

Data Validation Package

August 2008
Groundwater Sampling
at the Shirley Basin South, Wyoming
Disposal Site

January 2009



U.S. DEPARTMENT OF
ENERGY

Office of
Legacy Management

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Sampling Event Summary

Site: Shirley Basin South, Wyoming, Disposal Site

Sampling Period: August 11–13, 2008

The Long-Term Surveillance Plan for the U. S. Department of Energy Shirley Basin South (UMTRCA Title II) Disposal Site, Carbon County, Wyoming requires annual monitoring to verify continued compliance with the pertinent alternate concentration limits (ACLs) and Wyoming Class III (livestock use) groundwater protection standards. Point-of-compliance wells 5–SC, 51–SC, 5–DC, and 19–DC, and monitor wells 40–SC, 54–SC, 10–DC, and K.G.S.#3 were sampled as specified in the plan. Sampling and analysis was conducted in accordance with *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites*. The water level was measured at each sampled well.

Monitor wells with an “SC” suffix are completed in the Upper Sand aquifer of the Wind River Formation. Wells with a “DC” suffix are completed in the Main Sand aquifer, and K.G.S.#3 well is completed in the uncontaminated Lower Sand aquifer of the Wind River Formation. It has been determined using a down-hole video camera that well 54–SC is continuously screened through both the Upper Sand and Main Sand aquifers, and its water level indicates that sample results likely represent the Main Sand aquifer.

ACLs have been granted for the contaminants cadmium, chromium, lead, nickel, radium-226, radium-228, selenium, thorium-230, and uranium. Of these contaminants, only radium-228 remains above the ACL in an upward trend in both wells 5–DC and 54–SC as shown in Table 1. Radium-228 concentrations apparently are related to naturally occurring thorium ore in the Main Sand unit (the primary ore body at the site), and the upward trend may represent geochemical equilibration of the groundwater with aquifer material as the previously dewatered aquifer continues to rebound. No other ACLs were exceeded, and no comparable trends are occurring for the other constituents.

Table 1. Wells with Results Exceeding an ACL

Analyte	ACL ^a	5–DC	54–SC
Radium-228	25.7 pCi/L	41.8 pCi/L	125 pCi/L

^aACLs for Shirley Basin South Disposal Site.

pCi/L picocuries per liter

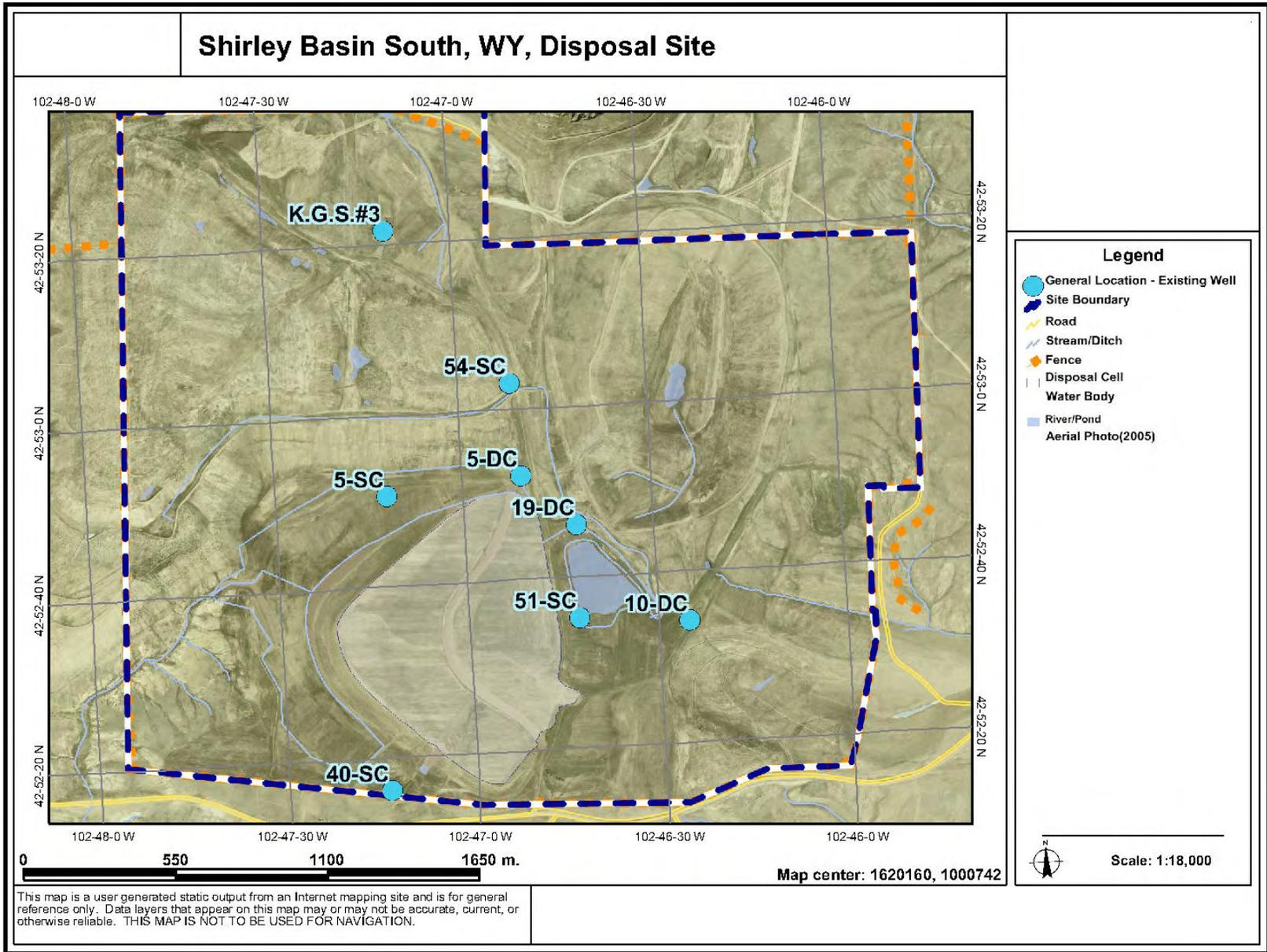
Sulfate and total dissolved solids continue to exceed their respective Wyoming Class III groundwater protection standards for livestock use in wells 5–DC, 5–SC, 51–SC, and 54–SC as they have done throughout the sampling history; however, there is no livestock use of the water at the site.

The water level and constituent concentrations in well K.G.S.#3 demonstrate hydraulic isolation of the Lower Sand Aquifer from the overlying contaminated aquifers.



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

1/30/09
Date



Shirley Basin South, Wyoming, Disposal Site Sample Location Map

Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	Shirley Basin South, Wyoming	Date(s) of Water Sampling	August 11–13, 2008
Date(s) of Verification	September 30, 2008	Name of Verifier	Steve Donovan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures? List other documents, SOPs, instructions.	Yes	Work Order Letter dated June 30, 2008.
2. Were the sampling locations specified in the planning documents sampled?	Yes	
3. Was a pre-trip calibration conducted as specified in the above-named documents?	Yes	Pre-trip calibration was performed on August 7, 2008.
4. Was an operational check of the field equipment conducted twice daily? Did the operational checks meet criteria?	Yes Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	Yes	
6. Was the category of the well documented?	Yes	
7. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged prior to sampling? Did the water level stabilize prior to sampling? Did pH, specific conductance, and turbidity measurements stabilize prior to sampling? Was the flow rate less than 500 mL/min? If a portable pump was used, was there a 4-hour delay between pump installation and sampling?	Yes Yes Yes Yes NA	

Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 mL/min?	Yes	Well 51-SC was Category II because of water level draw-down.
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected from well 40-SC.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with nondedicated equipment?	NA	
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were QC samples assigned a fictitious site identification number?	Yes	Location ID 2940 was used for duplicate sample.
Was the true identity of the samples recorded on the Quality Assurance Sample Log?	Yes	Duplicate identification is included in the trip report.
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	A thorium-230 sample was not collected from well 51-SC.
16. Were chain of custody records completed and was sample custody maintained?	Yes	
17. Are field data sheets signed and dated by both team members?	NA	The FDCS was used for data collection.
18. Was all other pertinent information documented on the field data sheets?	Yes	
19. Was the presence or absence of ice in the cooler documented at every sample location?	Yes	
20. Were water levels measured at the locations specified in the planning documents?	Yes	

Laboratory Performance Assessment

General Information

Report Number (RIN): 08071744
Sample Event: August 11–12, 2008
Site(s): Shirley Basin South, Wyoming
Laboratory: Paragon Analytics
Work Order No.: 0808139
Analysis: Metals, Inorganic, and Radiochemistry
Validator: Steve Donivan
Review Date: September 30, 2008

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

Table 2. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Cadmium (Cd), Lead (Pb), Selenium (Se), Uranium (U)	LMM-02	SW-846 3005A	SW-846 6020A
Chloride (Cl)	MIS-A-039	SW-846 9056	SW-846 9056
Chromium (Cr), Nickel (Ni)	LMM-01	SW-846 3005A	SW-846 6010B
Nitrate/Nitrite-N (NO ₃ -N)	WCH-A-022	MCAWW 353.2	MCAWW 353.2
Radium-226 (Ra-226)	ASP-A-016	SOP783R6	SOP783R6
Radium-228 (Ra-228)	GPC-A-020	SW-846 9320	SW-846 9320
Sulfate (SO ₄)	MIS-A-044	SW-846 9056	SW-846 9056
Thorium-230 (Th-230)	ASP-A-008	SOP776R9	SOP714R9
Total Dissolved Solids (TDS)	WCH-A-033	MCAWW 160.1	MCAWW 160.1

Data Qualifier Summary

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

Table 3. Data Qualifier Summary

Sample Number	Location	Analyte(s)	Flag	Reason
0808139-1	40-SC	Cd	U	Less than 5 times the method blank
0808139-1	40-SC	Pb	U	Less than 5 times the method blank
0808139-1	40-SC	Ra-226	J	Less than 3 times the MDC
0808139-1	40-SC	Ra-228	J	Less than 3 times the MDC
0808139-3	51-SC	Pb	U	Less than 5 times the method blank
0808139-3	51-SC	Se	J	Matrix spike failure
0808139-4	54-SC	Pb	U	Less than 5 times the method blank
0808139-5	10-DC	Cd	U	Less than 5 times the method blank
0808139-5	10-DC	Pb	U	Less than 5 times the method blank
0808139-5	10-DC	Se	U	Less than 5 times the calibration blank
0808139-6	5-DC	Cd	U	Less than 5 times the method blank
0808139-6	5-DC	Pb	U	Less than 5 times the method blank
0808139-7	19-DC	Cd	U	Less than 5 times the method blank
0808139-7	19-DC	Pb	U	Less than 5 times the method blank
0808139-7	19-DC	Se	U	Less than 5 times the calibration blank
0808139-8	K.G.S.#3	Cd	U	Less than 5 times the method blank
0808139-8	K.G.S.#3	Se	U	Less than 5 times the calibration blank
0808139-8	K.G.S.#3	Ra-226	J	Less than 3 times the MDC
0808139-9	40-SC Duplicate	Cd	U	Less than 5 times the method blank
0808139-9	40-SC Duplicate	Pb	U	Less than 5 times the method blank
0808139-9	40-SC Duplicate	Ra-226	J	Less than 3 times the MDC
0808139-9	40-SC Duplicate	Ra-228	J	Less than 3 times the MDC
0808139-9	40-SC Duplicate	Th-232	J	Less than 3 times the MDC

Sample Shipping/Receiving

Paragon Analytics in Fort Collins, Colorado, received nine water samples on August 15, 2008, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed on the forms with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The sample submittal documents including the COC forms and the sample tickets had no errors or omissions. A copy of the shipping labels displaying the air waybill numbers were included with the receiving documentation.

Preservation and Holding Times

The sample shipments were received intact with the temperatures inside the iced cooler at 0.4 °C, which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Laboratory Instrument Calibration

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

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

Calibrations for cadmium, lead, and uranium were performed on September 8, 2008; and for selenium on September 11, 2008. The initial calibrations were performed using six calibration standards resulting in calibration curves where the absolute value of the curve intercepts were less than 3 times the method detection limit (MDL) and the curve correlation coefficient (r^2) values were greater than 0.995. Calibration and laboratory spike standards were prepared from independent sources. Initial and continuing calibration verification checks (CCVs) were made at the required frequency resulting in nine CCVs. All initial and continuing calibration verification results were within the acceptance range. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curves near the practical quantitation limit with the results within the acceptance range. The mass calibration and resolution was checked at the beginning of each analytical run in accordance with the procedure. Internal standard recoveries were stable and within acceptance ranges.

Method SW-846 9056, Chloride, Sulfate

Initial calibrations were performed for chloride and sulfate using five calibration standards on August 18, 2008. The calibration curve r^2 values were greater than 0.995 and intercepts less than 3 times the MDL. Initial calibration and calibration check standards were prepared from independent sources. Initial and CCVs were made at the required frequency resulting in eight CCVs. All calibration checks met the acceptance criteria.

Method SW-846 6010B, Chromium, Nickel

Calibration for chromium and nickel was performed on September 9, 2008. The initial calibration was performed using one calibration standard and a blank. Calibration and laboratory spike standards were prepared from independent sources. Initial and CCVs were made at the required frequency resulting in nine CCVs. All initial and continuing calibration verification results were within the acceptance range. Reporting limit verification checks were made at the required frequency to verify the linearity of the calibration curves near the practical quantitation limit with the results within the acceptance range.

Method MCAWW 353.2, Nitrate-N

The initial calibration for $\text{NO}_3+\text{NO}_2\text{-N}$ was performed using seven calibration standards on August 18, 2008, resulting in a calibration curve r^2 value greater than 0.995 and an intercept less than 3 times the MDL. Initial and continuing calibration checks were made at the required frequency resulting in four CCVs that met the acceptance criteria.

Method MCAWW 160.1, Total Dissolved Solids

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

Radiochemical Analysis

Radiochemical results are qualified with a “J” flag (estimated) when the result is greater than the minimum detectable concentration (MDC), but less than 3 times the MDC. Radiochemical results are qualified with a “U” flag (not detected) when the result is greater than the MDC, but less than the two sigma total propagated uncertainty.

Radium-226

Emanation cell plateau voltage determinations were performed on September 18, 2007, and cell efficiency calibrations were performed on October 25, 2007. Daily efficiency calibration and background checks were performed on September 9, 2008. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Radium-228

Plateau voltage determinations were performed on November 6, 2007, and detector efficiency calibrations were performed on November 8, 2007. Daily efficiency calibration and background checks were performed on September 8, 2008. All calibration data met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples.

Review of the radium-228 data indicated that the sample bottles or results for samples 5–DC and 19–DC may have been switched. On September 23, 2008, a request was made of the laboratory to repeat the radium-228 analysis for these samples to confirm that no errors occurred during the original analysis.

Thorium Isotopes

Alpha spectrometry calibrations were performed on August 18, 2008. Instrument background was determined on August 18, 2008. All daily instrument calibration and background checks met the acceptance criteria. The chemical recoveries met the acceptance criteria of 40 to 110 percent for all samples. The full width at half maximum (FWHM) was reviewed for all analyses to evaluate the spectral resolution. All single peak FWHM values were below 100 demonstrating acceptable resolution. All internal standard peaks were within 50 KeV of the expected position.

Method and Calibration Blanks

All initial and continuing calibration blank (CCB) results were below the practical quantitation limits for method 6010B and 6020A analytes. In cases where blank concentration exceeded the instrument detection limit, 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.

The chloride, sulfate, NO₃+NO₂-N, and TDS method blanks, and initial and CCB results were below the MDL with the exception of the chloride CCB4 and sulfate CCB6 on August 18, 2008. The associated chloride and sulfate results were greater than 10 times the blank concentration.

The thorium isotopes, radium-226 and radium-228 method blank results were below the MDC.

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

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

Matrix Spike Analysis

Matrix spike and matrix spike duplicate samples (MS/MSD) were analyzed for metals and nitrate-N as a measure of method performance in the sample matrix. The MS/MSD analyses resulted in acceptable recovery and precision for all analytes with the exception of selenium. The associated sample selenium result is qualified with a “J” flag as an estimated value.

Laboratory Replicate Analysis

The laboratory replicate sample results demonstrate acceptable laboratory precision. The relative percent difference (RPD) values for the laboratory replicate samples and MSD sample results for non-radiochemical analytes were less than 20 percent. The radiochemical relative error ratio for the laboratory replicate sample was less than three.

Laboratory Control Sample

Laboratory control samples (LCS) were analyzed at the correct frequency to provide information on the accuracy of the analytical method and the overall laboratory performance, including sample preparation. The LCS results were acceptable for all analysis categories.

Metals Serial Dilution

Serial dilutions were prepared and analyzed for metals to monitor chemical or physical interferences in the sample matrix. The serial dilution data were not evaluated because the concentration of the undiluted sample was less than 50 times the practical quantitation limit.

Detection Limits/Dilutions

Samples were diluted in a consistent and acceptable manner when required. The samples were diluted prior to analysis of uranium to reduce interferences. The required detection limits were met for all analytes with the exception of thorium-228 and thorium-230 for samples 5-SC and 54-SC. The thorium-228 and thorium-230 results for these samples were greater than the reported detection limit.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers. The report received from the laboratory was complete.

Electronic Data Deliverable (EDD) File

The EDD file arrived on September 15, 2008. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 08071744 Lab Code: PAR Validator: Steve Donovan Validation Date: 9/30/2008
Project: Shirley Basin South Analysis Type: Metals General Chem Rad Organics
of Samples: 9 Matrix: WATER Requested Analysis Completed: Yes

Chain of Custody

Present: OK Signed: OK Dated: OK

Sample

Integrity: OK Preservation: OK Temperature: OK

Select Quality Parameters

- Holding Times
- Detection Limits
- Field/Trip Blanks
- Field Duplicates

All analyses were completed within the applicable holding times.

There are 4 detection limit failures.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM

RIN: 08071744 Lab Code: PAR

Non-Compliance Report: Detection Limits

Project: Shirley Basin South

Validation Date: 9/30/2008

Ticket	Location	Lab Sample ID	Method Code	Lab Method	Analyte Name	Result	Qualifier	Reported Detection Limit	Required Detection Limit	Units
GIS 008	54-SC	0808139-4	ASP-A-008	714R11	Thorium-230	5.69		1.8	1	pCi/L
GIS 008	54-SC	0808139-4	ASP-A-008	714R11	Thorium-228	7.65		1.3	1	pCi/L
GIS 006	5-SC	0808139-2	ASP-A-008	714R11	Thorium-230	518		3.4	1	pCi/L
GIS 006	5-SC	0808139-2	ASP-A-008	714R11	Thorium-228	51.3		2.6	1	pCi/L

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 08071744 **Lab Code:** PAR **Date Due:** 9/12/2008
Matrix: Water **Site Code:** SBS **Date Completed:** 9/16/2008

Analyte	Date Analyzed	CALIBRATION						Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	ICV	CCV	ICB	CCB						
CHLORIDE	08/18/2008	0.000	1.0000	OK	OK	OK	OK	OK	103.0				
CHLORIDE	08/19/2008				OK		OK	OK		105.0	103.0	1.00	
NITRATE/NITRITE AS N	08/18/2008	0.000	0.9999	OK	OK	OK	OK	OK	105.0	109.0	108.0	0	
SULFATE	08/18/2008	0.000	1.0000	OK	OK	OK	OK		104.0	114.0	113.0	0	
TOTAL DISSOLVED SOLIDS	08/19/2008							OK	103.0			1.00	

SAMPLE MANAGEMENT SYSTEM
Metals Data Validation Worksheet

RIN: 08071744 Lab Code: PAR Date Due: 9/12/2008
 Matrix: Water Site Code: SBS Date Completed: 9/16/2008

Analyte	Date Analyzed	CALIBRATION						Method	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
		Int.	R^2	ICV	CCV	ICB	CCB								
CADMIUM	09/08/2008	0.0000	1.0000	OK	OK	OK	OK	OK	97.0	95.0	95.0	1.0	91.0		79.0
CHROMIUM	09/09/2008			OK	OK	OK	OK	OK	102.0	93.0	94.0	1.0	94.0		85.0
CHROMIUM	09/09/2008												91.0		106.0
LEAD	09/08/2008	0.0000	1.0000	OK	OK	OK	OK	OK	97.0	100.0	100.0	0.0	103.0		118.0
NICKEL	09/09/2008			OK	OK	OK	OK	OK	101.0	92.0	93.0	1.0	92.0		98.0
NICKEL	09/09/2008												91.0		102.0
SELENIUM	09/11/2008	0.0000	1.0000	OK	OK	OK	OK	OK	98.0	122.0	126.0	3.0	96.0		75.0
URANIUM	09/08/2008	0.0000	1.0000	OK	OK	OK	OK	OK	97.0	103.0	103.0	0.0	106.0		111.0

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 08071744 **Lab Code:** PAR **Date Due:** 9/12/2008
Matrix: Water **Site Code:** SBS **Date Completed:** 9/16/2008

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
40-SC	Radium-226	09/09/2008			94.9			
5-SC	Radium-226	09/09/2008			88.5			
51-SC	Radium-226	09/09/2008			74.1			
54-SC	Radium-226	09/09/2008			83.0			
10-DC	Radium-226	09/09/2008			88.3			
5-DC	Radium-226	09/09/2008			86.6			
19-DC	Radium-226	09/09/2008			92.7			
K.G.S.#3	Radium-226	09/09/2008			99.0			
2940	Radium-226	09/09/2008			96.2			
Blank_Spike	Radium-226	09/09/2008			91.8	104.0		
Spike_Duplicate	Radium-226	09/09/2008			87.2	106.0		0.13
Blank	Radium-226	09/09/2008	0.0519	U	94.6			
40-SC	Radium-228	09/08/2008			57.5			
5-SC	Radium-228	09/08/2008			54.0			
51-SC	Radium-228	09/08/2008			49.4			
54-SC	Radium-228	09/08/2008			50.3			
10-DC	Radium-228	09/08/2008			59.2			
Blank_Spike	Radium-228	09/08/2008			58.5	89.0		
Spike_Duplicate	Radium-228	09/08/2008			58.6	97.8		0.44
Blank	Radium-228	09/08/2008	0.2220	U	54.8			
5-DC	Radium-228	09/09/2008			61.1			
19-DC	Radium-228	09/09/2008			54.7			
K.G.S.#3	Radium-228	09/09/2008			64.6			
2940	Radium-228	09/09/2008			62.8			
Blank_Spike	Radium-228	09/09/2008			63.0	101.0		
Spike_Duplicate	Radium-228	09/09/2008			61.7	108.0		0.33
Blank	Radium-228	09/09/2008	-0.0663	U	63.3			
5-SC	Thorium-228	08/20/2008			76.7			
54-SC	Thorium-228	08/20/2008			78.6			
10-DC	Thorium-228	08/20/2008			74.9			
5-DC	Thorium-228	08/20/2008			73.0			
19-DC	Thorium-228	08/20/2008			75.8			

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 08071744 **Lab Code:** PAR **Date Due:** 9/12/2008
Matrix: Water **Site Code:** SBS **Date Completed:** 9/16/2008

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
K.G.S.#3	Thorium-228	08/20/2008			74.0			
2940	Thorium-228	08/20/2008			73.6			
40-SC	Thorium-228	08/20/2008			73.6			0.51
Blank	Thorium-228	08/20/2008	0.6510	U	70.0			
40-SC	Thorium-228	08/23/2008			72.8			
Blank_Spike	Thorium-230	08/20/2008			70.3	107.0		
40-SC	Thorium-230	08/20/2008						2.76
Blank	Thorium-230	08/20/2008	0.8940	U				
40-SC	Thorium-232	08/20/2008						1.01
Blank	Thorium-232	08/20/2008	0.0530	U				

Sampling Quality Control Assessment

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

All monitor well sample results were qualified with an “F” flag in the database indicating the wells were purged and sampled using the low-flow sampling method. Well 51–SC data were further qualified with a “Q” flag indicating that a constant water level could not be maintained during the purge and sampling process.

Equipment Blank Assessment

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

Field Duplicate Assessment

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates which measure only laboratory performance. A duplicate sample was collected from well 40–SC. The non-radiometric duplicate results met the U.S. Environmental Protection Agency recommended laboratory duplicate criteria of having a RPD of less than 20 percent for results that are greater than 5 times the practical quantitation limit, and the radiochemical duplicate results had a RER of less than three, demonstrating acceptable overall precision.

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 08071744 Lab Code: PAR Project: Shirley Basin South Validation Date: 9/30/2008

Duplicate: 2940

Sample: 40-SC

Analyte	Sample			Duplicate			RPD	RER	Units
	Result	Flag	Error	Result	Flag	Error			
CADMIUM	0.18	B		0.15	B				UG/L
CHLORIDE	73			74			1.36		MG/L
CHROMIUM	0.54	U		0.54	U				UG/L
LEAD	0.074	B		0.13	B				UG/L
NICKEL	14	B		10	B		33.33		UG/L
NITRATE/NITRITE AS N	0.61			0.63			3.23		MG/L
Radium-226	0.496		0.25	0.24		0.158		1.7	pCi/L
Radium-228	1.15		0.492	0.789		0.406		1.1	pCi/L
SELENIUM	5			5.3			5.83		UG/L
SULFATE	2100			2100			0		MG/L
Thorium-228	0.154	U	0.271	0.046	U	0.254		0.6	pCi/L
Thorium-230	-0.209	U	0.308	-0.0551	U	0.332		0.7	pCi/L
Thorium-232	0.008	U	0.0746	0.137		0.113		1.9	pCi/L
TOTAL DISSOLVED SOLIDS	3200			3300			3.08		MG/L
URANIUM	0.55	E		0.36			41.76		UG/L

Certification

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

Laboratory Coordinator: Steve Donivan 1-30-2009
Steve Donivan Date

Data Validation Lead: Steve Donivan 1-30-2009
Steve Donivan Date

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Attachment 1
Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

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

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

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

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

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

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Attachment 2

Data Presentation

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Groundwater Quality Data

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

REPORT DATE: 1/13/2009

Location: 10-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/11/2008	N001	180.8 - 220.8	185		F	#		
Cadmium	mg/L	08/11/2008	N001	180.8 - 220.8	0.000094	B	UF	#	0.000038	
Chloride	mg/L	08/11/2008	N001	180.8 - 220.8	62		F	#	2	
Chromium	mg/L	08/11/2008	N001	180.8 - 220.8	0.00054	U	F	#	0.00054	
Lead	mg/L	08/11/2008	N001	180.8 - 220.8	0.00062		UF	#	0.000019	
Nickel	mg/L	08/11/2008	N001	180.8 - 220.8	0.001	U	F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/11/2008	N001	180.8 - 220.8	0.041		F	#	0.01	
Oxidation Reduction Potential	mV	08/11/2008	N001	180.8 - 220.8	-22.4		F	#		
pH	s.u.	08/11/2008	N001	180.8 - 220.8	6.65		F	#		
Radium-226	pCi/L	08/11/2008	N001	180.8 - 220.8	14.7		F	#	0.17	3.83
Radium-228	pCi/L	08/11/2008	N001	180.8 - 220.8	4.49		F	#	0.64	1.41
Selenium	mg/L	08/11/2008	N001	180.8 - 220.8	0.00023		UF	#	0.000024	
Specific Conductance	umhos/cm	08/11/2008	N001	180.8 - 220.8	2007		F	#		
Sulfate	mg/L	08/11/2008	N001	180.8 - 220.8	1100		F	#	10	
Temperature	C	08/11/2008	N001	180.8 - 220.8	9.7		F	#		
Thorium-228	pCi/L	08/11/2008	N001	180.8 - 220.8	0.54	U	F	#	0.54	0.303
Thorium-230	pCi/L	08/11/2008	N001	180.8 - 220.8	0.71	U	F	#	0.71	0.311
Thorium-232	pCi/L	08/11/2008	N001	180.8 - 220.8	0.14	U	F	#	0.14	0.114
Total Dissolved Solids	mg/L	08/11/2008	N001	180.8 - 220.8	1800		F	#	40	
Turbidity	NTU	08/11/2008	N001	180.8 - 220.8	1.93		F	#		
Uranium	mg/L	08/11/2008	N001	180.8 - 220.8	0.012		F	#	0.0000045	

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

REPORT DATE: 1/13/2009

Location: 19-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/13/2008	N001	177 - 237	216		F	#		
Cadmium	mg/L	08/13/2008	N001	177 - 237	0.000097	B	UF	#	0.000038	
Chloride	mg/L	08/13/2008	N001	177 - 237	94		F	#	4	
Chromium	mg/L	08/13/2008	N001	177 - 237	0.00054	U	F	#	0.00054	
Lead	mg/L	08/13/2008	N001	177 - 237	0.00011	B	UF	#	0.000019	
Nickel	mg/L	08/13/2008	N001	177 - 237	0.11		F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/13/2008	N001	177 - 237	0.018		F	#	0.01	
Oxidation Reduction Potential	mV	08/13/2008	N001	177 - 237	-80.6		F	#		
pH	s.u.	08/13/2008	N001	177 - 237	6.69		F	#		
Radium-226	pCi/L	08/13/2008	N001	177 - 237	6.26		F	#	0.16	1.7
Radium-228	pCi/L	08/13/2008	N001	177 - 237	5.71		F	#	0.91	1.81
Selenium	mg/L	08/13/2008	N001	177 - 237	0.00027		UF	#	0.000024	
Specific Conductance	umhos/cm	08/13/2008	N001	177 - 237	4231		F	#		
Sulfate	mg/L	08/13/2008	N001	177 - 237	2900		F	#	25	
Temperature	C	08/13/2008	N001	177 - 237	10.4		F	#		
Thorium-228	pCi/L	08/13/2008	N001	177 - 237	0.45	U	F	#	0.45	0.23
Thorium-230	pCi/L	08/13/2008	N001	177 - 237	0.72	U	F	#	0.72	0.406
Thorium-232	pCi/L	08/13/2008	N001	177 - 237	0.14	U	F	#	0.14	0.0875
Total Dissolved Solids	mg/L	08/13/2008	N001	177 - 237	4400		F	#	80	
Turbidity	NTU	08/13/2008	N001	177 - 237	5.37		F	#		
Uranium	mg/L	08/13/2008	N001	177 - 237	0.0002		F	#	0.0000045	

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

REPORT DATE: 1/13/2009

Location: 40-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/12/2008	N001	-	85		F	#		
Cadmium	mg/L	08/12/2008	N001	-	0.00018	B	UF	#	0.000038	
Cadmium	mg/L	08/12/2008	N002	-	0.00015	B	UF	#	0.000038	
Chloride	mg/L	08/12/2008	N001	-	73		F	#	4	
Chloride	mg/L	08/12/2008	N002	-	74		F	#	10	
Chromium	mg/L	08/12/2008	N001	-	0.00054	U	F	#	0.00054	
Chromium	mg/L	08/12/2008	N002	-	0.00054	U	F	#	0.00054	
Lead	mg/L	08/12/2008	N001	-	0.000074	B	UF	#	0.000019	
Lead	mg/L	08/12/2008	N002	-	0.00013	B	UF	#	0.000019	
Nickel	mg/L	08/12/2008	N001	-	0.014	B	F	#	0.001	
Nickel	mg/L	08/12/2008	N002	-	0.01	B	F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N001	-	0.61		F	#	0.01	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N002	-	0.63		F	#	0.01	
Oxidation Reduction Potential	mV	08/12/2008	N001	-	41.7		F	#		
pH	s.u.	08/12/2008	N001	-	6.32		F	#		
Radium-226	pCi/L	08/12/2008	N001	-	0.496		FJ	#	0.19	0.25
Radium-226	pCi/L	08/12/2008	N002	-	0.24		FJ	#	0.18	0.158
Radium-228	pCi/L	08/12/2008	N001	-	1.15		FJ	#	0.65	0.492
Radium-228	pCi/L	08/12/2008	N002	-	0.789		FJ	#	0.64	0.406
Selenium	mg/L	08/12/2008	N001	-	0.005		F	#	0.000024	
Selenium	mg/L	08/12/2008	N002	-	0.0053		F	#	0.000024	
Specific Conductance	umhos/cm	08/12/2008	N001	-	3301		F	#		

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

REPORT DATE: 1/13/2009

Location: 40-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Sulfate	mg/L	08/12/2008	N001	-	2100		F	#	25	
Sulfate	mg/L	08/12/2008	N002	-	2100		F	#	25	
Temperature	C	08/12/2008	N001	-	8.88		F	#		
Thorium-228	pCi/L	08/12/2008	N001	-	0.54	U	F	#	0.54	0.271
Thorium-228	pCi/L	08/12/2008	N002	-	0.54	U	F	#	0.54	0.254
Thorium-230	pCi/L	08/12/2008	N001	-	0.71	U	F	#	0.71	0.308
Thorium-230	pCi/L	08/12/2008	N002	-	0.72	U	F	#	0.72	0.332
Thorium-232	pCi/L	08/12/2008	N001	-	0.17	U	F	#	0.17	0.0746
Thorium-232	pCi/L	08/12/2008	N002	-	0.137		FJ	#	0.12	0.113
Total Dissolved Solids	mg/L	08/12/2008	N001	-	3200		F	#	40	
Total Dissolved Solids	mg/L	08/12/2008	N002	-	3300		F	#	80	
Turbidity	NTU	08/12/2008	N001	-	1.02		F	#		
Uranium	mg/L	08/12/2008	N001	-	0.00055	E	F	#	0.000045	
Uranium	mg/L	08/12/2008	N002	-	0.00036		F	#	0.000045	

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

REPORT DATE: 1/13/2009

Location: 5-DC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/12/2008	N001	-	0		F	#		
Cadmium	mg/L	08/12/2008	N001	-	0.00028	B	UF	#	0.000077	
Chloride	mg/L	08/12/2008	N001	-	180		F	#	10	
Chromium	mg/L	08/12/2008	N001	-	0.021		F	#	0.00054	
Lead	mg/L	08/12/2008	N001	-	0.0002	B	UF	#	0.000038	
Nickel	mg/L	08/12/2008	N001	-	0.91		F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N001	-	1	U	F	#	1	
pH	s.u.	08/12/2008	N001	-	4.06		F	#		
Radium-226	pCi/L	08/12/2008	N001	-	9.74		F	#	0.16	2.59
Radium-228	pCi/L	08/12/2008	N001	-	41.8		F	#	0.85	12.5
Selenium	mg/L	08/12/2008	N001	-	0.00036		F	#	0.000024	
Specific Conductance	umhos /cm	08/12/2008	N001	-	7050		F	#		
Sulfate	mg/L	08/12/2008	N001	-	6400		F	#	50	
Temperature	C	08/12/2008	N001	-	10.98		F	#		
Thorium-228	pCi/L	08/12/2008	N001	-	2.92		F	#	0.56	0.72
Thorium-230	pCi/L	08/12/2008	N001	-	1.53		F	#	0.73	0.552
Thorium-232	pCi/L	08/12/2008	N001	-	1.03		F	#	0.15	0.341
Total Dissolved Solids	mg/L	08/12/2008	N001	-	9000		F	#	400	
Turbidity	NTU	08/12/2008	N001	-	7.99		F	#		
Uranium	mg/L	08/12/2008	N001	-	0.058		F	#	0.000009	

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

REPORT DATE: 1/13/2009

Location: 5-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/12/2008	N001	49.3	- 57.7	0		F	#		
Cadmium	mg/L	08/12/2008	N001	49.3	- 57.7	0.041		F	#	0.0019	
Chloride	mg/L	08/12/2008	N001	49.3	- 57.7	340		F	#	10	
Chromium	mg/L	08/12/2008	N001	49.3	- 57.7	0.31		F	#	0.00054	
Lead	mg/L	08/12/2008	N001	49.3	- 57.7	0.0042	B	F	#	0.00095	
Nickel	mg/L	08/12/2008	N001	49.3	- 57.7	2.6		F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N001	49.3	- 57.7	1	U	F	#	1	
Oxidation Reduction Potential	mV	08/12/2008	N001	49.3	- 57.7	279.6		F	#		
pH	s.u.	08/12/2008	N001	49.3	- 57.7	3.33		F	#		
Radium-226	pCi/L	08/12/2008	N001	49.3	- 57.7	5.93		F	#	0.16	1.65
Radium-228	pCi/L	08/12/2008	N001	49.3	- 57.7	2.28		F	#	0.7	0.797
Selenium	mg/L	08/12/2008	N001	49.3	- 57.7	0.02		F	#	0.00012	
Specific Conductance	umhos/cm	08/12/2008	N001	49.3	- 57.7	12114		F	#		
Sulfate	mg/L	08/12/2008	N001	49.3	- 57.7	14000		F	#	100	
Temperature	C	08/12/2008	N001	49.3	- 57.7	9.98		F	#		
Thorium-228	pCi/L	08/12/2008	N001	49.3	- 57.7	51.3		F	#	2.6	9.06
Thorium-230	pCi/L	08/12/2008	N001	49.3	- 57.7	518		F	#	3.4	80.2
Thorium-232	pCi/L	08/12/2008	N001	49.3	- 57.7	14		F	#	0.94	3.16
Total Dissolved Solids	mg/L	08/12/2008	N001	49.3	- 57.7	20000		F	#	200	
Turbidity	NTU	08/12/2008	N001	49.3	- 57.7	9.88		F	#		
Uranium	mg/L	08/12/2008	N001	49.3	- 57.7	3.6		F	#	0.00022	

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

REPORT DATE: 1/13/2009

Location: 51-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/13/2008	N001	-	0		FQ	#		
Cadmium	mg/L	08/13/2008	N001	-	0.0077		FQ	#	0.000038	
Chloride	mg/L	08/13/2008	N001	-	380		FQ	#	20	
Chromium	mg/L	08/13/2008	N001	-	0.55		FQ	#	0.00054	
Lead	mg/L	08/13/2008	N001	-	0.00041	B	UFQ	#	0.000019	
Nickel	mg/L	08/13/2008	N001	-	2.6		FQ	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/13/2008	N001	-	1	U	FQ	#	1	
Oxidation Reduction Potential	mV	08/13/2008	N001	-	380.2		FQ	#		
pH	s.u.	08/13/2008	N001	-	3.3		FQ	#		
Radium-226	pCi/L	08/13/2008	N001	-	1.81		FQ	#	0.2	0.607
Radium-228	pCi/L	08/13/2008	N001	-	0.78	U	FQ	#	0.78	0.363
Selenium	mg/L	08/13/2008	N001	-	0.00043	N	FQJ	#	0.000024	
Specific Conductance	umhos/cm	08/13/2008	N001	-	9714		FQ	#		
Sulfate	mg/L	08/13/2008	N001	-	11000		FQ	#	100	
Temperature	C	08/13/2008	N001	-	9.6		FQ	#		
Total Dissolved Solids	mg/L	08/13/2008	N001	-	14000		FQ	#	200	
Turbidity	NTU	08/13/2008	N001	-	9.83		FQ	#		
Uranium	mg/L	08/13/2008	N001	-	0.081		FQ	#	0.000045	

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

REPORT DATE: 1/13/2009

Location: 54-SC WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Lab	Qualifiers Data	QA	Detection Limit	Uncertainty
Alkalinity, Total (As CaCO3)	mg/L	08/12/2008	N001	-	0		F	#		
Cadmium	mg/L	08/12/2008	N001	-	0.0019		F	#	0.000077	
Chloride	mg/L	08/12/2008	N001	-	380		F	#	20	
Chromium	mg/L	08/12/2008	N001	-	0.33		F	#	0.00054	
Lead	mg/L	08/12/2008	N001	-	0.00065	B	UF	#	0.000038	
Nickel	mg/L	08/12/2008	N001	-	2.4		F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N001	-	1	U	F	#	1	
Oxidation Reduction Potential	mV	08/12/2008	N001	-	209.5		F	#		
pH	s.u.	08/12/2008	N001	-	4.04		F	#		
Radium-226	pCi/L	08/12/2008	N001	-	19		F	#	0.19	4.92
Radium-228	pCi/L	08/12/2008	N001	-	125		F	#	0.8	37
Selenium	mg/L	08/12/2008	N001	-	0.00048		F	#	0.000024	
Specific Conductance	umhos/cm	08/12/2008	N001	-	9132		F	#		
Sulfate	mg/L	08/12/2008	N001	-	9100		F	#	50	
Temperature	C	08/12/2008	N001	-	15.31		F	#		
Thorium-228	pCi/L	08/12/2008	N001	-	7.65		F	#	1.3	1.79
Thorium-230	pCi/L	08/12/2008	N001	-	5.69		F	#	1.8	1.59
Thorium-232	pCi/L	08/12/2008	N001	-	6.7		F	#	0.5	1.54
Total Dissolved Solids	mg/L	08/12/2008	N001	-	14000		F	#	200	
Turbidity	NTU	08/12/2008	N001	-	5.96		F	#		
Uranium	mg/L	08/12/2008	N001	-	0.04		F	#	0.000009	

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

REPORT DATE: 1/13/2009

Location: K.G.S.#3 WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID			Lab	Data	QA		
Alkalinity, Total (As CaCO3)	mg/L	08/12/2008	N001	420 - 450	59		F	#		
Cadmium	mg/L	08/12/2008	N001	420 - 450	0.00011	B	UF	#	0.000038	
Chloride	mg/L	08/12/2008	N001	420 - 450	18		F	#	2	
Chromium	mg/L	08/12/2008	N001	420 - 450	0.00054	U	F	#	0.00054	
Lead	mg/L	08/12/2008	N001	420 - 450	0.00085		F	#	0.000019	
Nickel	mg/L	08/12/2008	N001	420 - 450	0.001	U	F	#	0.001	
Nitrate + Nitrite as Nitrogen	mg/L	08/12/2008	N001	420 - 450	0.01	U	F	#	0.01	
Oxidation Reduction Potential	mV	08/12/2008	N001	420 - 450	-147.2		F	#		
pH	s.u.	08/12/2008	N001	420 - 450	9.2		F	#		
Radium-226	pCi/L	08/12/2008	N001	420 - 450	0.205		FJ	#	0.15	0.136
Radium-228	pCi/L	08/12/2008	N001	420 - 450	0.58	U	F	#	0.58	0.337
Selenium	mg/L	08/12/2008	N001	420 - 450	0.000052	B	UF	#	0.000024	
Specific Conductance	umhos/cm	08/12/2008	N001	420 - 450	722		F	#		
Sulfate	mg/L	08/12/2008	N001	420 - 450	260		F	#	5	
Temperature	C	08/12/2008	N001	420 - 450	13.63		F	#		
Thorium-228	pCi/L	08/12/2008	N001	420 - 450	0.57	U	F	#	0.57	0.247
Thorium-230	pCi/L	08/12/2008	N001	420 - 450	0.73	U	F	#	0.73	0.396
Thorium-232	pCi/L	08/12/2008	N001	420 - 450	0.12	U	F	#	0.12	0.086
Total Dissolved Solids	mg/L	08/12/2008	N001	420 - 450	450		F	#	20	
Turbidity	NTU	08/12/2008	N001	420 - 450	9.72		F	#		
Uranium	mg/L	08/12/2008	N001	420 - 450	0.0002		F	#	0.0000045	

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

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- P > 25% difference in detected pesticide or Aroclor concentrations between 2 columns.
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X,Y,Z Laboratory defined qualifier, see case narrative.

DATA QUALIFIERS:

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

QA QUALIFIER:

- # Validated according to quality assurance guidelines.

Static Water Level Data

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STATIC WATER LEVELS (USEE700) FOR SITE SBS01, Shirley Basin South Disposal Site
REPORT DATE: 1/13/2009

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)	Water Level Flag
10-DC		7113.02	08/11/2008	17:47:08	171.49	6941.53	
19-DC		7112.04	08/13/2008	10:30:05	170.98	6941.06	
40-SC		7058.48	08/12/2008	11:00:10	9.37	7049.11	
5-DC		7119.84	08/12/2008	18:38:09	179.18	6940.66	
5-SC		7056.45	08/12/2008	16:45:54	56.69	6999.76	
51-SC		7091.68	08/13/2008	09:00:03	98.62	6993.06	
54-SC		7158.78	08/12/2008	12:05:31	208.08	6950.7	
K.G.S.#3		7171.03	08/12/2008	15:17:19	224.58	6946.45	

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

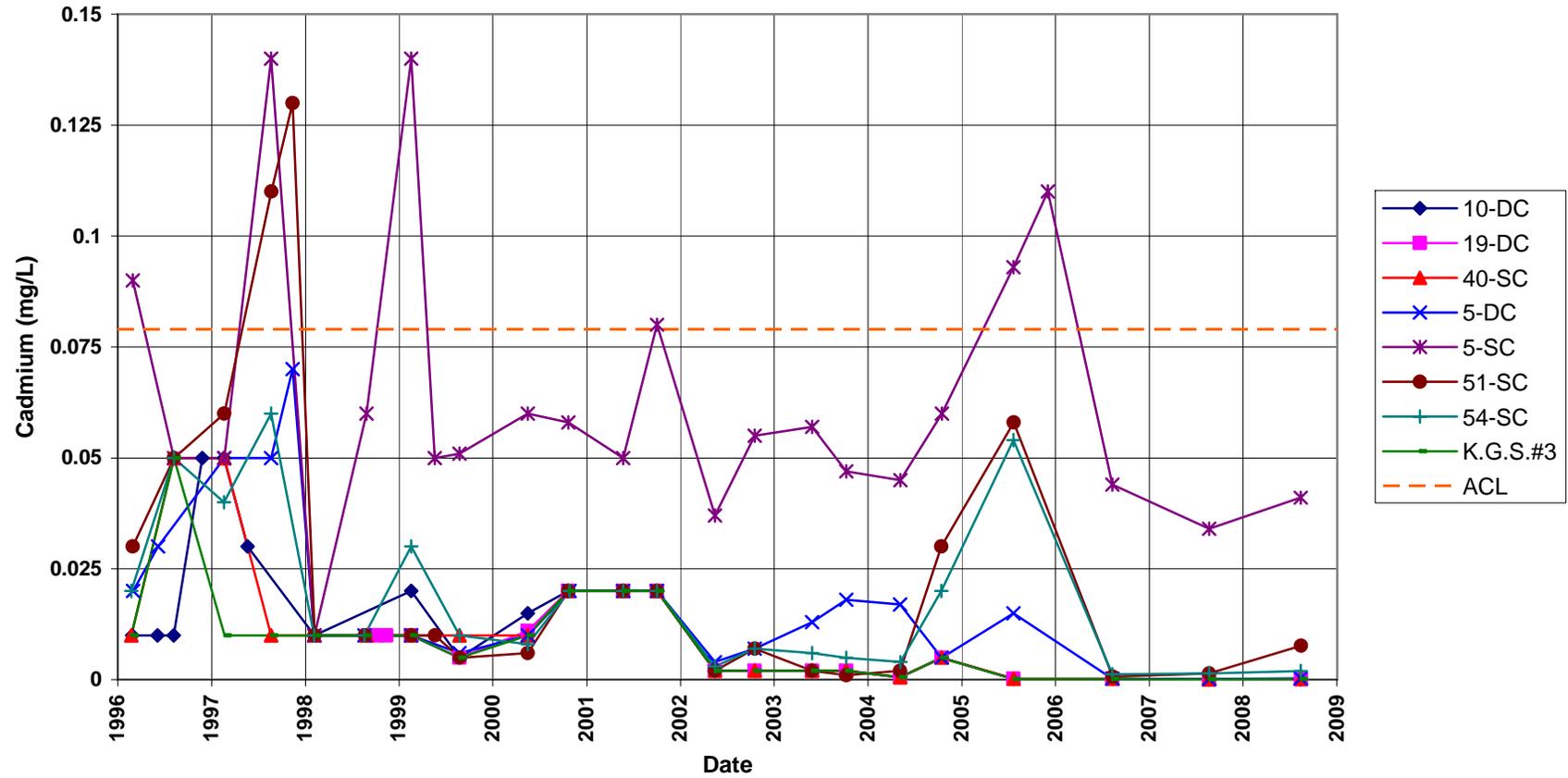
WATER LEVEL FLAGS: D Dry F FLOWING

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Time-Concentration Graphs

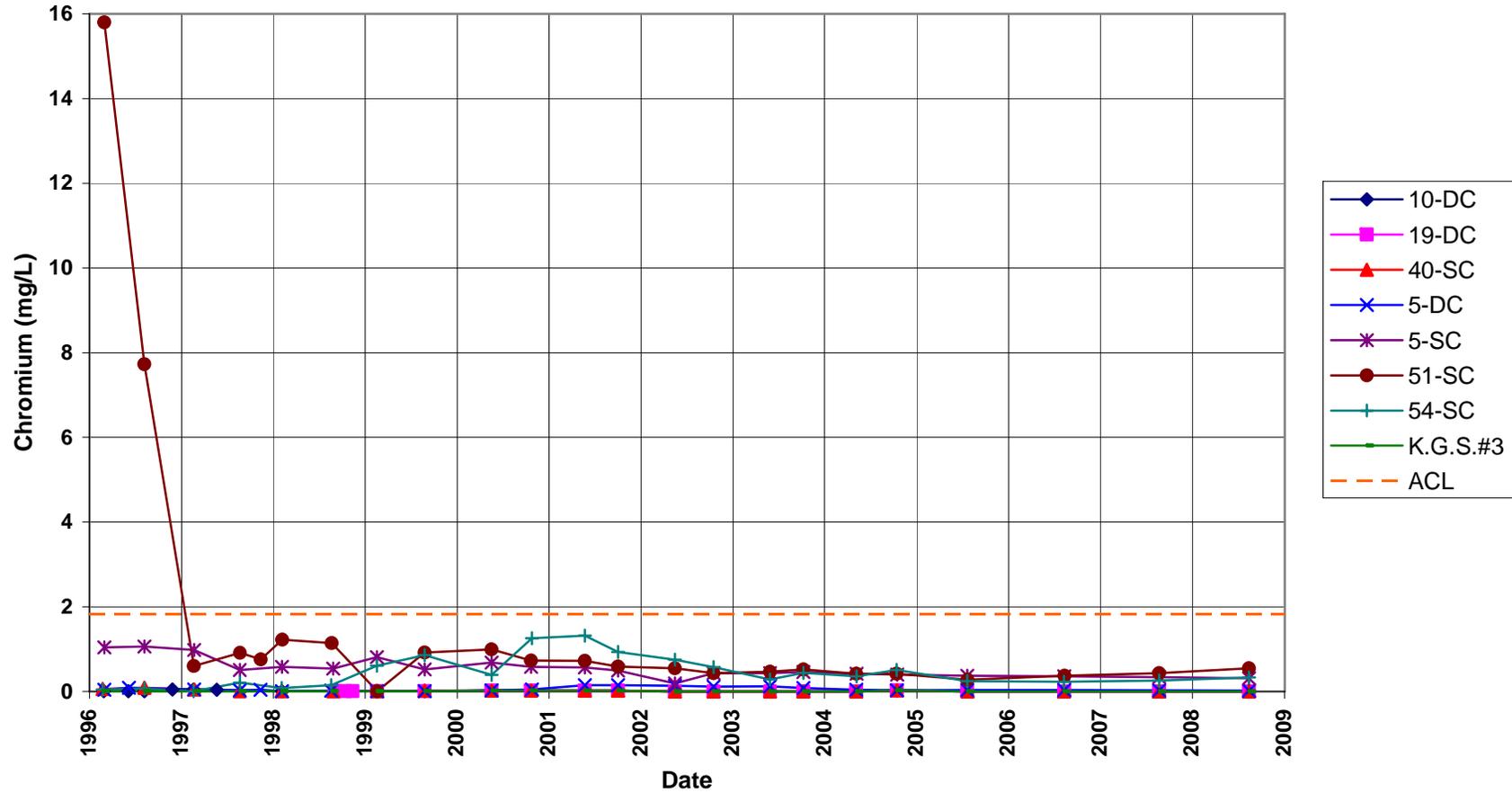
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**Shirley Basin South Disposal Site
Cadmium Concentration**
Alternate Concentration Limit = 0.079 mg/L

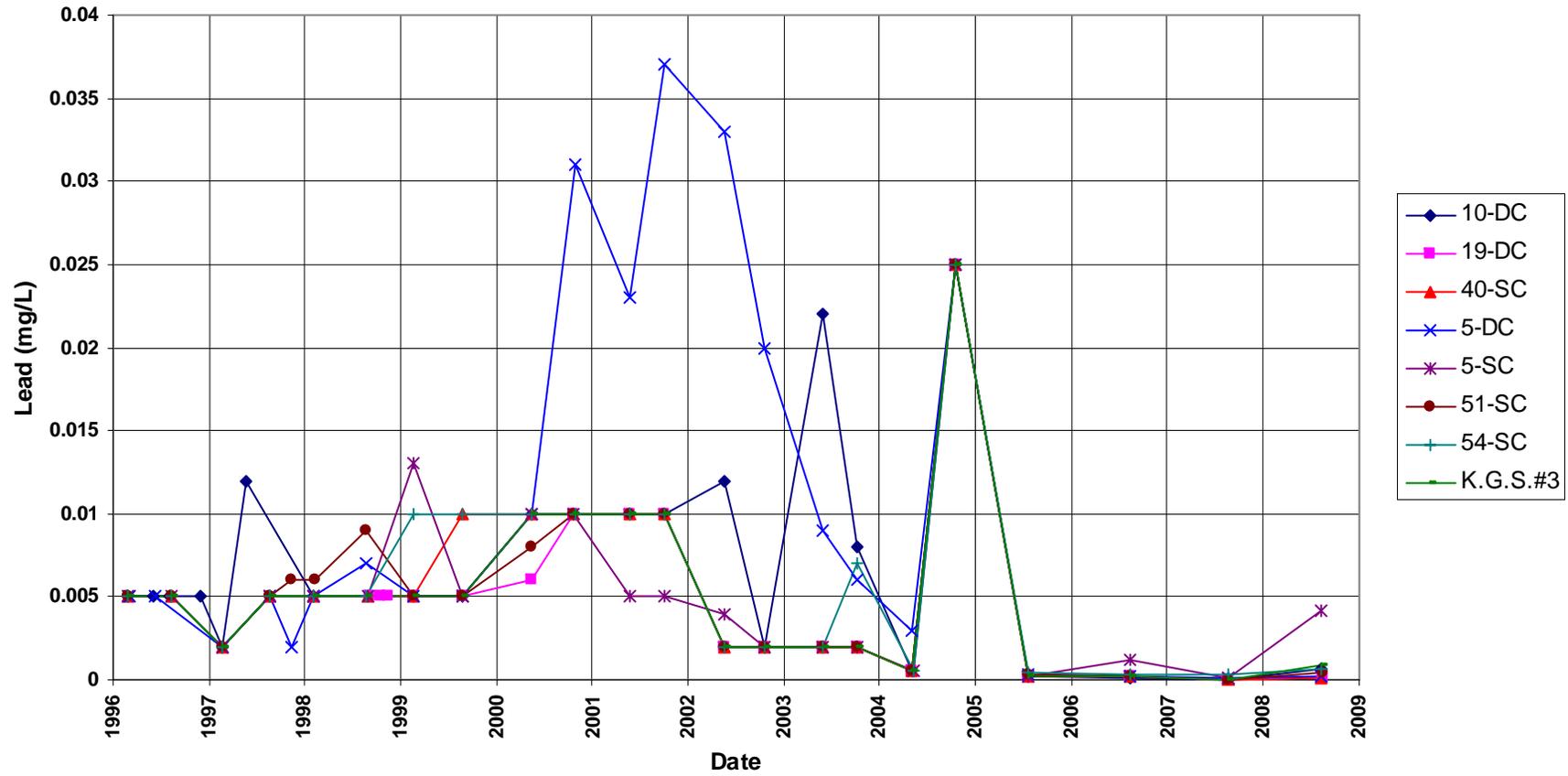


Shirley Basin South Disposal Site Chromium Concentration

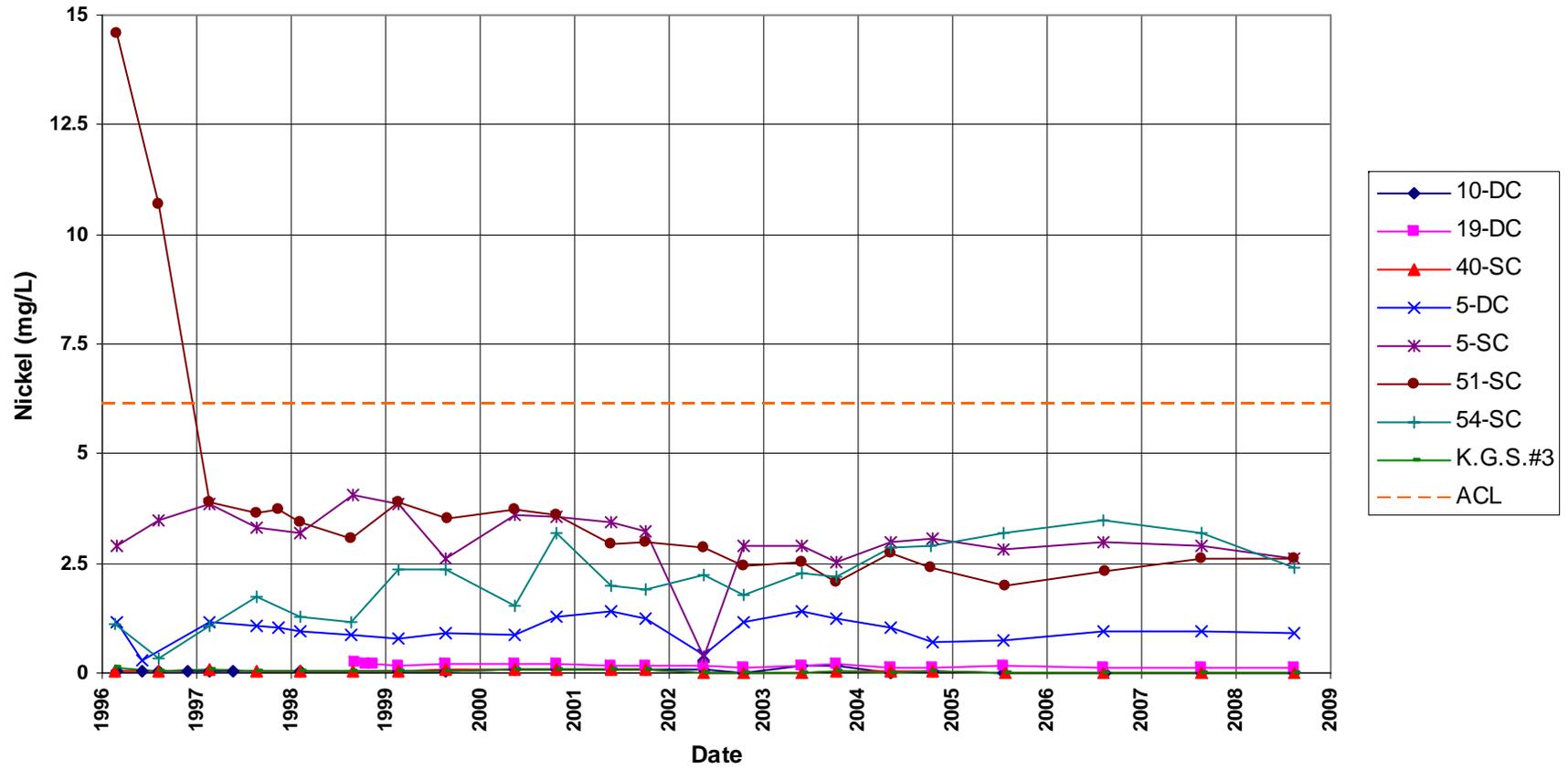
Alternate Concentration Limit = 1.83 mg/L



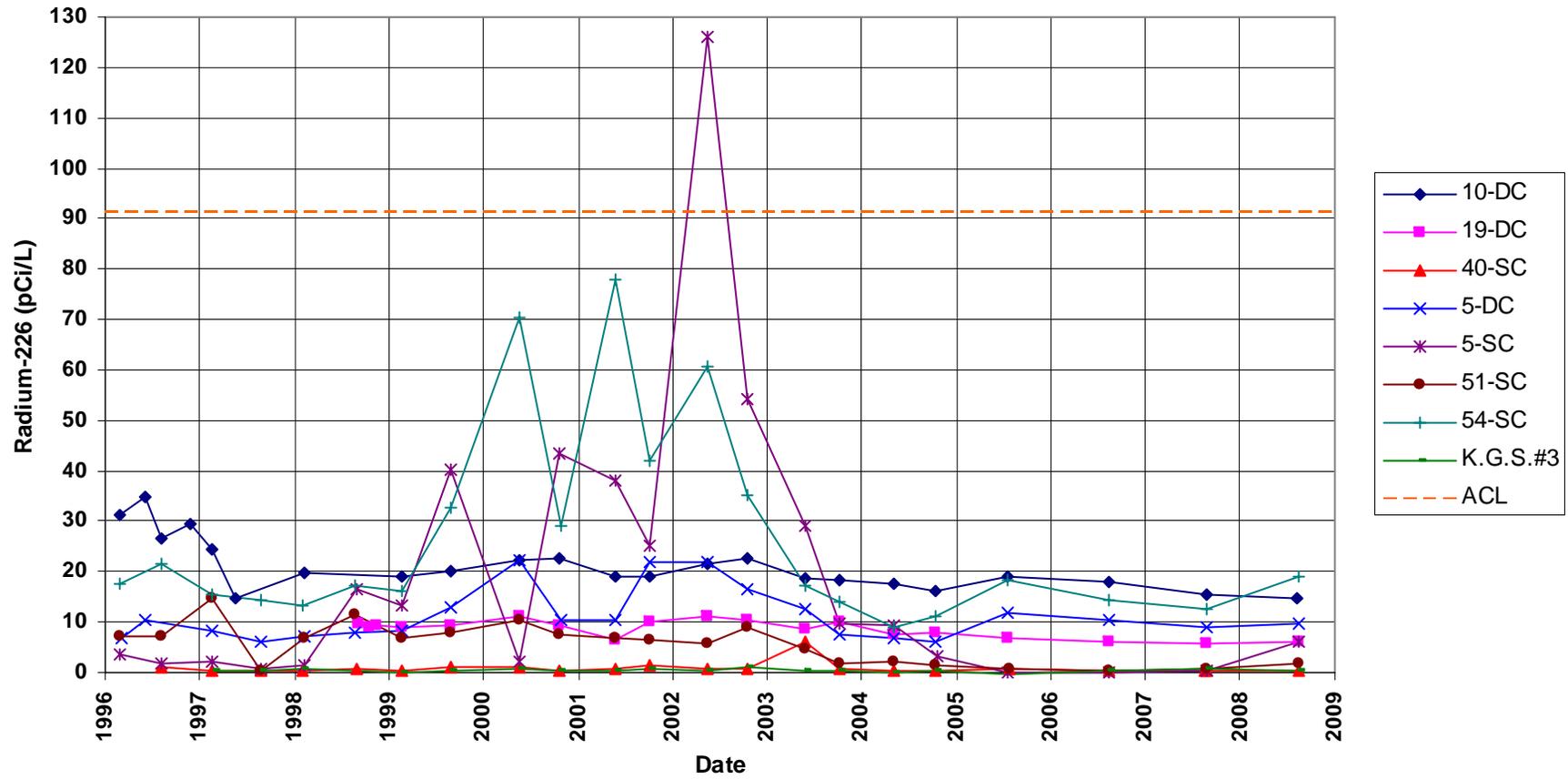
Shirley Basin South Disposal Site
Lead Concentration
Alternate Concentration Limit = 0.05 mg/L



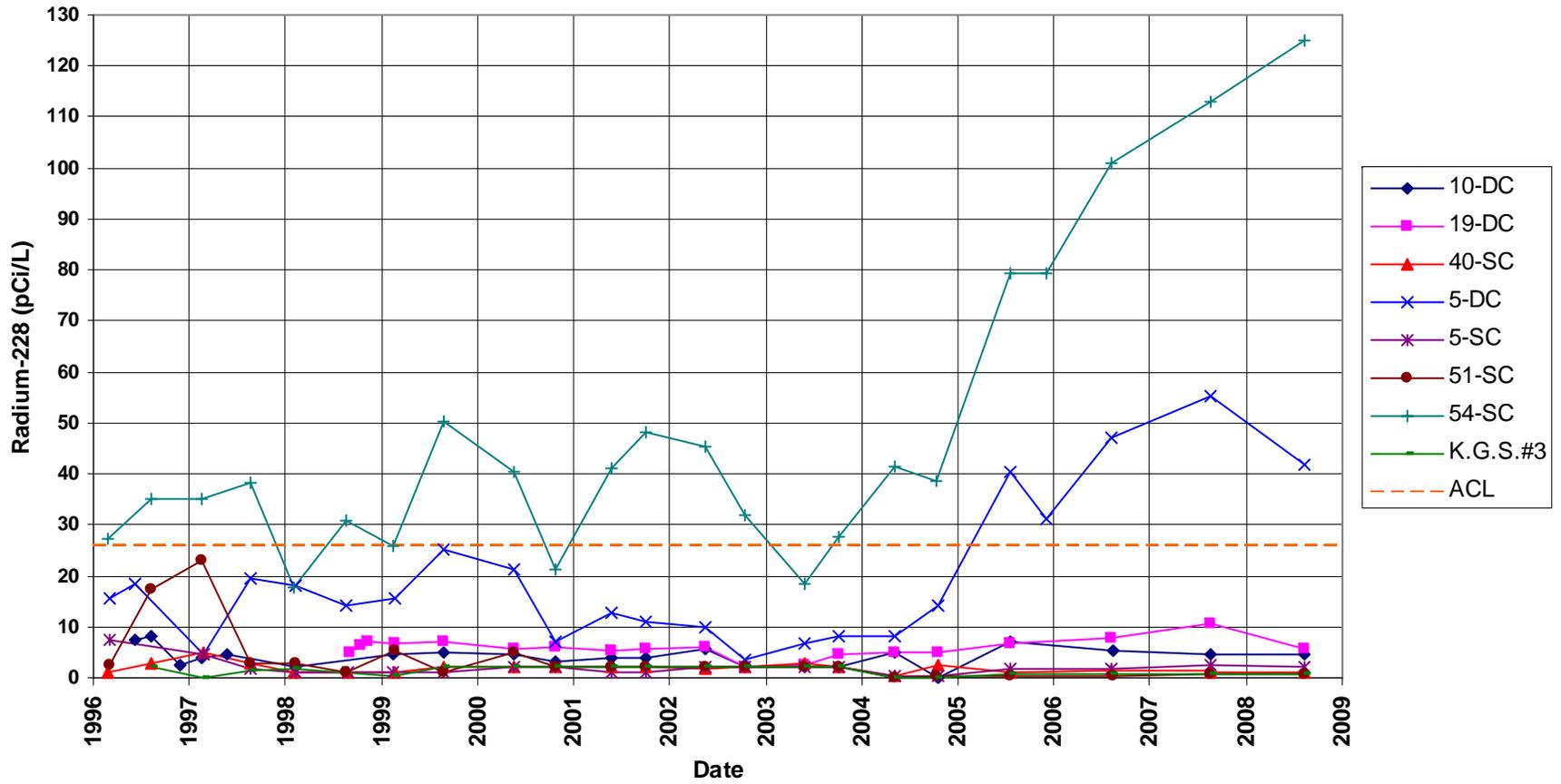
**Shirley Basin South Disposal Site
Nickel Concentration**
Alternate Concentration Limit = 6.15 mg/L



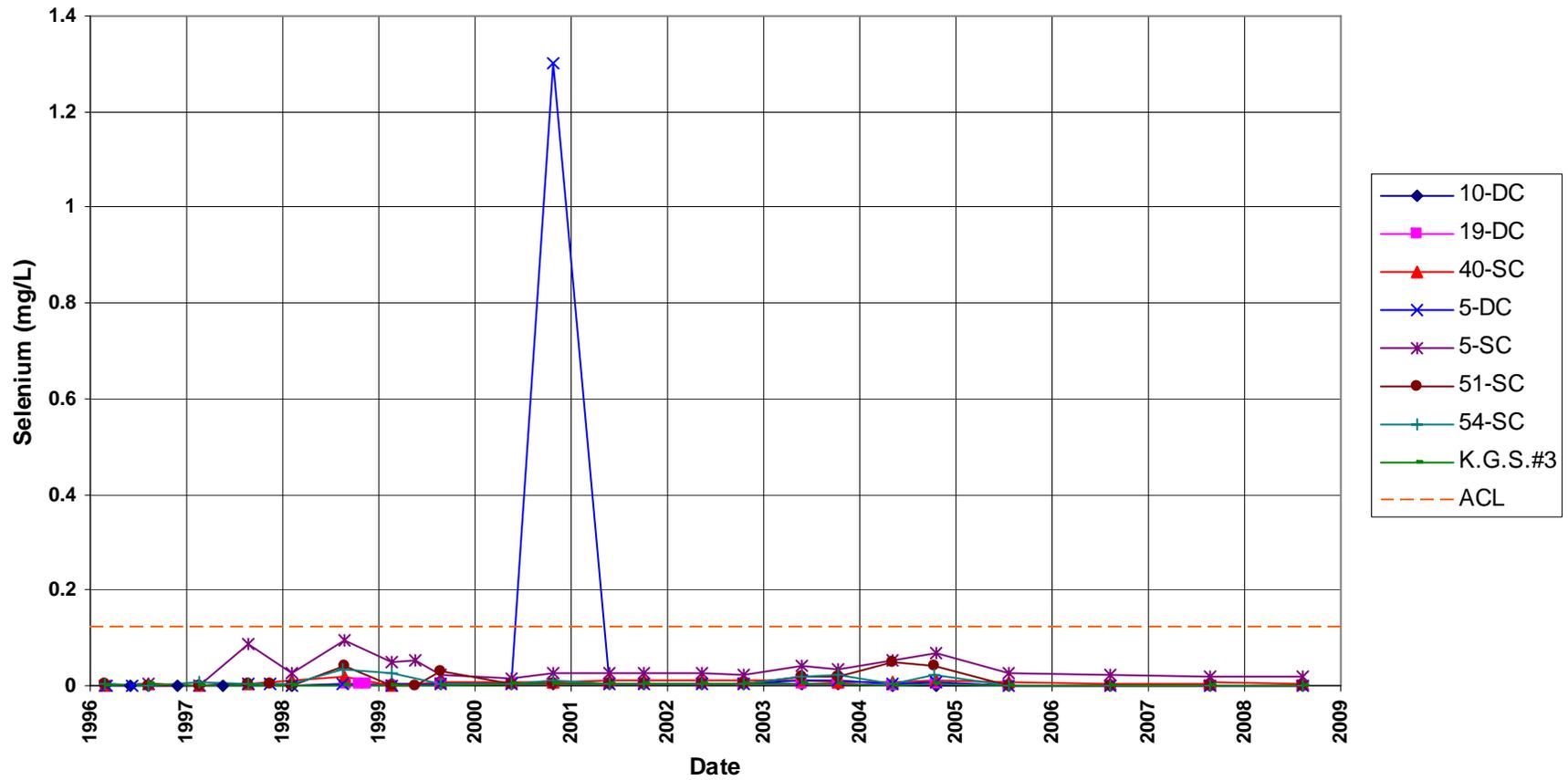
Shirley Basin South Disposal Site
Radium-226 Concentration
 Alternate Concentration Limit = 25.7 pCi/L



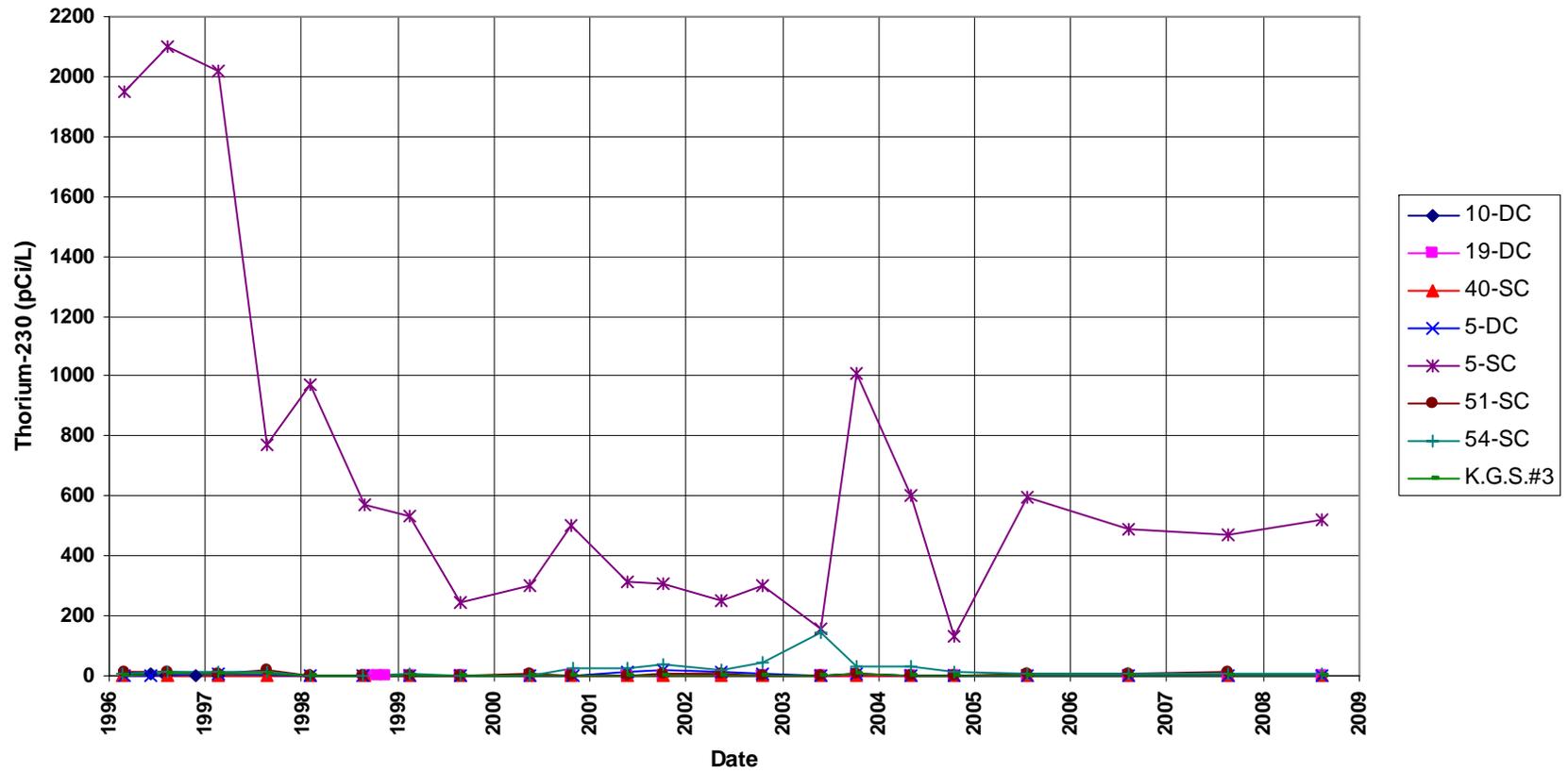
Shirley Basin South Disposal Site
Radium-228 Concentration
 Alternate Concentration Limit = 25.7 pCi/L



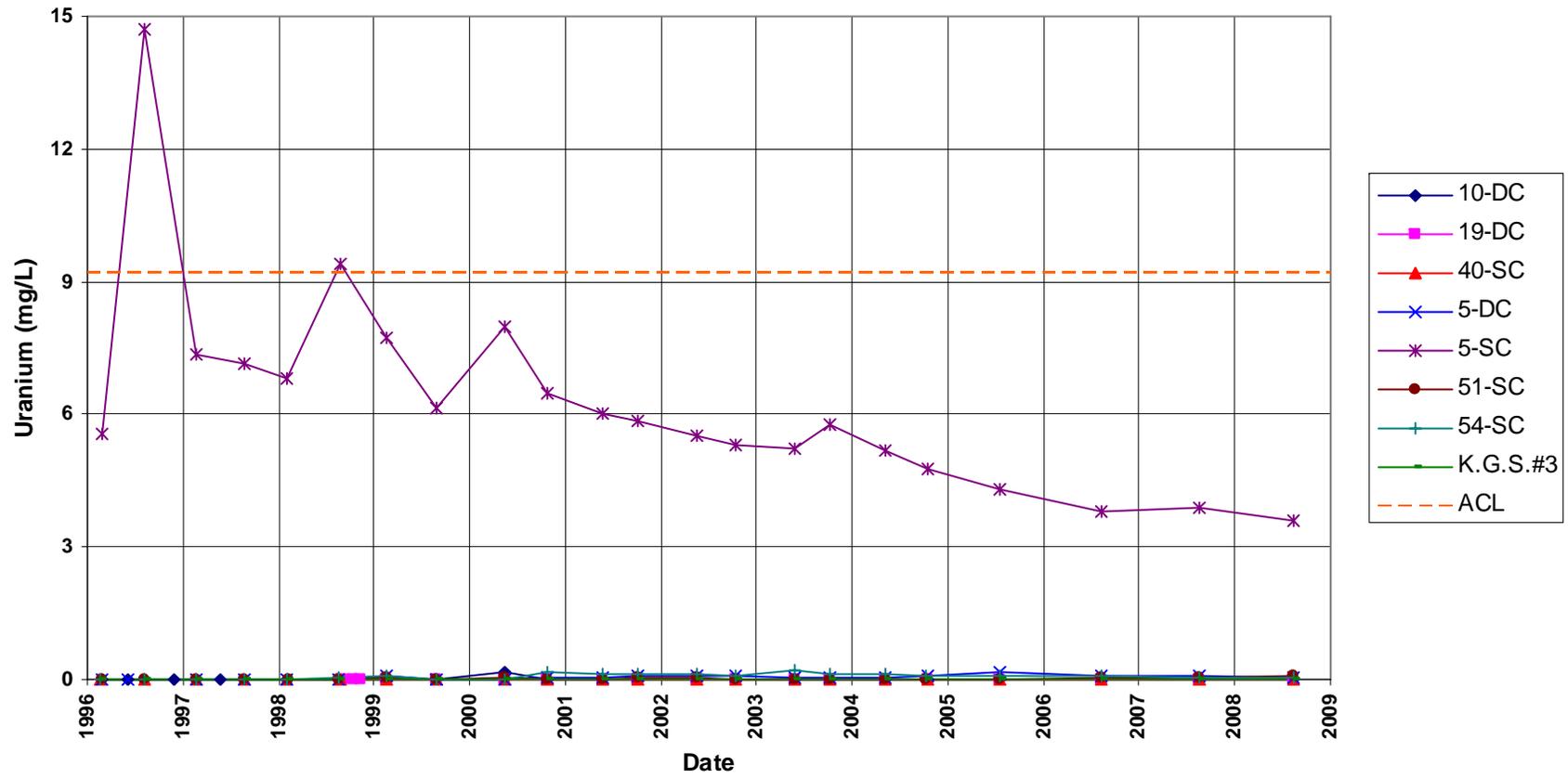
Shirley Basin South Disposal Site
Selenium Concentration
Alternate Concentration Limit = 0.12 mg/L



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



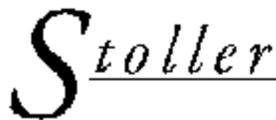
Shirley Basin South Disposal Site
Uranium Concentration
Alternate Concentration Limit = 9.2 mg/L



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Attachment 3
Sampling and Analysis Work Order

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established 1959

Task Order LM00-501
Control Number 08-0475

June 30, 2008

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

SUBJECT: Contract No. DE-AM01-07LM00060, Stoller
August 2008 Environmental Sampling at Shirley Basin South, Wyoming

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

Dear Mr. Surovchak:

The purpose of this letter is to inform you of the upcoming sampling event at Shirley Basin South, Wyoming. Enclosed are the map and tables specifying sample locations and analytes for routine monitoring at the Shirley Basin South Disposal Site. Water quality data will be collected at this site as part of the environmental sampling currently scheduled to begin the week of August 4, 2008.

The following list shows the monitor wells (with zone of completion) scheduled to be sampled during this event.

Monitor Wells*

40-SC Nr 51-SC Nr 10-DC RI 5-DC Nr 19-DC RI K.G.S.#3 Nr
5-SC Nr 54-SC Nr

*NOTE: RI – Wind River - Lower Confined Sandstone; Nr – No Recovery of Data For Classifying

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.

If you have any questions, please call me at 970-248-6022.

The S.M. Stoller Corporation 2597 B Y Road Grand Junction, CO 81503 (970) 248-6000 Fax: (970) 248-6040

Constituent Sampling Breakdown

Site	Shirley Basin South		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	8	0			
Field Measurements					
Alkalinity	X				
Dissolved Oxygen					
Redox Potential	X				
pH	X				
Specific Conductance	X				
Turbidity	X				
Temperature	X				
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Beryllium					
Bromide					
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
Iron					
Lead	X		0.002	SW-846 6020	LMM-02
Lead-210					
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
Strontium					
Sulfate	X		0.5	SW-846 9056	MIS-A-044
Sulfide					
Thorium-230	X		1 pCi/L	Alpha Spectrometry	ASP-A-008
Tin					
Total Dissolved Solids	X		10	SM2540 C	WCH-A-033
Uranium	X		0.0001	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	13	0			

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

Attachment 4

Trip Report

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Memorandum

Control Number N/A

DATE: August 18, 2008

TO: Dick Johnson

FROM: Daniel L. Sellers

SUBJECT: Trip Report

Site: Shirley Basin South, WY, Disposal Site

Dates of Sampling Event: August 11–13, 2008

Team Members: Dave Atkinson and Dan Sellers

Number of Locations Sampled: 8 wells were sampled for metals (Cd, Cr, Pb, Ni, Se, U), Th-230, Ra-226/228, TDS, nitrites/nitrates, and anions (Cl, SO₄). In addition, 1 duplicate sample was collected. No equipment blank was required due to dedicated tubing and equipment used at each well.

Locations Not Sampled/Reason: None.

Location Specific Information:

Ticket Number	Location	Sample Date	Description
GIS 005	40-SC	8/12/008	Cat. I
GIS 006	5-SC	8/12/2008	Cat. I
GIS 007	51-SC	8/13/2008	Cat. II; Insufficient water. Th-230 not collected. Need to lower pump 5.0 ft.
GIS 008	54-SC	8/12/2008	Cat. I
GIS 009	10-DC	8/11/2008	Cat. I
GIS 010	5-DC	8/12/2008	Cat. I
GIS 011	19-DC	8/13/2008	Cat. I
GIS 012	K.G.S.#3	8/12/2008	Cat. I

Field Variance: None.

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

False Id	True Id	Sample Type	Associated Matrix	Ticket Number
2940	40-SC	Duplicate	Groundwater	GIS 013

Requisition Numbers Assigned: All samples were assigned to RIN 08071744.

Sample Shipment: Samples were shipped to Paragon Analytics on August 14, 2008.

Water Level Measurements: Water levels were collected at all sampled wells:

Well Inspection Summary: All wells were in good condition. Well KGS #3 has black 1.5-inch diameter pipe and a pump installed. The cap would not close, exposing the well to rain and snow.

Equipment: All wells were equipped with dedicated bladder pumps, except for well 40-SC which was sampled using a peristaltic pump with dedicated tubing.

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

Fences, Gates, Locks: OK

Signs: No missing or vandalized signs were observed.

Trespassing/Site Disturbances: N/A

Site Issues

Disposal Cell/Drainage Structure Integrity: OK

Vegetation/Noxious Weed Concerns: N/A

Maintenance Requirements: None observed

Corrective Action Taken: Need to lower pump at well location 51-SC to 213.0 ft.

DLS/lcg

cc: Scott Surovchak, DOE (e)
Cheri Bahrke, Stoller (e)
Steve Donovan, Stoller (e)
EDD Delivery (e)

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