DC	Cadmium	J	Reporting limit verification failure
1106401-10	5-DC	Lead	J	Negative blank
1106401-10	5-DC	Thorium-230	J	Less than the determination limit
1106401-11	5-SC	Lead	J	Negative blank
1106401-11	5-SC	Radium-226	J	Yield adjusted by laboratory
All	All	Radium-228	J	Yield adjusted by laboratory

Sample Shipping/Receiving

Eleven water samples were hand-delivered on June 30, 2011, to the ALS Laboratory Group in Fort Collins, Colorado, accompanied by a Chain of Custody form. The Chain of Custody 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

Chain of Custody was complete with no errors or omissions. (The Trip Report provides sampling dates and sample delivery dates that are one week too early).

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 2.0 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. 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. All calibration and laboratory spike standards were prepared from independent sources

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 7, 2011, 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). Initial and continuing calibration verification checks were made at the required frequency resulting in five verification checks. All calibration checks met the acceptance criteria.

Method SW-846 6010B, Chromium and Nickel

Calibrations were performed on July 14, 2011, using three 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. Initial and continuing calibration verification checks were made at the required frequency resulting in 13 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 were performed on July 11, 2011, using four 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. Initial and continuing calibration verification checks were made at the required frequency resulting in 9 verification checks. 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, with the following

exceptions. The cadmium and selenium check results were outside the acceptance range. Results less than 5 times the PQL are qualified with a “J” flag (estimated). 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 June 15, 2011, 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. 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

Radiochemical results are qualified with a “U” flag (not detected) when the result is greater than the minimum detectable concentration (MDC) but less than the Decision Level Concentration, estimated as 3 times the one-sigma total propagated uncertainty. Results above the Decision Level Concentration and the MDC are qualified with a “J” flag (estimated) when the result is less than the Determination Limit (3 times the MDC).

Radium-226

Samples were screened for radium-226 by gas flow proportional counting. The potential for interference by other alpha-emitting radium isotopes was reduced by allowing a decay period of at least 14 days to elapse. Plateau voltage determinations were performed in October 2010 and efficiency calibrations were performed in May 2011. Daily instrument checks met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples. A chemical recovery was adjusted by the laboratory to minimize a possible low bias. The result for this sample is qualified with a “J” flag (estimated).

Radium-228

Plateau voltage determinations and detector efficiency calibrations were performed in June 2011. Daily instrument checks performed on July 7-8, 2011, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples. Chemical recoveries were adjusted by the laboratory to minimize possible low biases. The results for the samples are qualified with a “J” flag (estimated). For sample 54-SC, the laboratory noted that the alpha count rate exceeded threshold limits, which may indicate a slight high bias for the reported result. This result has been previously qualified.

Thorium Isotopes

Alpha spectrometry calibrations and instrument backgrounds were performed within a month prior to sample analysis. The tracer recoveries met the acceptance criteria of 30 to 110 percent for all samples. The full width at half maximum was reviewed to evaluate the spectral resolution. For several samples, the tracer full width at half maximum exceeded 100 kiloelectron 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 kiloelectron 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 practical quantitation limits for all analytes. In cases where a blank concentration exceeds or equals 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. For lead and nickel, the method blank results were negative and the absolute values were greater than the MDL but less than the practical quantitation limit. Results less than 5 times the MDL are qualified with a “J” flag (estimated).

Radiochemistry

The radiochemistry method blank results were less than the Decision Level Concentration.

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

ICP interference check samples ICSEA and ICSEB 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 analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria, with the exception of the matrix spike replicate for nitrate + nitrite as N. The associated result is qualified with a “J” flag (estimated). The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than 3, 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 50 times the PQL for method 6010 or greater than 100 times the PQL for method 6020. 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 as specified in *Quality Systems for Analytical Services*. All reported MDCs were less than the required MDCs.

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 July 27, 2011. 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: 11063905 Lab Code: PAR Validator: Gretchen Baer Validation Date: 8/29/2011

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

of Samples: 11 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
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 11063905Lab Code: PARDate Due: 7/28/2011Matrix: WaterSite Code: SBSDate Completed: 7/28/2011

Analyte	Method Type	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	ICV	CCV	ICB	CCB								
Cadmium	ICP/MS	07/11/2011	-0.0090	1.0000	OK	OK	OK	OK	OK	111.0	110.0	107.0	3.0	103.0		67.0
Cadmium	ICP/MS	07/11/2011														150.0
Chromium	ICP/ES	07/14/2011	-0.7000	1.0000	OK	OK	OK	OK	OK	101.0	93.0	92.0	2.0	88.0		107.0
Lead	ICP/MS	07/11/2011	-0.0400	1.0000	OK	OK	OK	OK	OK	107.0	106.0	104.0	1.0	105.0		94.0
Lead	ICP/MS	07/11/2011														105.0
Nickel	ICP/ES	07/14/2011	-2.2000	1.0000	OK	OK	OK	OK	OK	101.0	92.0	91.0	1.0	90.0		102.0
Selenium	ICP/MS	07/11/2011	-0.0150	1.0000	OK	OK	OK	OK	OK	103.0	110.0	107.0	3.0	108.0	10.0	65.0
Selenium	ICP/MS	07/11/2011														132.0
Uranium	ICP/MS	07/11/2011	-0.0010	1.0000	OK	OK	OK	OK	OK	103.0	109.0	108.0	0.0	105.0		120.0
Uranium	ICP/MS	07/11/2011											4.0			95.0

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 11063905 **Lab Code:** PAR **Date Due:** 7/28/2011
Matrix: Water **Site Code:** SBS **Date Completed:** 7/28/2011

Analyte	Date Analyzed	CALIBRATION						Method	LCS	MS	MSD	DUP	Serial Dil.
		Int.	R^2	ICV	CCV	ICB	CCB	Blank	%R	%R	%R	RPD	%R
CHLORIDE	06/30/2011	0.019	1.0000	OK	OK	OK	OK	OK	97	101	105	2	
Nitrate+Nitrite as N	07/07/2011	0.000	1.0000	OK	OK	OK	OK	OK	105	93	116	22	
SULFATE	06/30/2011	0.331	0.9999	OK	OK	OK	OK	OK	95				
TOTAL DISSOLVED SOLIDS	07/05/2011							OK	95			1	

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 11063905 **Lab Code:** PAR **Date Due:** 7/28/2011
Matrix: Water **Site Code:** SBS **Date Completed:** 7/28/2011

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
100-SC	Radium-226	07/21/2011			92.2			
10-DC	Radium-226	07/21/2011			85.1			
110-DC	Radium-226	07/21/2011			93.6			
112-DC	Radium-226	07/21/2011			90.5			
113-DC	Radium-226	07/21/2011			89.2			
19-DC	Radium-226	07/21/2011			88.5			
2174	Radium-226	07/21/2011			89.1			
40-SC	Radium-226	07/21/2011			91.5			
54-SC	Radium-226	07/21/2011			89.7			
5-DC	Radium-226	07/21/2011			92.1			
5-SC	Radium-226	07/21/2011			93.2			
54-SC Dup	Radium-226	07/21/2011			89.7			0.29
5-DC Dup	Radium-226	07/21/2011			88.7			0.65
LCS	Radium-226	07/21/2011			90.2	107		
Blank	Radium-226	07/21/2011	0.0178	U	91.9			
100-SC	Radium-228	07/07/2011			67.3			
10-DC	Radium-228	07/07/2011			73.1			
110-DC	Radium-228	07/07/2011			70.3			
112-DC	Radium-228	07/07/2011			66.9			
113-DC	Radium-228	07/07/2011			70.7			
19-DC	Radium-228	07/07/2011			74.9			
2174	Radium-228	07/07/2011			77.5			
40-SC	Radium-228	07/07/2011			76.2			
54-SC	Radium-228	07/07/2011			77.2			
5-DC	Radium-228	07/07/2011			76.9			
5-SC	Radium-228	07/07/2011			75.1			
LCS	Radium-228	07/07/2011			75.1	107		
LCSD	Radium-228	07/07/2011			74.6	94		0.6
Blank	Radium-228	07/07/2011	0.1	U	72.2			
100-SC	Thorium-228	07/13/2011			64.6			
10-DC	Thorium-228	07/13/2011			59.3			
110-DC	Thorium-228	07/13/2011			67.9			

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 11063905 **Lab Code:** PAR **Date Due:** 7/28/2011
Matrix: Water **Site Code:** SBS **Date Completed:** 7/28/2011

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
112-DC	Thorium-228	07/13/2011			70.7			
113-DC	Thorium-228	07/13/2011			66.9			
19-DC	Thorium-228	07/13/2011			68.3			
40-SC	Thorium-228	07/13/2011			74			
5-DC	Thorium-228	07/13/2011			66.3			
5-SC	Thorium-228	07/13/2011			56			
113-DC Dup	Thorium-228	07/13/2011			61.9			0.39
Blank	Thorium-228	07/13/2011	-0.0197	U	69.4			
2174	Thorium-228	07/18/2011			68.8			
54-SC	Thorium-228	07/18/2011			73.9			
2174 Dup	Thorium-228	07/18/2011			60.5			1.54
Blank	Thorium-228	07/18/2011	-0.034	U	59.6			
Blank	Thorium-228	07/18/2011	0.0272	U	62.1			
LCS	Thorium-230	07/13/2011			66.4	98.4		
113-DC Dup	Thorium-230	07/13/2011						0.5
Blank	Thorium-230	07/13/2011	0.0008	U				
LCS	Thorium-230	07/18/2011			63.7	99.2		
LCS	Thorium-230	07/18/2011			65.2	110		
LCSD	Thorium-230	07/18/2011			61.9	97.1		0.2
2174 Dup	Thorium-230	07/18/2011						0.77
Blank	Thorium-230	07/18/2011	0.0952	U				
Blank	Thorium-230	07/18/2011	0.0538	U				
113-DC Dup	Thorium-232	07/13/2011						0.11
Blank	Thorium-232	07/13/2011	0.0196	U				
2174 Dup	Thorium-232	07/18/2011						1.53
Blank	Thorium-232	07/18/2011	0.0287	U				
Blank	Thorium-232	07/18/2011	-0.0006	U				

Sampling Quality Control Assessment

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

Sampling Protocol

Sample results for all monitoring 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 exception of well 100-SC, which was classified as Category II. The sample results for this well 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. The relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. Duplicate samples were collected from location 40-SC (field duplicate ID 2174). The non-radiochemical duplicate results met the criteria, demonstrating acceptable overall precision. The relative error ratios for radiochemical duplicate results (calculated using the one-sigma total propagated uncertainty) were less than 3, indicating acceptable precision.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

Page 1 of 1

RIN: 11063905 Lab Code: PAR Project: Shirley Basin South Validation Date: 8/29/2011

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Cadmium	0.15	B		10	0.12	U		10			UG/L
CHLORIDE	36			20	37			20	2.74		MG/L
Chromium	0.51	U		1	0.51	U		1			UG/L
Lead	0.068	U		10	0.068	U		10			UG/L
Nickel	9.7			1	8.7			1	10.87		UG/L
Nitrate+Nitrite as N	1.4			1	1.4			1	0		MG/L
Radium-226	0.45		0.231	1	0.212		0.164	1		1.6	pCi/L
Radium-228	1.1		0.436	1	0.905		0.396	1		0.6	pCi/L
Selenium	6.8			10	7.2			10	5.71		UG/L
SULFATE	1500			20	1500			20	0		MG/L
Thorium-228	-0.139	U	0.286	1	0.41	U	0.415	1		2.1	pCi/L
Thorium-230	-0.0545	U	0.368	1	-0.0327	U	0.312	1		0.1	pCi/L
Thorium-232	-0.0055	U	0.0995	1	0.00424	U	0.0995	1		0.1	pCi/L
TOTAL DISSOLVED SOLIDS	2300			1	2300			1	0		MG/L
Uranium	0.1	B		10	0.12			10			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 Donovan 9-26-2011
Steve Donovan Date

Data Validation Lead: Gretchen Baer 9/26/11
Gretchen Baer Date

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.

No laboratory results from this sampling event were identified as potential outliers. In the Data Validation Package for the June 2010 sampling event, the thorium-228 result (5.83 pCi/L) for location 5-DC was identified as a potential high outlier. The thorium-228 result at this location for the June 2011 sampling event was higher at 8.33 pCi/L.

Potential anomalies in the field parameters were also examined for patterns of repeated high or low bias, which suggest a systematic error due to instrument malfunction. No such patterns were found. High turbidity measurements indicate wells that may need to be re-developed. The trip report recommends re-development at wells 10-DC, 54-SC, 5-DC, 5-SC, and K.G.S. #3.

All data from this event are acceptable as qualified.

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Data Validation Outliers Report - No Field Parameters

Comparison: All Historical Data

Laboratory: ALS Laboratory Group

RIN: 11063905

Report Date: 9/2/2011

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers		Result	Qualifiers		Result	Qualifiers		N	N Below Detect	
						Lab	Data		Lab	Data		Lab	Data			
SBS01	110-DC	N001	06/29/2011	Lead	0.0054		F	0.0044		F	0.0018		F	5	0	No
SBS01	40-SC	N001	06/29/2011	Total Dissolved Solids	2300		F	4000		FJ	2600		F	14	0	No
SBS01	40-SC	N002	06/29/2011	Total Dissolved Solids	2300		F	4000		FJ	2600		F	14	0	No
SBS01	40-SC	N001	06/29/2011	Uranium	0.0001	B	F	0.11			0.00025		F	87	25	No
SBS01	40-SC	N002	06/29/2011	Uranium	0.00012		F	0.11			0.00025		F	87	25	No
SBS01	54-SC	0001	06/28/2011	Nitrate + Nitrite as Nitrogen	0.012		F	20	U	F	0.02		FQ	7	5	No
SBS01	54-SC	0001	06/28/2011	Thorium-228	5.98		F	10.4		F	6.42		FQ	7	0	No
SBS01	54-SC	0001	06/28/2011	Thorium-232	3.93		F	8.72		F	4.45		FQ	7	0	No
SBS01	54-SC	0001	06/28/2011	Total Dissolved Solids	11000		F	14000		F	11500			9	0	No
SBS01	5-DC	0001	06/28/2011	Nitrate + Nitrite as Nitrogen	0.01	U	F	10	U	F	0.027		F	7	5	No
SBS01	5-DC	0001	06/28/2011	Thorium-228	8.33		F	5.83		FJ	1.97		F	7	0	No
SBS01	5-DC	0001	06/28/2011	Total Dissolved Solids	10000		F	9400		F	6620			9	0	No

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

Data Validation Outliers Report - Field Parameters Only

Comparison: All Historical Data

Laboratory: Field Measurements

RIN: 11063905

Report Date: 9/2/2011

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Qualifiers Lab Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect	
SBS01	10-DC	N001	06/28/2011	Turbidity	98.9	F	7.91			1.93	F	7	0	Yes	
SBS01	54-SC	N001	06/28/2011	Oxidation Reduction Potential	1.1	F	306.8			209.5	F	7	0	Yes	
SBS01	54-SC	N001	06/28/2011	Turbidity	77.8	F	19.8	F	1.27			8	0	Yes	
SBS01	5-DC	N001	06/28/2011	Oxidation Reduction Potential	13.4	F	271.6	F	186.4	F	F	6	0	Yes	
SBS01	5-DC	N001	06/28/2011	Turbidity	41.1	F	9.6	F	0.64	F	F	8	0	Yes	
SBS01	5-SC	N001	06/29/2011	Turbidity	60.1	F	24.6	FQ	2.98	F	F	8	0	No	
SBS01	K.G.S.#3	N001	06/29/2011	Oxidation Reduction Potential	12		-28.6	F	-160	F	F	6	0	No	
SBS01	K.G.S.#3	N001	06/29/2011	Turbidity	46.5		9.72	F	1.52	F	F	6	0	Yes	

STATISTICAL TESTS:

The distribution of the data is tested for normality or lognormality using the Shapiro-Wilk Test

Outliers are identified using Dixon's Test when there are 25 or fewer data points.

Outliers are identified using Rosner's Test when there are 26 or more data points.

See Data Quality Assessment: Statistical Methods for Practitioners, EPA QC/G-9S, February 2006.

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: 9/2/2011

Location: 10-DC WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Cadmium	mg/L	06/28/2011	0001	180.8 - 220.8	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/28/2011	0001	180.8 - 220.8	54		F	#	4	
Chromium	mg/L	06/28/2011	0001	180.8 - 220.8	0.00051	U	F	#	0.00051	
Lead	mg/L	06/28/2011	0001	180.8 - 220.8	0.000068	U	JF	#	0.000068	
Nickel	mg/L	06/28/2011	0001	180.8 - 220.8	0.00093	U	JF	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/28/2011	0001	180.8 - 220.8	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	06/28/2011	N001	180.8 - 220.8	0.5		F	#		
pH	s.u.	06/28/2011	N001	180.8 - 220.8	6.77		F	#		
Radium-226	pCi/L	06/28/2011	0001	180.8 - 220.8	16.3		F	#	0.16	4.24
Radium-228	pCi/L	06/28/2011	0001	180.8 - 220.8	4.08		JF	#	0.43	1.27
Selenium	mg/L	06/28/2011	0001	180.8 - 220.8	0.00028		JF	#	0.000032	
Specific Conductance	umhos/cm	06/28/2011	N001	180.8 - 220.8	2061		F	#		
Sulfate	mg/L	06/28/2011	0001	180.8 - 220.8	1000		F	#	10	
Temperature	C	06/28/2011	N001	180.8 - 220.8	11.45		F	#		
Thorium-228	pCi/L	06/28/2011	0001	180.8 - 220.8	0.63	U	F	#	0.63	0.332
Thorium-230	pCi/L	06/28/2011	0001	180.8 - 220.8	0.76	U	F	#	0.76	0.473
Thorium-232	pCi/L	06/28/2011	0001	180.8 - 220.8	0.18	U	F	#	0.18	0.117
Total Dissolved Solids	mg/L	06/28/2011	0001	180.8 - 220.8	1800		F	#	40	
Turbidity	NTU	06/28/2011	N001	180.8 - 220.8	98.9		F	#		
Uranium	mg/L	06/28/2011	0001	180.8 - 220.8	0.014		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 100-SC WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Cadmium	mg/L	06/28/2011	N001	210	-	225	0.00036		JFQ	#	0.00012	
Chloride	mg/L	06/28/2011	N001	210	-	225	140		FQ	#	4	
Chromium	mg/L	06/28/2011	N001	210	-	225	0.00051	U	FQ	#	0.00051	
Lead	mg/L	06/28/2011	N001	210	-	225	0.00012	B	JFQ	#	0.000068	
Nickel	mg/L	06/28/2011	N001	210	-	225	0.0036	B	JFQ	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/28/2011	N001	210	-	225	0.01	U	JFQ	#	0.01	
Oxidation Reduction Potential	mV	06/28/2011	N001	210	-	225	118.2		FQ	#		
pH	s.u.	06/28/2011	N001	210	-	225	7.07		FQ	#		
Radium-226	pCi/L	06/28/2011	N001	210	-	225	4.76		FQ	#	0.16	1.35
Radium-228	pCi/L	06/28/2011	N001	210	-	225	3.84		JFQ	#	0.48	1.21
Selenium	mg/L	06/28/2011	N001	210	-	225	0.00013		JFQ	#	0.000032	
Specific Conductance	umhos/cm	06/28/2011	N001	210	-	225	2389		FQ	#		
Sulfate	mg/L	06/28/2011	N001	210	-	225	1100		FQ	#	10	
Temperature	C	06/28/2011	N001	210	-	225	11.3		FQ	#		
Thorium-228	pCi/L	06/28/2011	N001	210	-	225	0.6	U	FQ	#	0.6	0.37
Thorium-230	pCi/L	06/28/2011	N001	210	-	225	0.73	U	FQ	#	0.73	0.506
Thorium-232	pCi/L	06/28/2011	N001	210	-	225	0.17	U	FQ	#	0.17	0.108
Total Dissolved Solids	mg/L	06/28/2011	N001	210	-	225	2000		FQ	#	40	
Turbidity	NTU	06/28/2011	N001	210	-	225	4.33		FQ	#		
Uranium	mg/L	06/28/2011	N001	210	-	225	0.0027		FQ	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 110-DC WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Cadmium	mg/L	06/29/2011	N001	255	-	305	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/29/2011	N001	255	-	305	210		F	#	10	
Chromium	mg/L	06/29/2011	N001	255	-	305	0.00051	U	F	#	0.00051	
Lead	mg/L	06/29/2011	N001	255	-	305	0.0054		F	#	0.000068	
Nickel	mg/L	06/29/2011	N001	255	-	305	0.0012	B	JF	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	N001	255	-	305	0.044		F	#	0.01	
Oxidation Reduction Potential	mV	06/29/2011	N001	255	-	305	-4.1		F	#		
pH	s.u.	06/29/2011	N001	255	-	305	6.59		F	#		
Radium-226	pCi/L	06/29/2011	N001	255	-	305	149		F	#	0.18	37.4
Radium-228	pCi/L	06/29/2011	N001	255	-	305	5.63		JF	#	0.44	1.73
Selenium	mg/L	06/29/2011	N001	255	-	305	0.000099	B	JF	#	0.000032	
Specific Conductance	umhos/cm	06/29/2011	N001	255	-	305	3678		F	#		
Sulfate	mg/L	06/29/2011	N001	255	-	305	1900		F	#	25	
Temperature	C	06/29/2011	N001	255	-	305	12.25		F	#		
Thorium-228	pCi/L	06/29/2011	N001	255	-	305	0.55	U	F	#	0.55	0.297
Thorium-230	pCi/L	06/29/2011	N001	255	-	305	0.73	U	F	#	0.73	0.406
Thorium-232	pCi/L	06/29/2011	N001	255	-	305	0.14	U	F	#	0.14	0.103
Total Dissolved Solids	mg/L	06/29/2011	N001	255	-	305	3600		F	#	80	
Turbidity	NTU	06/29/2011	N001	255	-	305	6.65		F	#		
Uranium	mg/L	06/29/2011	N001	255	-	305	0.011		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 112-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Cadmium	mg/L	06/28/2011	N001	203	-	253	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/28/2011	N001	203	-	253	54		F	#	4	
Chromium	mg/L	06/28/2011	N001	203	-	253	0.00051	U	F	#	0.00051	
Lead	mg/L	06/28/2011	N001	203	-	253	0.000068	U	JF	#	0.000068	
Nickel	mg/L	06/28/2011	N001	203	-	253	0.00093	U	JF	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/28/2011	N001	203	-	253	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	06/28/2011	N001	203	-	253	10		F	#		
pH	s.u.	06/28/2011	N001	203	-	253	7.28		F	#		
Radium-226	pCi/L	06/28/2011	N001	203	-	253	17		F	#	0.16	4.42
Radium-228	pCi/L	06/28/2011	N001	203	-	253	3.93		JF	#	0.5	1.24
Selenium	mg/L	06/28/2011	N001	203	-	253	0.000074	B	JF	#	0.000032	
Specific Conductance	umhos/cm	06/28/2011	N001	203	-	253	2230		F	#		
Sulfate	mg/L	06/28/2011	N001	203	-	253	1100		F	#	10	
Temperature	C	06/28/2011	N001	203	-	253	11.44		F	#		
Thorium-228	pCi/L	06/28/2011	N001	203	-	253	0.48	U	F	#	0.48	0.3
Thorium-230	pCi/L	06/28/2011	N001	203	-	253	0.69	U	F	#	0.69	0.4
Thorium-232	pCi/L	06/28/2011	N001	203	-	253	0.16	U	F	#	0.16	0.0998
Total Dissolved Solids	mg/L	06/28/2011	N001	203	-	253	2000		F	#	40	
Turbidity	NTU	06/28/2011	N001	203	-	253	1.82		F	#		
Uranium	mg/L	06/28/2011	N001	203	-	253	0.027		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 113-DC WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Cadmium	mg/L	06/29/2011	N001	235	-	285	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/29/2011	N001	235	-	285	8.2		F	#	1	
Chromium	mg/L	06/29/2011	N001	235	-	285	0.00051	U	F	#	0.00051	
Lead	mg/L	06/29/2011	N001	235	-	285	0.00018	B	JF	#	0.000068	
Nickel	mg/L	06/29/2011	N001	235	-	285	0.00093	U	JF	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	N001	235	-	285	0.074		F	#	0.01	
Oxidation Reduction Potential	mV	06/29/2011	N001	235	-	285	19.4		F	#		
pH	s.u.	06/29/2011	N001	235	-	285	7.46		F	#		
Radium-226	pCi/L	06/29/2011	N001	235	-	285	2.27		F	#	0.17	0.723
Radium-228	pCi/L	06/29/2011	N001	235	-	285	2.45		JF	#	0.48	0.818
Selenium	mg/L	06/29/2011	N001	235	-	285	0.00005	B	JF	#	0.000032	
Specific Conductance	umhos/cm	06/29/2011	N001	235	-	285	1477		F	#		
Sulfate	mg/L	06/29/2011	N001	235	-	285	610		F	#	10	
Temperature	C	06/29/2011	N001	235	-	285	11.29		F	#		
Thorium-228	pCi/L	06/29/2011	N001	235	-	285	0.52	U	F	#	0.52	0.304
Thorium-230	pCi/L	06/29/2011	N001	235	-	285	0.71	U	F	#	0.71	0.419
Thorium-232	pCi/L	06/29/2011	N001	235	-	285	0.2	U	F	#	0.2	0.105
Total Dissolved Solids	mg/L	06/29/2011	N001	235	-	285	1100		F	#	40	
Turbidity	NTU	06/29/2011	N001	235	-	285	3.97		F	#		
Uranium	mg/L	06/29/2011	N001	235	-	285	0.0012		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 19-DC WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Cadmium	mg/L	06/29/2011	N001	177	-	237	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/29/2011	N001	177	-	237	63		F	#	10	
Chromium	mg/L	06/29/2011	N001	177	-	237	0.00051	U	F	#	0.00051	
Lead	mg/L	06/29/2011	N001	177	-	237	0.000068	U	JF	#	0.000068	
Nickel	mg/L	06/29/2011	N001	177	-	237	0.21		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	N001	177	-	237	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	06/29/2011	N001	177	-	237	-61.4		F	#		
pH	s.u.	06/29/2011	N001	177	-	237	6.68		F	#		
Radium-226	pCi/L	06/29/2011	N001	177	-	237	6.18		F	#	0.19	1.72
Radium-228	pCi/L	06/29/2011	N001	177	-	237	4.19		JF	#	0.45	1.31
Selenium	mg/L	06/29/2011	N001	177	-	237	0.00011		JF	#	0.000032	
Specific Conductance	umhos/cm	06/29/2011	N001	177	-	237	2905		F	#		
Sulfate	mg/L	06/29/2011	N001	177	-	237	1700		F	#	25	
Temperature	C	06/29/2011	N001	177	-	237	10.18		F	#		
Thorium-228	pCi/L	06/29/2011	N001	177	-	237	0.53	U	F	#	0.53	0.251
Thorium-230	pCi/L	06/29/2011	N001	177	-	237	0.72	U	F	#	0.72	0.332
Thorium-232	pCi/L	06/29/2011	N001	177	-	237	0.16	U	F	#	0.16	0.106
Total Dissolved Solids	mg/L	06/29/2011	N001	177	-	237	2800		F	#	80	
Turbidity	NTU	06/29/2011	N001	177	-	237	7.55		F	#		
Uranium	mg/L	06/29/2011	N001	177	-	237	0.00058		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 40-SC WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Cadmium	mg/L	06/29/2011	N001	-	0.00015	B	JF	#	0.00012	
Cadmium	mg/L	06/29/2011	N002	-	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/29/2011	N001	-	36		F	#	4	
Chloride	mg/L	06/29/2011	N002	-	37		F	#	4	
Chromium	mg/L	06/29/2011	N001	-	0.00051	U	F	#	0.00051	
Chromium	mg/L	06/29/2011	N002	-	0.00051	U	F	#	0.00051	
Lead	mg/L	06/29/2011	N001	-	0.000068	U	JF	#	0.000068	
Lead	mg/L	06/29/2011	N002	-	0.000068	U	JF	#	0.000068	
Nickel	mg/L	06/29/2011	N001	-	0.0097		F	#	0.00093	
Nickel	mg/L	06/29/2011	N002	-	0.0087		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	N001	-	1.4		F	#	0.01	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	N002	-	1.4		F	#	0.01	
Oxidation Reduction Potential	mV	06/29/2011	N001	-	52.7		F	#		
pH	s.u.	06/29/2011	N001	-	6.24		F	#		
Radium-226	pCi/L	06/29/2011	N001	-	0.45		JF	#	0.16	0.231
Radium-226	pCi/L	06/29/2011	N002	-	0.212		UF	#	0.18	0.164
Radium-228	pCi/L	06/29/2011	N001	-	1.1		JF	#	0.42	0.436
Radium-228	pCi/L	06/29/2011	N002	-	0.905		JF	#	0.43	0.396
Selenium	mg/L	06/29/2011	N001	-	0.0068		F	#	0.00032	
Selenium	mg/L	06/29/2011	N002	-	0.0072		F	#	0.00032	
Specific Conductance	umhos/cm	06/29/2011	N001	-	2573		F	#		

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 40-SC WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Sulfate	mg/L	06/29/2011	N001	-	1500		F	#	10	
Sulfate	mg/L	06/29/2011	N002	-	1500		F	#	10	
Temperature	C	06/29/2011	N001	-	9.08		F	#		
Thorium-228	pCi/L	06/29/2011	N001	-	0.59	U	F	#	0.59	0.286
Thorium-228	pCi/L	06/29/2011	N002	-	0.65	U	F	#	0.65	0.415
Thorium-230	pCi/L	06/29/2011	N001	-	0.69	U	F	#	0.69	0.368
Thorium-230	pCi/L	06/29/2011	N002	-	0.59	U	F	#	0.59	0.312
Thorium-232	pCi/L	06/29/2011	N001	-	0.19	U	F	#	0.19	0.0995
Thorium-232	pCi/L	06/29/2011	N002	-	0.17	U	F	#	0.17	0.0995
Total Dissolved Solids	mg/L	06/29/2011	N001	-	2300		F	#	40	
Total Dissolved Solids	mg/L	06/29/2011	N002	-	2300		F	#	40	
Turbidity	NTU	06/29/2011	N001	-	1.21		F	#		
Uranium	mg/L	06/29/2011	N001	-	0.0001	B	F	#	0.000029	
Uranium	mg/L	06/29/2011	N002	-	0.00012		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 5-DC WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Cadmium	mg/L	06/28/2011	0001	-	0.00012	U	JF	#	0.00012	
Chloride	mg/L	06/28/2011	0001	-	190		F	#	20	
Chromium	mg/L	06/28/2011	0001	-	0.016		F	#	0.00051	
Lead	mg/L	06/28/2011	0001	-	0.000068	U	JF	#	0.000068	
Nickel	mg/L	06/28/2011	0001	-	0.71		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/28/2011	0001	-	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	06/28/2011	N001	-	13.4		F	#		
pH	s.u.	06/28/2011	N001	-	4.17		F	#		
Radium-226	pCi/L	06/28/2011	0001	-	12		F	#	0.16	3.16
Radium-228	pCi/L	06/28/2011	0001	-	50.5		JF	#	0.43	15
Selenium	mg/L	06/28/2011	0001	-	0.02		F	#	0.00032	
Specific Conductance	umhos/cm	06/28/2011	N001	-	7687		F	#		
Sulfate	mg/L	06/28/2011	0001	-	6500		F	#	50	
Temperature	C	06/28/2011	N001	-	11.41		F	#		
Thorium-228	pCi/L	06/28/2011	0001	-	8.33		F	#	0.6	1.71
Thorium-230	pCi/L	06/28/2011	0001	-	1.45		JF	#	0.75	0.632
Thorium-232	pCi/L	06/28/2011	0001	-	1.23		F	#	0.2	0.445
Total Dissolved Solids	mg/L	06/28/2011	0001	-	10000		F	#	200	
Turbidity	NTU	06/28/2011	N001	-	41.1		F	#		
Uranium	mg/L	06/28/2011	0001	-	0.039		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 5-SC WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Cadmium	mg/L	06/29/2011	0001	49.3	-	57.7	0.04		F	#	0.00012	
Chloride	mg/L	06/29/2011	0001	49.3	-	57.7	290		F	#	20	
Chromium	mg/L	06/29/2011	0001	49.3	-	57.7	0.25		F	#	0.00051	
Lead	mg/L	06/29/2011	0001	49.3	-	57.7	0.00009	B	JF	#	0.000068	
Nickel	mg/L	06/29/2011	0001	49.3	-	57.7	2.4		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/29/2011	0001	49.3	-	57.7	0.02		F	#	0.01	
Oxidation Reduction Potential	mV	06/29/2011	N001	49.3	-	57.7	303.4		F	#		
pH	s.u.	06/29/2011	N001	49.3	-	57.7	3.43		F	#		
Radium-226	pCi/L	06/29/2011	0001	49.3	-	57.7	5.43		JF	#	0.18	1.53
Radium-228	pCi/L	06/29/2011	0001	49.3	-	57.7	3.26		JF	#	0.43	1.04
Selenium	mg/L	06/29/2011	0001	49.3	-	57.7	0.086		F	#	0.00032	
Specific Conductance	umhos/cm	06/29/2011	N001	49.3	-	57.7	11762		F	#		
Sulfate	mg/L	06/29/2011	0001	49.3	-	57.7	13000		F	#	100	
Temperature	C	06/29/2011	N001	49.3	-	57.7	12.25		F	#		
Thorium-228	pCi/L	06/29/2011	0001	49.3	-	57.7	52.2		F	#	0.67	8.86
Thorium-230	pCi/L	06/29/2011	0001	49.3	-	57.7	454		F	#	0.81	73.7
Thorium-232	pCi/L	06/29/2011	0001	49.3	-	57.7	11.2		F	#	0.17	2.21
Total Dissolved Solids	mg/L	06/29/2011	0001	49.3	-	57.7	19000		F	#	200	
Turbidity	NTU	06/29/2011	N001	49.3	-	57.7	60.1		F	#		
Uranium	mg/L	06/29/2011	0001	49.3	-	57.7	3.6		F	#	0.00029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: 54-SC WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Cadmium	mg/L	06/28/2011	0001	-	0.0029		F	#	0.00012	
Chloride	mg/L	06/28/2011	0001	-	370		F	#	20	
Chromium	mg/L	06/28/2011	0001	-	0.16		F	#	0.00051	
Lead	mg/L	06/28/2011	0001	-	0.00056		F	#	0.000068	
Nickel	mg/L	06/28/2011	0001	-	2.6		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	06/28/2011	0001	-	0.012		F	#	0.01	
Oxidation Reduction Potential	mV	06/28/2011	N001	-	1.1		F	#		
pH	s.u.	06/28/2011	N001	-	3.99		F	#		
Radium-226	pCi/L	06/28/2011	0001	-	19.5		F	#	0.15	5.04
Radium-228	pCi/L	06/28/2011	0001	-	103		JF	#	0.41	30.5
Selenium	mg/L	06/28/2011	0001	-	0.049		F	#	0.00032	
Specific Conductance	umhos/cm	06/28/2011	N001	-	7934		F	#		
Sulfate	mg/L	06/28/2011	0001	-	7300		F	#	50	
Temperature	C	06/28/2011	N001	-	16.32		F	#		
Thorium-228	pCi/L	06/28/2011	0001	-	5.98		F	#	0.55	1.24
Thorium-230	pCi/L	06/28/2011	0001	-	3.94		F	#	0.45	0.891
Thorium-232	pCi/L	06/28/2011	0001	-	3.93		F	#	0.13	0.855
Total Dissolved Solids	mg/L	06/28/2011	0001	-	11000		F	#	200	
Turbidity	NTU	06/28/2011	N001	-	77.8		F	#		
Uranium	mg/L	06/28/2011	0001	-	0.082		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site

REPORT DATE: 9/2/2011

Location: K.G.S.#3 WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Oxidation Reduction Potential	mV	06/29/2011	N001	433.76 - 463.76	12			#		
pH	s.u.	06/29/2011	N001	433.76 - 463.76	7.43			#		
Specific Conductance	umhos /cm	06/29/2011	N001	433.76 - 463.76	781			#		
Temperature	C	06/29/2011	N001	433.76 - 463.76	15.23			#		
Turbidity	NTU	06/29/2011	N001	433.76 - 463.76	46.5			#		

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

QA QUALIFIER:

- # Validated according to quality assurance guidelines.

Static Water Level Data

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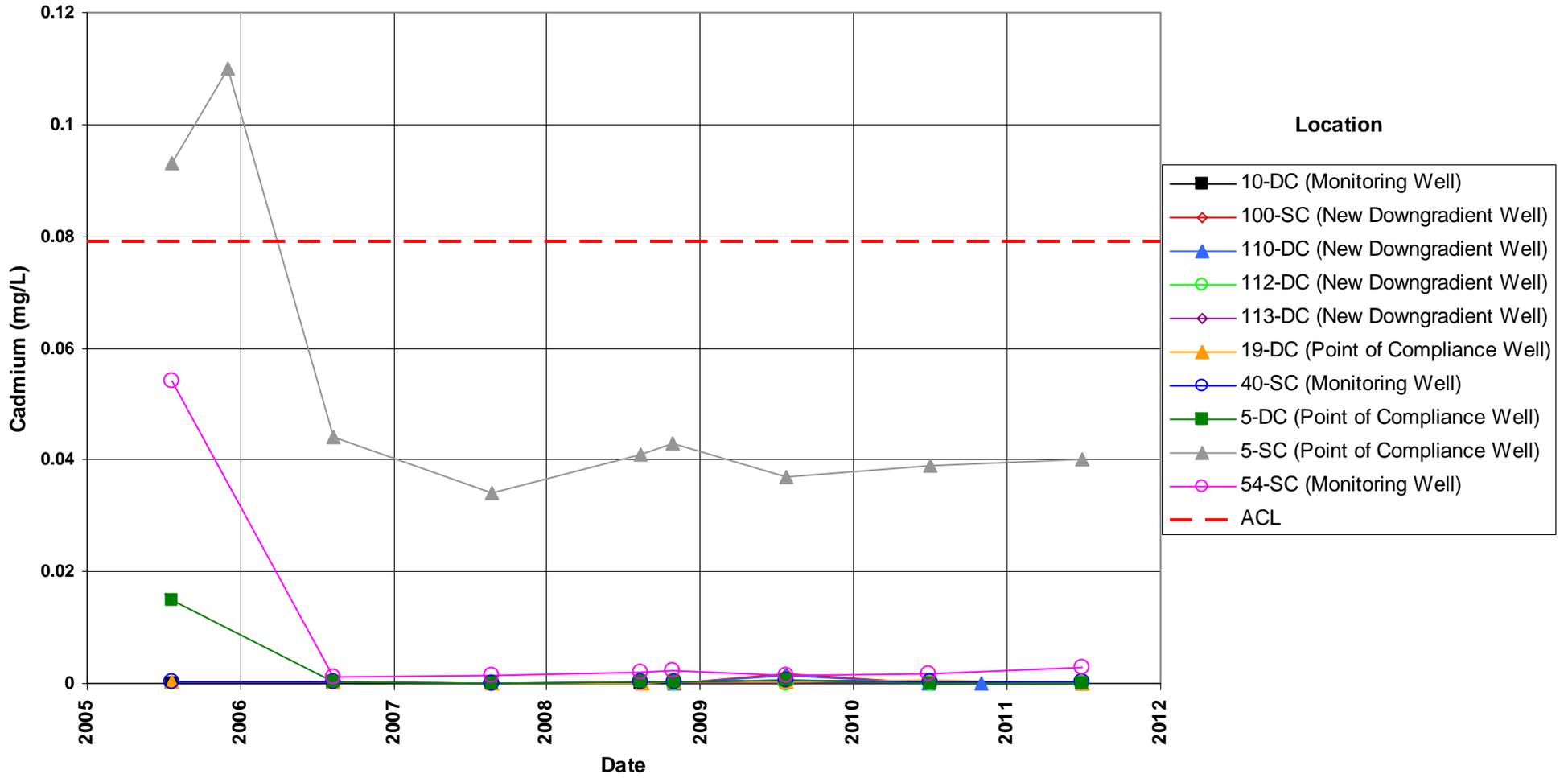
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Time-Concentration Graphs

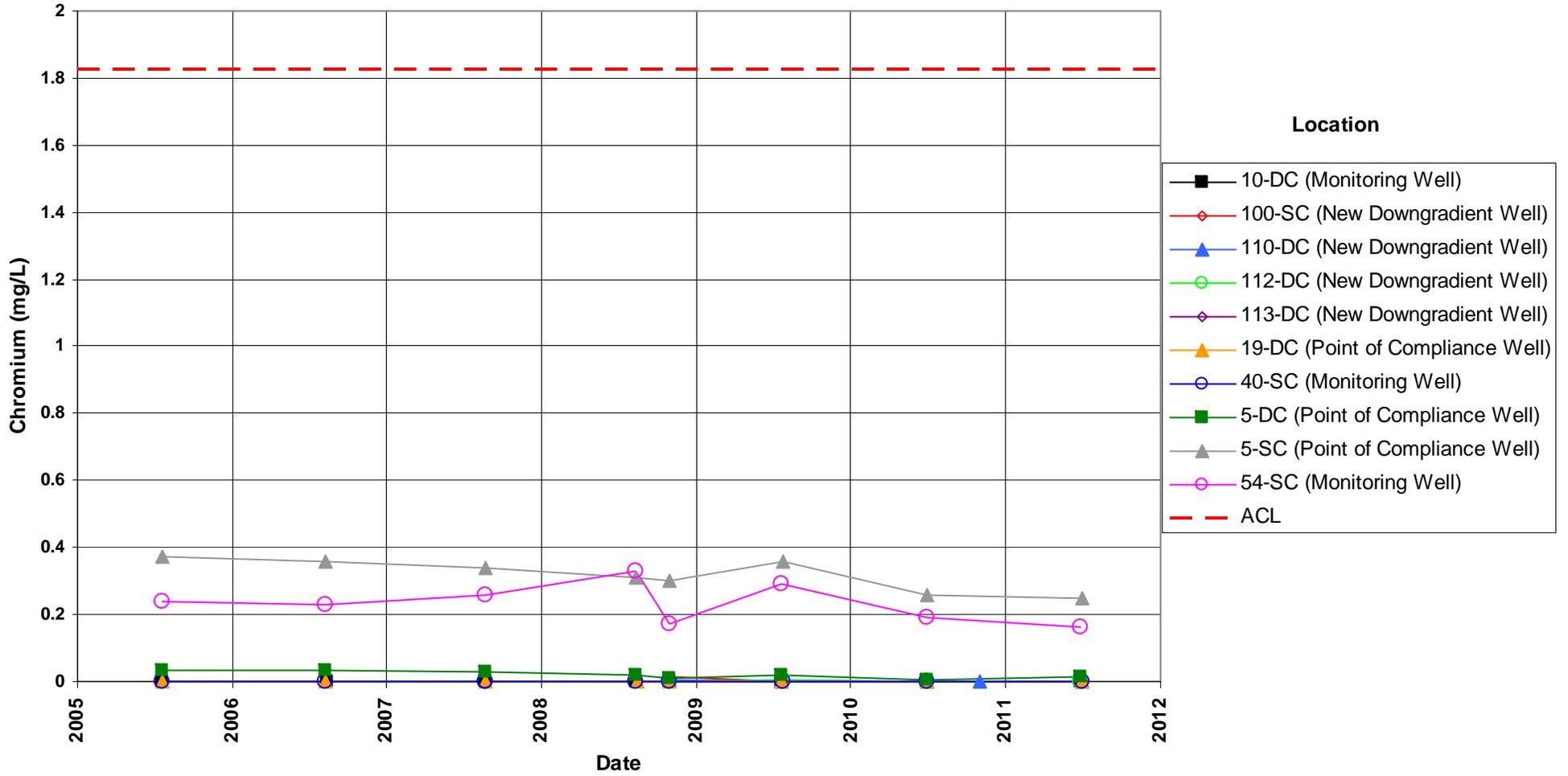
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Shirley Basin South Disposal Site Cadmium Concentration

Alternate Concentration Limit (ACL) = 0.079 mg/L

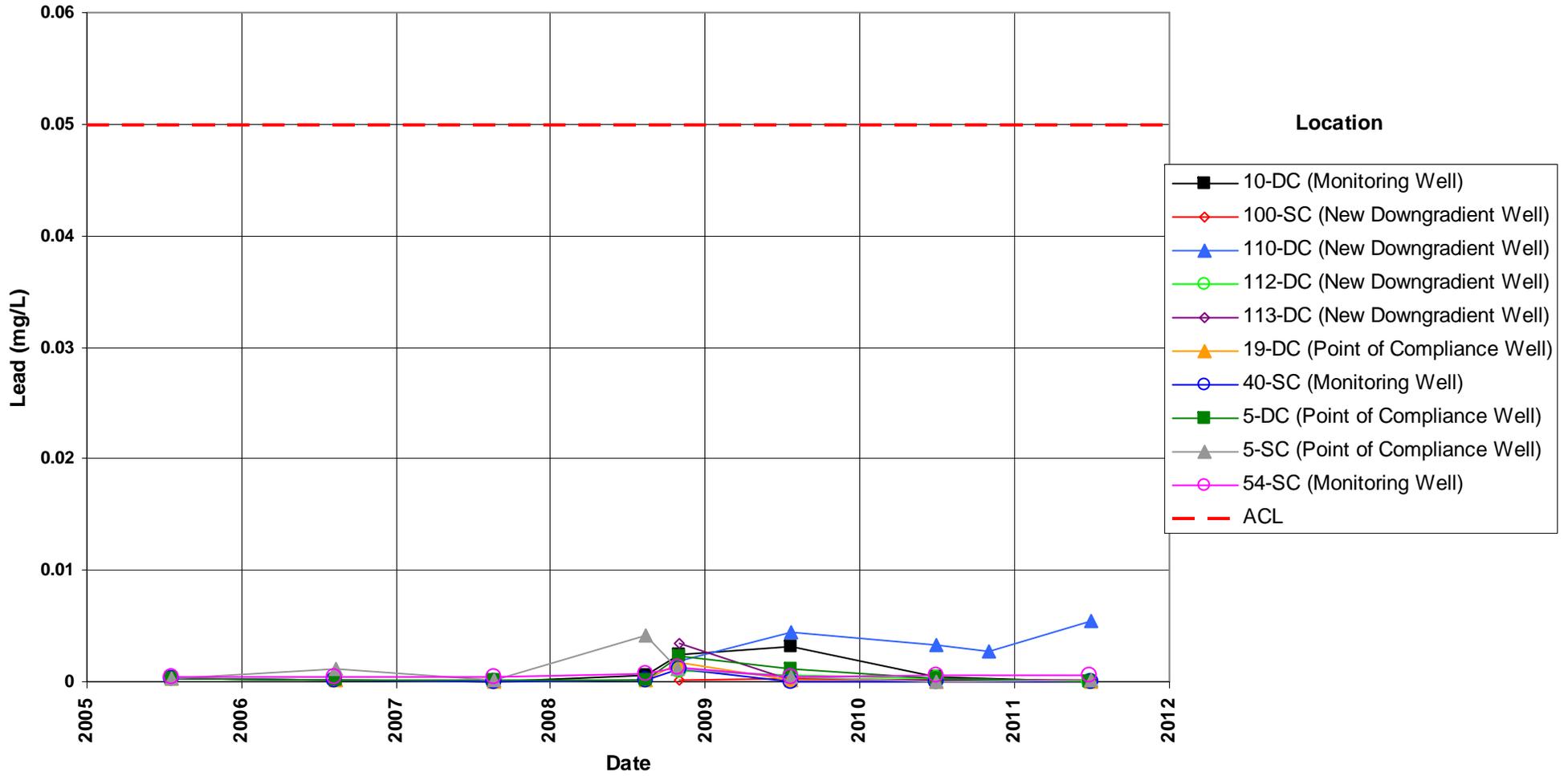


**Shirley Basin South Disposal Site
Chromium Concentration**
Alternate Concentration Limit (ACL) = 1.83 mg/L

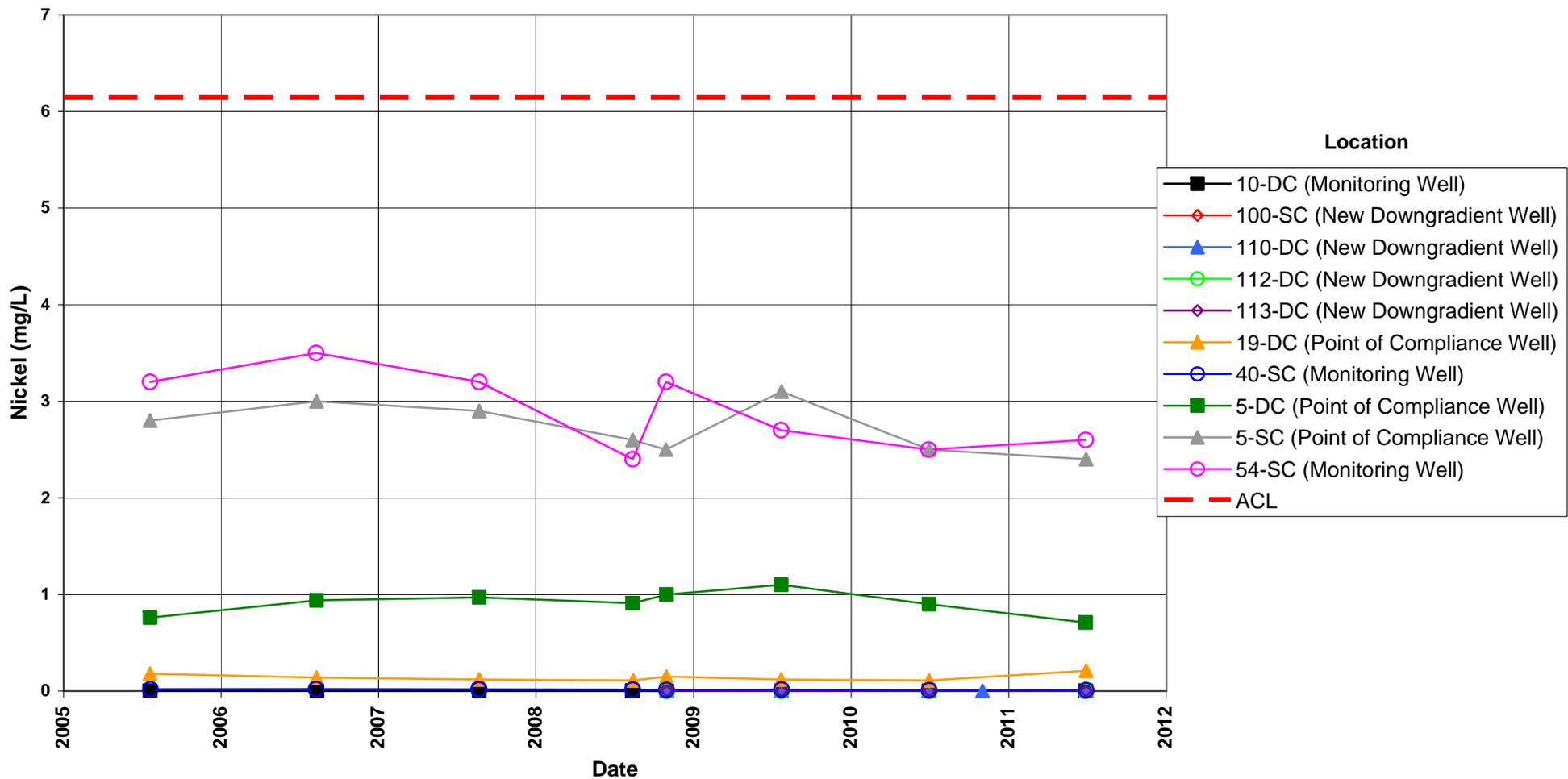


Shirley Basin South Disposal Site Lead Concentration

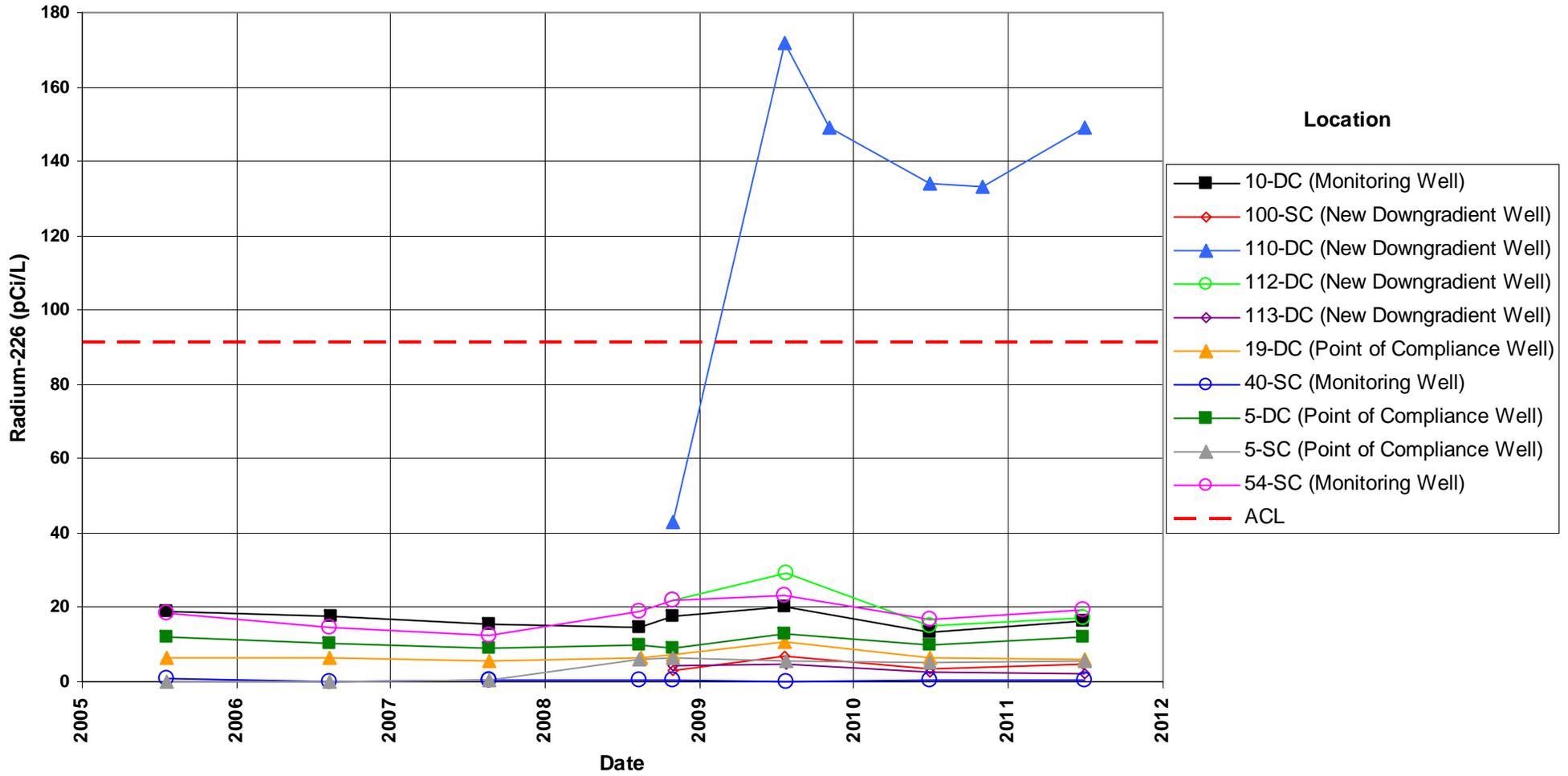
Alternate Concentration Limit (ACL) = 0.05 mg/L



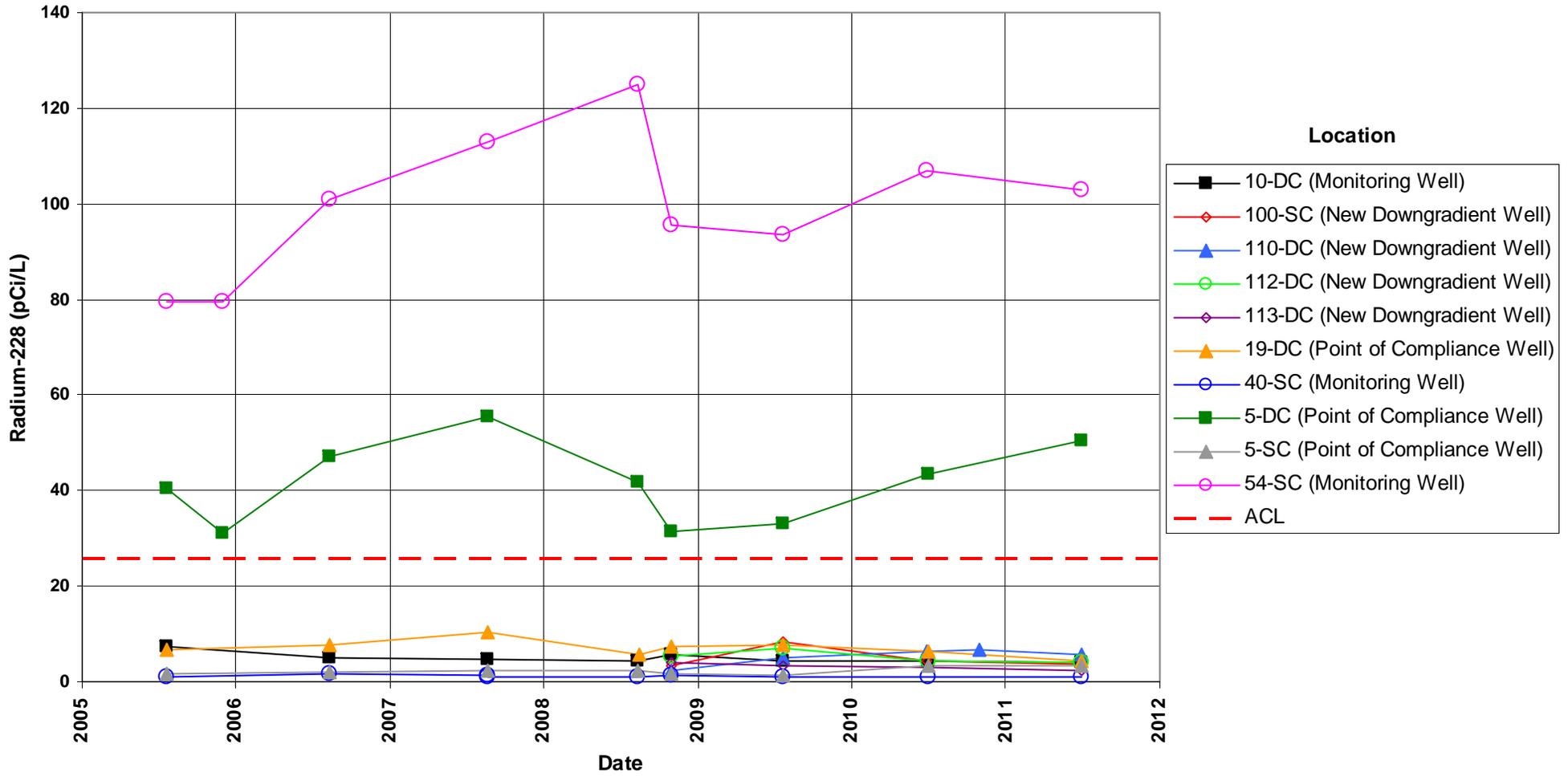
**Shirley Basin South Disposal Site
Nickel Concentration**
Alternate Concentration Limit (ACL) = 6.15 mg/L



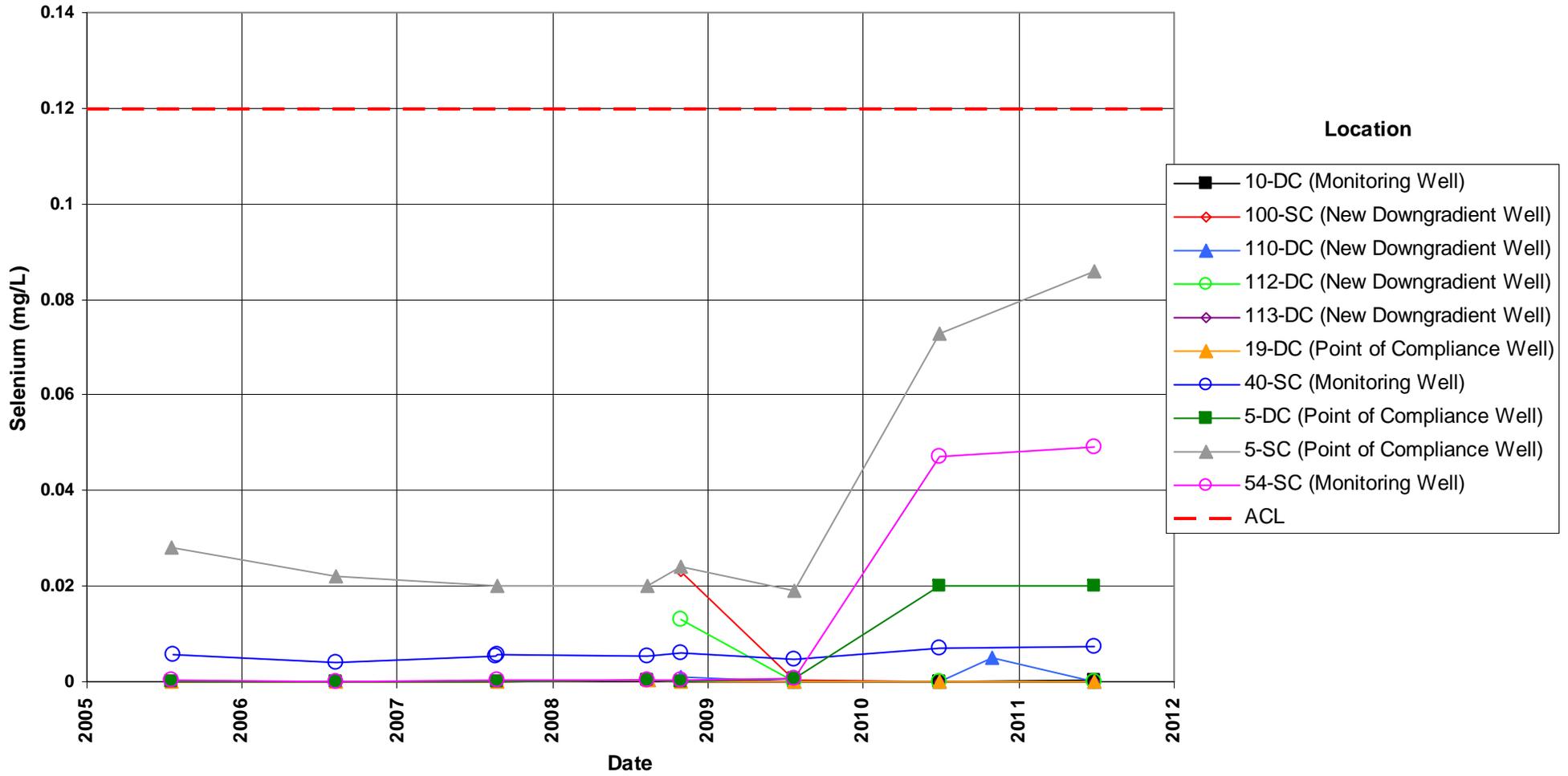
Shirley Basin South Disposal Site
Radium-226 Concentration
 Alternate Concentration Limit (ACL) = 91.3 pCi/L



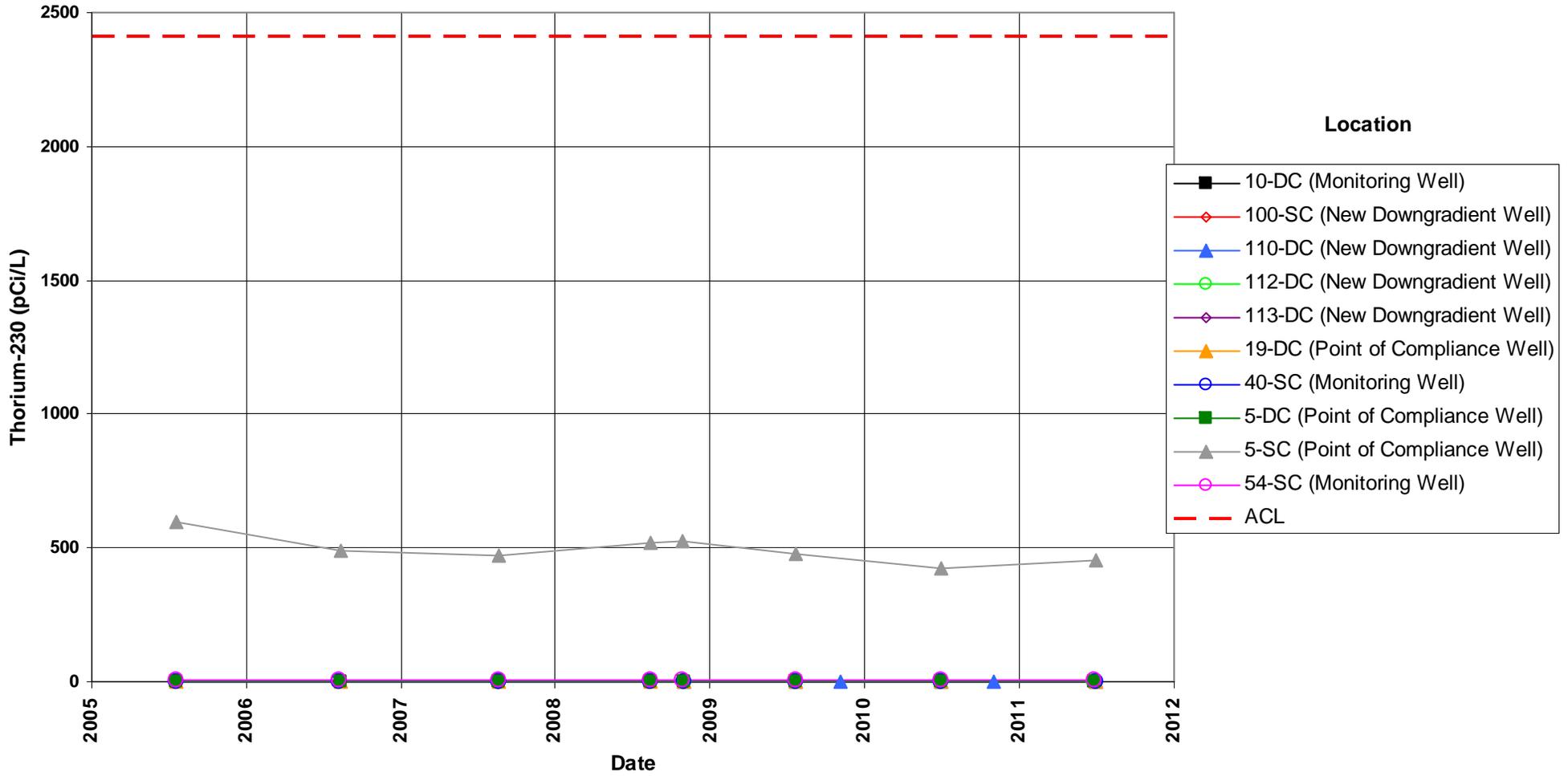
**Shirley Basin South Disposal Site
Radium-228 Concentration**
Alternate Concentration Limit (ACL) = 25.7 pCi/L



**Shirley Basin South Disposal Site
Selenium Concentration**
Alternate Concentration Limit (ACL) = 0.12 mg/L

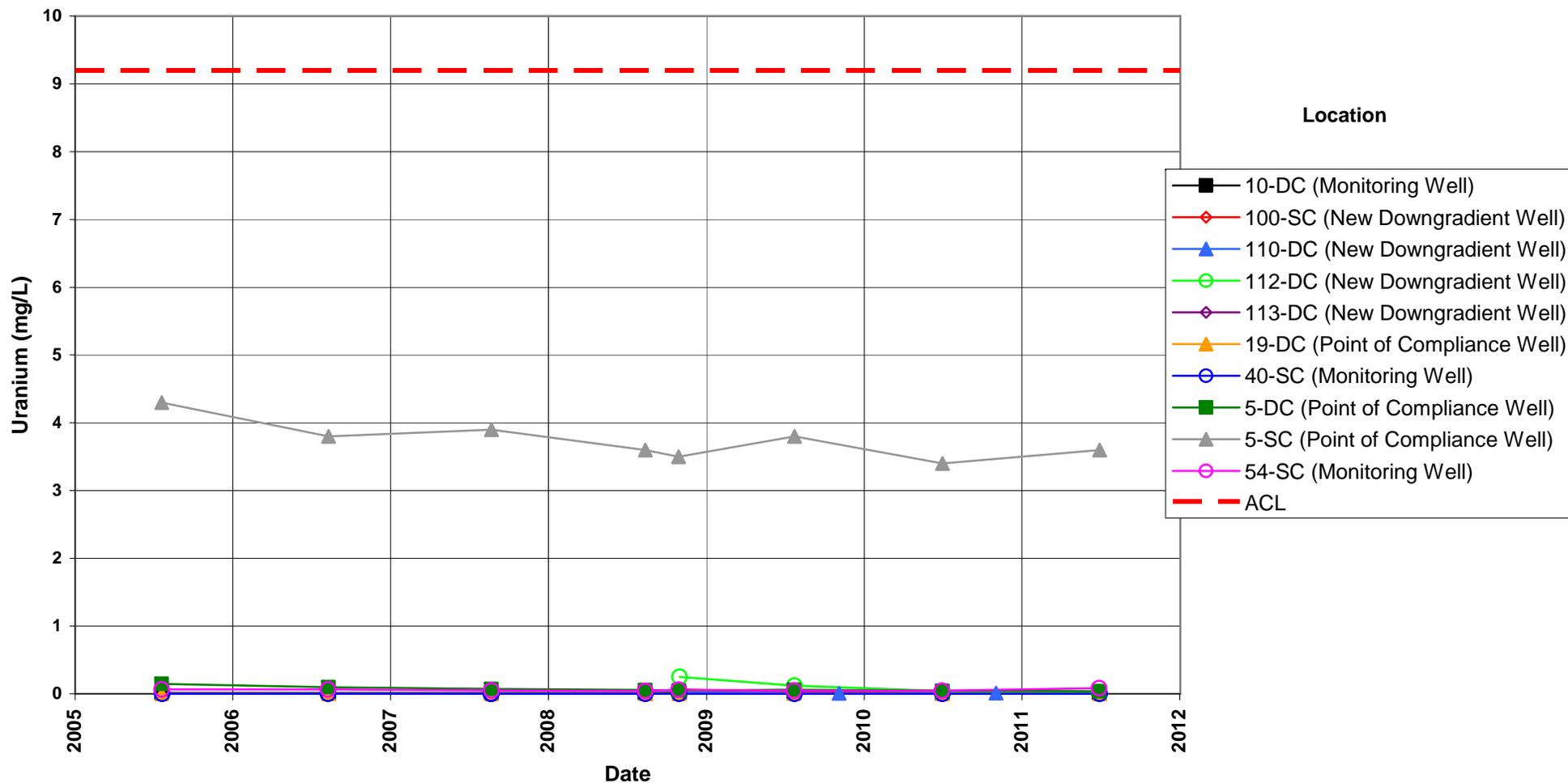


Shirley Basin South Disposal Site
Thorium-230 Concentration
 Alternate Concentration Limit (ACL) = 2,409 pCi/L



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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Task Order LM00-501
Control Number 11-0679

May 25, 2011

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

SUBJECT: Contract No. DE-AM01-07LM00060, S.M. Stoller Corporation (Stoller)
June 2011 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, WY. 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 monitoring wells at this site as part of the routine environmental sampling currently scheduled to begin the week of June 27, 2011.

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

Monitoring Wells*

40-SC	51-SC	10-DC	5-DC	19-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 contact me at (970) 248-6022 if you have any questions.

Sincerely,

Richard K. Johnson
Site Lead

The S.M. Stoller Corporation 2597 Legacy Way Grand Junction, CO 81503 (970) 248-6000 Fax (970) 248-6040

Scott Surovchak
Control Number 11-0679
Page 2

RKJ/lcg/lb

Enclosures (3)

cc: (electronic)
Steve Donovan, Stoller
Bev Gallagher, Stoller
Lauren Goodknight, Stoller
Richard Johnson, Stoller
EDD Delivery
rc-grand.junction
File: SBS 410.02 (A)

Sampling Frequencies for Locations at Shirley Basin South, Wyoming

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
100-SC			X			
101-SC			X			
102-SC			X			
110-DC			X			
112-DC			X			
113-DC			X			
40-SC			X			
5-SC			X			
51-SC			X			
54-SC			X			
10-DC			X			
5-DC			X			
19-DC			X			
K.G.S.#3			X			

Sampling conducted in June

Constituent Sampling Breakdown

Site	Shirley Basin South		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
	Analyte	Groundwater			
Approx. No. Samples/yr	14	0			
Field Measurements					
Alkalinity					
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH ₃ -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 (NO ₃ +NO ₂)-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 private well samples are to be unfiltered. The total number of analytes does not include field parameters.

Attachment 4 Trip Report

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Memorandum

DATE: July 5, 2011
TO: Dick Johnson
FROM: Jeff Price
SUBJECT: Trip Report

Site: Shirley Basin, Wyoming

Dates of Sampling Event: June 20 – 23, 2011

Team Members: Heidi Frasure and Jeff Price.

Number of Locations Sampled: 10 monitoring wells.

Locations Not Sampled/Reason: Wells 51-SC, 101-SC, and 102-SC were dry; well K.G.S.#3 could not be sampled because excessive suspended black fine particles, in the water column, plugged the pump intake screen.

Location Specific Information: Well K.G.S.#3 needs to be purged with a submersible pump to reduce the amount of suspended fine particles. There is currently a privately owned dedicated submersible pump in this well that could possibly be used for well development. Also, samples collected from wells 10-DC, 54-SC, 5-DC, and 5-SC, required filtration (additional well development is recommended).

Field Variance: None.

Quality Control Sample Cross Reference: Following are the false identifications assigned to the quality control samples:

False ID	True ID	Sample Type	Ticket Number
2174	40-SC	Duplicate	JHT 508

Requisition Numbers Assigned: Samples were assigned to report identification number (RIN) 11063905. Samples were delivered by Stoller personnel on June 23 to ALS Laboratory Group.

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

Well Inspection Summary: All well and protective casings are in good condition.

Equipment: All equipment functioned properly.

Regulatory: None

Institutional Controls

Fences, Gates, Locks: All ok.

Signs: All ok.

Trespassing/Site Disturbances: None observed.

Site Issues: None

Disposal Cell/Drainage Structure Integrity: Ok.

Vegetation/Noxious Weed Concerns: None noticed.

Maintenance Requirements: None.

Access Issues: None

Corrective Action Required/Taken: See location specific information.

(JEP/lb)

cc: (electronic)

Scott Surovchak, DOE

Steve Donovan, Stoller

Jeff Price, Stoller

EDD Delivery

\\Condor\home\L40048\My Documents\Ground Water\BLU\0811blu-rpt.doc