Data Validation Package

July 2014
Groundwater Sampling at the Shirley Basin South, Wyoming, Disposal Site

October 2014

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Sampling Event Summary

Site: Shirley Basin South, Wyoming, Disposal Site

Sampling Period: July 30–31, 2014

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, 54-SC, and K.G.S.#3 were sampled as specified in the plan. POC well 51-SC was dry at the time of sampling. Also sampled were five of the six newer monitoring wells installed downgradient of the disposal cell in 2008 (100-SC, 102-SC, 110-DC, 112-DC, and 113-DC); downgradient well 101-SC was dry at the time of sampling. The water level was measured at each sampled well except for K.G.S.#3. A water level was not measured in K.G.S.#3 because of the possibility that the water level probe would become tangled with the dedicated pump tubing and power cable. Sampling and analyses were conducted in accordance with the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/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 in Table 1, radium-228 concentrations remain above the ACL in well 54-SC, with no apparent trend (see page 68). The former licensee attributed elevated radium-228 levels at the site to natural thorium in the uranium ore. Consequently, the elevated concentrations in the well 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	54-SC
Radium-226	**91.3 pCi/L**	129 pCi/L	----
Radium-228	**25.7 pCi/L**	----	76.8 pCi/L

ACL = alternate concentration limit
pCi/L = picocuries per liter

Radium-226 concentrations continue to exceed the ACL in downgradient well 110-DC (Table 1). There are insufficient data to definitively determine why radium-226 is elevated at well 110-DC.

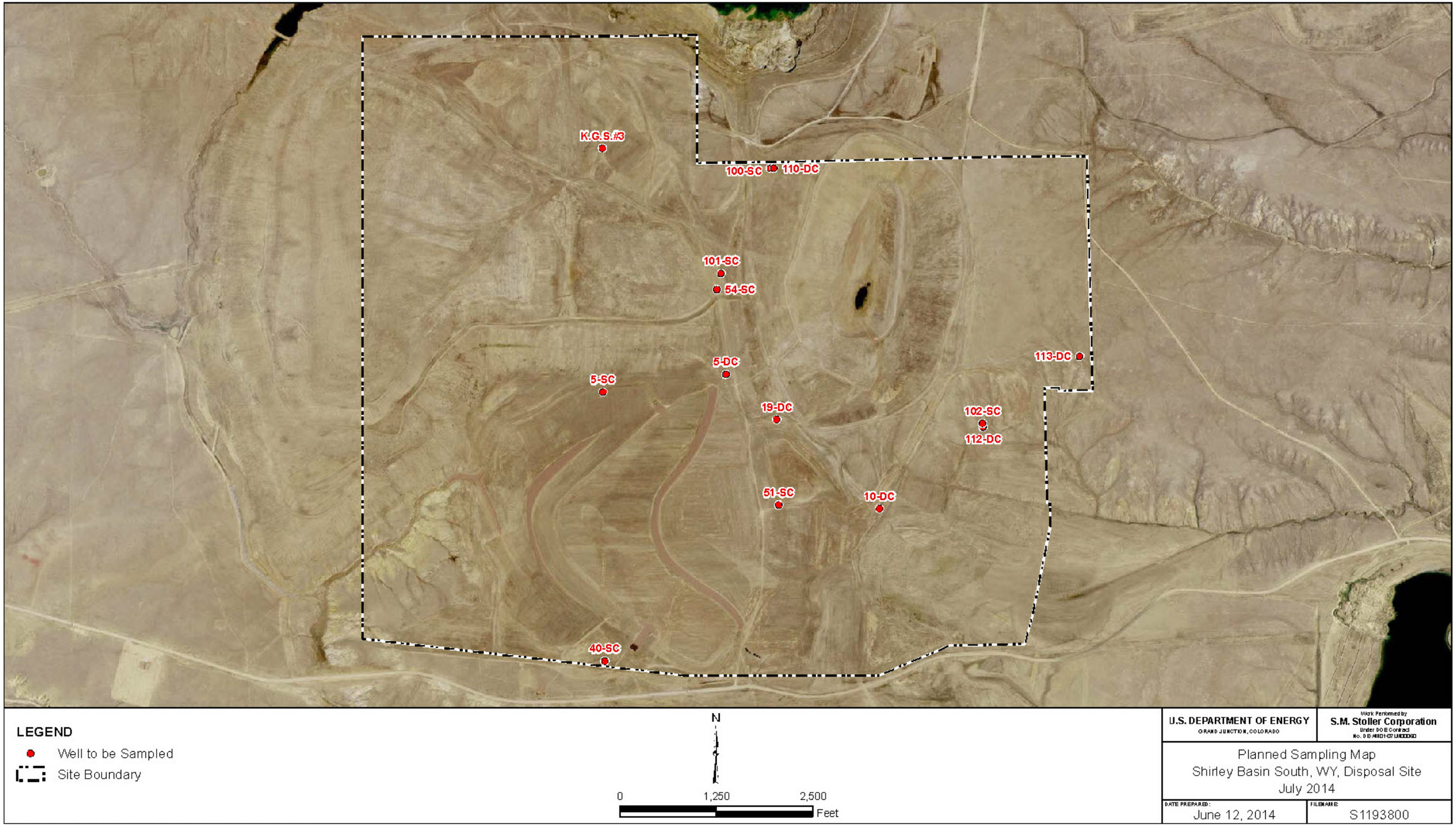
Concentrations of sulfate and total dissolved solids continue to exceed their respective Wyoming Class III groundwater protection standards for livestock use in wells 5-DC, 5-SC, and 54-SC as they have done throughout the sampling history; however, there is no livestock use of the water from these aquifers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

J.E. Price

Jeffrey Price, Site Lead
The S.M. Stoller Corporation,
a wholly owned subsidiary of
Huntington Ingalls Industries

10/27/14

Date



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	Shirley Basin South, Wyoming	**Date(s) of Water Sampling**	July 30–31, 2014
Date(s) of Verification	October 10, 2014	**Name of Verifier**	

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
List any Program Directives or other documents, SOPs, instructions.		Work Order letter dated June 23, 2014.
2. Were the sampling locations specified in the planning documents sampled?	No	Locations 51-SC and 101-SC were dry and not sampled.
3. Were calibrations conducted as specified in the above-named documents?	Yes	Calibrations were performed on July 28, 2014.
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. Were wells categorized correctly?	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 meet criteria prior to sampling?	Yes	
Was the flow rate less than 500 mL/min?	Yes	

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?	NA	There were no Category II wells.
Was one pump/tubing volume removed prior to sampling?		
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected at location K.G.S.#3.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One equipment blank was collected.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were the true identities of the QC samples documented?	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. Was all pertinent information documented on the field data sheets?	Yes	
18. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
19. Were water levels measured at the locations specified in the planning documents?	Yes	

Laboratory Performance Assessment

General Information

Report Number (RIN): 14076359
Sample Event: July 30–31, 2014
Site(s): Shirley Basin South, Wyoming
Laboratory: ALS Laboratory Group, Fort Collins, Colorado
Work Order No.: 1408074
Analysis: Metals, Inorganic, and Radiochemistry
Validator: Stephen Donivan
Review Date: October 10, 2014

This validation was performed according to the *Environmental Procedures Catalog* (LMS/POL/S04325, continually updated), "Standard Practice for Validation of Environmental 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. Analytes and MethodsTable 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	EPA 353.2	EPA 353.2
Radium-226	GPC-A-018	SOP712	SOP724
Radium-228	GPC-A-020	SOP749	SOP724
Sulfate	MIS-A-044	SW-846 9056	SW-846 9056
Thorium Isotopes	ASP-A-008	SOP776, SOP777	SOP714
Total Dissolved Solids	WCH-A-033	EPA 160.1	EPA 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
All	All	Nitrate + Nitrite as N	J	Sample preservation
All	All	Sulfate	J	Sample preservation
1408074-2	102-SC	Uranium	J	Serial dilution result

Table 3 (continued). Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
1408074-3	10-DC	Thorium-228	J	Less than the Determination Limit
1408074-4	110-DC	Thorium-228	J	Less than the Determination Limit
1408074-4	110-DC	Thorium-230	J	Less than the Determination Limit
1408074-5	112-DC	Thorium-228	J	Less than the Determination Limit
1408074-5	112-DC	Thorium-230	J	Less than the Determination Limit
1408074-6	113-DC	Thorium-228	J	Less than the Determination Limit
1408074-6	113-DC	Thorium-232	U	Less than the Decision Level Concentration
1408074-7	19-DC	Thorium-228	U	Less than the Decision Level Concentration
1408074-8	K.G.S.#3 Duplicate	Thorium-228	U	Less than the Decision Level Concentration
1408074-8	K.G.S.#3 Duplicate	Radium-226	J	Less than the Determination Limit
1408074-8	K.G.S.#3 Duplicate	Radium-228	J	Less than the Determination Limit
1408074-10	40-SC	Radium-226	J	Less than the Determination Limit
1408074-10	40-SC	Radium-228	J	Less than the Determination Limit
1408074-12	5-DC	Thorium-230	J	Less than the Determination Limit
1408074-14	K.G.S.#3	Radium-226	J	Less than the Determination Limit
1408074-14	K.G.S.#3	Thorium-230	J	Less than the Determination Limit

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received 14 water samples on August 4, 2014, accompanied a Chain of Custody form. The Chain of Custody 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 receiving documentation included copies of the air bills. The Chain of Custody form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact with the temperature inside the iced cooler at 17.6 °C, which does not comply with requirements. The sample shipment was planned for a Saturday delivery but did not arrive until the following Monday at the elevated temperature. The sample nitrate + nitrite as N and sulfate results are qualified with a "J" flag as estimated values because of the non-compliant sample preservation. 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.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is

greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

For radiochemical analytes (those measured by radiometric counting) the MDL and PQL are not applicable, and these results are evaluated using the minimum detectable concentration (MDC), Decision Level Concentration (DLC), and Determination Limit (DL). The MDC is a measure of radiochemical method performance and was calculated and reported as specified in *Quality Systems for Analytical Services*. The DLC is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, and is estimated as 3 times the one-sigma total propagated uncertainty. Results that are greater than the MDC, but less than the DLC are qualified with a "U" flag (not detected). The DL for radiochemical results is the lowest concentration that can be reliably measured, and is defined as 3 times the MDC. Results not previously "U" qualified that are less than the DL are qualified with a "J" flag as estimated values.

The reported MDLs for all metal and wet chemical analytes, and MDCs for radiochemical analytes, demonstrate compliance with contractual requirements.

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 EPA 160.1, Total Dissolved Solids
There is no initial or continuing calibration requirement associated with the determination of total dissolved solids.

Method SW-846 9056, Chloride and Sulfate
Calibrations were performed on August 4, 2014, using six 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. All calibration checks met the acceptance criteria.

Method EPA 353.2, Nitrate + Nitrite as N
Calibrations were performed on August 7, 2014, 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 MDL. Initial and continuing calibration verification checks were made at the required frequency. All calibration checks met the acceptance criteria.

Method SW-846 6010B, Chromium and Nickel
Calibrations were performed on August 26, 2014, using three calibration standards. The calibration curve correlation coefficient values were greater than 0.995. The absolute values of

the intercepts were less than or only slightly above 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency. 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 PQL, and all results were within the acceptance range.

Method SW-846 6020A, Cadmium, Lead, Selenium, and Uranium
Calibrations were performed on August 26, 2014, 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. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curve near the PQL. 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.

Radiochemical Analysis

Radium-226
Prior to analysis, 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. Efficiency calibrations were performed in July–August 2013. Daily instrument checks performed on August 29, 2014, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Radium–228
Detector efficiency calibrations were performed in May 2013. Daily instrument checks performed on September 5, 2014, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

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 with the following exception. The chemical yield for sample 19-DC is below the 30 percent lower control limit at 26.7 percent. The spectral quality was determined to be adequate for accurate quantification. 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 PQL for all analytes. 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
The method blank results were less than the DLC.

Inductively Coupled Plasma Interference Check Sample Analysis

Interference check samples 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 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical measurements, the relative error ratio (the ratio of the absolute difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. All replicate results met these criteria, demonstrating 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 MDL. All evaluated serial dilution data were acceptable with the following exception. The uranium serial dilution prepared

from sample 102-SC did not meet the acceptance criteria. The associated sample uranium result is qualified with a "J" flag as an estimated value.

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 were satisfactory.

Electronic Data Deliverable (EDD) File

The EDD file arrived on September 9, 2014. 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 that 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: 14076359 **Lab Code:** PAR **Validator:** Stephen Donivan **Validation Date:** 10/10/2014

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

# of Samples: 14 **Matrix:** WATER **Requested Analysis Completed:** Yes

Chain of Custody

Present: OK **Signed:** OK **Dated:** OK

Sample

Integrity: OK **Preservation:** OK **Temperature:** NO

Select Quality Parameters

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

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 14076359 **Lab Code:** PAR **Date Due:** 09/01/2014

Matrix: Water **Site Code:** SBS01 **Date Completed:** 09/11/2014

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	CCV	CCB								
Cadmium	ICP/MS	08/26/2014	0.0000	1.0000	OK	OK	OK	101.0	90.0	95.0	6.0	99.0		77.0
Chromium	ICP/ES	08/26/2014	0.0000	1.0000	OK	OK	OK	105.0	93.0	93.0	0.0	96.0		98.0
Lead	ICP/MS	08/26/2014	0.0000	1.0000	OK	OK	OK	96.0	95.0	94.0	0.0	101.0		118.0
Nickel	ICP/ES	08/26/2014	0.0000	1.0000	OK	OK	OK	103.0	94.0	94.0	0.0	96.0		100.0
Selenium	ICP/MS	08/26/2014	0.0000	1.0000	OK	OK	OK	108.0	107.0	108.0	1.0	100.0		90.0
Uranium	ICP/MS	08/26/2014	0.0000	1.0000	OK	OK	OK	93.0	102.0	105.0	2.0	105.0	14.0	100.0

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 14076359 **Lab Code:** PAR **Date Due:** 09/01/2014

Matrix: Water **Site Code:** SBS01 **Date Completed:** 09/11/2014

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
10-DC	Radium-226	08/29/2014			98.3			
Blank_Spike	Radium-226	08/29/2014			99.3	103.00		
Blank	Radium-226	08/29/2014	0.0600	U	99.1			
110-DC	Radium-226	08/29/2014			97.5			
100-SC	Radium-226	08/29/2014			96.8			
112-DC	Radium-226	08/29/2014			100.0			
113-DC	Radium-226	08/29/2014			96.1			
K.G.S.#3	Radium-226	08/29/2014			95.1			
40-SC	Radium-226	08/29/2014			99.4			
54-SC	Radium-226	08/29/2014			92.5			
102-SC	Radium-226	08/29/2014			97.5			
2658	Radium-226	08/29/2014			101.0			
19-DC	Radium-226	08/29/2014			97.9			
Blank_Spike_Du	Radium-226	08/29/2014			97.6	101.00		0.10
5-DC	Radium-226	08/29/2014			95.4			
2174	Radium-226	08/29/2014			93.4			
5-SC	Radium-226	08/29/2014			99.4			
110-DC	Radium-228	09/05/2014			99.8			
54-SC	Radium-228	09/05/2014			93.9			
112-DC	Radium-228	09/05/2014			99.3			
10-DC	Radium-228	09/05/2014			103.0			
5-SC	Radium-228	09/05/2014			102.0			
Blank	Radium-228	09/05/2014	0.0800	U	97.6			
102-SC	Radium-228	09/05/2014			99.5			
2658	Radium-228	09/05/2014			98.3			
113-DC	Radium-228	09/05/2014			99.1			
19-DC	Radium-228	09/05/2014			100.0			
Blank_Spike	Radium-228	09/05/2014			98.4	104.00		
2174	Radium-228	09/05/2014			96.3			
5-DC	Radium-228	09/05/2014			97.6			
100-SC	Radium-228	09/05/2014			102.0			
40-SC	Radium-228	09/05/2014			99.4			

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 14076359 **Lab Code:** PAR **Date Due:** 09/01/2014

Matrix: Water **Site Code:** SBS01 **Date Completed:** 09/11/2014

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
K.G.S.#3	Radium-228	09/05/2014			95.8			
Blank_Spike_Du	Radium-228	09/05/2014			102.0	88.00		0.90
Blank	Thorium-228	08/21/2014	0.0100	U	85.0			
102-SC	Thorium-228	08/21/2014			85.8			0.28
100-SC	Thorium-228	08/21/2014			57.8			
10-DC	Thorium-228	08/21/2014			43.8			
102-SC	Thorium-228	08/21/2014			56.9			
110-DC	Thorium-228	09/04/2014			62.9			
113-DC	Thorium-228	09/04/2014			76.0			
2174	Thorium-228	09/04/2014			85.0			
2658	Thorium-228	09/04/2014			74.9			
40-SC	Thorium-228	09/04/2014			53.6			
5-DC	Thorium-228	09/04/2014			44.1			
112-DC	Thorium-228	09/04/2014			64.5			
5-SC	Thorium-228	09/04/2014			70.1			
K.G.S.#3	Thorium-228	09/04/2014			86.1			
54-SC	Thorium-228	09/04/2014			66.2			
19-DC	Thorium-228	09/04/2014			26.7			
Blank	Thorium-228	09/04/2014	0.0200	U	86.2			
54-SC	Thorium-228	09/04/2014			57.1			0.22
Blank	Thorium-230	08/21/2014	0.0650	U				
102-SC	Thorium-230	08/21/2014						1.01
Blank_Spike	Thorium-230	08/21/2014			85.1	95.30		
Blank	Thorium-230	09/04/2014	-0.0020	U				
Blank_Spike	Thorium-230	09/04/2014			44.2	107.00		
54-SC	Thorium-230	09/04/2014						1.22
Blank	Thorium-232	08/21/2014	0	U				
102-SC	Thorium-232	08/21/2014						0.14
54-SC	Thorium-232	09/04/2014						1.13
Blank	Thorium-232	09/04/2014	0.0020	U				

SAMPLE MANAGEMENT SYSTEM

Wet Chemistry Data Validation Worksheet

RIN: 14076359 **Lab Code:** PAR **Date Due:** 09/01/2014

Matrix: Water **Site Code:** SBS01 **Date Completed:** 09/11/2014

Analyte	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	CCV	CCB						
CHLORIDE	08/18/2014	0.000	1.0000	OK	OK	OK	96.00	95.0	96.0	1.00	
Nitrate+Nitrite as N	08/07/2014	0.000	1.0000	OK	OK	OK	104.00	111.0	108.0	3.00	
SULFATE	08/18/2014	0.000	0.9998	OK	OK	OK	93.00	97.0	97.0	0	
TOTAL DISSOLVED SOLIDS	08/06/2014				OK		98.00			2.00	
TOTAL DISSOLVED SOLIDS	08/06/2014									0	

Sampling Quality Control Assessment

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

Sampling Protocol

With the exception of well K.G.S.#3, all wells were classified as Category I and sampled using the low-flow technique. The sample results from these wells are qualified with an "F" flag indicating the low-flow sampling technique. Well K.G.S.#3 was sampled from the intake pipe at the top of the storage tank; this location was considered to be a category IV well.

Equipment Blank Assessment

Equipment blanks are prepared and analyzed to document contamination attributable to the sample collection process. One equipment blank was collected during this event. Sulfate was detected in this equipment blank. The sulfate concentration in the associated sample was much greater than the blank concentration, not requiring qualification.

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 location K.G.S.#3. For non-radiochemical measurements, the relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical measurements, the relative error ratio (the ratio of the absolute difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. The duplicate results met the criteria, demonstrating acceptable overall precision.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Equipment/Trip Blanks

RIN: 14076359 **Lab Code:** PAR **Project:** Shirley Basin South **Validation Date:** 10/10/2014

Blank Data

Blank Type	Lab Sample ID	Lab Method	Analyte Name	Result	Qualifier	MDL	Units
Equipment Blank	1408074-9	SW9056	SULFATE	0.53		0.5	MG/L

Sample ID	Sample Ticket	Location	Result	Dilution Factor	Lab Qualifier	Validation Qualifier
1408074-14	MIZ 766	K.G.S.#3	230	10		

SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 14076359 **Lab Code:** PAR **Project:** Shirley Basin South **Validation Date:** 10/10/2014

Duplicate: 2174 **Sample:** K.G.S.#3

Analyte	Sample Result	Sample Flag	Sample Error	Sample Dilution	Duplicate Result	Duplicate Flag	Duplicate Error	Duplicate Dilution	RPD	RER	Units
Cadmium	0.12	U		10	0.12	U		10			UG/L
CHLORIDE	4.2			10	4.1			10			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	0.93	U		1	0.93	U		1			UG/L
Nitrate+Nitrite as N	0.021			1	0.026			1			MG/L
Radium-226	0.368		0.207	1	0.363		0.209	1		0	pCi/L
Radium-228	1.2		0.391	1	1.04		0.362	1		0.6	pCi/L
Selenium	0.032	U		1	0.032	U		1			UG/L
SULFATE	230			10	220			10	4.44		MG/L
Thorium-228	0.0349	U	0.036	1	0.0557		0.0381	1		0.8	pCi/L
Thorium-230	0.219		0.108	1	-0.0689	U	0.0821	1		4.2	pCi/L
Thorium-232	0.00337	U	0.0165	1	-0.0107	U	0.0176	1		1.1	pCi/L
TOTAL DISSOLVED SOLIDS	500			1	500			1	0		MG/L
Uranium	0.2			10	0.23			10	13.95		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: Stephen Donivan — Stephen Donivan — 10-24-2014 — Date

Data Validation Lead: Stephen Donivan — Stephen Donivan — 10-24-2014 — 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 can result from transcription errors, data-coding errors, or measurement system problems. However, outliers can also represent true extreme values of a distribution and can 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.** Do this by generating the Outliers Report using the Sample Management System from data in the environmental database. The application compares the new data set (in standard environmental database units) with historical data and lists the new data that fall outside the historical data range. A determination is also made as to whether the data are normally distributed using the Shapiro-Wilk Test.
2. **Apply the appropriate statistical test.** Dixon's Test for extreme values 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.** The review should include an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values.

Two laboratory results were identified as potential outliers. The data associated with these results were further reviewed. There were no errors noted and the laboratory data are acceptable as qualified.

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Data Validation Outliers Report - No Field Parameters
Comparison: All historical Data Beginning 01/01/2004
Laboratory: ALS Laboratory Group
RIN: 14076359
Report Date: 10/13/2014

					Current			Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
						Qualifiers			Qualifiers			Qualifiers				
Site Code	Location Code	Sample ID	Sample Date	Analyte	Result	Lab	Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect	
SBS01	100-SC	N001	07/30/2014	Nickel	0.00110	B	F	0.0140	B	FQ	0.00220	B	FQJ	6	0	No
SBS01	100-SC	N001	07/30/2014	Selenium	0.0001		F	0.0230		FQ	0.00013		JFQ	6	0	NA
SBS01	110-DC	N001	07/30/2014	Lead	0.00079		F	0.00980		F	0.00083		JF	8	0	No
SBS01	110-DC	N001	07/30/2014	Thorium-230	1.62		FJ	0.900	U	F	0.0463	U	F	10	10	Yes
SBS01	112-DC	N001	07/30/2014	Chloride	45.0		F	190		F	49.0		FQ	6	0	NA
SBS01	112-DC	N001	07/30/2014	Nickel	0.00260	B	F	0.00190	B	F	0.00093	U	F	6	4	No
SBS01	113-DC	N001	07/30/2014	Thorium-232	0.0417		F	0.240	U	F	0.0620	U	F	6	6	No
SBS01	40-SC	N001	07/30/2014	Nickel	0.00093	U	F	0.0200	B	F	0.00480	B	F	17	0	No
SBS01	54-SC	N001	07/30/2014	Cadmium	0.00091		F	0.0540		F	0.00120		F	10	0	NA
SBS01	54-SC	N001	07/30/2014	Chromium	0.380		F	0.330		F	0.140		F	10	0	No
SBS01	54-SC	N001	07/30/2014	Nickel	1.90		F	3.50		F	2.40		F	10	0	No
SBS01	54-SC	N001	07/30/2014	Radium-226	11.8		F	23.3		F	12.5		F	10	0	No
SBS01	54-SC	N001	07/30/2014	Selenium	0.0850		F	0.0590		F	0.00014		UF	10	2	NA
SBS01	54-SC	N001	07/30/2014	Thorium-230	7.47		F	6.07		F	2.40		F	10	0	NA
SBS01	54-SC	N001	07/30/2014	Uranium	0.0210		F	0.0820		F	0.0400		F	10	0	No
SBS01	5-DC	N001	07/30/2014	Nickel	1.40		F	1.20		F	0.240		F	10	0	No
SBS01	5-DC	N001	07/30/2014	Radium-228	12.9		F	55.4		F	15.8		FJ	11	0	No

Data Validation Outliers Report - No Field Parameters
Comparison: All historical Data Beginning 01/01/2004
Laboratory: ALS Laboratory Group
RIN: 14076359
Report Date: 10/13/2014

					Current	Qualifiers		Historical Maximum	Qualifiers		Historical Minimum	Qualifiers		Number of Data Points		Statistical Outlier
Site Code	Location Code	Sample ID	Sample Date	Analyte	Result	*Lab*	*Data*	Result	*Lab*	*Data*	Result	*Lab*	*Data*	N	N Below Detect	
SBS01	5-DC	N001	07/30/2014	Sulfate	8400		FJ	7800		F	3600		F	10	0	No
SBS01	5-DC	N001	07/30/2014	Total Dissolved Solids	13000		F	12000		F	5100		F	10	0	No
SBS01	5-DC	N001	07/30/2014	Uranium	0.230		F	0.150		F	0.00460		F	10	0	Yes
SBS01	5-SC	0001	07/30/2014	Selenium	0.120		F	0.0980		F	0.0190		F	11	0	No
SBS01	5-SC	0001	07/30/2014	Total Dissolved Solids	17000		F	20000		F	18000		F	11	0	NA
SBS01	K.G.S.#3	N002	07/30/2014	Chloride	4.10			24.0			4.50			9	0	No
SBS01	K.G.S.#3	N001	07/30/2014	Chloride	4.20			24.0			4.50			9	0	No
SBS01	K.G.S.#3	N002	07/30/2014	Uranium	0.00023			0.00022			0.00001	B	F	9	1	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.

NA: Data are not normally or lognormally distributed.

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: 10/13/2014
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	07/30/2014	N001	180.8	-	220.8	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	180.8	-	220.8	56		F	#	4	
Chromium	mg/L	07/30/2014	N001	180.8	-	220.8	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	180.8	-	220.8	0.0011		F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	180.8	-	220.8	0.00093	U	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	180.8	-	220.8	0.01	U	FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	180.8	-	220.8	-38.1		F	#		
pH	s.u.	07/30/2014	N001	180.8	-	220.8	6.7		F	#		
Radium-226	pCi/L	07/30/2014	N001	180.8	-	220.8	13.9		F	#	0.16	3.63
Radium-228	pCi/L	07/30/2014	N001	180.8	-	220.8	4.11		F	#	0.33	1.02
Selenium	mg/L	07/30/2014	N001	180.8	-	220.8	0.000039	B	F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	180.8	-	220.8	2142		F	#		
Sulfate	mg/L	07/30/2014	N001	180.8	-	220.8	990		FJ	#	10	
Temperature	C	07/30/2014	N001	180.8	-	220.8	10.12		F	#		
Thorium-228	pCi/L	07/30/2014	N001	180.8	-	220.8	0.25		FJ	#	0.23	0.16
Thorium-230	pCi/L	07/30/2014	N001	180.8	-	220.8	0.24	U	F	#	0.24	0.139
Thorium-232	pCi/L	07/30/2014	N001	180.8	-	220.8	0.02	U	F	#	0.02	0.0364
Total Dissolved Solids	mg/L	07/30/2014	N001	180.8	-	220.8	1900		F	#	40	
Turbidity	NTU	07/30/2014	N001	180.8	-	220.8	8.9		F	#		
Uranium	mg/L	07/30/2014	N001	180.8	-	220.8	0.017		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	N001	210	-	225	0.00019	B	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	210	-	225	160		F	#	4	
Chromium	mg/L	07/30/2014	N001	210	-	225	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	210	-	225	0.00009	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	210	-	225	0.0011	B	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	210	-	225	0.02		FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	210	-	225	59.6		F	#		
pH	s.u.	07/30/2014	N001	210	-	225	6.99		F	#		
Radium-226	pCi/L	07/30/2014	N001	210	-	225	4.1		F	#	0.15	1.17
Radium-228	pCi/L	07/30/2014	N001	210	-	225	3.98		F	#	0.31	0.983
Selenium	mg/L	07/30/2014	N001	210	-	225	0.0001		F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	210	-	225	2454		F	#		
Sulfate	mg/L	07/30/2014	N001	210	-	225	1100		FJ	#	10	
Temperature	C	07/30/2014	N001	210	-	225	10.21		F	#		
Thorium-228	pCi/L	07/30/2014	N001	210	-	225	0.18	U	F	#	0.18	0.114
Thorium-230	pCi/L	07/30/2014	N001	210	-	225	0.21	U	F	#	0.21	0.116
Thorium-232	pCi/L	07/30/2014	N001	210	-	225	0.076	U	F	#	0.076	0.0416
Total Dissolved Solids	mg/L	07/30/2014	N001	210	-	225	2100		F	#	40	
Turbidity	NTU	07/30/2014	N001	210	-	225	1.46		F	#		
Uranium	mg/L	07/30/2014	N001	210	-	225	0.0028		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	0001	168.5	-	183.5	0.00026	B	F	#	0.00012	
Chloride	mg/L	07/30/2014	0001	168.5	-	183.5	180		F	#	4	
Chromium	mg/L	07/30/2014	0001	168.5	-	183.5	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	0001	168.5	-	183.5	0.00007	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	0001	168.5	-	183.5	0.00093	U	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	0001	168.5	-	183.5	0.49		FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	168.5	-	183.5	93.9		F	#		
pH	s.u.	07/30/2014	N001	168.5	-	183.5	7.5		F	#		
Radium-226	pCi/L	07/30/2014	0001	168.5	-	183.5	1.82		F	#	0.19	0.594
Radium-228	pCi/L	07/30/2014	0001	168.5	-	183.5	1.85		F	#	0.33	0.514
Selenium	mg/L	07/30/2014	0001	168.5	-	183.5	0.00019		F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	168.5	-	183.5	1831		F	#		
Sulfate	mg/L	07/30/2014	0001	168.5	-	183.5	600		FJ	#	10	
Temperature	C	07/30/2014	N001	168.5	-	183.5	10.7		F	#		
Thorium-228	pCi/L	07/30/2014	0001	168.5	-	183.5	0.21	U	F	#	0.21	0.116
Thorium-230	pCi/L	07/30/2014	0001	168.5	-	183.5	0.21	U	F	#	0.21	0.12
Thorium-232	pCi/L	07/30/2014	0001	168.5	-	183.5	0.069	U	F	#	0.069	0.0436
Total Dissolved Solids	mg/L	07/30/2014	0001	168.5	-	183.5	1400		F	#	40	
Turbidity	NTU	07/30/2014	N001	168.5	-	183.5	329		F	#		
Uranium	mg/L	07/30/2014	0001	168.5	-	183.5	0.01	E	FJ	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: 110-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	07/30/2014	N001	255	-	305	0.00012	B	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	255	-	305	210		F	#	10	
Chromium	mg/L	07/30/2014	N001	255	-	305	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	255	-	305	0.00079		F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	255	-	305	0.00093	U	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	255	-	305	0.011		FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	255	-	305	-18.1		F	#		
pH	s.u.	07/30/2014	N001	255	-	305	6.45		F	#		
Radium-226	pCi/L	07/30/2014	N001	255	-	305	129		F	#	0.17	32.4
Radium-228	pCi/L	07/30/2014	N001	255	-	305	6.31		F	#	0.32	1.51
Selenium	mg/L	07/30/2014	N001	255	-	305	0.000066	B	F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	255	-	305	3691		F	#		
Sulfate	mg/L	07/30/2014	N001	255	-	305	1800		FJ	#	25	
Temperature	C	07/30/2014	N001	255	-	305	10.6		F	#		
Thorium-228	pCi/L	07/30/2014	N001	255	-	305	0.451		FJ	#	0.31	0.265
Thorium-230	pCi/L	07/30/2014	N001	255	-	305	1.62		FJ	#	0.88	0.678
Thorium-232	pCi/L	07/30/2014	N001	255	-	305	0.3	U	F	#	0.3	0.208
Total Dissolved Solids	mg/L	07/30/2014	N001	255	-	305	3500		F	#	40	
Turbidity	NTU	07/30/2014	N001	255	-	305	6.68		F	#		
Uranium	mg/L	07/30/2014	N001	255	-	305	0.012		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	N001	203	-	253	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	203	-	253	45		F	#	4	
Chromium	mg/L	07/30/2014	N001	203	-	253	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	203	-	253	0.00038	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	203	-	253	0.0026	B	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	203	-	253	0.01	U	FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	203	-	253	10.4		F	#		
pH	s.u.	07/30/2014	N001	203	-	253	7.14		F	#		
Radium-226	pCi/L	07/30/2014	N001	203	-	253	14.1		F	#	0.17	3.68
Radium-228	pCi/L	07/30/2014	N001	203	-	253	3.77		F	#	0.33	0.939
Selenium	mg/L	07/30/2014	N001	203	-	253	0.000044	B	F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	203	-	253	2256		F	#		
Sulfate	mg/L	07/30/2014	N001	203	-	253	1100		FJ	#	10	
Temperature	C	07/30/2014	N001	203	-	253	10.28		F	#		
Thorium-228	pCi/L	07/30/2014	N001	203	-	253	0.232		FJ	#	0.083	0.0864
Thorium-230	pCi/L	07/30/2014	N001	203	-	253	0.272		FJ	#	0.17	0.128
Thorium-232	pCi/L	07/30/2014	N001	203	-	253	0.049	U	F	#	0.049	0.0224
Total Dissolved Solids	mg/L	07/30/2014	N001	203	-	253	1900		F	#	40	
Turbidity	NTU	07/30/2014	N001	203	-	253	2.6		F	#		
Uranium	mg/L	07/30/2014	N001	203	-	253	0.06		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: 113-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	07/30/2014	N001	235	-	285	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	235	-	285	7.2		F	#	4	
Chromium	mg/L	07/30/2014	N001	235	-	285	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	235	-	285	0.0002	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	235	-	285	0.00093	U	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	235	-	285	0.01	U	FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	235	-	285	-121		F	#		
pH	s.u.	07/30/2014	N001	235	-	285	7.52		F	#		
Radium-226	pCi/L	07/30/2014	N001	235	-	285	3.37		F	#	0.2	1
Radium-228	pCi/L	07/30/2014	N001	235	-	285	2.81		F	#	0.36	0.732
Selenium	mg/L	07/30/2014	N001	235	-	285	0.000032	U	F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	235	-	285	1531		F	#		
Sulfate	mg/L	07/30/2014	N001	235	-	285	590		FJ	#	10	
Temperature	C	07/30/2014	N001	235	-	285	10.26		F	#		
Thorium-228	pCi/L	07/30/2014	N001	235	-	285	0.208		FJ	#	0.074	0.076
Thorium-230	pCi/L	07/30/2014	N001	235	-	285	0.16	U	F	#	0.16	0.0898
Thorium-232	pCi/L	07/30/2014	N001	235	-	285	0.0417		F	#	0.028	0.0281
Total Dissolved Solids	mg/L	07/30/2014	N001	235	-	285	1100		F	#	40	
Turbidity	NTU	07/30/2014	N001	235	-	285	1.9		F	#		
Uranium	mg/L	07/30/2014	N001	235	-	285	0.0012		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	0001	177	-	237	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	0001	177	-	237	64		F	#	10	
Chromium	mg/L	07/30/2014	0001	177	-	237	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	0001	177	-	237	0.000068	U	F	#	0.000068	
Nickel	mg/L	07/30/2014	0001	177	-	237	0.24		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	0001	177	-	237	0.01	U	FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	177	-	237	-66.2		F	#		
pH	s.u.	07/30/2014	N001	177	-	237	6.47		F	#		
Radium-226	pCi/L	07/30/2014	0001	177	-	237	6.36		F	#	0.18	1.74
Radium-228	pCi/L	07/30/2014	0001	177	-	237	5.32		F	#	0.34	1.29
Selenium	mg/L	07/30/2014	0001	177	-	237	0.000032	U	F	#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	177	-	237	3450		F	#		
Sulfate	mg/L	07/30/2014	0001	177	-	237	2100		FJ	#	25	
Temperature	C	07/30/2014	N001	177	-	237	9.83		F	#		
Thorium-228	pCi/L	07/30/2014	0001	177	-	237	0.257		UF	#	0.25	0.177
Thorium-230	pCi/L	07/30/2014	0001	177	-	237	0.29	U	F	#	0.29	0.186
Thorium-232	pCi/L	07/30/2014	0001	177	-	237	0.12	U	F	#	0.12	0.0596
Total Dissolved Solids	mg/L	07/30/2014	0001	177	-	237	3300		F	#	80	
Turbidity	NTU	07/30/2014	N001	177	-	237	18.2		F	#		
Uranium	mg/L	07/30/2014	0001	177	-	237	0.0018		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	N001	-	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	-	34		F	#	4	
Chromium	mg/L	07/30/2014	N001	-	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	-	0.000068	U	F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	-	0.00093	U	F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	-	0.87		FJ	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	-	56.2		F	#		
pH	s.u.	07/30/2014	N001	-	6.24		F	#		
Radium-226	pCi/L	07/30/2014	N001	-	0.479		FJ	#	0.17	0.236
Radium-228	pCi/L	07/30/2014	N001	-	0.718		FJ	#	0.35	0.294
Selenium	mg/L	07/30/2014	N001	-	0.0042		F	#	0.00032	
Specific Conductance	umhos /cm	07/30/2014	N001	-	2596		F	#		
Sulfate	mg/L	07/30/2014	N001	-	1500		FJ	#	10	
Temperature	C	07/30/2014	N001	-	9.44		F	#		
Thorium-228	pCi/L	07/30/2014	N001	-	0.1	U	F	#	0.1	0.0623
Thorium-230	pCi/L	07/30/2014	N001	-	0.19	U	F	#	0.19	0.12
Thorium-232	pCi/L	07/30/2014	N001	-	0.05	U	F	#	0.05	0.0263
Total Dissolved Solids	mg/L	07/30/2014	N001	-	2400		F	#	40	
Turbidity	NTU	07/30/2014	N001	-	1.43		F	#		
Uranium	mg/L	07/30/2014	N001	-	0.00021		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: 5-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	07/30/2014	N001	-	0.00012	U	F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	-	220		F	#	20	
Chromium	mg/L	07/30/2014	N001	-	0.00051	U	F	#	0.00051	
Lead	mg/L	07/30/2014	N001	-	0.00039	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	-	1.4		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	-	0.1	U	FJ	#	0.1	
Oxidation Reduction Potential	mV	07/30/2014	N001	-	129.2		F	#		
pH	s.u.	07/30/2014	N001	-	4.67		F	#		
Radium-226	pCi/L	07/30/2014	N001	-	4.39		F	#	0.17	1.25
Radium-228	pCi/L	07/30/2014	N001	-	12.9		F	#	0.35	3.03
Selenium	mg/L	07/30/2014	N001	-	0.018		F	#	0.00032	
Specific Conductance	umhos /cm	07/30/2014	N001	-	9867		F	#		
Sulfate	mg/L	07/30/2014	N001	-	8400		FJ	#	50	
Temperature	C	07/30/2014	N001	-	9.1		F	#		
Thorium-228	pCi/L	07/30/2014	N001	-	2.09		F	#	0.14	0.412
Thorium-230	pCi/L	07/30/2014	N001	-	0.504		FJ	#	0.22	0.185
Thorium-232	pCi/L	07/30/2014	N001	-	0.363		F	#	0.049	0.115
Total Dissolved Solids	mg/L	07/30/2014	N001	-	13000		F	#	200	
Turbidity	NTU	07/30/2014	N001	-	6.16		F	#		
Uranium	mg/L	07/30/2014	N001	-	0.23		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
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	07/30/2014	0001	49.3	-	57.7	0.036		F	#	0.00012	
Chloride	mg/L	07/30/2014	0001	49.3	-	57.7	320		F	#	20	
Chromium	mg/L	07/30/2014	0001	49.3	-	57.7	0.25		F	#	0.00051	
Lead	mg/L	07/30/2014	0001	49.3	-	57.7	0.00014	B	F	#	0.000068	
Nickel	mg/L	07/30/2014	0001	49.3	-	57.7	2.6		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	0001	49.3	-	57.7	0.1	U	FJ	#	0.1	
Oxidation Reduction Potential	mV	07/30/2014	N001	49.3	-	57.7	300.2		F	#		
pH	s.u.	07/30/2014	N001	49.3	-	57.7	3.24		F	#		
Radium-226	pCi/L	07/30/2014	0001	49.3	-	57.7	4.99		F	#	0.17	1.4
Radium-228	pCi/L	07/30/2014	0001	49.3	-	57.7	2.61		F	#	0.34	0.681
Selenium	mg/L	07/30/2014	0001	49.3	-	57.7	0.12		F	#	0.00032	
Specific Conductance	umhos /cm	07/30/2014	N001	49.3	-	57.7	11427		F	#		
Sulfate	mg/L	07/30/2014	0001	49.3	-	57.7	12000		FJ	#	100	
Temperature	C	07/30/2014	N001	49.3	-	57.7	9.79		F	#		
Thorium-228	pCi/L	07/30/2014	0001	49.3	-	57.7	49		F	#	0.77	8.07
Thorium-230	pCi/L	07/30/2014	0001	49.3	-	57.7	411		F	#	1.7	63.7
Thorium-232	pCi/L	07/30/2014	0001	49.3	-	57.7	12.4		F	#	0.31	2.4
Total Dissolved Solids	mg/L	07/30/2014	0001	49.3	-	57.7	17000		F	#	200	
Turbidity	NTU	07/30/2014	N001	49.3	-	57.7	29.2		F	#		
Uranium	mg/L	07/30/2014	0001	49.3	-	57.7	3.2		F	#	0.00058	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: 54-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	07/30/2014	N001	-	0.00091		F	#	0.00012	
Chloride	mg/L	07/30/2014	N001	-	360		F	#	20	
Chromium	mg/L	07/30/2014	N001	-	0.38		F	#	0.00051	
Lead	mg/L	07/30/2014	N001	-	0.00054		F	#	0.000068	
Nickel	mg/L	07/30/2014	N001	-	1.9		F	#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	-	0.1	U	FJ	#	0.1	
Oxidation Reduction Potential	mV	07/30/2014	N001	-	225.7		F	#		
pH	s.u.	07/30/2014	N001	-	4.01		F	#		
Radium-226	pCi/L	07/30/2014	N001	-	11.8		F	#	0.18	3.11
Radium-228	pCi/L	07/30/2014	N001	-	76.8		F	#	0.37	17.7
Selenium	mg/L	07/30/2014	N001	-	0.085		F	#	0.00032	
Specific Conductance	umhos /cm	07/30/2014	N001	-	9319		F	#		
Sulfate	mg/L	07/30/2014	N001	-	8300		FJ	#	50	
Temperature	C	07/30/2014	N001	-	11		F	#		
Thorium-228	pCi/L	07/30/2014	N001	-	9.79		F	#	0.4	1.79
Thorium-230	pCi/L	07/30/2014	N001	-	7.47		F	#	0.88	1.49
Thorium-232	pCi/L	07/30/2014	N001	-	6.81		F	#	0.2	1.31
Total Dissolved Solids	mg/L	07/30/2014	N001	-	12000		F	#	200	
Turbidity	NTU	07/30/2014	N001	-	5.81		F	#		
Uranium	mg/L	07/30/2014	N001	-	0.021		F	#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: K.G.S.#3 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Cadmium	mg/L	07/30/2014	N001	420 - 450	0.00012	U		#	0.00012	
Cadmium	mg/L	07/30/2014	N002	420 - 450	0.00012	U		#	0.00012	
Chloride	mg/L	07/30/2014	N001	420 - 450	4.2			#	2	
Chloride	mg/L	07/30/2014	N002	420 - 450	4.1			#	2	
Chromium	mg/L	07/30/2014	N001	420 - 450	0.00051	U		#	0.00051	
Chromium	mg/L	07/30/2014	N002	420 - 450	0.00051	U		#	0.00051	
Lead	mg/L	07/30/2014	N001	420 - 450	0.000068	U		#	0.000068	
Lead	mg/L	07/30/2014	N002	420 - 450	0.000068	U		#	0.000068	
Nickel	mg/L	07/30/2014	N001	420 - 450	0.00093	U		#	0.00093	
Nickel	mg/L	07/30/2014	N002	420 - 450	0.00093	U		#	0.00093	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N001	420 - 450	0.021		J	#	0.01	
Nitrate + Nitrite as Nitrogen	mg/L	07/30/2014	N002	420 - 450	0.026		J	#	0.01	
Oxidation Reduction Potential	mV	07/30/2014	N001	420 - 450	28.6			#		
pH	s.u.	07/30/2014	N001	420 - 450	6.96			#		
Radium-226	pCi/L	07/30/2014	N001	420 - 450	0.368		J	#	0.17	0.207
Radium-226	pCi/L	07/30/2014	N002	420 - 450	0.363		J	#	0.19	0.209
Radium-228	pCi/L	07/30/2014	N001	420 - 450	1.2			#	0.36	0.391
Radium-228	pCi/L	07/30/2014	N002	420 - 450	1.04		J	#	0.37	0.362
Selenium	mg/L	07/30/2014	N001	420 - 450	0.000032	U		#	0.000032	

Groundwater Quality Data by Location (USEE100) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014
Location: K.G.S.#3 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Selenium	mg/L	07/30/2014	N002	420 - 450	0.000032	U		#	0.000032	
Specific Conductance	umhos /cm	07/30/2014	N001	420 - 450	866			#		
Sulfate	mg/L	07/30/2014	N001	420 - 450	230		J	#	5	
Sulfate	mg/L	07/30/2014	N002	420 - 450	220		J	#	5	
Temperature	C	07/30/2014	N001	420 - 450	19.14			#		
Thorium-228	pCi/L	07/30/2014	N001	420 - 450	0.055	U		#	0.055	0.036
Thorium-228	pCi/L	07/30/2014	N002	420 - 450	0.0557		U	#	0.049	0.0381
Thorium-230	pCi/L	07/30/2014	N001	420 - 450	0.219		J	#	0.15	0.108
Thorium-230	pCi/L	07/30/2014	N002	420 - 450	0.15	U		#	0.15	0.0821
Thorium-232	pCi/L	07/30/2014	N001	420 - 450	0.031	U		#	0.031	0.0165
Thorium-232	pCi/L	07/30/2014	N002	420 - 450	0.043	U		#	0.043	0.0176
Total Dissolved Solids	mg/L	07/30/2014	N001	420 - 450	500			#	20	
Total Dissolved Solids	mg/L	07/30/2014	N002	420 - 450	500			#	20	
Turbidity	NTU	07/30/2014	N001	420 - 450	1.46			#		
Uranium	mg/L	07/30/2014	N001	420 - 450	0.0002			#	0.000029	
Uranium	mg/L	07/30/2014	N002	420 - 450	0.00023			#	0.000029	

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.

Equipment Blank Data

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BLANKS REPORT

LAB: PARAGON/ALS LABORATORY GROUP (Fort Collins, CO)
RIN: 14076359
Report Date: 10/13/2014

Parameter	Site Code	Location ID	Sample Date	Sample ID	Units	Result	Qualifiers Lab	Qualifiers Data	Detection Limit	Uncertainty	Sample Type
Cadmium	SBS01	0999	07/31/2014	N001	mg/L	0.00012	U		0.00012		E
Chloride	SBS01	0999	07/31/2014	N001	mg/L	0.2	U		0.2		E
Chromium	SBS01	0999	07/31/2014	N001	mg/L	0.00051	U		0.00051		E
Lead	SBS01	0999	07/31/2014	N001	mg/L	0.000068	U		0.000068		E
Nickel	SBS01	0999	07/31/2014	N001	mg/L	0.00093	U		0.00093		E
Nitrate + Nitrite as Nitrogen	SBS01	0999	07/31/2014	N001	mg/L	0.01	U	J	0.01		E
Radium-226	SBS01	0999	07/31/2014	N001	pCi/L	0.16	U		0.16	0.0836	E
Radium-228	SBS01	0999	07/31/2014	N001	pCi/L	0.35	U		0.35	0.196	E
Selenium	SBS01	0999	07/31/2014	N001	mg/L	0.000032	U		0.000032		E
Sulfate	SBS01	0999	07/31/2014	N001	mg/L	0.53		J	0.5		E
Thorium-228	SBS01	0999	07/31/2014	N001	pCi/L	0.081	U		0.081	0.0423	E
Thorium-230	SBS01	0999	07/31/2014	N001	pCi/L	0.16	U		0.16	0.0898	E
Thorium-232	SBS01	0999	07/31/2014	N001	pCi/L	0.03	U		0.03	0.0196	E
Total Dissolved Solids	SBS01	0999	07/31/2014	N001	mg/L	20	U		20		E
Uranium	SBS01	0999	07/31/2014	N001	mg/L	0.000029	U		0.000029		E

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.		

SAMPLE TYPES:

E	Equipment Blank.

Static Water Level Data

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STATIC WATER LEVELS (USEE700) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 10/13/2014

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		7113.1	07/30/2014	13:27:22	167.63	6945.47	
100-SC		7153.56	07/30/2014	13:25:08	209.88	6943.68	
101-SC		7168.35	07/30/2014	15:52:00			D
102-SC		7126.74	07/30/2014	17:55:49	179.98	6946.76	
110-DC		7153.92	07/30/2014	14:05:16	207.22	6946.7	
112-DC		7125.62	07/30/2014	14:31:44	179.93	6945.69	
113-DC		7135.93	07/30/2014	15:50:25	188.68	6947.25	
19-DC		7112.1	07/30/2014	12:17:12	181.4	6930.7	
40-SC		7058.3	07/30/2014	15:40:05	9.19	7049.11	
5-DC		7119.94	07/30/2014	10:45:13	188.7	6931.24	
5-SC		7053.31	07/30/2014	10:30:45	57.25	6996.06	
51-SC		7092.6	07/30/2014	15:51:00			D
54-SC		7158.74	07/30/2014	12:05:01	208.8	6949.94	

FLOW CODES: B BACKGROUND C CROSS GRADIENT D DOWN GRADIENT F OFFSITE
N UNKNOWN O ONSITE U UPGRADIENT

WATER LEVEL FLAGS: D Dry F Flowing B Below top of pump

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Time-Concentration Graphs

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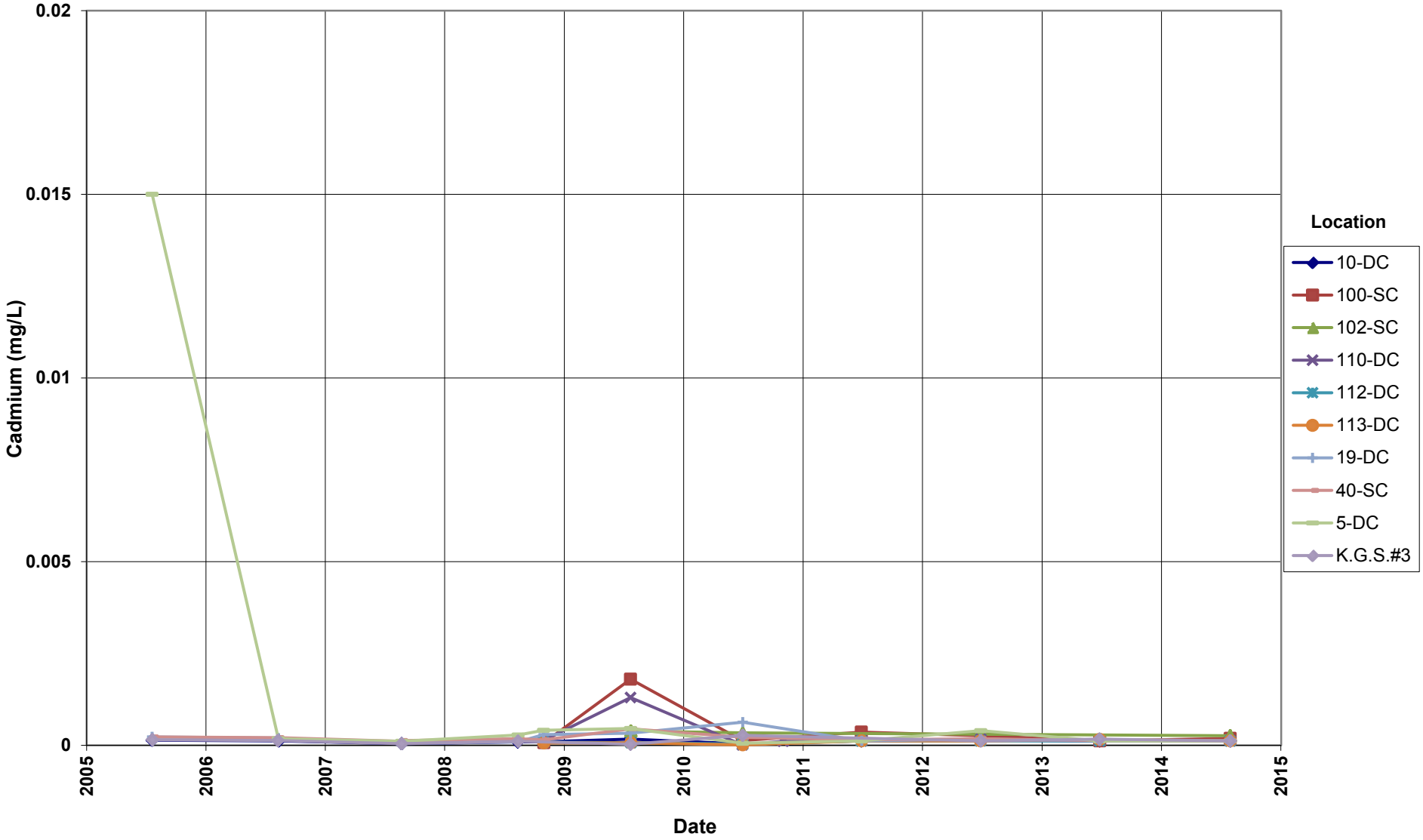
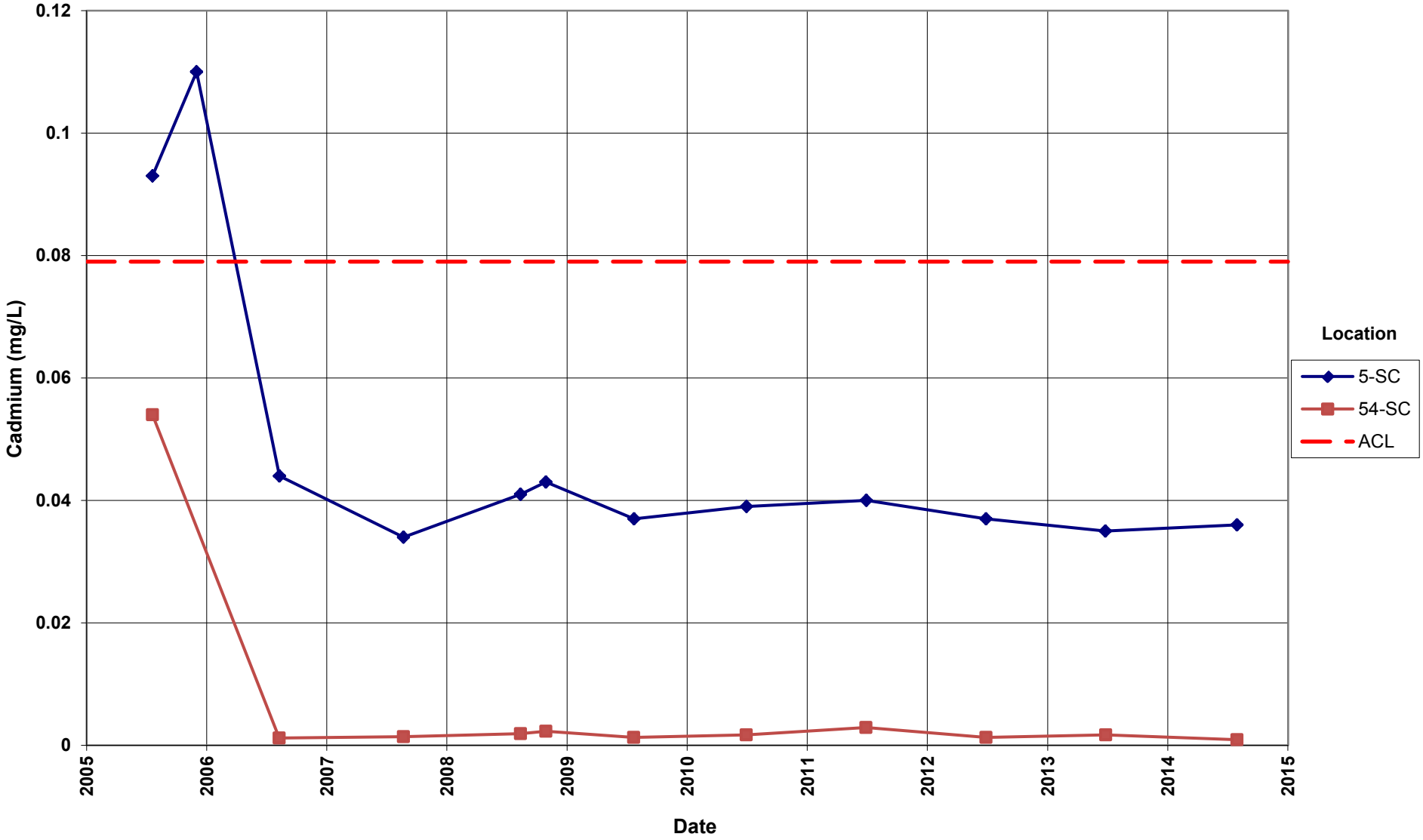
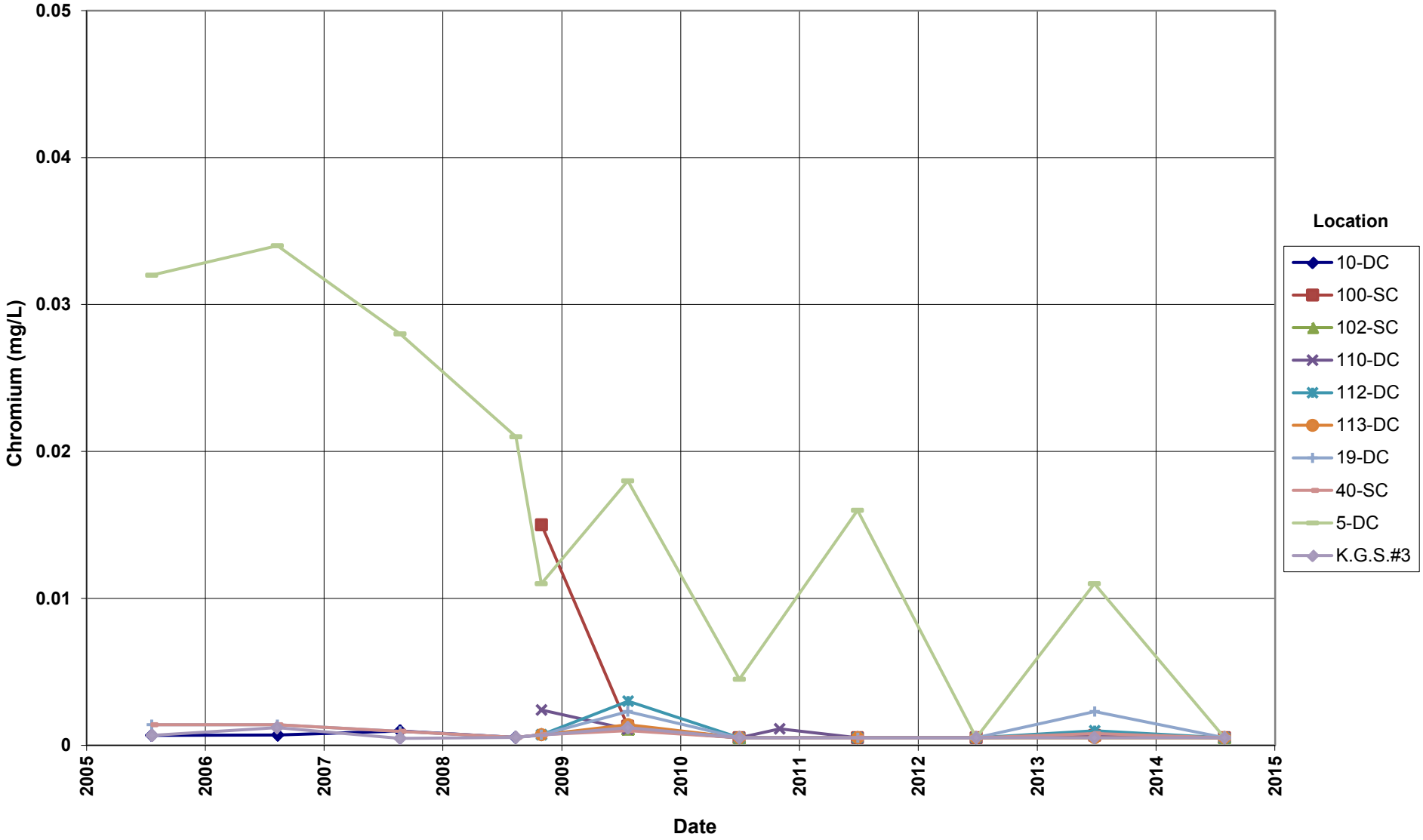
Shirley Basin South Disposal Site
Cadmium Concentration
Alternate Concentration Limit (ACL) = 0.079 mg/L



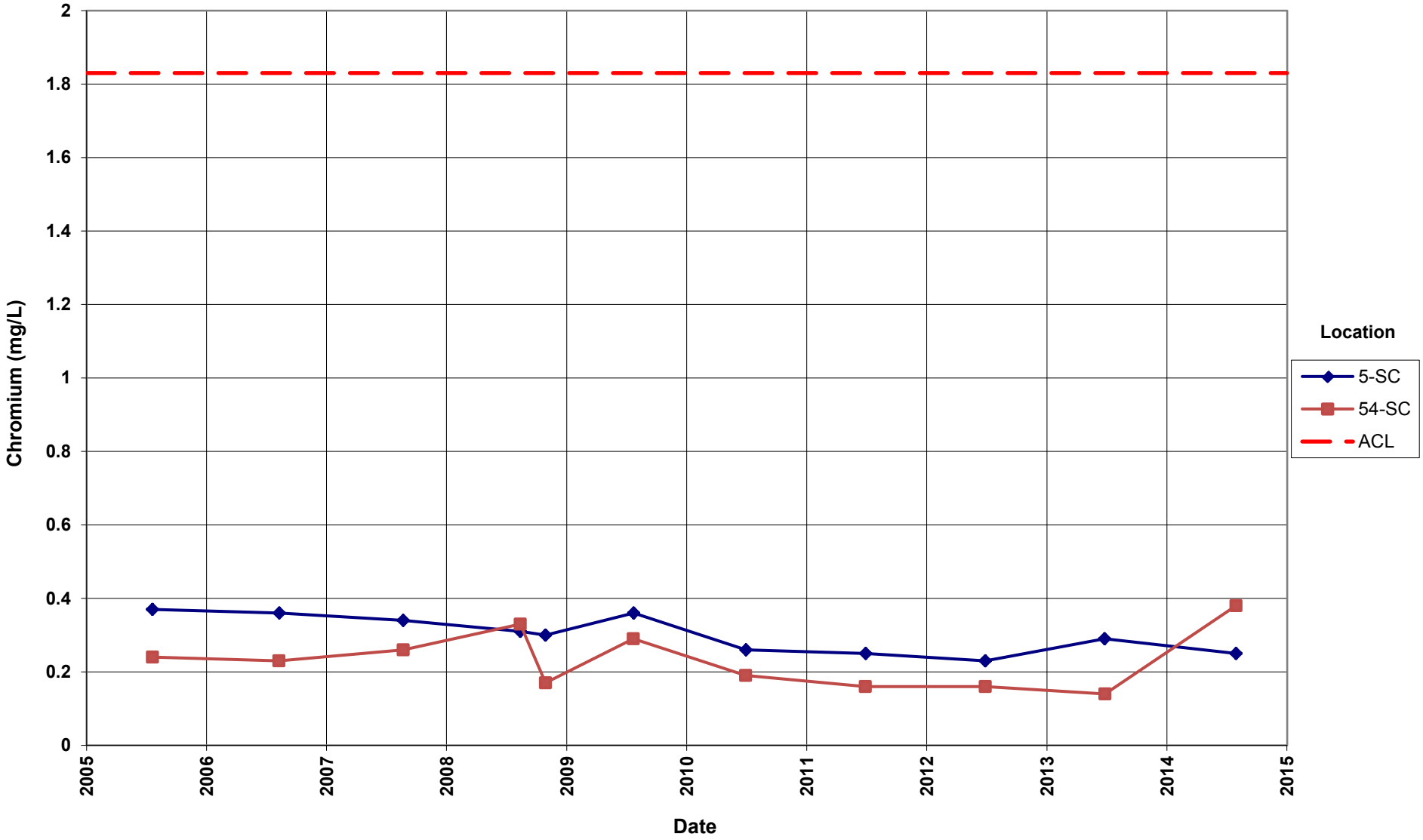
Shirley Basin South Disposal Site
Cadmium Concentration
Alternate Concentration Limit (ACL) = 0.079 mg/L



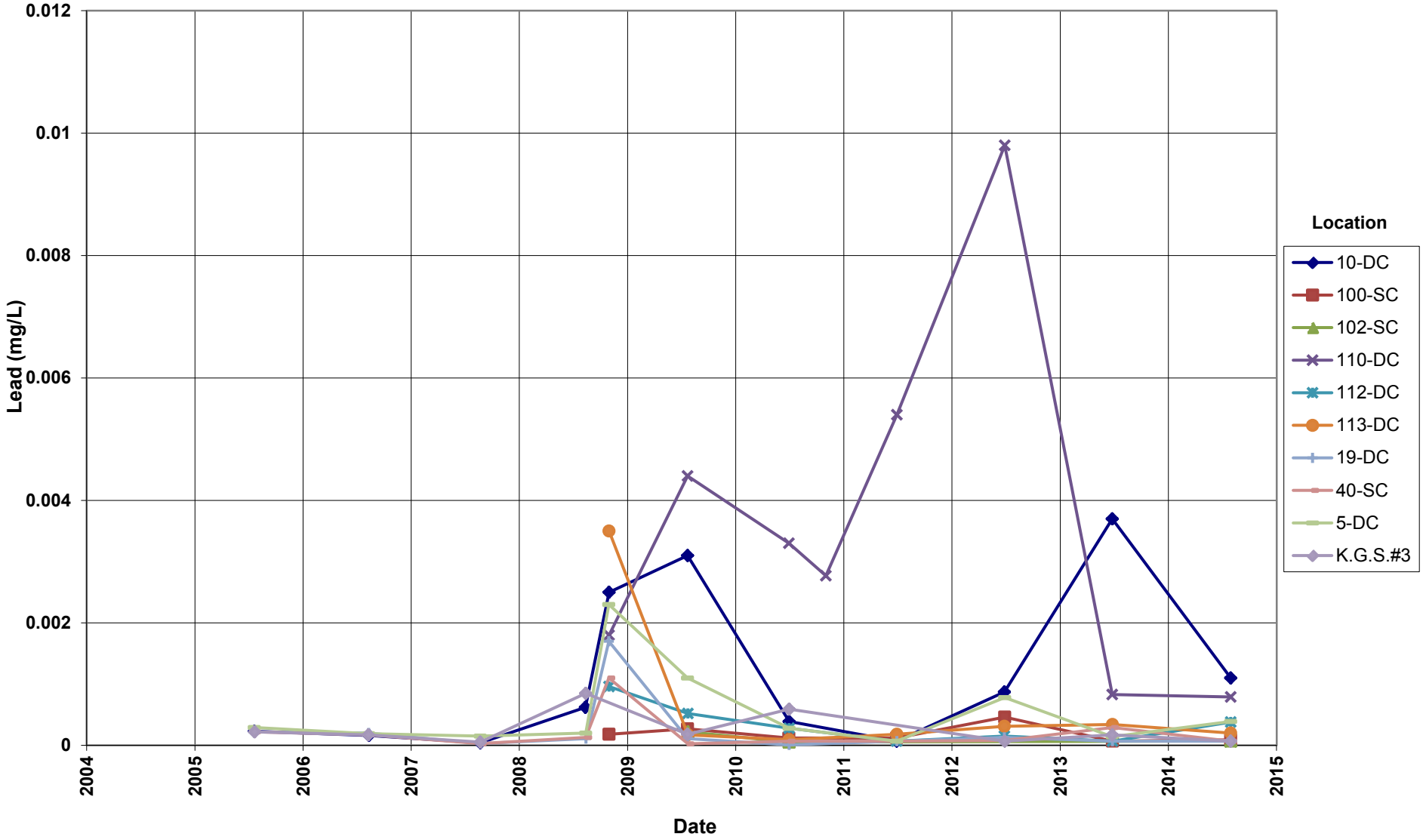
Shirley Basin South Disposal Site
Chromium Concentration
Alternate Concentration Limit (ACL) = 1.83 mg/L



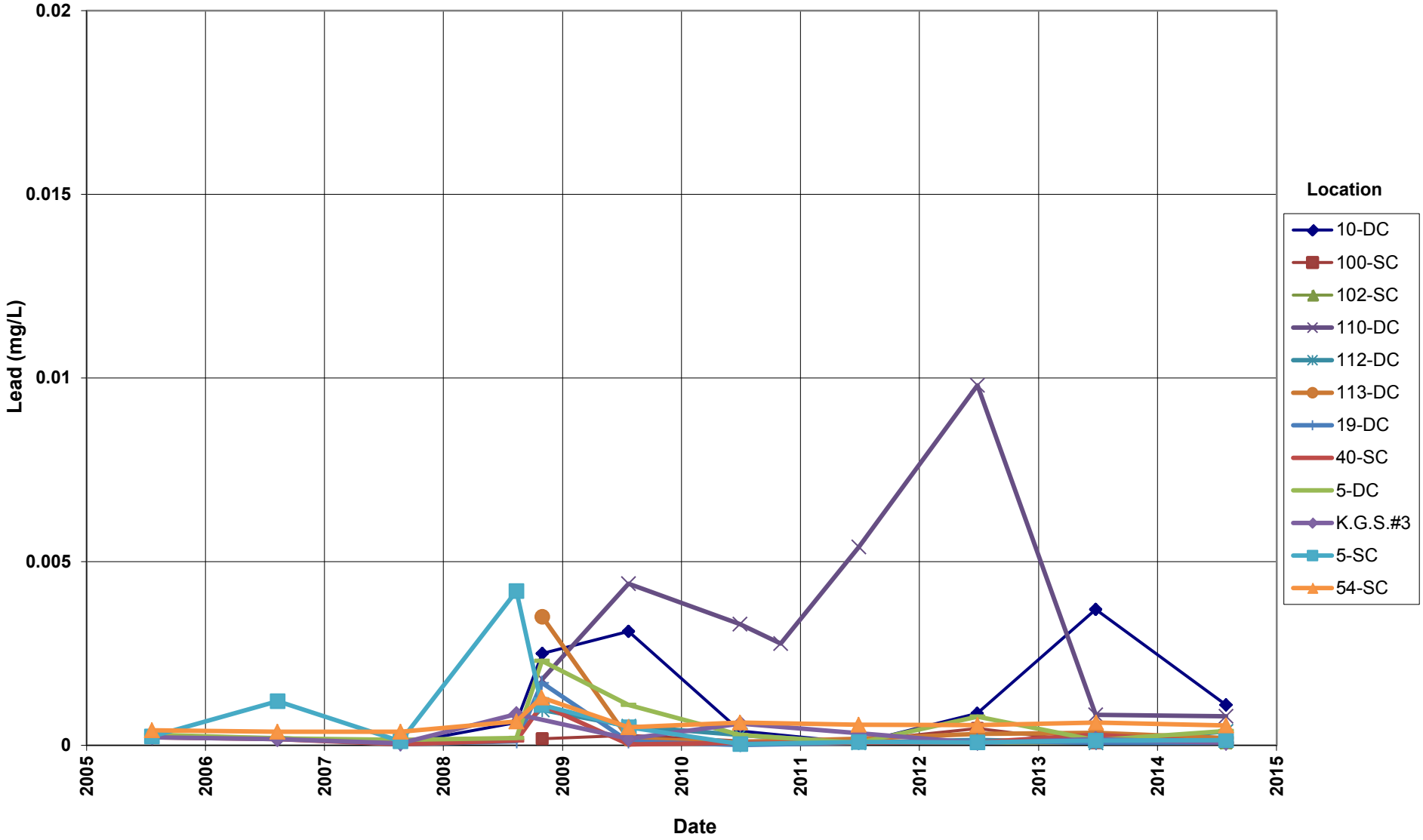
Shirley Basin South Disposal Site
Chromium Concentration
Alternate Concentration Limit (ACL) = 1.83 mg/L



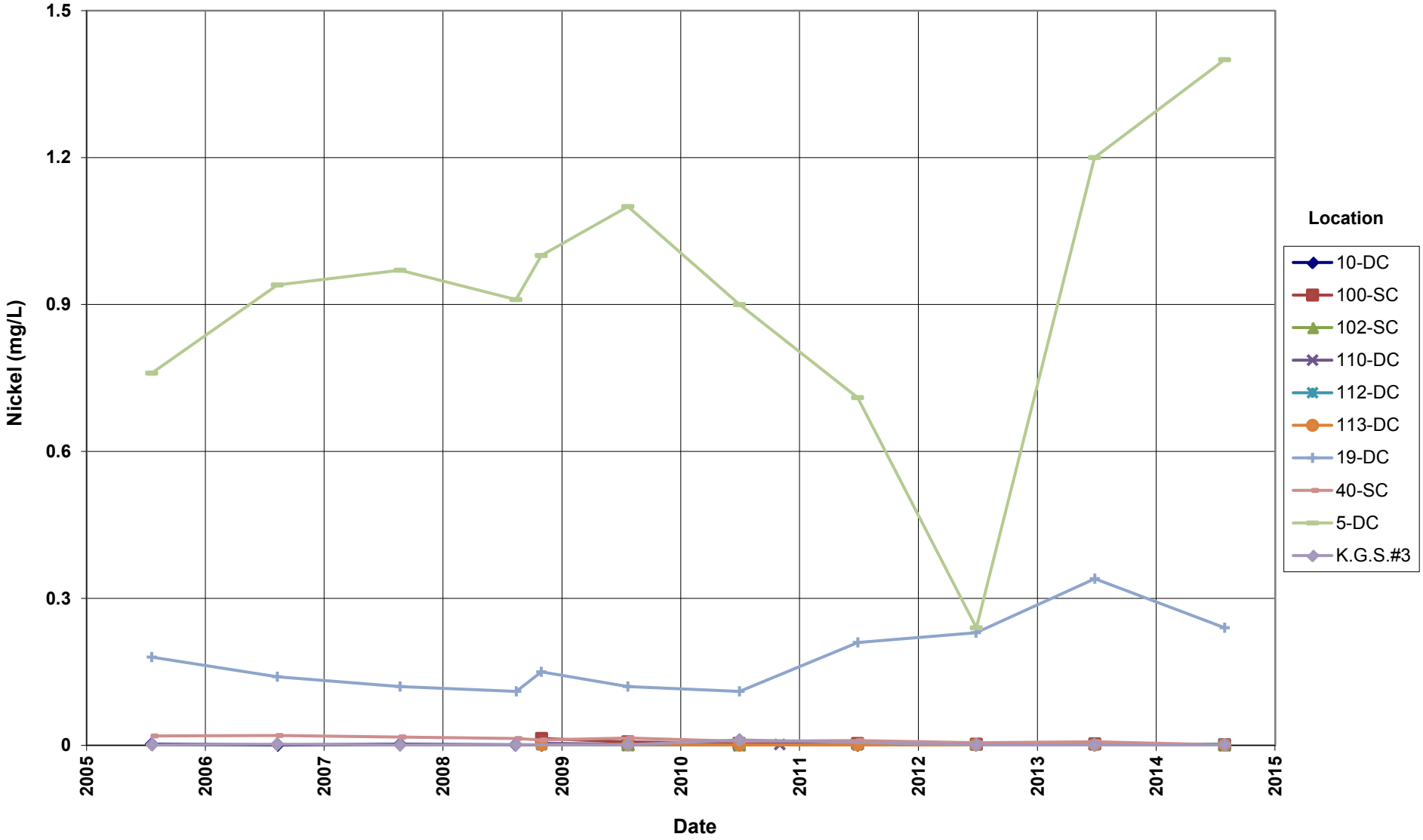
Shirley Basin South Disposal Site
Lead Concentration
Alternate Concentration Limit (ACL) = 0.05 mg/L



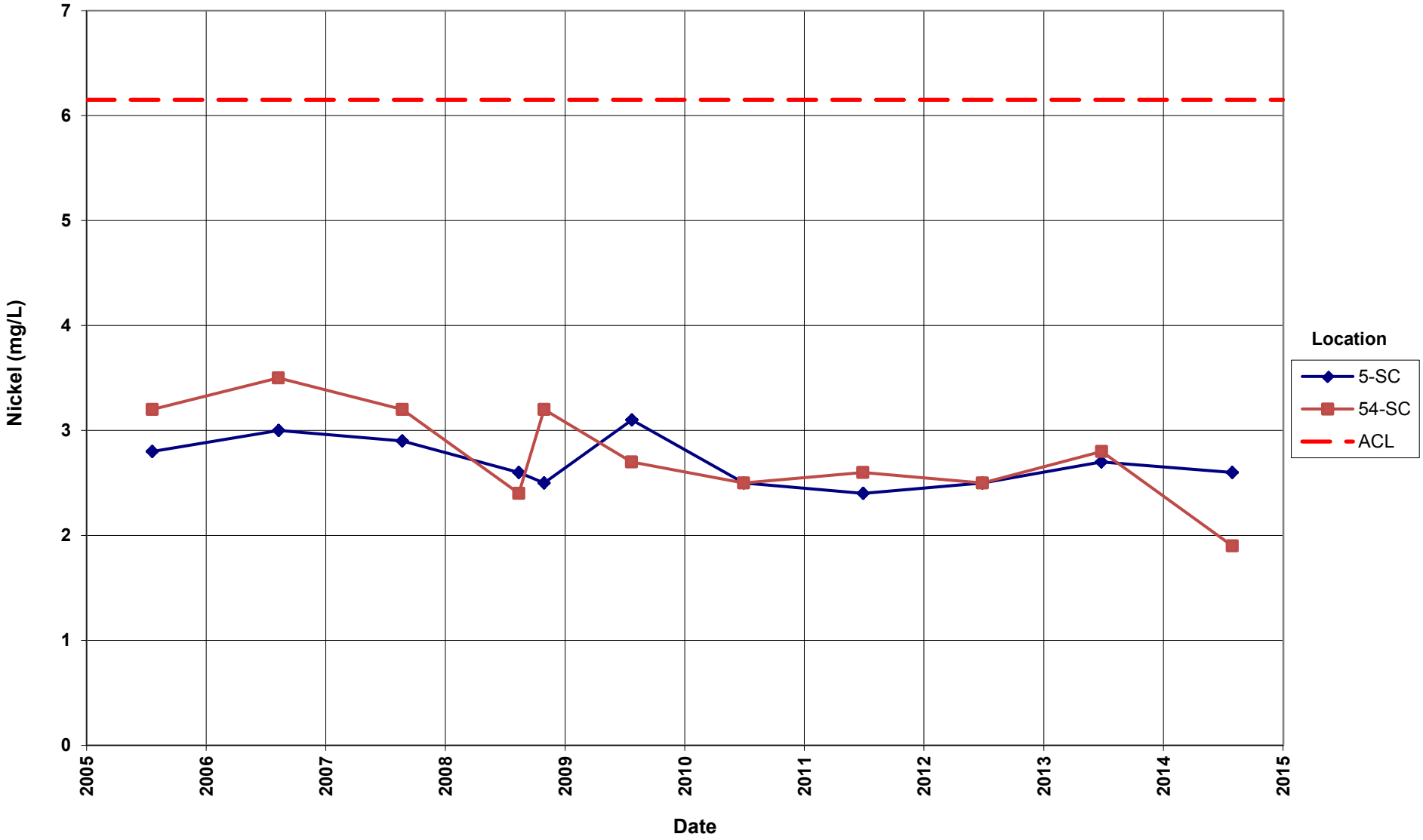
Shirley Basin South Disposal Site
Lead Concentration
Alternate Concentration Limit (ACL) = 0.05 mg/L



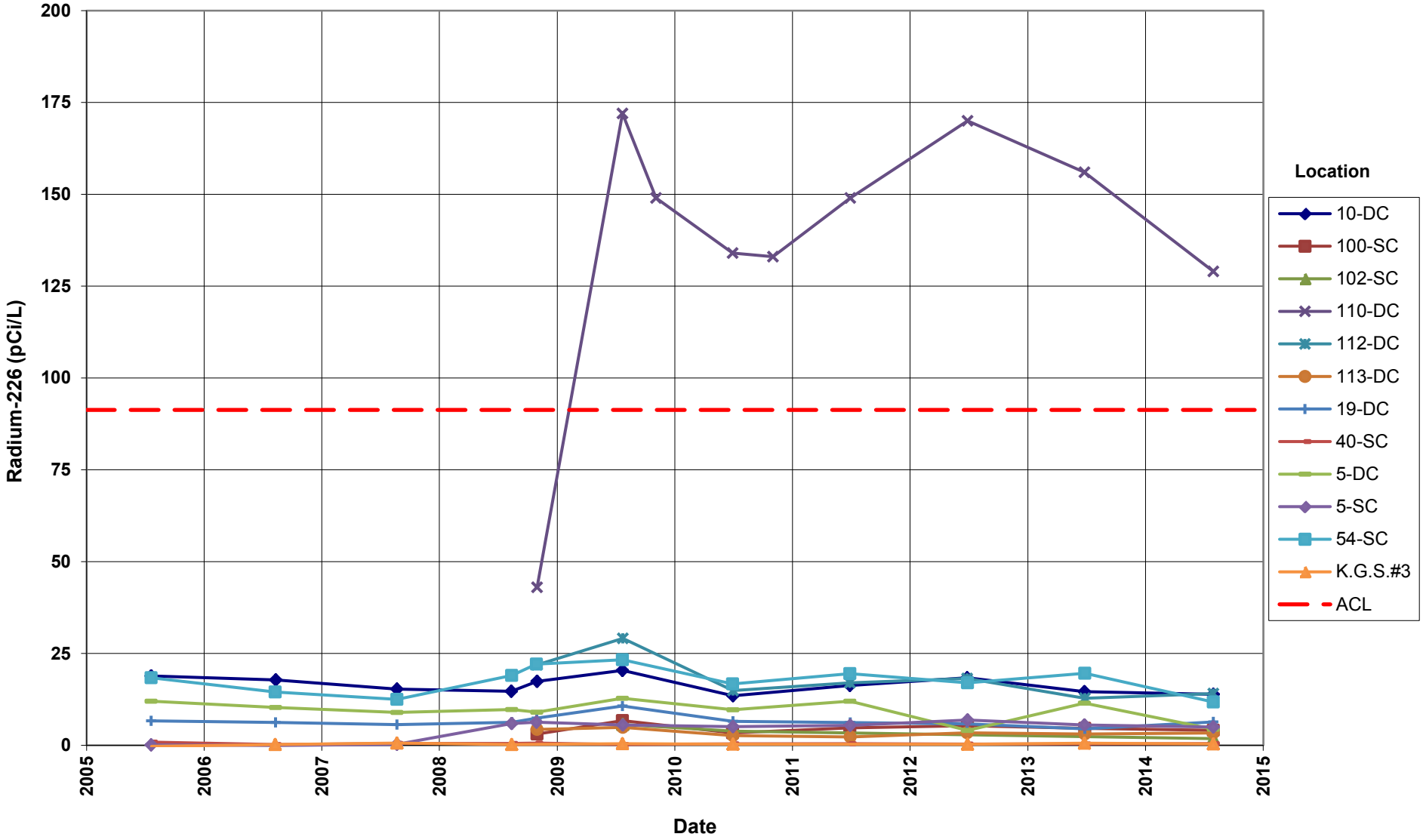
Shirley Basin South Disposal Site
Nickel Concentration
Alternate Concentration Limit (ACL) = 6.15 mg/L



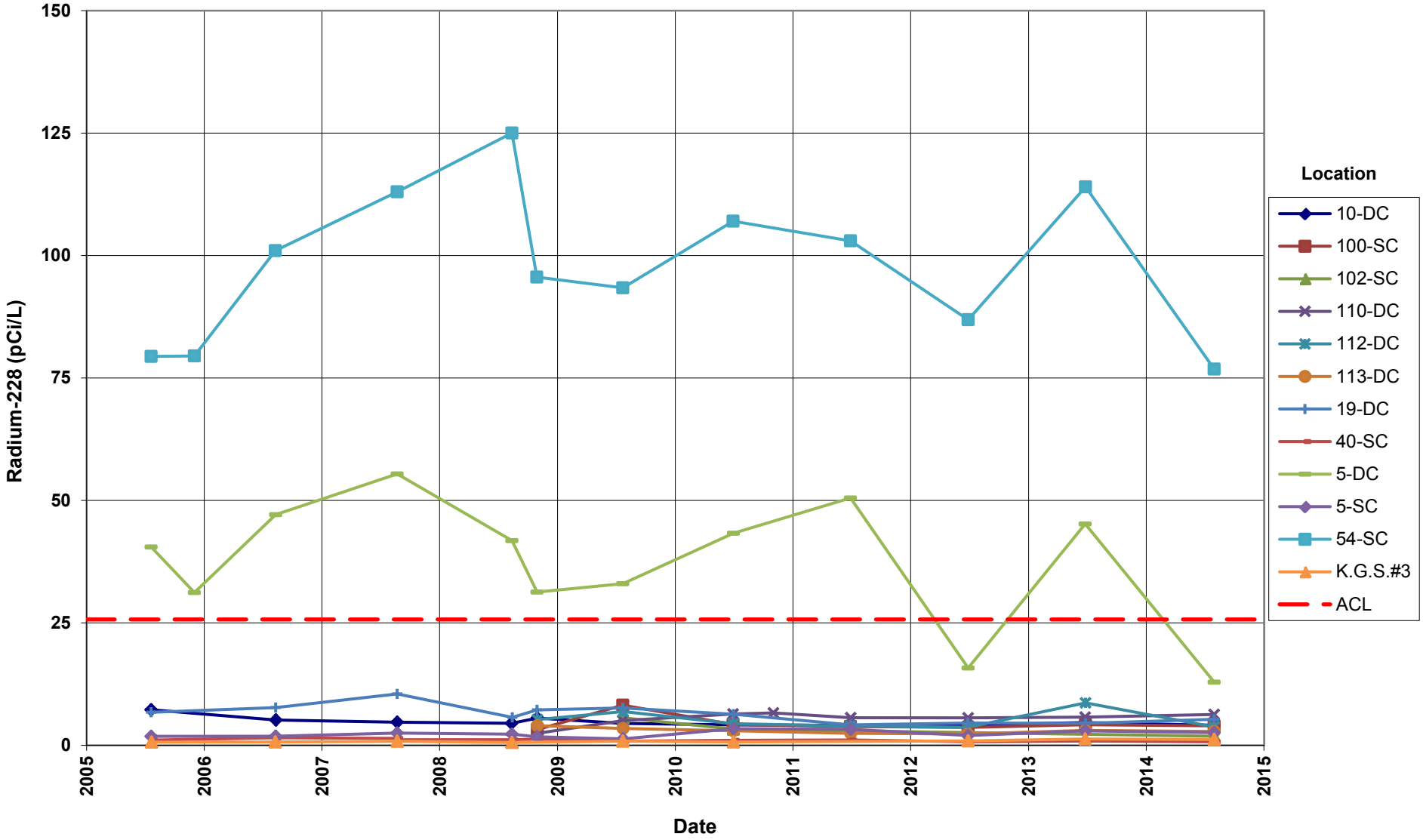
Shirley Basin South Disposal Site
Nickel Concentration
Alternate Concentration Limit (ACL) = 6.15 mg/L



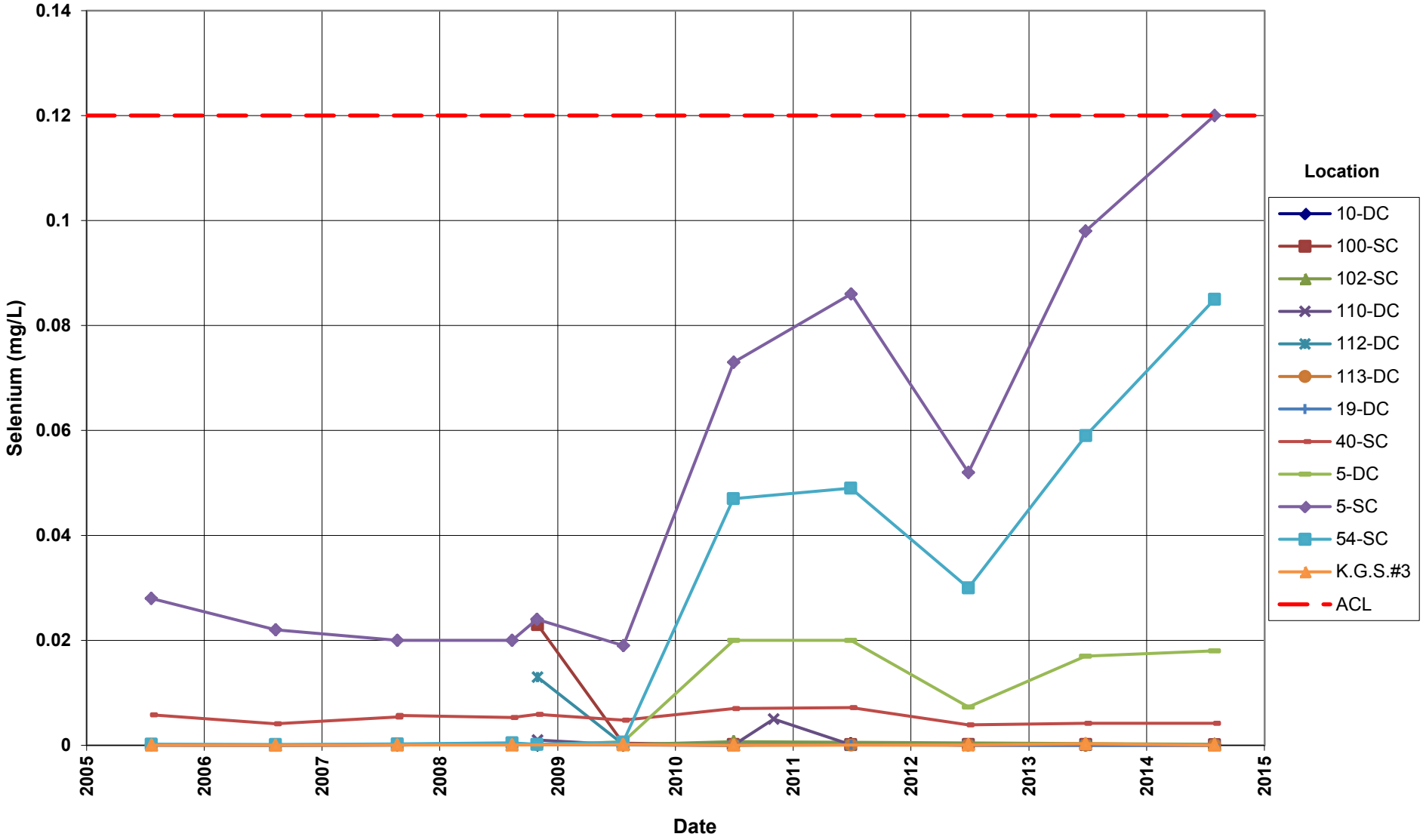
Shirley Basin South Disposal Site
Radium-226 Concentration
Alternate Concentration Limit (ACL) = 91.3 pCi/L



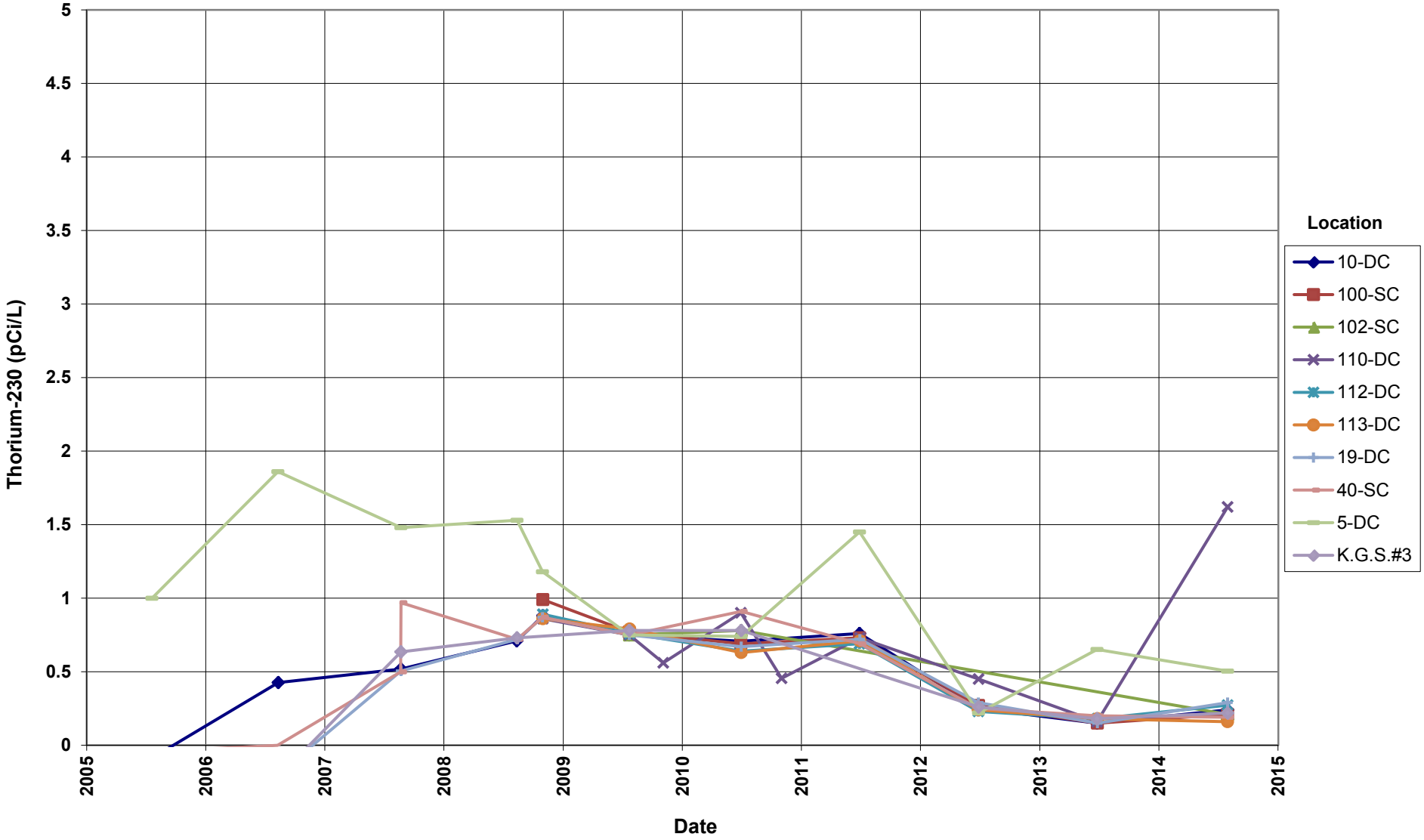
Shirley Basin South Disposal Site
Radium-228 Concentration
Alternate Concentration Limit (ACL) = 25.7 pCi/L



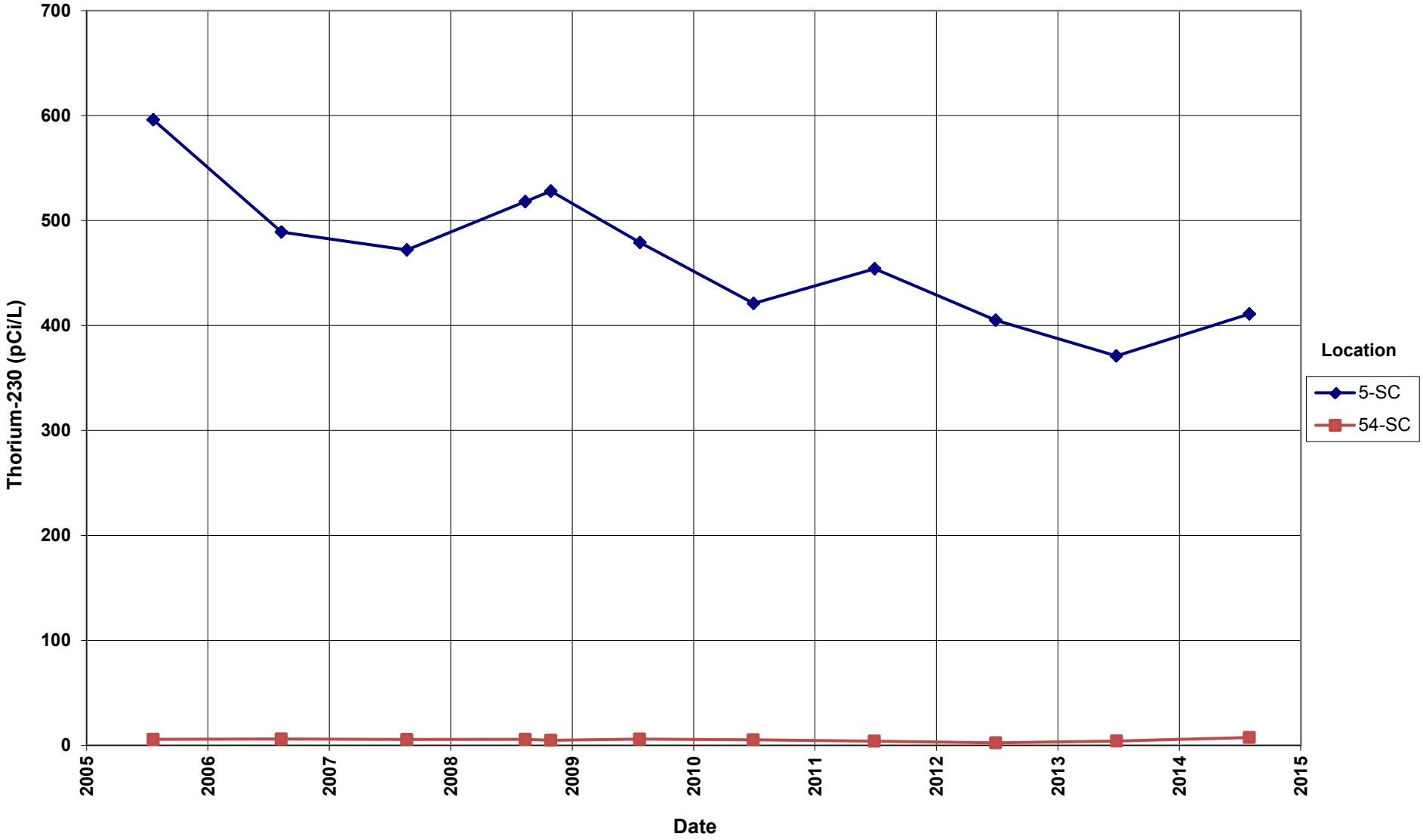
Shirley Basin South Disposal Site
Selenium Concentration
Alternate Concentration Limit (ACL) = 0.12 mg/L



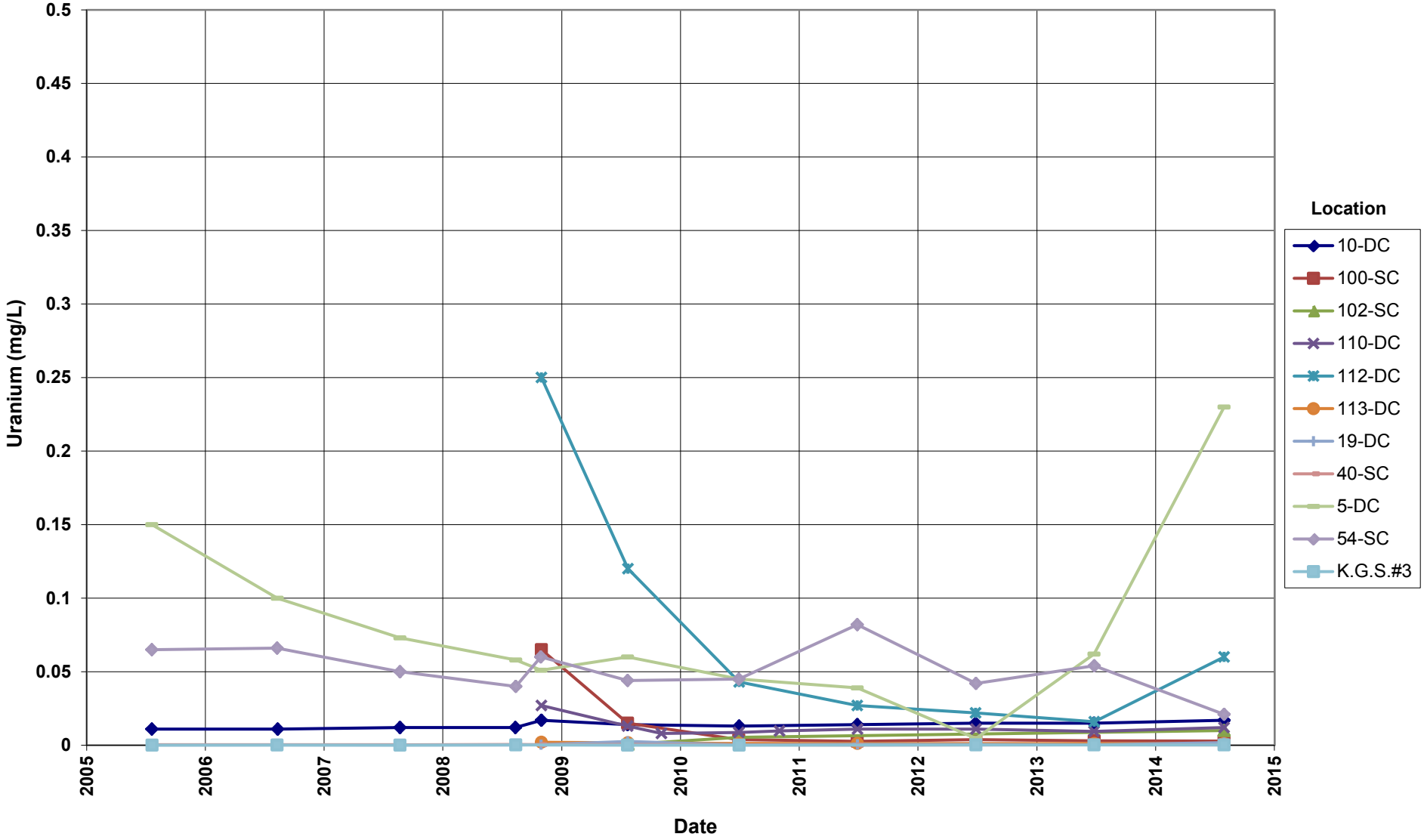
Shirley Basin South Disposal Site
Thorium-230 Concentration
Alternate Concentration Limit (ACL) = 2,409 pCi/L



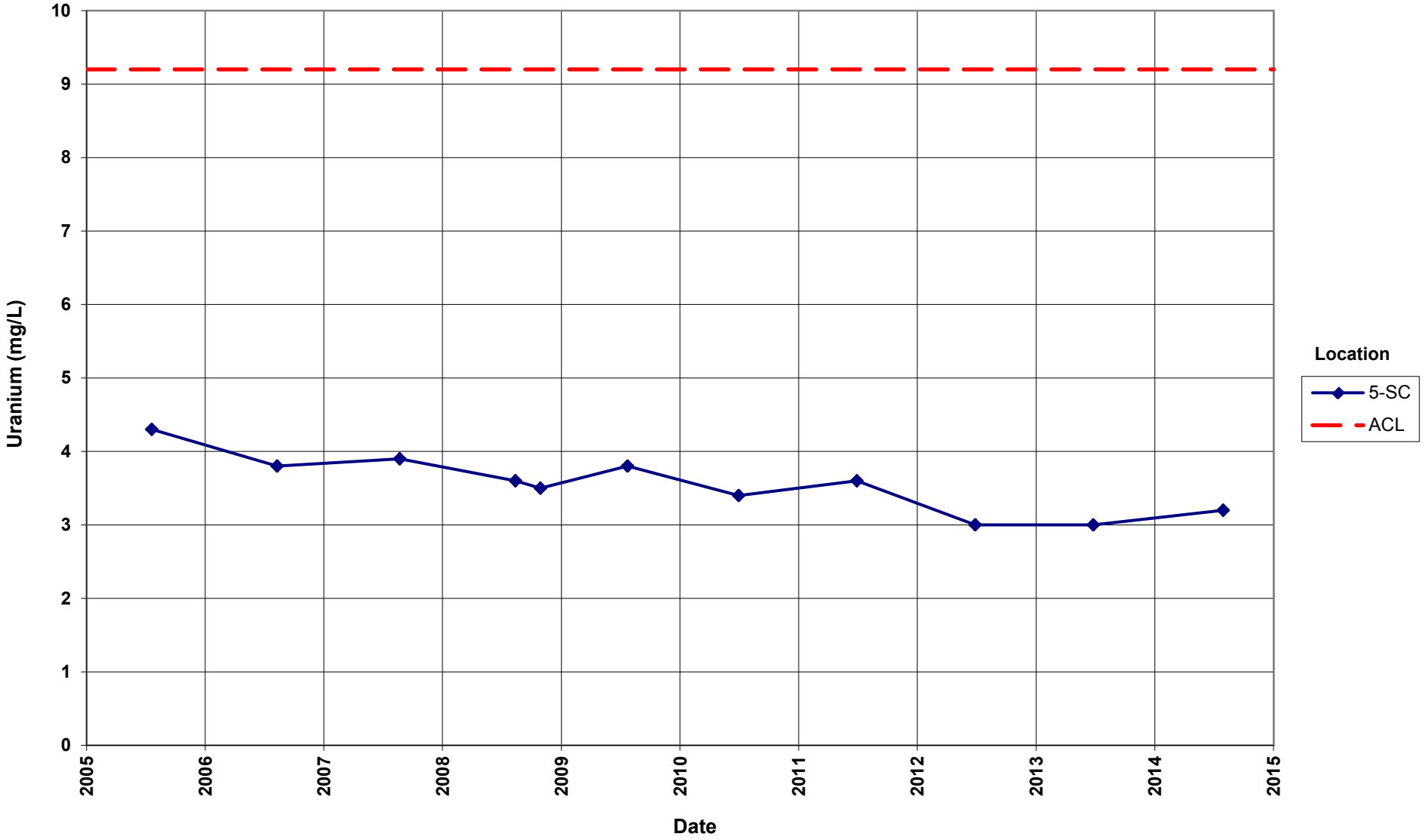
Shirley Basin South Disposal Site
Thorium-230 Concentration
Alternate Concentration Limit (ACL) = 2,409 pCi/L



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



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

June 19, 2014

Task Order LM00-501
Control Number 14-0676

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, The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller)
July 2014 Environmental Sampling at the Shirley Basin South, Wyoming, Disposal Site

REFERENCE: Task Order LM00-501-03-223-402, Shirley Basin South, Wyoming, 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 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 July 28, 2014.

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.

A SUBSIDIARY OF HUNTINGTON INGALLS INDUSTRIES
2597 Legacy Way • Grand Junction, CO 81503-1789 • Telephone (970) 248-6000 • Fax (970) 248-6040

Please contact me at (970) 248-6592 if you have any questions.

Sincerely,

J. E. Price

Jeffrey E. Price
Site Lead

JEP/lcg/lb

Enclosures (3)

cc: (electronic)
Christina Pennal, DOE
Steve Donivan, Stoller
Bev Gallagher, Stoller
Lauren Goodknight, Stoller
Jeffrey Price, Stoller
EDD Delivery
rc-grand.junction
File: SBS 410.02(A)

A SUBSIDIARY OF HUNTINGTON INGALLS INDUSTRIES
2597 Legacy Way • Grand Junction, CO 81503-1789 • Telephone (970) 248-6000 • Fax (970) 248-6040

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				
Analyte	Groundwater	Surface Water	Required Detection Limit (mg/L)	Analytical Method	Line Item Code
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 (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

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	14	0			
Total Organic Carbon					
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	0			

Notes: 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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Memorandum

DATE: August 12, 2014

TO: Jeff Price

FROM: Tashina Jasso

SUBJECT: Well Sampling Report

Site: Shirley Basin South, Wyoming, Disposal

Dates of Event: July 29 - 31, 2014

Team Members: Dan Sellers, David Atkinson, Jeff Price, Tashina Jasso

Number of Locations Sampled: 12 monitoring wells were sampled for metals (Cd, Cr, Pb, Ni, Se, and U), chlorine, sulfate, thorium-230, radium-226, radium-228 and TDS.

Locations Not Sampled/Reason: All locations were sampled with the exception of monitoring wells 51-SC and 101-SC which were not sampled because of dry conditions.

Location Specific Information:

Location IDs	Comments
102-SC, 19-DC, 5-DC	A 0.45 µm pore size filter was used for collecting these samples.
102-SC	The bladder pump was replaced and approximately 6 inches of tubing from the surface end was trimmed off due to a hole in the tubing.

Quality Control Sample Cross Reference: The following are the false identifications assigned to quality control samples.

False ID	Ticket Number	True ID	Sample Type	Associated Matrix
2174	MIZ 765	K.G.S.#3	Duplicate	Groundwater
2658	MIR 843	K.G.S#3	RINST/EQBLANK	Surface water

Report Identification Number (RIN) Assigned: All samples were assigned to RIN 14076359.

Sample Shipment: Samples were shipped from Grand Junction to ALS Laboratory Group on August 1, 2014.

Water Level Measurements: Water levels were measured at all wells from the top of casing.

Well Inspection Summary: All wells were in good condition.

Field Variance: None.

Equipment: All equipment functioned properly. All wells were sampled with a dedicated bladder pump and tubing with the exception of well 40-SC, which was sampled with a peristaltic pump and dedicated tubing.

Sampling Method: Samples were collected according to the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351, continually updated).

Stakeholder/ Regulatory: None.

Institutional Controls: No issues identified.

Disposal Cell/ Drainage Structure Integrity: No issues observed.
Fences, Gates, Locks: All appeared to be in working condition.
Trespassing/Site Disturbances: Nothing to note.

Site Issues:

Vegetation/Noxious Weed Concerns: None observed.
Maintenance Requirements: None observed.
Access Issues: None.
Safety Issues: None.

Corrective Action Taken: None.

TJ/lcg

cc: (electronic)
Scott Surovchak, DOE
Steve Donivan, Stoller
Jeff Price, Stoller
EDD Delivery