Data Validation Package

July 2016
Groundwater Sampling at the Shirley Basin South, Wyoming, Disposal Site

November 2016

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Sampling Event Summary

Site: Shirley Basin South, Wyoming, Disposal Site

Sampling Period: July 14–15, 2016

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. Planned monitoring locations are shown in Attachment 1, Sampling and Analysis Work Order. Point-of-compliance (POC) wells 19-DC, 5-DC, and 5-SC, and monitoring wells 10-DC, 110-DC, 112-DC, 113-DC, 40-SC, 54-SC, 100-SC, 102-SC, and K.G.S.#3 were sampled. POC well 51-SC and downgradient well 101-SC were dry at the time of sampling. The water level was measured at each sampled well. See Attachment 2, Trip Report for additional details. 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, , http://energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites).

ACLs are approved for cadmium, chromium, lead, nickel, radium-226, radium-228, selenium, thorium-230, and uranium in site groundwater. Time-concentration graphs of the contaminants of concern in POC wells are included in Attachment 3, Data Presentation. The only ACL exceedance in a POC well was radium-228 in well 5-DC where the concentration was 30.7 picocuries per liter (pCi/L), exceeding the ACL of 25.7 pCi/L.

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 — November 1, 2016

Jeffrey Price, Site Lead
Navarro Research and Engineering, Inc.

Date

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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 14–15, 2016
Date(s) of Verification	October 18, 2016	**Name of Verifier**	Stephen Donivan

	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 July 6, 2016.
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 field equipment calibrations conducted as specified in the above-named documents?	Yes	Calibrations were performed on July 14, 2016.
4. Was an operational check of the field equipment conducted daily?	Yes	
Did the operational checks meet criteria?	No	The turbidity meter malfunctioned; turbidities were not measured.
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	No	Turbidities were not measured (see above). Alkalinity was not measured at wells 5-DC and 5-SC because the pH values were lower than 4.3.
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?	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 K.G.S.#3.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	An equipment blank was not required.
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	All samples were filtered.
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

Task ID:	SBS01.1-16070001
Sample Event:	July 14–15, 2016
Site(s):	Shirley Basin South, Wyoming
Laboratory:	ALS Laboratory Group, Fort Collins, Colorado
Work Order No.:	1607302
Analysis:	Metals, Inorganic, and Radiochemistry
Validator:	Stephen Donivan
Review Date:	October 18, 2016

This validation was performed according to "Standard Practice for Validation of Environmental Data" found in Appendix A of the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated, http://energy.gov/lm/downloads/sampling-and-analysis-plan-us-department-energy-office-legacy-management-sites). The procedure was applied at Level 3, Data Validation.

This validation includes the evaluation of data quality indicators (DQIs) associated with the data. DQIs are the quantitative and qualitative descriptors that are used to interpret the degree of acceptability or utility of data. Indicators of data quality include the analysis of laboratory control samples to assess accuracy; duplicates and replicates to assess precision; and interference check samples to assess bias (Data Validation Worksheets, Figures 1–4). The DQIs comparability, completeness, and sensitivity are also evaluated in the sections to follow. An assessment of anomalous data is included in Attachment 4.

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 1.

Table 1. 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 (TDS)	WCH-A-033	EPA 160.1	EPA 160.1

Data Qualifier Summary

Analytical results were qualified as listed in Table 2. Refer to the sections below for an explanation of the data qualifiers applied.

Table 2. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
All	All	Chloride	J	Missed holding time
All	All	Sulfate	J	Missed holding time
1607302-3	10-DC	Thorium-228	J	Less than the Determination Limit
1607302-3	10-DC	Thorium-230	U	Less than the Decision Level Concentration
1607302-3	10-DC	Thorium-232	U	Less than the Decision Level Concentration
1607302-5	112-DC	Thorium-232	U	Less than the Decision Level Concentration
1607302-7	19-DC	Thorium-228	J	Less than the Determination Limit
1607302-7	19-DC	Thorium-232	U	Less than the Decision Level Concentration
1607302-8	40-SC	Radium-226	U	Less than the Decision Level Concentration
1607302-10	5-DC	Thorium-228	J	Less than the Determination Limit
1607302-10	5-DC	Thorium-232	J	Less than the Determination Limit
1607302-12	K.G.S.#3	Thorium-232	U	Less than the Decision Level Concentration
1607302-12	K.G.S.#3	Radium-226	J	Less than the Determination Limit
1607302-12	K.G.S.#3	Uranium	J	Field duplicate result
1607302-13	K.G.S.#3 Duplicate	Radium-226	J	Less than the Determination Limit
1607302-13	K.G.S.#3 Duplicate	Uranium	J	Field duplicate result

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received 13 water samples on July 16, 2016, 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 at 2.2 °C which does complies with requirementsAll 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 with the following exception. The chloride and sulfate analyses were performed outside the holding time due to a laboratory error. This had minimal impact to data quality. The chloride and sulfate sample results are qualified with a “J” flag as estimated values.

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% confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for an analyte, defined as 5 times the MDL, is the lowest concentration that can be quantitatively measured, and is used when evaluating laboratory method performance in the sections below.

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% 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 using six calibration standards on August 27, 2016. 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 as required by the cited method. The initial calibration verification (ICV) and continuing calibration verification (CCV) 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 using seven calibration standards on July 20 and 22, 2016. 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 as required by the cited method. The ICV and CCV 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 5, 2016, 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 as required by the cited method. The ICV and CCV 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 5, 2016, 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 as required by the cited method. The ICV and CCV 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. 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
Efficiency calibrations were performed in April and May 2015 and re-verified November 2015. Daily instrument checks performed on August 19, 2016, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% for all samples. The potential for interference by other alpha-emitting radium isotopes was reduced by allowing a decay period of at least 14 days to elapse.

Radium–228
Detector efficiency calibrations were performed in February 3, 2015, and re-verified on November 4, 2015. Daily instrument checks performed on August 10, 2016, met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110% 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% 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
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. All method blank and calibration blank results associated with the samples were below the PQL for all analytes.

Radiochemistry
The method blank results were less than the DLC.

Inductively Coupled Plasma Interference Check Sample Analysis

Interference check samples are analyzed to verify the instrumental interelement and background correction factors and assess any bias due to interelement interferences. Interference check samples were analyzed at the required frequency with all results meeting the acceptance criteria.

Matrix Spike Analysis

Matrix spikes are aliquots of environmental samples to which a known concentration of an analyte has been added before analysis. Matrix spike and matrix-spike duplicate (MS/MSD) analysis are used to assess the performance of the method by measuring the effects of interferences caused by the sample matrix and reflects the bias of the method for the particular matrix in question. 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. 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.

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 8, 2016. The EDD was examined to verify that the file was complete and in compliance with requirements. The contents of the file were compared 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.

General Data Validation Report

Page 1 of 1

Task Code: SBS01.1-16070001 **Lab Code:** PAR **Validator:** Stephen Donivan **Validation Date:** 10-11-2016

Project: Shirley Basin South Disposal Site **# Samples:** 15

Analysis Type: [X] General Chemistry [X] Metals [ ] Organics [X] Radiochemistry

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation OK Temperature: NO

Check	Summary
Holding Times:	There were 26 analyses performed outside the applicable holding times.
Detection Limits:	The reported detection limits are equal to or below the contract required limits.
Field Duplicates:	There was 1 duplicate evaluated.

Figure 1. General Validation Worksheet

Metals Data Validation Worksheet

17-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Analyte	Method	Analysis Date	QC Type	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	ICSAB	Serial Dilution	CRI	Comments
Barium	EPA 903.0	08-19-2016	LCS	93.59		40	110						
Barium	EPA 903.0	08-19-2016	LCSD	95.59		40	110						
Barium	EPA 903.0	08-19-2016	MB	96.19		40	110						
Barium	EPA 904.0	08-10-2016	LCS	95.59		40	110						
Barium	EPA 904.0	08-10-2016	LCSD	97.00		40	110						
Barium	EPA 904.0	08-10-2016	MB	95.80		40	110						
Cadmium	SW-846 6020	08-05-2016	LCS	86.00		80	120		20				
Cadmium	SW-846 6020	08-05-2016	MB							84		89	MB < MDL
Cadmium	SW-846 6020	08-05-2016	MS	81.00		75	125		20				
Cadmium	SW-846 6020	08-05-2016	MSD		78.00	75	125	3	20				
Cadmium	SW-846 6020	08-05-2016	R						20				

QC Types: LCS: Laboratory Control Sample MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

QC Checks: CRI: Quantitation limit check ICSAB: ICP interference check RPD: Relative Percent Difference

Figure 2. Metals Validation Worksheet

Metals Data Validation Worksheet

17-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Analyte	Method	Analysis Date	QC Type	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	ICSAB	Serial Dilution	CRI	Comments
Chromium	SW-846 6010	08-05-2016	LCS	103.00		80	120		20				
Chromium	SW-846 6010	08-05-2016	MB							93		101	MB < MDL
Chromium	SW-846 6010	08-05-2016	MS	95.00		80	120		20				
Chromium	SW-846 6010	08-05-2016	MSD		95.00	80	120	0	20				
Chromium	SW-846 6010	08-05-2016	R						20				
Lead	SW-846 6020	08-05-2016	LCS	89.00		80	120		20				
Lead	SW-846 6020	08-05-2016	MB							87		97	MB < MDL
Lead	SW-846 6020	08-05-2016	MS	83.00		75	125		20				
Lead	SW-846 6020	08-05-2016	MSD		82.00	75	125	2	20				
Lead	SW-846 6020	08-05-2016	R						20				
Nickel	SW-846 6010	08-05-2016	LCS	100.00		80	120		20				
Nickel	SW-846 6010	08-05-2016	MB							94		104	MB < MDL

QC Types: LCS: Laboratory Control Sample MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

QC Checks: CRI: Quantitation limit check ICSAB: ICP interference check RPD: Relative Percent Difference

Figure 2 (continued). Metals Validation Worksheet

Metals Data Validation Worksheet

17-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Analyte	Method	Analysis Date	QC Type	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	ICSAB	Serial Dilution	CRI	Comments
Nickel	SW-846 6010	08-05-2016	MS	94.00		80	120		20				
Nickel	SW-846 6010	08-05-2016	MSD		93.00	80	120	1	20				
Nickel	SW-846 6010	08-05-2016	R						20				
Selenium	SW-846 6020	08-05-2016	LCS	105.00		80	120		20				
Selenium	SW-846 6020	08-05-2016	MB							104		93	MB < MDL
Selenium	SW-846 6020	08-05-2016	MS	105.00		75	125		20				
Selenium	SW-846 6020	08-05-2016	MSD		102.00	75	125	3	20				
Selenium	SW-846 6020	08-05-2016	R						20				
Uranium	SW-846 6020	08-05-2016	LCS	99.00		80	120		20				
Uranium	SW-846 6020	08-05-2016	MB							98	4	120	MB < MDL
Uranium	SW-846 6020	08-05-2016	MS	97.00		75	125		20				
Uranium	SW-846 6020	08-05-2016	MSD		94.00	75	125	3	20				

QC Types: LCS: Laboratory Control Sample MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

QC Checks: CRI: Quantitation limit check ICSAB: ICP interference check RPD: Relative Percent Difference

Figure 2 (continued). Metals Validation Worksheet

Metals Data Validation Worksheet

17-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Analyte	Method	Analysis Date	QC Type	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	ICSAB	Serial Dilution	CRI	Comments
Uranium	SW-846 6020	08-05-2016	R					5	20				

QC Types: LCS: Laboratory Control Sample MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

QC Checks: CRI: Quantitation limit check ICSAB: ICP interference check RPD: Relative Percent Difference

Figure 2 (continued). Metals Validation Worksheet

Radiochemistry Data Validation Worksheet

18-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Sample ID	Analyte	Analysis Date	QC Type	Result Type	Result	Flag	TPU	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	RER	Comments
	Radium-226	08-19-2016	LCS	SC	43.30		11	95.80		75	125				
	Radium-226	08-19-2016	LCSD	SC	44.70		11.3	98.90	98.90	75	125			0.181	
	Radium-226	08-19-2016	MB	TRG	0.05	U	0.0948								
	Radium-228	08-10-2016	LCS	SC	8.96		2.34	118.00		75	125				
	Radium-228	08-10-2016	LCSD	SC	8.18		2.15	108.00	108.00	75	125			0.49	
	Radium-228	08-10-2016	MB	TRG	0.43	U	0.321								
	Thorium-228	08-11-2016	MB	TRG	-3.07e-03	U	0.0253								
	Thorium-229	08-11-2016	LCS	SUR	53.90		0.375	53.90		30	110				
	Thorium-229	08-11-2016	LCSD	SUR	50.90		0.357	50.90		30	110				
	Thorium-229	08-11-2016	MB	SUR	43.50		0.305	43.50		30	110				
	Thorium-230	08-11-2016	LCS	SC	4.95		0.806	101.00		75	125				
	Thorium-230	08-11-2016	LCSD	SC	5.19		0.855	105.00	105.00	75	125			0.409	
	Thorium-230	08-11-2016	MB	TRG	0.06	U	0.0607								
	Thorium-232	08-11-2016	MB	TRG	0.02	U	0.0206								
SBS01.1-16070001-001	Thorium-228	08-11-2016	R	TRG	0.16		0.114							0.36	
SBS01.1-16070001-001	Thorium-229	08-11-2016	R	SUR	55.10		1.53	55.09		30	110				
SBS01.1-16070001-001	Thorium-230	08-11-2016	R	TRG	0.18	U	0.202							0.253	
SBS01.1-16070001-001	Thorium-232	08-11-2016	R	TRG	0.05	U	0.0541							1.16	

QC Types: LCS: Laboratory Control Sample LCSD: Laboratory Control Sample Duplicate MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

Result Types: IS: Internal Standard SC: Spike Analyte TRG: Target analyte

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio TPU: Total Propagated Uncertainty

Figure 3. Radiochemistry Validation Worksheet

Wet Chemistry Data Validation Worksheet

13-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 **Lab Code:** PAR

Analyte	Method	Analysis Date	QC Type	Spike Recovery	Spike Dup Recovery	Lower Limit	Upper Limit	RPD	RPD Limit	Comments
Chloride	SW-846 9056	08-31-2016	LCS	95.00		90	110		15	
Chloride	SW-846 9056	08-31-2016	MB							MB < MDL
Chloride	SW-846 9056	08-31-2016	MS	102.00		85	115		15	
Chloride	SW-846 9056	08-31-2016	MSD		101.00	85	115	0	15	
Nitrate + Nitrite as Nitrogen	EPA 353.2	07-20-2016	LCS	99.00		90	110		20	
Nitrate + Nitrite as Nitrogen	EPA 353.2	07-20-2016	LCSD	97.00	97.00	90	110	3	20	
Nitrate + Nitrite as Nitrogen	EPA 353.2	07-20-2016	MB							MB < MDL
Nitrate + Nitrite as Nitrogen	EPA 353.2	07-20-2016	MS	83.00		75	125		20	
Nitrate + Nitrite as Nitrogen	EPA 353.2	07-20-2016	MSD		80.00	75	125	5	20	
Sulfate	SW-846 9056	08-31-2016	LCS	95.00		90	110		15	
Sulfate	SW-846 9056	08-31-2016	MB							MB < MDL
Sulfate	SW-846 9056	08-31-2016	MS	105.00		85	115		15	
Sulfate	SW-846 9056	08-31-2016	MSD		104.00	85	115	1	15	
Total Dissolved Solids	EPA 160.1	07-19-2016	LCS	100.00		85	115		5	
Total Dissolved Solids	EPA 160.1	07-19-2016	LCSD	97.00	97.00	85	115	3	5	
Total Dissolved Solids	EPA 160.1	07-19-2016	MB							MB < MDL
Total Dissolved Solids	EPA 160.1	07-19-2016	R					2	5	

QC Types: LCS: Laboratory Control Sample MB: Method Blank MS: Matrix Spike MSD: Matrix Spike Duplicate R: Replicate

QC Checks: RPD: Relative Percent Difference

Figure 4. Wet Chemistry Validation Worksheet

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 or II 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. The data from wells 100-SC and 102-SC were further qualified with a "Q" flag because these are Category II wells.

Equipment Blank Assessment

Equipment blanks are prepared and analyzed to document contamination attributable to the sample collection process. An equipment blank was not required for this sampling event.

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 (RPD) for duplicate results that are greater than 5 times the PQL should be less than 20%. 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, with the exception of the uranium results (Figure 5). The associated sample and duplicate uranium results are qualified with a "J" flag as estimated values.

Validation Report: Field Duplicates

11-Oct-2016

Project: Shirley Basin South Disposal Site **Task Code:** SBS01.1-16070001 Lab Code: PAR

	Duplicate: SBS01.1-16070001-015				Sample: SBS01.1-16070001-014 K.G.S.#3						
Analyte	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**Result**	**Qualifiers**	**Uncert.**	**Dilution**	**RPD**	**RER**	**Units**
Cadmium	0.000055	U		10	0.000055	U		10			mg/L
Chloride	3.4			4	3.6			4	5.7		mg/L
Chromium	0.00051	U		1	0.00051	U		1			mg/L
Lead	0.00013	U		10	0.00013	U		10			mg/L
Nickel	0.00093	U		1	0.00093	U		1			mg/L
Nitrate + Nitrite as Nitrogen	0.047			1	0.047			1	0		mg/L
Selenium	0.00066	U		10	0.00066	U		10			mg/L
Sulfate	230			4	230			4	0		mg/L
Thorium-228	0.0848	U	0.0913	1	0.0421	U	0.111	1		0.6	pCi/L
Thorium-230	0.00745	U	0.177	1	-0.0245	U	0.183	1		0.2	pCi/L
Thorium-232	0.00916	U	0.0449	1	0.0307		0.0503	1		-0.6	pCi/L
Total Dissolved Solids	490			1	530			1			mg/L
Uranium	0.00035			10	0.0021			10	142.9		mg/L

QC Checks: RPD: Relative Percent Difference RER: Relative Error Ratio

Figure 5. Field Duplicate

Certification

All laboratory analytical quality control criteria were met except as qualified in this report. The data qualifiers listed on the environmental 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 — Date: 10-31-2016

Data Validation Lead: Stephen Donivan — Date: 10-31-2016

Attachment 1

Sampling and Analysis Work Order

July 6, 2016

Task Assignment 103
Control Number 16-0714

U.S. Department of Energy
Office of Legacy Management
ATTN: Richard Bush
Site Manager
2597 Legacy Way
Grand Junction, CO 81503

SUBJECT: Contract No. DE-LM0000421, Navarro Research & Engineering, Inc. (Navarro)
Task Assignment 103 LTS&M-UMTRCA TI & TII Sites, D&D Sites, Other Sites, and Other
July 2016 Environmental Sampling at the Shirley Basin South, Wyoming, Disposal Site

REFERENCE: Task Assignment 103, 1-103-1-02-223, Shirley Basin South, Wyoming, Disposal Site

Dear Mr. Bush:

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 11, 2016.

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) 248-6592 if you have any questions.

Sincerely,

J. E. Price

Jeffrey E. Price
LMS Site Lead

JEP/lcg/csa

Enclosures

cc: (electronic)
Christina Pennal, DOE
Jeff Carman, Navarro
Beverly Cook, Navarro
Steve Donivan, Navarro
Lauren Goodknight, Navarro
Sam Marutzky, Navarro
Diana Osborne, Navarro
Jeffrey Price, Navarro
EDD Delivery
rc-grand.junction
File: SBS 400.02

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Shirley Basin South, Wyoming, Disposal Site Planned Sample Locations

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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 July						

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	X				
Dissolved Oxygen	X				
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 Specrtrometry	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 2

Trip Report

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memo

NAVARRO

To: Jeff Price, Navarro
From: Rob Rice, Navarro
Date: July 20, 2016
CC: Richard Bush, DOE
Steve Donivan, Navarro
EDD Delivery
Re: Sampling Trip Report

Site: Shirley Basin South, Wyoming, Disposal Site

Dates of Event: July 14–15, 2016

Team Members: Rob Rice and Jeff Price, Navarro

Number of Locations Sampled: Samples were collected from 12 of the 14 locations identified in the sampling notification letter.

Locations Not Sampled/Reason: Locations 51-SC and 101-SC were dry and not sampled.

Location Specific Information: The pH values for 5-DC and 5-SC were lower than 4.3; alkalinity was not measured.

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

False ID	Ticket Number	True ID	Sample Type	Associated Matrix	Associated Samples
2658	SBS01.1-16070001-015	K.G.S.#3	Duplicate	Groundwater	All

Task Code Assigned: Samples were assigned to Task Code SBS01.1-16070001. Field data sheets can be found in \\crow\SMS\SBS01.1-16070001\FieldData.

Sample Shipment: Samples were shipped overnight via FedEx from Grand Junction to ALS Lab on July 15, 2016.

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

Well Inspection Summary: No issues were identified.

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

Field Variance: Because the turbidity meter malfunctioned, samples were filtered.

Equipment: Turbidity meter malfunctioned.

Dataloggers: N/A.

Stakeholder/Regulatory/DOE: Jim O'Connor, P.G. Project Geologist GPC Section/ Groundwater Program/WQD Wyoming Department of Environmental Quality, was on site and attended the annual site inspection.

Institutional Controls:

Fences, Gates, and Locks: No issues were observed.
Signs: No issues were observed.
Trespassing/Site Disturbances: None observed.
Disposal Cell/Drainage Structure Integrity: No issues were observed.

Safety Issues: None observed.

Access Issues: None observed.

General Information: Nothing to note.

Immediate Actions Taken: None.

Future Actions Required or Suggested: None.

Attachment 3

Data Presentation

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Groundwater Quality Data

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Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 10-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	209				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	55		1.5		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	3.83				F	Y
Lead	mg/L	07/14/2016	F	D	0.00024		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	0.00093		0.00093	U	F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	-52.7				F	Y
pH	s.u.	07/14/2016	F	N	6.90				F	Y
Radium-226	pCi/L	07/14/2016	F	N	15.2	3.94	0.144		F	Y
Radium-228	pCi/L	07/14/2016	F	N	5.11	1.27	0.4		F	Y
SC	umhos/cm	07/14/2016	F	N	2156				F	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	F	Y
Sulfate	mg/L	07/14/2016	F	N	1000		7.5		FJ	Y
TEMP	C	07/14/2016	F	N	9.86				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.237	0.13	0.158		FJ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 10-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.324	0.215	0.319		FU	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.0922	0.0654	0.0679		FU	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	1800				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.012		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 100-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	119				FQ	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	FQ	Y
Chloride	mg/L	07/14/2016	F	N	180		1.5		FJQ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	FQ	Y
DO	mg/L	07/14/2016	F	N	4.17				FQ	Y
Lead	mg/L	07/14/2016	F	D	0.00015		0.00013	J	FQ	Y
Nickel	mg/L	07/14/2016	F	D	0.0028		0.00093	J	FQ	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJQ	Y
ORP	mV	07/14/2016	F	N	4.2				FQ	Y
pH	s.u.	07/14/2016	F	N	7.38				FQ	Y
Radium-226	pCi/L	07/14/2016	F	N	4.48	1.25	0.164		FQ	Y
Radium-228	pCi/L	07/14/2016	F	N	5.94	1.46	0.398		FQ	Y
SC	umhos/cm	07/14/2016	F	N	2611				FQ	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	FQ	Y
Sulfate	mg/L	07/14/2016	F	N	1300		7.5		FJQ	Y
TEMP	C	07/14/2016	F	N	12.21				FQ	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.285	0.19	0.285	U	FQ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 100-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.45	0.277	0.45	U	FQ	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.122	0.0813	0.122	U	FQ	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	2300				FJQ	Y
Uranium	mg/L	07/14/2016	F	D	0.0034		0.000012		FQ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 102-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	87				FQ	Y
Cadmium	mg/L	07/14/2016	F	D	0.00033		0.000055	J	FQ	Y
Chloride	mg/L	07/14/2016	F	N	150		1.2		FJQ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	FQ	Y
DO	mg/L	07/14/2016	F	N	4.95				FQ	Y
Lead	mg/L	07/14/2016	F	D	0.00013		0.00013	U	FQ	Y
Nickel	mg/L	07/14/2016	F	D	0.00093		0.00093	U	FQ	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.51		0.003		FJQ	Y
ORP	mV	07/14/2016	F	N	5.2				FQ	Y
pH	s.u.	07/14/2016	F	N	7.89				FQ	Y
Radium-226	pCi/L	07/14/2016	F	N	1.75	0.572	0.179		FQ	Y
Radium-228	pCi/L	07/14/2016	F	N	2.76	0.763	0.455		FQ	Y
SC	umhos/cm	07/14/2016	F	N	1897				FQ	Y
Selenium	mg/L	07/14/2016	F	D	0.0014		0.00066		FQ	Y
Sulfate	mg/L	07/14/2016	F	N	750		6		FJQ	Y
TEMP	C	07/14/2016	F	N	9.84				FQ	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.155	0.0897	0.155	U	FQ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 102-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.316	0.21	0.316	U	FQ	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.0667	0.052	0.0667	U	FQ	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	1500				FJQ	Y
Uranium	mg/L	07/14/2016	F	D	0.014		0.000012		FQ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 110-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	312				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	200		2.4		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	3.01				F	Y
Lead	mg/L	07/14/2016	F	D	0.00013		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	0.00093		0.00093	U	F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	-34.1				F	Y
pH	s.u.	07/14/2016	F	N	6.72				F	Y
Radium-226	pCi/L	07/14/2016	F	N	125	31.4	0.155		F	Y
Radium-228	pCi/L	07/14/2016	F	N	7.97	1.92	0.395		F	Y
SC	umhos/cm	07/14/2016	F	N	3775				F	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	F	Y
Sulfate	mg/L	07/14/2016	F	N	1900		12		FJ	Y
TEMP	C	07/14/2016	F	N	10.52				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.36	0.248	0.36	U	F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 110-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.563	0.314	0.563	U	F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.226	0.13	0.0472		F	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	3400				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.0099		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 112-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	203				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	33		1.5		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	2.60				F	Y
Lead	mg/L	07/14/2016	F	D	0.00015		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	0.00093		0.00093	U	F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	-60.2				F	Y
pH	s.u.	07/14/2016	F	N	7.40				F	Y
Radium-226	pCi/L	07/14/2016	F	N	10.5	2.76	0.148		F	Y
Radium-228	pCi/L	07/14/2016	F	N	5.71	1.41	0.423		F	Y
SC	umhos/cm	07/14/2016	F	N	2195				F	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	F	Y
Sulfate	mg/L	07/14/2016	F	N	1100		7.5		FJ	Y
TEMP	C	07/14/2016	F	N	10.36				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.212	0.142	0.212	U	F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 112-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.34	0.189	0.34	U	F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.0317	0.052	0.0286		FU	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	1800				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.0093		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 113-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	178				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	7		0.6		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	3.25				F	Y
Lead	mg/L	07/14/2016	F	D	0.00021		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	0.0011		0.00093	J	F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.059		0.003		FJ	Y
ORP	mV	07/14/2016	F	N	-53.2				F	Y
pH	s.u.	07/14/2016	F	N	7.71				F	Y
Radium-226	pCi/L	07/14/2016	F	N	1.74	0.563	0.163		F	Y
Radium-228	pCi/L	07/14/2016	F	N	2.95	0.801	0.45		F	Y
SC	umhos/cm	07/14/2016	F	N	1532				F	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	F	Y
Sulfate	mg/L	07/14/2016	F	N	640		3		FJ	Y
TEMP	C	07/14/2016	F	N	10.50				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.199	0.116	0.199	U	F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 113-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.328	0.188	0.328	U	F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.092	0.0485	0.092	U	F	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	1100				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.00095		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 19-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	220				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	56		2.4		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	2.60				F	Y
Lead	mg/L	07/14/2016	F	D	0.00013		0.00013	U	F	Y
Nickel	mg/L	07/14/2016	F	D	0.41		0.00093		F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	-77.1				F	Y
pH	s.u.	07/14/2016	F	N	6.58				F	Y
Radium-226	pCi/L	07/14/2016	F	N	4.88	1.36	0.179		F	Y
Radium-228	pCi/L	07/14/2016	F	N	5.79	1.43	0.45		F	Y
SC	umhos/cm	07/14/2016	F	N	3768				F	Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U	F	Y
Sulfate	mg/L	07/14/2016	F	N	2300		12		FJ	Y
TEMP	C	07/14/2016	F	N	10.03				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.255	0.133	0.158		FJ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 19-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.318	0.209	0.318	U	F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.0368	0.0454	0.0249		FU	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	3500				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.00016		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 40-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	69				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	24		1.5		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	0.73				F	Y
Lead	mg/L	07/14/2016	F	D	0.00013		0.00013	U	F	Y
Nickel	mg/L	07/14/2016	F	D	0.0099		0.00093		F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.98		0.003		FJ	Y
ORP	mV	07/14/2016	F	N	65.5				F	Y
pH	s.u.	07/14/2016	F	N	6.44				F	Y
Radium-226	pCi/L	07/14/2016	F	N	0.176	0.133	0.144		FU	Y
Radium-228	pCi/L	07/14/2016	F	N	1.73	0.537	0.436		F	Y
SC	umhos/cm	07/14/2016	F	N	2470				F	Y
Selenium	mg/L	07/14/2016	F	D	0.0052		0.00066		F	Y
Sulfate	mg/L	07/14/2016	F	N	1500		7.5		FJ	Y
TEMP	C	07/14/2016	F	N	9.72				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	0.168	0.104	0.168	U	F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 40-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.366	0.197	0.366	U	F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.124	0.0655	0.124	U	F	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	2200				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.00011		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 5-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	39				F	Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U	F	Y
Chloride	mg/L	07/14/2016	F	N	240		7.5		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U	F	Y
DO	mg/L	07/14/2016	F	N	1.52				F	Y
Lead	mg/L	07/14/2016	F	D	0.00033		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	2		0.00093		F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	141.5				F	Y
pH	s.u.	07/14/2016	F	N	4.77				F	Y
Radium-226	pCi/L	07/14/2016	F	N	6.97	1.9	0.16		F	Y
Radium-228	pCi/L	07/14/2016	F	N	30.7	7.13	0.423		F	Y
SC	umhos/cm	07/14/2016	F	N	12696				F	Y
Selenium	mg/L	07/14/2016	F	D	0.0091		0.00066		F	Y
Sulfate	mg/L	07/14/2016	F	N	12000		38		FJ	Y
TEMP	C	07/14/2016	F	N	9.42				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	4.25	0.792	0.13		FJ	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 5-DC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.658	0.273	0.342		F	Y
Thorium-232	pCi/L	07/14/2016	F	N	0.21	0.108	0.0975		FJ	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	18000				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.14		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 5-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Cadmium	mg/L	07/14/2016	F	D	0.032		0.000055		F	Y
Chloride	mg/L	07/14/2016	F	N	300		7.5		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.25		0.00051		F	Y
DO	mg/L	07/14/2016	F	N	1.12				F	Y
Lead	mg/L	07/14/2016	F	D	0.00016		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	2.6		0.00093		F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.035		0.003		FJ	Y
ORP	mV	07/14/2016	F	N	302.6				F	Y
pH	s.u.	07/14/2016	F	N	3.32				F	Y
Radium-226	pCi/L	07/14/2016	F	N	5.34	1.47	0.167		F	Y
Radium-228	pCi/L	07/14/2016	F	N	3.09	0.827	0.437		F	Y
SC	umhos/cm	07/14/2016	F	N	11711				F	Y
Selenium	mg/L	07/14/2016	F	D	0.097		0.00066		F	Y
Sulfate	mg/L	07/14/2016	F	N	12000		38		FJ	Y
TEMP	C	07/14/2016	F	N	10.42				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	47.7	9.01	1.78		F	Y
Thorium-230	pCi/L	07/14/2016	F	N	416	67.1	3.74		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 5-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-232	pCi/L	07/14/2016	F	N	9.83	2.75	1.32		F	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	16000				FJ	Y
Uranium	mg/L	07/14/2016	F	D	3.5		0.00012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 54-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Cadmium	mg/L	07/14/2016	F	D	0.00032		0.000055	J	F	Y
Chloride	mg/L	07/14/2016	F	N	340		6		FJ	Y
Chromium	mg/L	07/14/2016	F	D	0.29		0.00051		F	Y
DO	mg/L	07/14/2016	F	N	1.15				F	Y
Lead	mg/L	07/14/2016	F	D	0.00025		0.00013	J	F	Y
Nickel	mg/L	07/14/2016	F	D	2.1		0.00093		F	Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.003		0.003	U	FJ	Y
ORP	mV	07/14/2016	F	N	234.0				F	Y
pH	s.u.	07/14/2016	F	N	4.08				F	Y
Radium-226	pCi/L	07/14/2016	F	N	10.3	2.73	0.155		F	Y
Radium-228	pCi/L	07/14/2016	F	N	99.5	22.9	0.467		F	Y
SC	umhos/cm	07/14/2016	F	N	9346				F	Y
Selenium	mg/L	07/14/2016	F	D	0.057		0.00066		F	Y
Sulfate	mg/L	07/14/2016	F	N	8500		30		FJ	Y
TEMP	C	07/14/2016	F	N	11.76				F	Y
Thorium-228	pCi/L	07/14/2016	F	N	13.9	2.28	0.13		F	Y
Thorium-230	pCi/L	07/14/2016	F	N	8.79	1.5	0.324		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: 54-SC

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-232	pCi/L	07/14/2016	F	N	9.94	1.67	0.0897		F	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	12000				FJ	Y
Uranium	mg/L	07/14/2016	F	D	0.013		0.000012		F	Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: K.G.S.#3

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
ALK	mg/L	07/14/2016	F	N	139					Y
Cadmium	mg/L	07/14/2016	F	D	0.000055		0.000055	U		Y
Chloride	mg/L	07/14/2016	F	N	3.6		0.24		J	Y
Chromium	mg/L	07/14/2016	F	D	0.00051		0.00051	U		Y
DO	mg/L	07/14/2016	F	N	6.37					Y
Lead	mg/L	07/14/2016	F	D	0.00013		0.00013	U		Y
Nickel	mg/L	07/14/2016	F	D	0.00093		0.00093	U		Y
Nitrate + Nitrite as Nitrogen	mg/L	07/14/2016	F	N	0.047		0.003		J	Y
ORP	mV	07/14/2016	F	N	46.4					Y
pH	s.u.	07/14/2016	F	N	6.72					Y
Radium-226	pCi/L	07/14/2016	F	N	0.364	0.204	0.18		J	Y
Radium-228	pCi/L	07/14/2016	F	N	1.42	0.476	0.443			Y
SC	umhos/cm	07/14/2016	F	N	954					Y
Selenium	mg/L	07/14/2016	F	D	0.00066		0.00066	U		Y
Sulfate	mg/L	07/14/2016	F	N	230		1.2		J	Y
TEMP	C	07/14/2016	F	N	23.1					Y
Thorium-228	pCi/L	07/14/2016	F	N	0.198	0.111	0.198	U		Y

Groundwater Quality Data by Location For Site SBS01, Shirley Basin South Disposal Site

Location: K.G.S.#3

Report Date: 10/18/2016

Parameter	Units	Sample Date	Sample Type	Fraction	Result	Uncertainty	MDC/MDL	Lab	Data	QA
Thorium-230	pCi/L	07/14/2016	F	N	0.334	0.183	0.334	U		Y
Thorium-232	pCi/L	07/14/2016	F	N	0.0307	0.0503	0.0277		U	Y
Total Dissolved Solids	mg/L	07/14/2016	F	N	530				J	Y
Uranium	mg/L	07/14/2016	F	D	0.0021		0.000012		J	Y

SAMPLE TYPE: D = Duplicate E = Equipment Blank F = Field Sample FB = Field Blank TB = Trip Blank

FRACTION: D = Dissolved N = NA T = Total

MDC / MDL: MDC = Radiochemical minimum detectable concentration MDL = Non-radiochemical minimum detection limit

LAB QUALIFIERS (details can be found in laboratory report):
* = One or more quality control criteria failed (e.g., laboratory control sample, surrogate spike, or calibration verification recovery).
B = Blank contamination. The reported result is associated with a contaminated blank.
D = Result is from the analysis of a diluted sample.
H = Holding time was exceeded.
J = The reported result is an estimated value (e.g., matrix interference was observed or the analyte was detected at a concentration outside the quantitation range).
U = Analytical result is below the MDC or MDL.
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 not detected.
G = Possible grout contamination, pH > 9
Q = Qualitative result due to sampling technique.
X = Location is undefined.
J = Estimated value
R = Rejected, unusable result

QA QUALIFIER: Yes = Validated, acceptable as qualified.

Static Water Level Data

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Static Water Levels For Site SBS01, Shirley Basin South Disposal Site

Measurement Date Between : 07/14/2016 and 07/15/2016

Report Date: 10/18/2016

Location Code	Measurement Date	Top of Casing Elevation	Water Elevation	Water Level Depth	Units	Dry (y/n)
10-DC	07/14/2016	7113.07	6946.67	166.4	ft	
100-SC	07/14/2016	7153.56	6946.13	207.43	ft	
101-SC	07/14/2016	7168.35	6976.26		ft	Y
102-SC	07/14/2016	7126.74	6947.04	179.7	ft	
110-DC	07/14/2016	7153.92	6948.48	205.44	ft	
112-DC	07/14/2016	7125.62	6946.94	178.68	ft	
113-DC	07/14/2016	7135.93	6948.19	187.74	ft	
19-DC	07/14/2016	7112.08	6947.48	164.6	ft	
40-SC	07/14/2016	7058.29	7049.27	9.02	ft	
5-DC	07/14/2016	7119.94	6947.94	172	ft	
5-SC	07/14/2016	7056.31	6998.81	57.5	ft	
51-SC	07/14/2016	7091.61	6976.61		ft	Y
54-SC	07/14/2016	7158.74	6950.07	208.67	ft	

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Hydrographs

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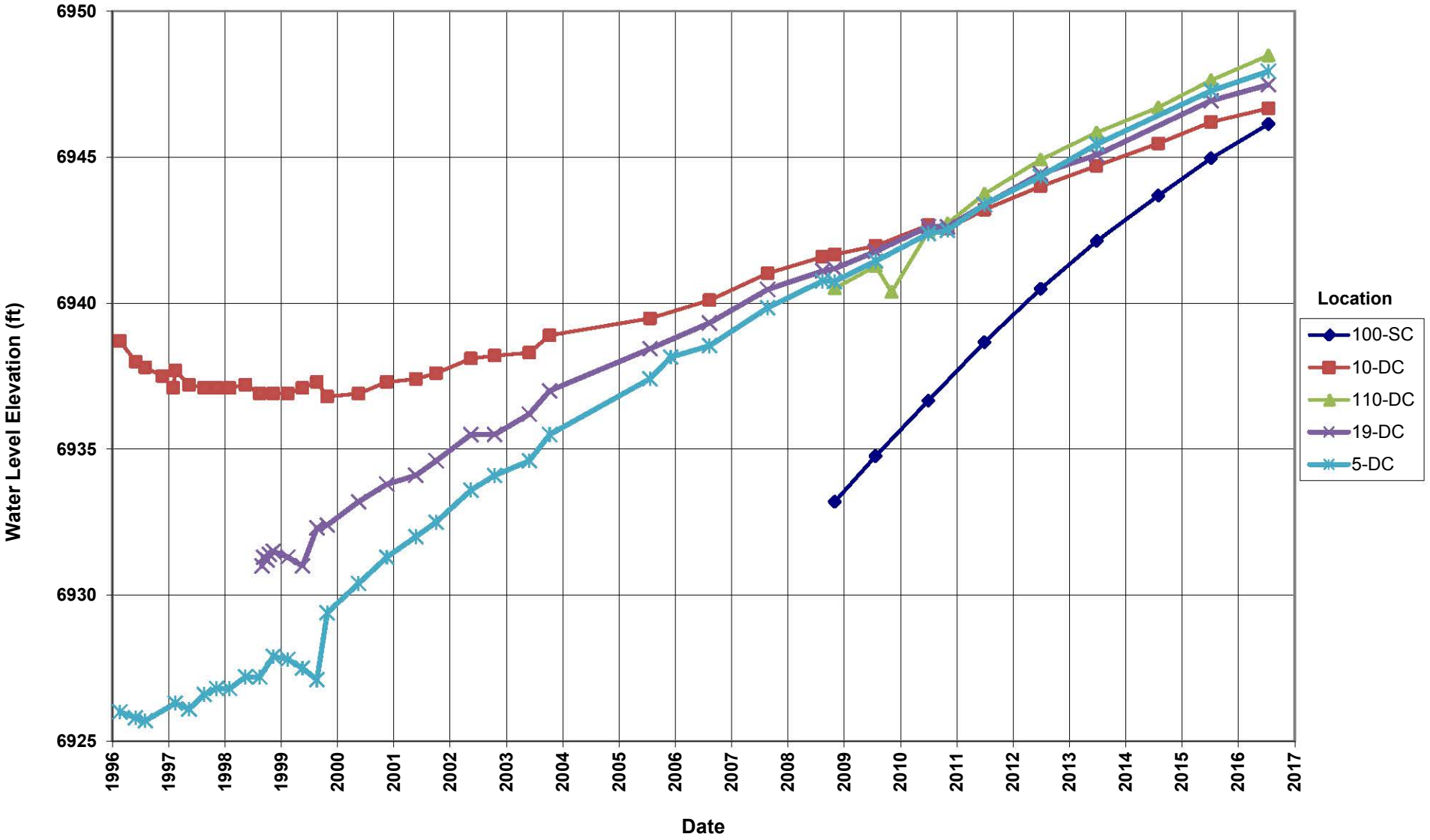
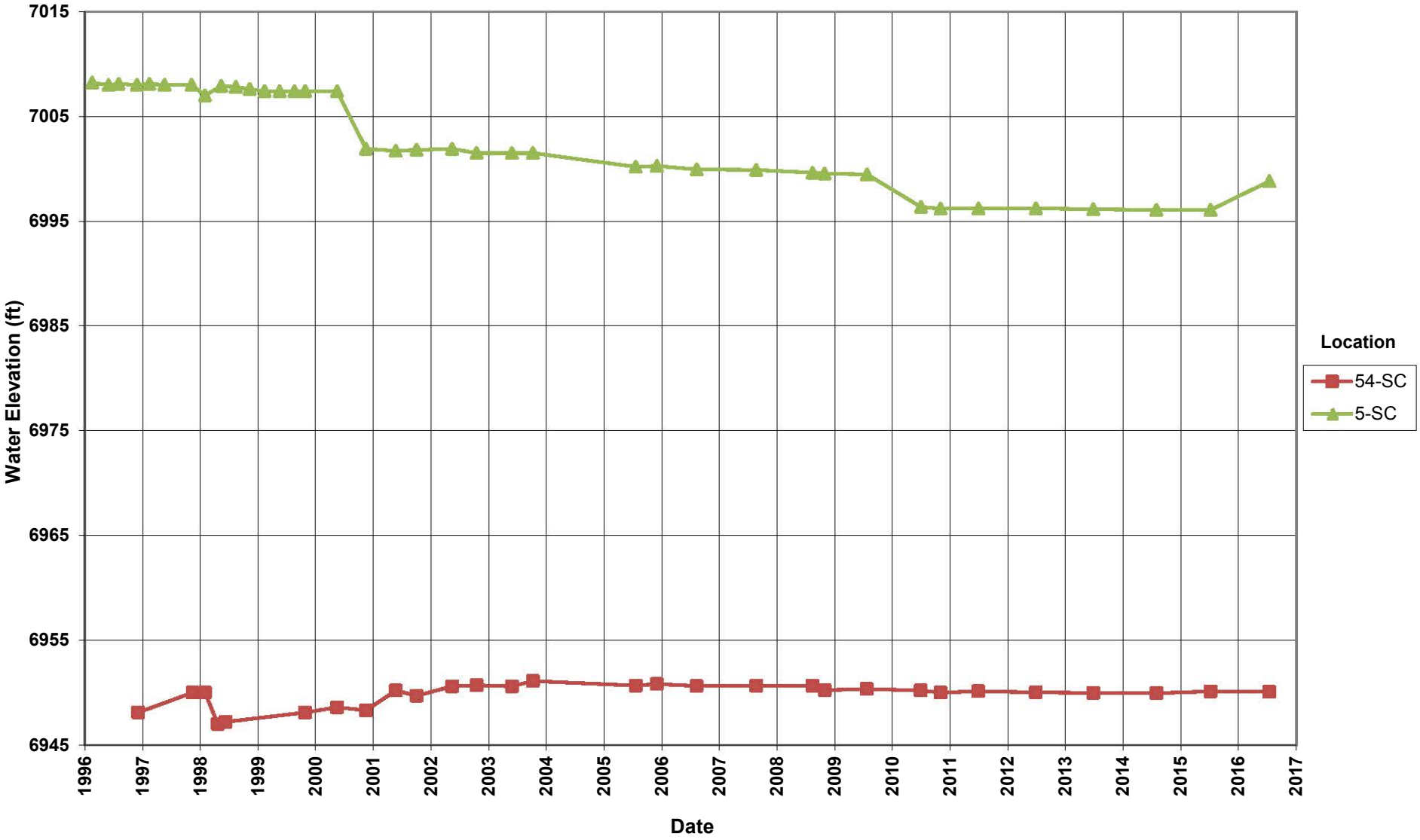
Shirley Basin South Disposal Site
Hydrograph



Shirley Basin South Disposal Site
Hydrograph



Time-Concentration Graphs

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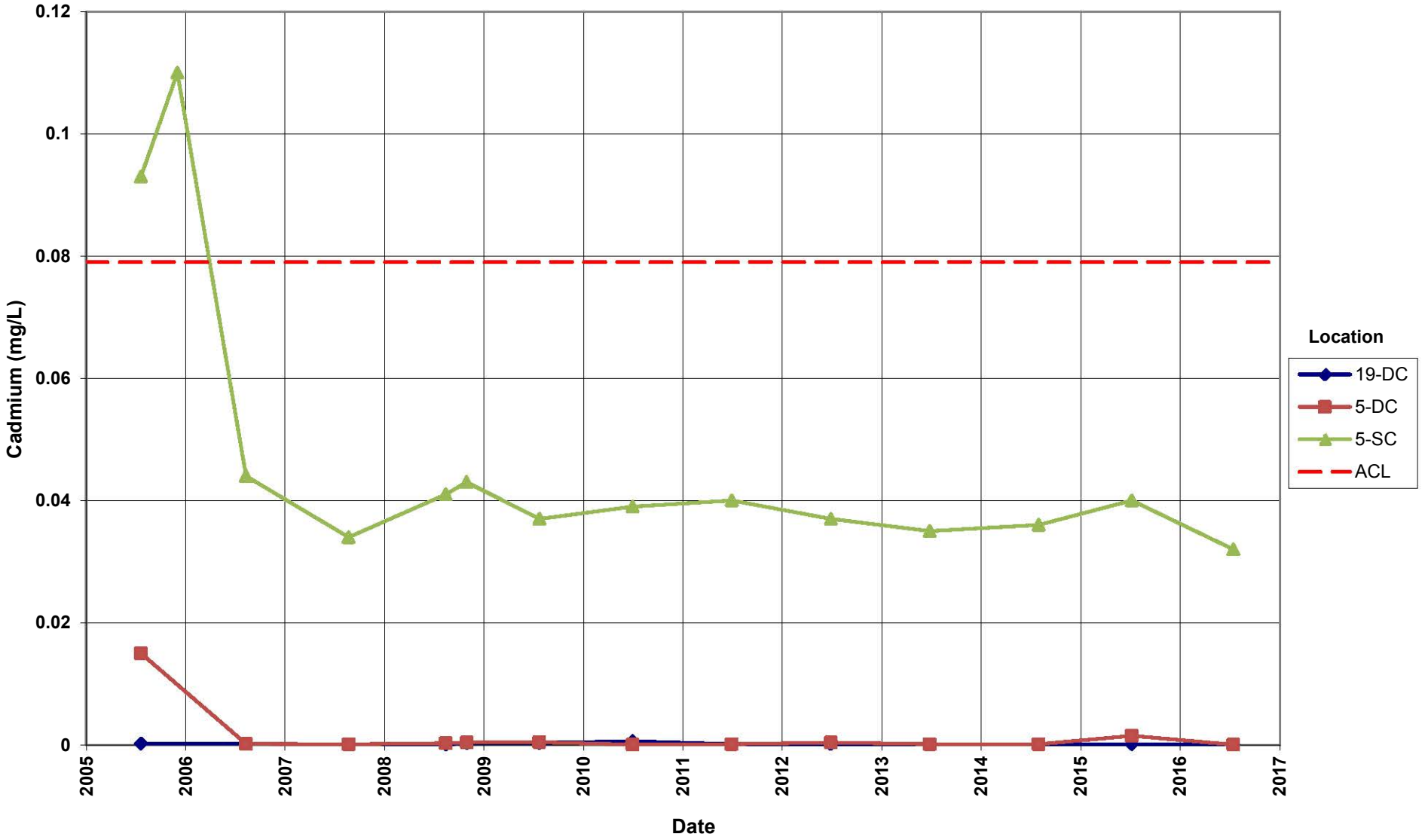
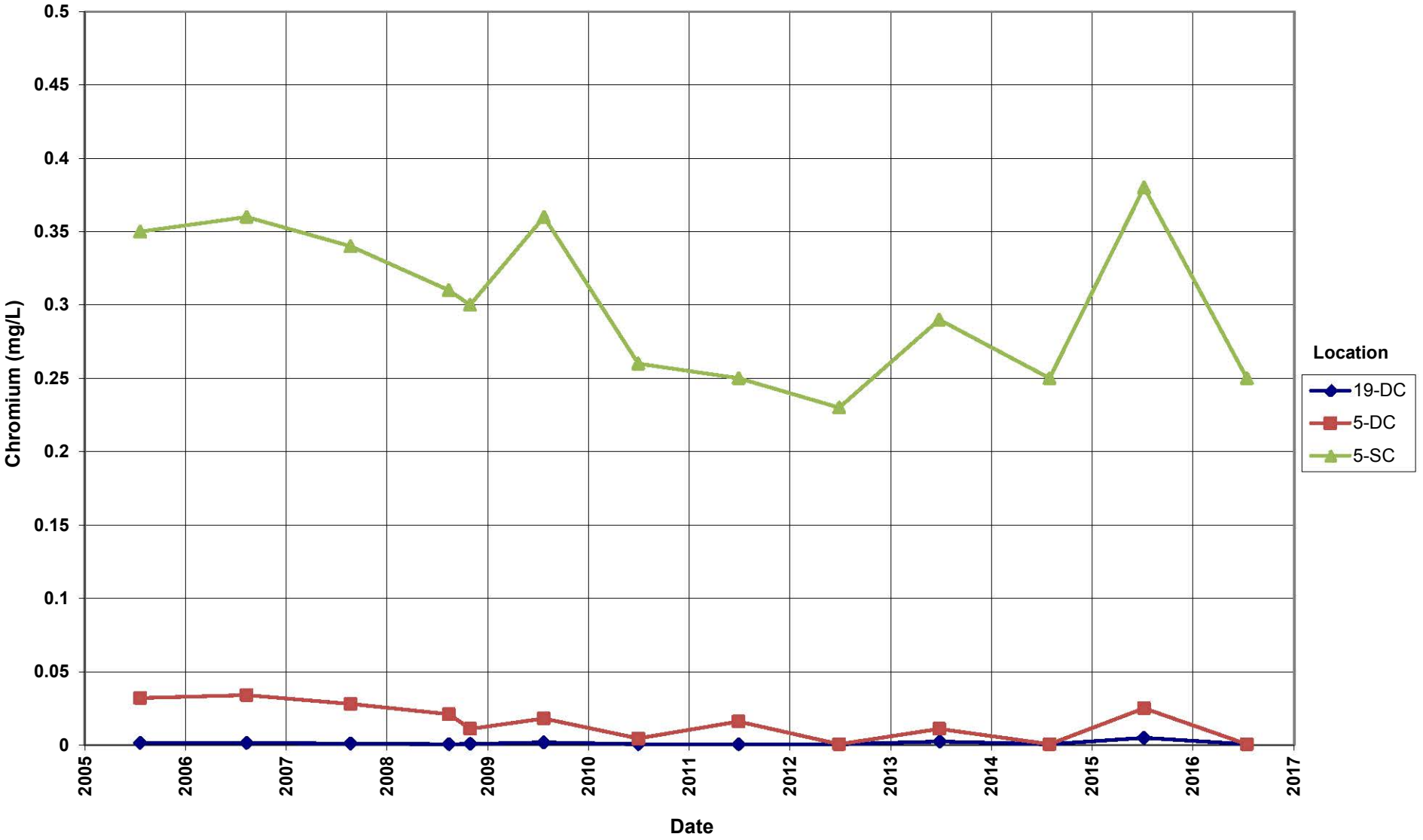
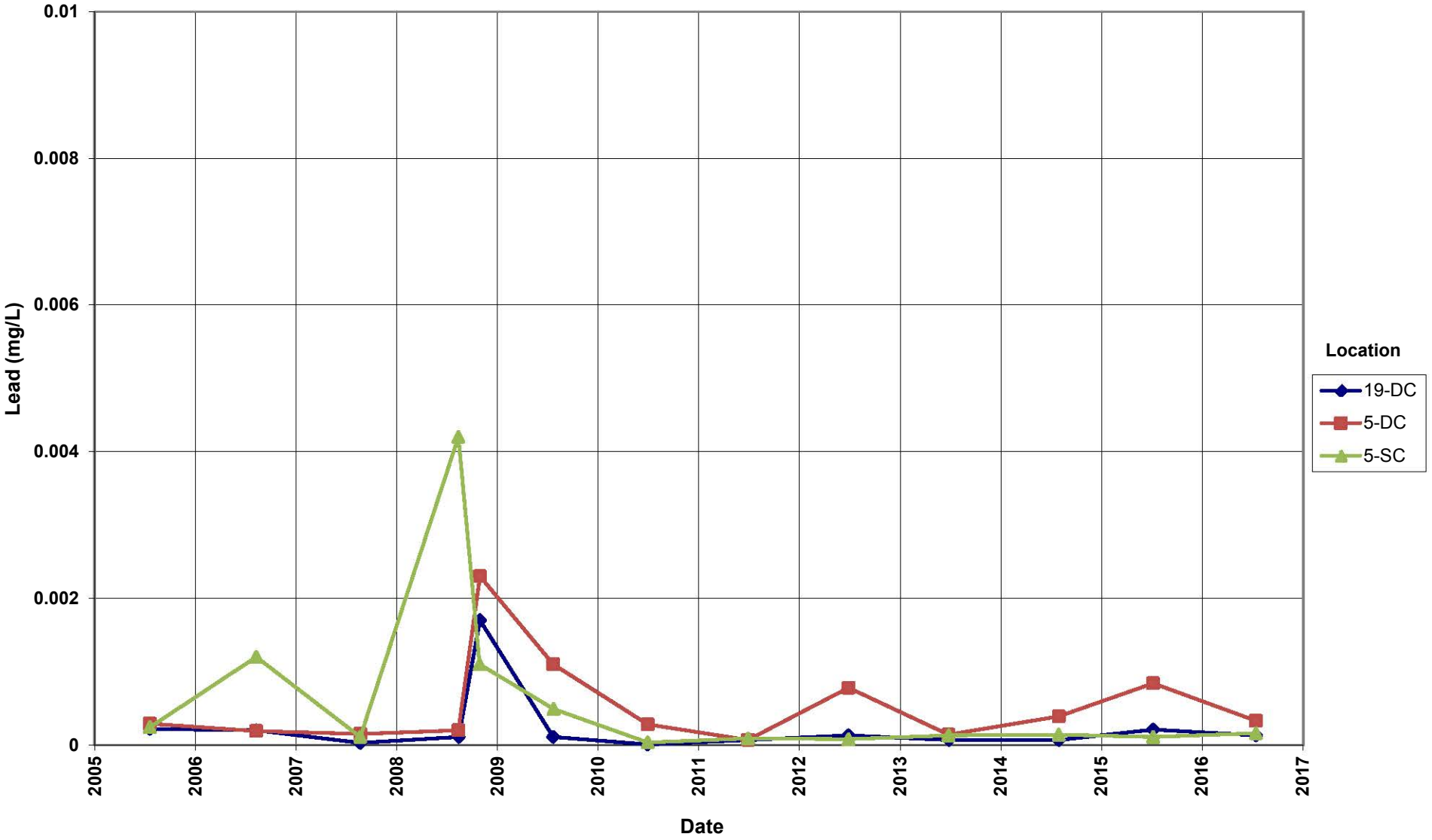
Shirley Basin South Disposal Site
Cadmium Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 0.079 mg/L



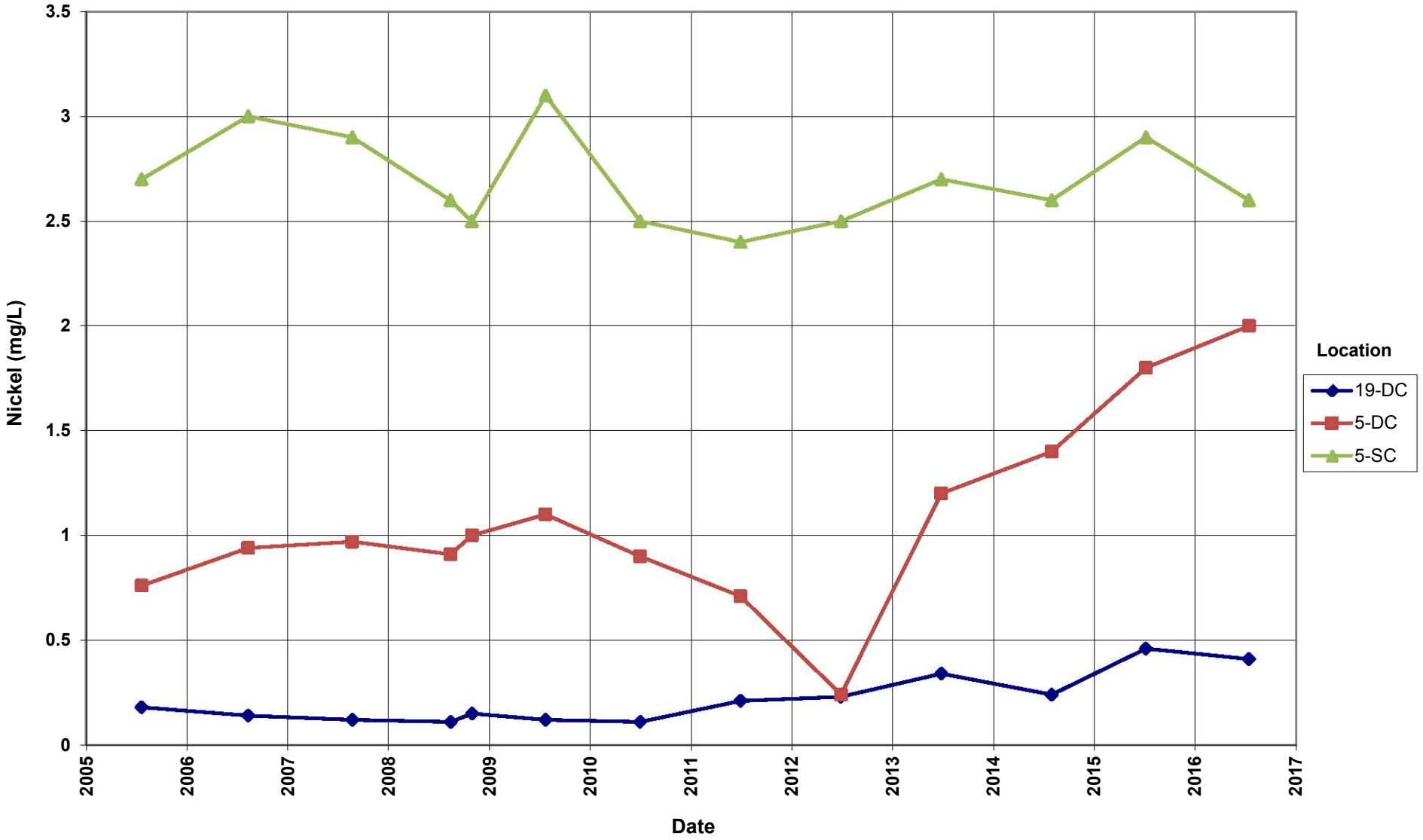
Shirley Basin South Disposal Site
Chromium Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 1.83 mg/L



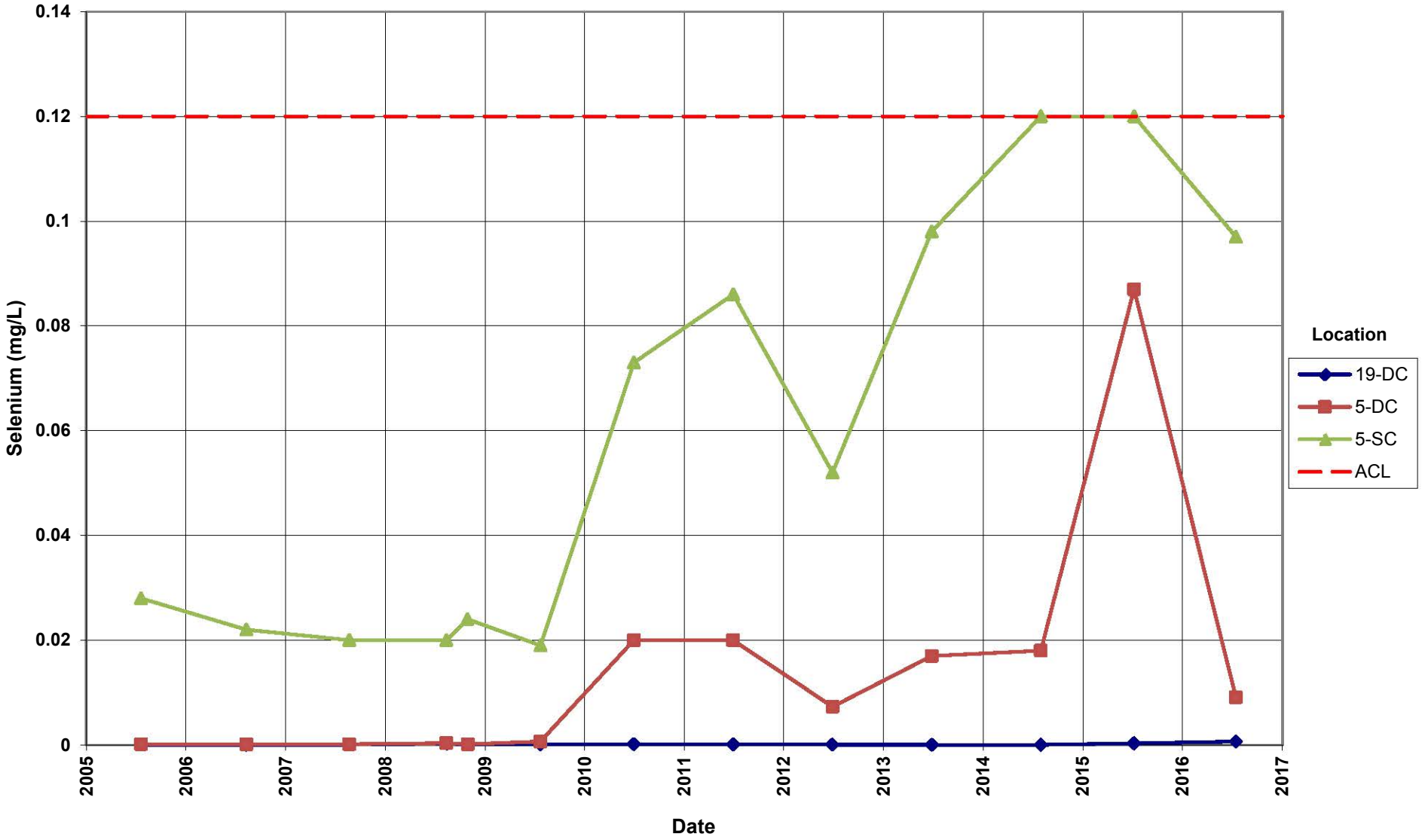
Shirley Basin South Disposal Site
Lead Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 0.05 mg/L



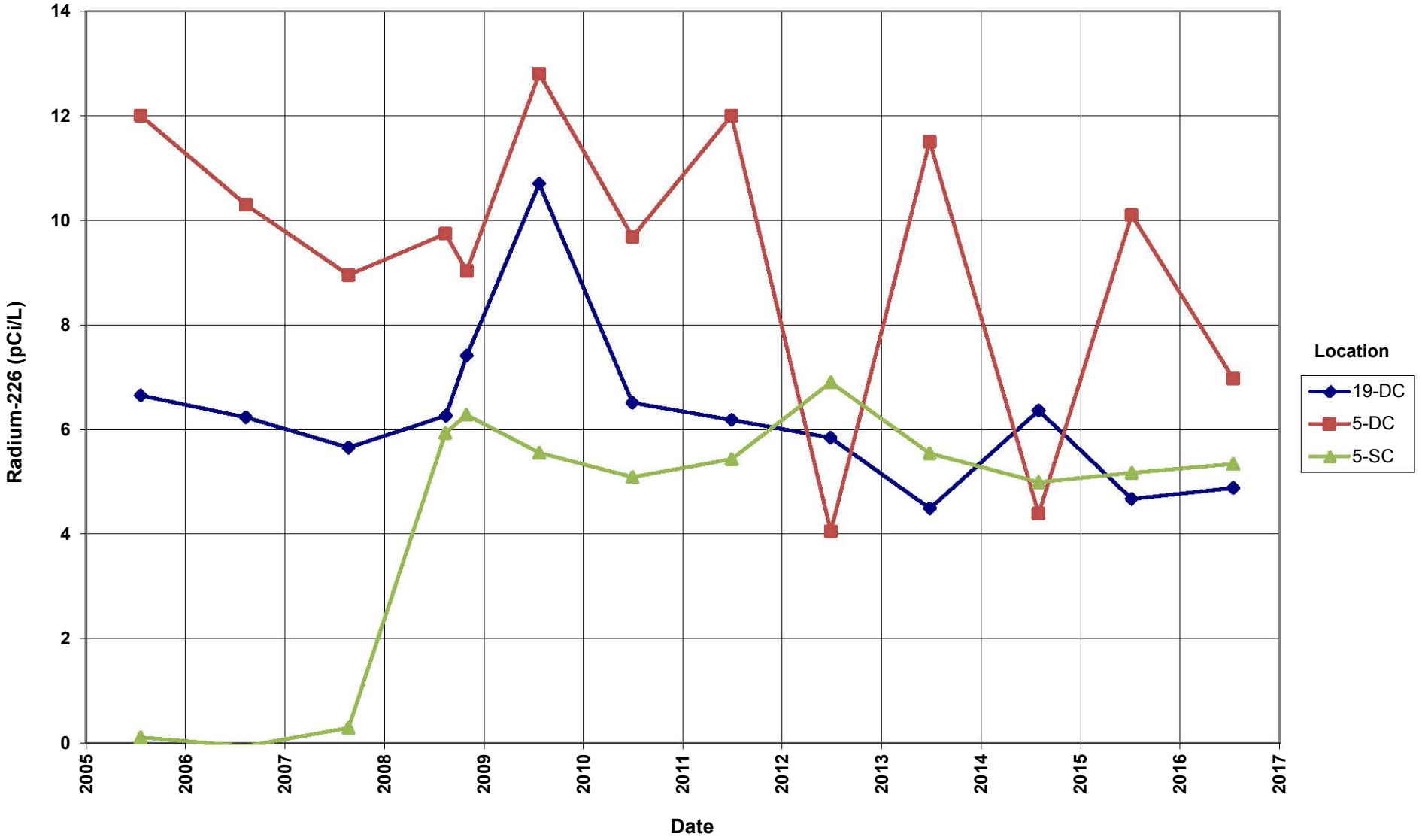
Shirley Basin South Disposal Site
Nickel Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 6.15 mg/L



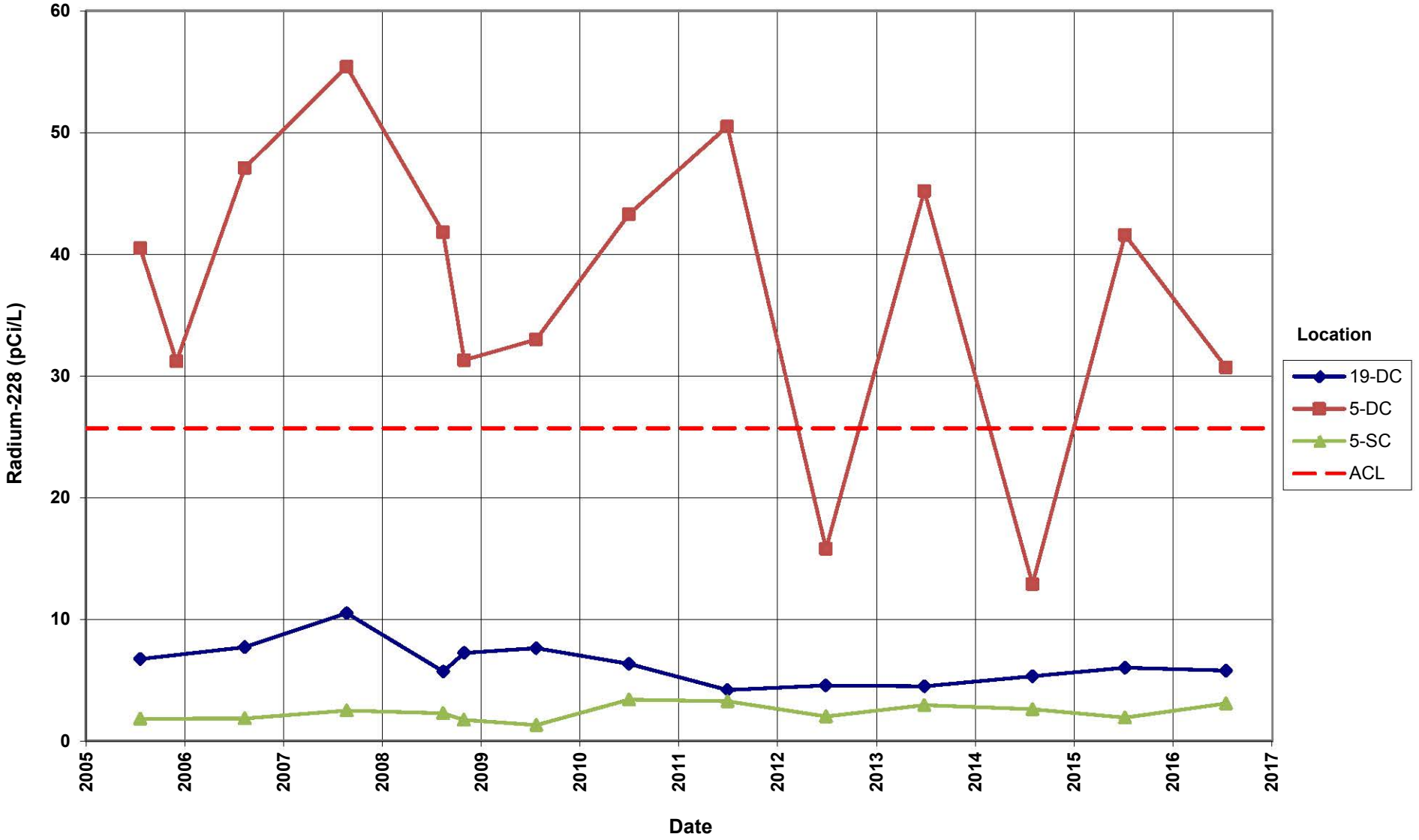
Shirley Basin South Disposal Site
Selenium Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 0.12 mg/L



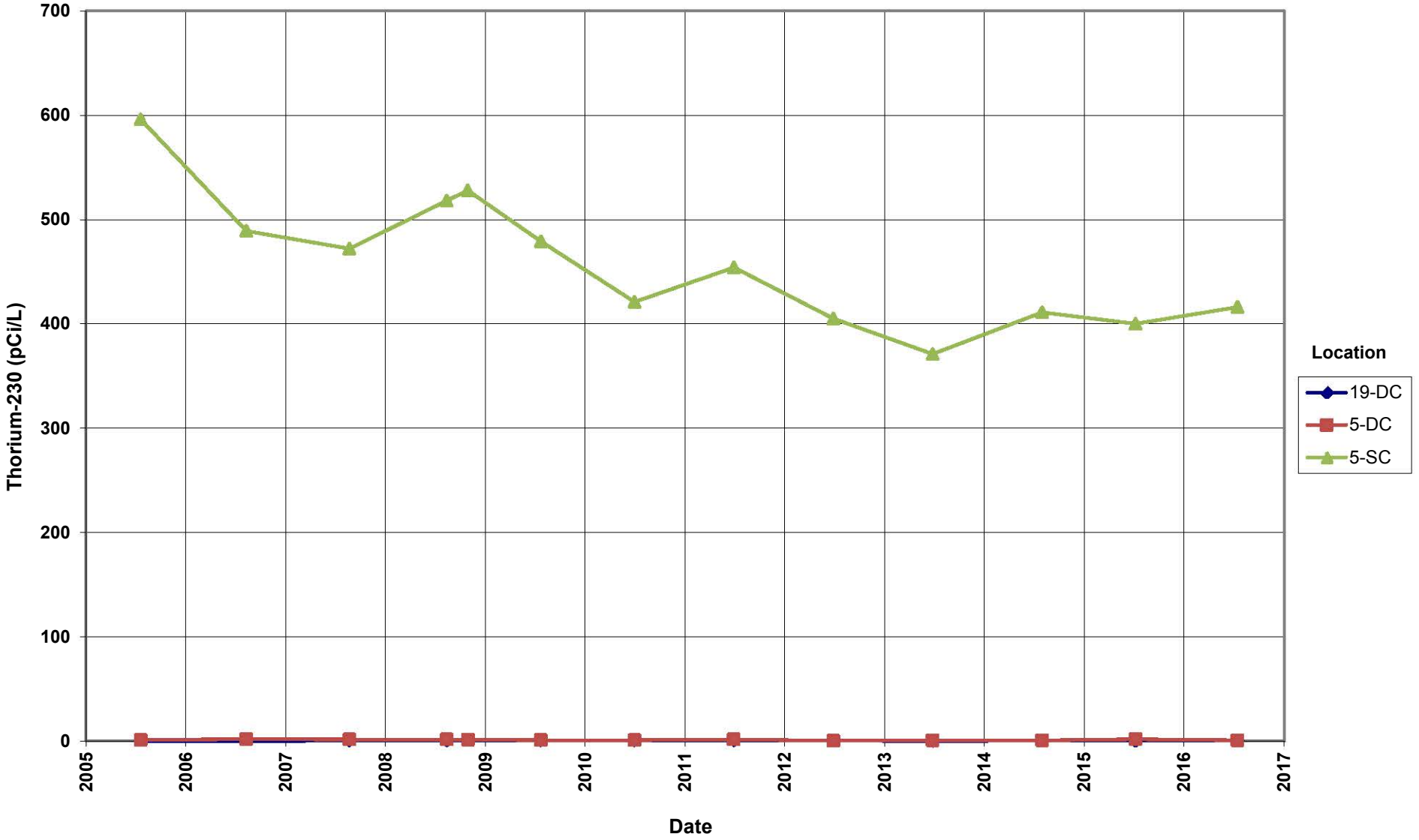
Shirley Basin South Disposal Site
Radium-226 Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 91.3 pCi/L



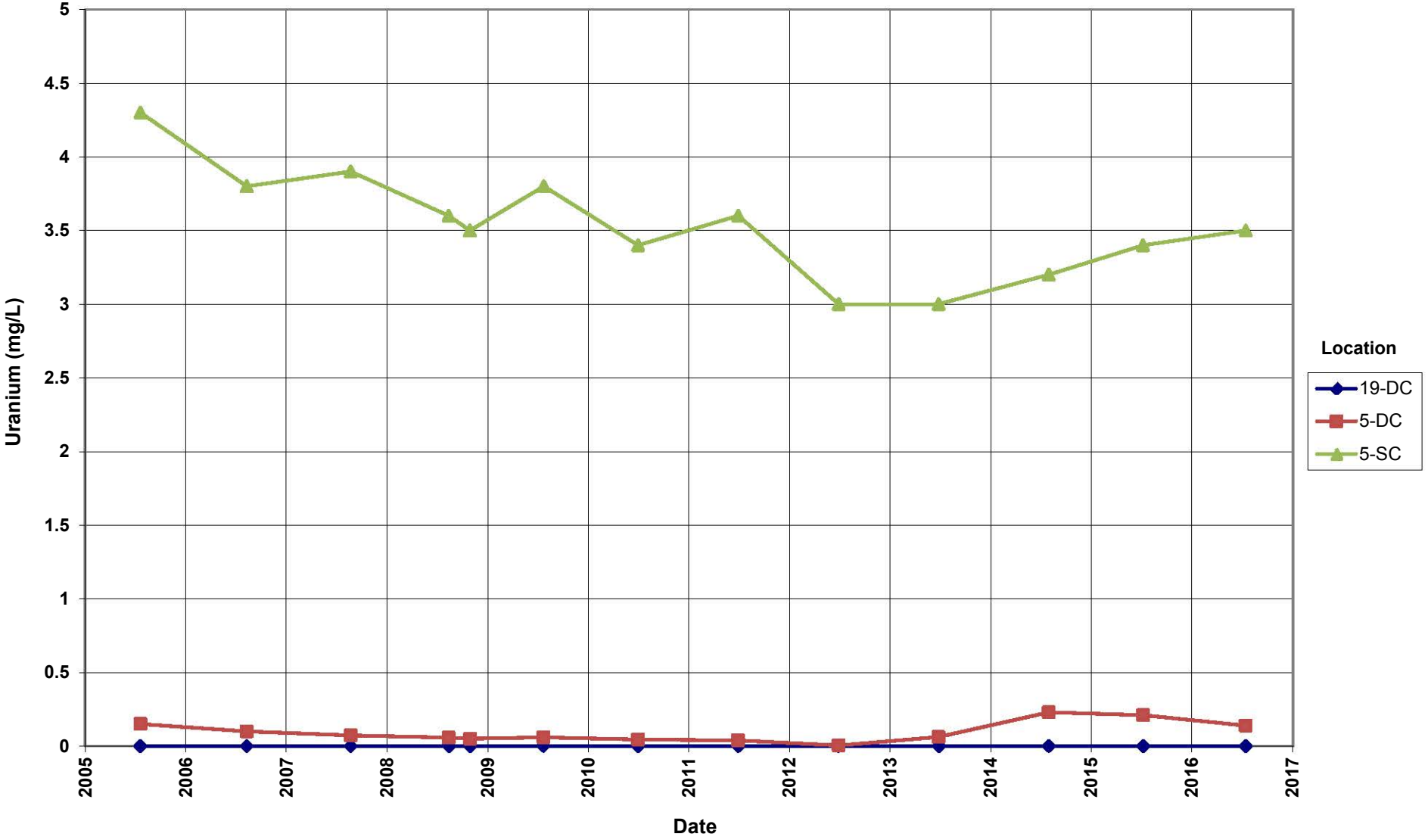
Shirley Basin South Disposal Site
Radium-228 Concentration
Point of Compliance Wells
Alternate Concentration Limit (ACL) = 25.7 pCi/L



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



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



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Attachment 4

Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

Potential outliers are results that lie outside the historical range, possibly due to transcription errors, data calculation errors, or measurement system problems. However, outliers can also represent true values outside the historical range. Potential outliers are identified by generating the Data Validation Outliers Report from data in the environmental database. The new data are compared to historical values and data that fall outside the historical data range are listed on the report along with the historical minimum and maximum values. The potential outliers are further reviewed and may be subject to statistical evaluation using the ProUCL application developed by the EPA (https://www.epa.gov/land-research/proucl-software). The review also includes an evaluation of any notable trends in the data that may indicate the outliers represent true extreme values. There were four statistical outliers identified by ProUCL. There were no errors noted during the review of these data and the data for this event are acceptable as qualified.

Data Validation Outliers Report - No Field Parameters **Report Date: 10/11/2016**

Comparison to Historical Data Since: 01/01/2005 12:00:00 AM Fraction: Any

Task: SBS01.1-16070001

Analyte	Location	Analysis Location	Units	Fraction	Result	Type	HistMIN	HistMAX	HistSetSize	5% Critical Value	Test Statistic	Outlier?
Total Dissolved Solids	100-SC	LB	mg/L	N	2300	> HistMAX	1800	2200	8	0.512	0.333	No
Sulfate	100-SC	LB	mg/L	N	1300	> HistMAX	310	1100	8	0.512	0.526	Yes
Radium-228	110-DC	LB	pCi/L	N	7.97	> HistMAX	2.46	6.93	10	0.477	0.356	No
Lead	110-DC	LB	mg/L	D	0.00013	< HistMIN	0.00025	0.0098	10	0.512	0.125	No
Radium-226	112-DC	LB	pCi/L	N	10.5	< HistMIN	10.9	29.1	8	0.512	0.035	No
Uranium	112-DC	LB	mg/L	D	0.0093	< HistMIN	0.011	0.25	8	0.512	0.015	No
Chloride	112-DC	LB	mg/L	N	33	< HistMIN	39	190	8	0.512	0.286	No
Radium-226	113-DC	LB	pCi/L	N	1.74	< HistMIN	2.27	4.87	8	0.512	0.205	No
Uranium	113-DC	LB	mg/L	D	0.00095	< HistMIN	0.00099	0.002	8	0.512	0.053	No
Uranium	19-DC	LB	mg/L	D	0.00016	< HistMIN	0.00018	0.0026	12	0.546	0.018	No
Total Dissolved Solids	40-SC	LB	mg/L	N	2200	< HistMIN	2300	4000	18	0.521	0.059	No
Radium-228	40-SC	LB	pCi/L	N	1.73	> HistMAX	0.642	1.55	18	0.576	0.306	No
Chloride	40-SC	LB	mg/L	N	24	< HistMIN	33	120	18	0.521	0.094	No
Thorium-230	54-SC	LB	pCi/L	N	8.79	> HistMAX	2.4	7.47	11	0.521	0.379	No
Thorium-228	54-SC	LB	pCi/L	N	13.9	> HistMAX	5.57	12	11	0.521	0.442	No
Thorium-232	54-SC	LB	pCi/L	N	9.94	> HistMAX	3.48	8.72	11	0.521	0.285	No
Radium-226	54-SC	LB	pCi/L	N	10.3	< HistMIN	11.8	23.3	11	0.521	0.186	No
Lead	54-SC	LB	mg/L	D	0.00025	< HistMIN	0.00037	0.0013	11	0.554	0.649	Yes

Data Validation Outliers Report - No Field Parameters **Report Date: 10/11/2016**

Comparison to Historical Data Since: 01/01/2005 12:00:00 AM Fraction: Any

Task: SBS01.1-16070001

Analyte	Location	Analysis Location	Units	Fraction	Result	Type	HistMIN	HistMAX	HistSetSize	5% Critical Value	Test Statistic	Outlier?
Uranium	54-SC	LB	mg/L	D	0.013	< HistMIN	0.02	0.082	11	0.521	0.151	No
Total Dissolved Solids	5-DC	LB	mg/L	N	18000	> HistMAX	5100	14000	11	0.521	0.510	No
Nickel	5-DC	LB	mg/L	D	2	> HistMAX	0.24	1.8	11	0.521	0.465	No
Sulfate	5-DC	LB	mg/L	N	12000	> HistMAX	3600	9500	11	0.521	0.545	Yes
Chloride	5-DC	LB	mg/L	N	240	> HistMAX	71	220	11	0.546	0.222	No
Thorium-232	5-SC	LB	pCi/L	N	9.83	< HistMIN	10.1	14	11	0.521	0.327	No
Total Dissolved Solids	5-SC	LB	mg/L	N	16000	< HistMIN	17000	20000	11	0.521	0.500	No
Cadmium	5-SC	LB	mg/L	D	0.032	< HistMIN	0.034	0.11	13	0.546	0.250	No
Uranium	K.G.S.#3	LB	mg/L	D	0.0021	> HistMAX	1E-05	0.00023	12	0.477	0.913	Yes
Chloride	K.G.S.#3	LB	mg/L	N	3.6	< HistMIN	4.1	24	12	0.576	0.052	No

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