

Data Validation Package

May 2015
Groundwater Sampling at the
Shoal, Nevada, Site

March 2016

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Contents

Sampling Event Summary	1
Shoal, Nevada, Site Sample Location Map	3
Data Assessment Summary.....	5
Water Sampling Field Activities Verification Checklist	7
Laboratory Performance Assessment	9
Sampling Quality Control Assessment	19
Certification	22

Attachment 1—Assessment of Anomalous Data

Potential Outliers Report

Attachment 2—Data Presentation

Groundwater Quality Data
Equipment Blank Data
Static Water Level Data
Time-Concentration Graphs

Attachment 3—Sampling and Analysis Work Order

Attachment 4—Trip Report

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Sampling Event Summary

Site: Shoal, Nevada, Site

Sampling Period: May 26–29, 2015

The U.S. Department of Energy Office of Legacy Management conducted annual sampling at the Shoal, Nevada, Site (Shoal) in May 2015. Groundwater samples were collected from wells MV-1, MV-2, MV-3, MV-4, MV-5, H-3, HC-1, HC-2d, HC-3, HC-4, HC-5, HC-6, HC-7, HC-8, and HS-1. Sampling was conducted as specified in 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>). Monitoring wells MV-1, MV-2, MV-3, MV-4, MV-5, HC-2d, HC-4, HC-5, HC-7, HC-8, and HS-1 were purged prior to sampling using dedicated submersible pumps. At least one well casing volume was removed, and field parameters (temperature, pH, and specific conductance) were allowed to stabilize before samples were collected. Samples were collected from wells H-3, HC-1, HC-3, and HC-6 using a depth-specific bailer because these wells are not completed with dedicated submersible pumps.

Samples were submitted under Requisition Index Number (RIN) 15057042 to ALS Laboratory Group in Fort Collins, Colorado, for the determination of bromide, gross alpha, gross beta, tritium, uranium isotopes, and total uranium (by mass); and under RIN 15057043 to the University of Arizona for the determination of carbon-14 and iodine-129. A duplicate sample from location MV-2 was included with RIN 15057042.

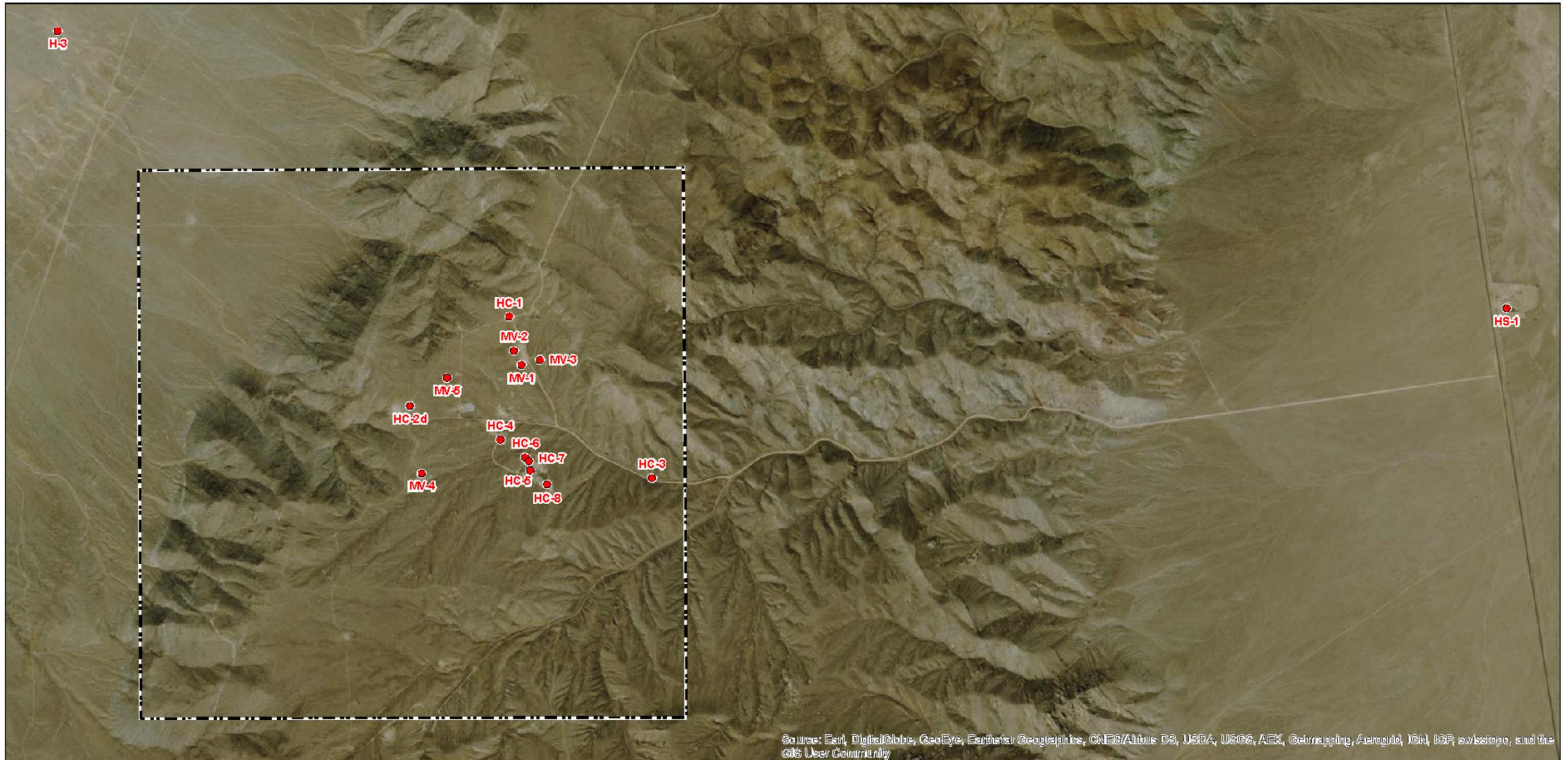
The laboratory results from the 2015 sampling event are consistent with those of previous years with the exception of sample results from well HC-4. This well continues to be the only well with tritium concentrations above the laboratory's minimum detectable concentration which is attributed to the wells proximity to the nuclear detonation. The tritium concentration (731 picocuries per liter [pCi/L]) is consistent with past results and is below the U.S. Environmental Protection Agency's (EPA) maximum contaminant level (MCL) of 20,000 pCi/L. However, concentrations of gross alpha, uranium, and carbon-14 all increased in the sample from well HC-4 during this sampling event. Concentrations of gross alpha and uranium have been above the EPA MCLs in this well since 2012 and the highest concentrations of gross alpha (60.6 pCi/L) and uranium (110 micrograms per liter) were detected during this sampling event. Refer to the time-concentration plots included with this report. Also see the *2015 Groundwater Monitoring Report Project Shoal Area: Subsurface Corrective Action Unit 447* for additional information on the 2015 sampling results.



Rick Findlay, Site Lead
Navarro Research and Engineering, Inc.

4-13-2016
Date

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LEGEND WELL TO BE SAMPLED SITE BOUNDARY		
	U.S. DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT	Work Performed by Stoller Newport News Nuclear, Inc. Under DOE Contract Number DE-EM000415
Planned Sampling Map Shoal, NV, Site May 2015		
DATE PREPARED: May 1, 2015	FILE NAME: S1288600	

Shoal, Nevada, Site Sample Location Map

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Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	Shoal, Nevada, Site	Date(s) of Water Sampling	May 26–29, 2015
Date(s) of Verification	February 17, 2016	Name of Verifier	Stephen Donovan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures? List any Program Directives or other documents, SOPs, instructions.	Yes	Work Order letter dated May 4, 2015. Program Directive SHL 2015 02.
2. Were the sampling locations specified in the planning documents sampled?	Yes	
3. Were field equipment calibrations conducted as specified in the above-named documents?	Yes	Calibrations were performed May 26, 2015.
4. Was an operational check of the field equipment conducted 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. Were wells categorized correctly?	No	All wells were incorrectly identified as Category I.
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 meet criteria prior to sampling? Was the flow rate less than 500 mL/min?	NA	Wells were sampled with submersible pumps or a bailer.

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? Was one pump/tubing volume removed prior to sampling?	NA	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected from well MV-2.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One equipment blank was collected.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were the true identities of the QC samples documented?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	Yes	
16. Were chain of custody records completed and was sample custody maintained?	Yes	
17. Was all pertinent information documented on the field data sheets?	Yes	
18. Was the presence or absence of ice in the cooler documented at every sample location?	NA	Sample cooling was not required.
19. Were water levels measured at the locations specified in the planning documents?	Yes	

Laboratory Performance Assessment

General Information

Report Numbers (RINs): 15057042
 Sample Event: May 26–29, 2015
 Site(s): Shoal Site, Nevada
 Laboratory: ALS Laboratory Group, Fort Collins, Colorado
 Work Order No.: 1506099
 Analysis: Metals, Radiochemistry, and Wet Chemistry
 Validator: Stephen Donovan
 Review Date: August 13, 2015

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/POL/S04325, continually updated) “Standard Practice for Validation of Environmental Data.” The procedure was applied at Level 2, Data Deliverables Verification. 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
Bromide	MIS-A-045	SW-856 9056	SW-856 9056
Gamma Emitting Nuclides	GAM-A-001	SOP 713R13	SOP 713R13
Gross Alpha/Beta	GPC-A-001	SOP 724	SOP 724
Tritium	LSC-A-001	SOP 700	SOP 704
Uranium	LMM-02	SW-846 3005A	SW-846 6020A
Uranium Isotopes	LMR-02	SOP 776, 778	SOP 714

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	Flag	Reason
1506099-1	Equipment Blank	Uranium-234	J	Less than the Determination Limit
1506099-1	Equipment Blank	Gross Beta	J	Less than the Determination Limit
1506099-4	HC-1	Gross Alpha	J	Less than the Determination Limit
1506099-4	HC-1	Gross Beta	J	Less than the Determination Limit
1506099-4	HC-1	Uranium-235	U	Less than the Decision Level
1506099-5	HC-2d	Uranium-235	J	Less than the Determination Limit
1506099-6	HC-3	Gross Beta	J	Equipment blank result
1506099-6	HC-3	Uranium-234	J	Less than the Determination Limit

Table 2 (continued). Data Qualifier Summary

Sample Number	Location	Analyte	Flag	Reason
1506099-6	HC-3	Uranium-238	J	Less than the Determination Limit
1506099-7	HC-4	Tritium	J	Less than the Determination Limit
1506099-10	HC-7	Gross Beta	J	Less than the Determination Limit
1506099-11	HC-8	Gross Alpha	J	Less than the Determination Limit
1506099-11	HC-8	Gross Beta	J	Less than the Determination Limit
1506099-11	HC-8	Uranium-238	J	Less than the Determination Limit
1506099-13	MV-1	Gross Beta	J	Less than the Determination Limit
1506099-15	MV-3	Gross Beta	J	Less than the Determination Limit
1506099-17	MV-5	Uranium-238	J	Less than the Determination Limit

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received 17 water samples on June 5, 2015, accompanied by a Chain of Custody form. Copies of the air bills were included in the receiving documentation. The Chain of Custody was checked to confirm that all of the samples were listed with sample collection dates and times, and that signatures and dates were present indicating sample relinquishment and receipt. The Chain of Custody was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact at ambient temperature 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.

Detection and Quantitation Limits

The method detection limit (MDL) was reported for all metal and wet chemical analytes as required. The MDL, as defined in 40 CFR 136, is the minimum concentration of an analyte that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The practical quantitation limit (PQL) for these analytes is the lowest concentration that can be reliably measured, and is defined as 5 times the MDL.

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

defined as 3 times the MDC. Results not previously “U” qualified that are less than the DL are qualified with a “J” flag as estimated values.

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

Laboratory Instrument Calibration

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

Method 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. All method blank and calibration blank results were below the PQLs for all analytes. In cases where a blank concentration exceeds the MDL, the associated sample results are qualified with a “U” flag (not detected) when the sample result is greater than the MDL but less than 5 times the blank concentration. For some metals, the blanks were negative and the absolute values were greater than the MDL but less than the PQL. All associated results for field samples were greater than 5 times the MDL, so no results are qualified. The radiochemistry method blank results were less than the DL.

Inductively Coupled Plasma Interference Check Sample Analysis

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

Matrix Spike Analysis

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

Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative percent difference for non-radiochemical replicate results that are greater than 5 times the PQL should be less than 20 percent. For results that are less than 5 times the PQL, the range should be no greater than the PQL. The replicate results met these criteria. The relative

error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than 3, indicating acceptable precision.

Laboratory Control Sample

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

Metals Serial Dilution

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

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 July 8, 2015. The Sample Management System EDD validation module was used to verify that the EDD file was complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure that all and only the requested data are delivered. The contents of the EDD were manually examined to verify that the sample results accurately reflect the data contained in the sample data package.

SAMPLE MANAGEMENT SYSTEM

General Data Validation Report

RIN: 15057042 Lab Code: PAR Validator: Stephen Donovan Validation Date: 08/13/2015
Project: Shoal Site Analysis Type: Metals General Chem Rad Organics
of Samples: 17 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 0 detection limit failures.

There was 1 trip/equipment blank evaluated.

There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM

Metals Data Validation Worksheet

RIN: 15057042

Lab Code: PAR

Date Due: 07/03/2015

Matrix: Water

Site Code: SHL01

Date Completed: 07/09/2015

Analyte	Method Type	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	Dup. RPD	ICSAB %R	Serial Dil. %R	CRI %R
			Int.	R^2	CCV	CCB								
Uranium	ICP/MS	06/18/2015	0.0000	1.0000	OK	OK	OK	108.0	106.0	106.0	0.0	109.0		95.0

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 15057042 Lab Code: PAR Date Due: 07/03/2015
 Matrix: Water Site Code: SHL01 Date Completed: 07/09/2015

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
Blank	GROSS ALPHA	06/17/2015	0.5900	U				
HC-7	GROSS ALPHA	06/17/2015					104.0	
Blank_Spike	GROSS ALPHA	06/17/2015				91.80		
MV-5	GROSS ALPHA	06/24/2015						1.56
Blank_Spike	GROSS BETA	06/17/2015				101.00		
HC-7	GROSS BETA	06/17/2015					107.0	
Blank	GROSS BETA	06/17/2015	1.0300	U				
MV-5	GROSS BETA	06/24/2015						0.39
HC-2d	H-3	07/04/2015						1.03
MV-1	H-3	07/04/2015					112.0	
Blank	H-3	07/05/2015	21.0000	U				
Blank_Spike	H-3	07/05/2015				106.00		
2723	U-234	06/24/2015			76.9			
2724	U-234	06/24/2015			88.7			
HC-1	U-234	06/24/2015			86.7			
HC-2d	U-234	06/24/2015			65.9			
HC-3	U-234	06/24/2015			87.9			
HC-4	U-234	06/24/2015			87.2			
HC-5	U-234	06/24/2015			60.1			
HC-6	U-234	06/24/2015			83.1			
HC-7	U-234	06/25/2015			90.2			
HC-8	U-234	06/25/2015			87.6			
MV-1	U-234	06/25/2015			86.4			
MV-2	U-234	06/25/2015			85.1			
MV-3	U-234	06/25/2015			84.5			
MV-4	U-234	06/25/2015			81.6			
MV-5	U-234	06/25/2015			87.4			
Blank_Spike	U-234	06/25/2015			69.5	107.00		
Blank_Spike_Du	U-234	06/25/2015			84.2	93.10		
Blank	U-234	06/25/2015	0.0070	U	76.1			
Blank	U-235	06/25/2015	0.0310	U				
Blank	U-238	06/25/2015	0.0120	U				

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 15057042 **Lab Code:** PAR **Date Due:** 07/03/2015
Matrix: Water **Site Code:** SHL01 **Date Completed:** 07/09/2015

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
Blank_Spike	Uranium-238	06/25/2015				110.00		
Blank_Spike_Du	Uranium-238	06/25/2015				110.00		

SAMPLE MANAGEMENT SYSTEM
Wet Chemistry Data Validation Worksheet

RIN: 15057042 **Lab Code:** PAR **Date Due:** 07/03/2015
Matrix: Water **Site Code:** SHL01 **Date Completed:** 07/09/2015

Analyte	Date Analyzed	CALIBRATION				Method Blank	LCS %R	MS %R	MSD %R	DUP RPD	Serial Dil. %R
		Int.	R^2	CCV	CCB						
BROMIDE	06/09/2015	0.000	1.0000	OK	OK	OK	98.00	100.0	100.0	1.00	

General Information

Requisition No. (RIN): 15057043
Sample Event: May 27–29, 2015
Site(s): Shoal Site
Laboratory: NSF Arizona AMS Laboratory, Tucson, Arizona
Analysis: Carbon-14, Iodine-129
Validator: Stephen Donovan
Review Date: February 17, 2016

This validation was performed according to the *Environmental Procedures Catalog* (LMS/POL/S04325), “Standard Practice for Validation of Environmental Data.” The procedure was applied at Level 1, Data Deliverables Examination. 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 3.

Table 3. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Carbon-14	LMR-18	NA	Mass Spectrometry
Iodine-129	LMR-19	NA	Mass Spectrometry

Data Qualifier Summary

None of the analytical results required qualification.

Sample Shipping/Receiving

The NSF Arizona AMS Laboratory in Tucson, Arizona, received 13 water samples on June 5, 2015, submitted for the determination carbon-14 and iodine-129. The analytical reports were checked to confirm that the samples scheduled were received and analyzed.

Preservation and Holding Times

The sample shipment was received intact with the samples in the correct container type and preserved correctly for the requested analyses. All samples were analyzed within the applicable holding times.

Completeness

The electronic data deliverables were the only deliverables received for this RIN.

Deliverables

The final results report arrived on February 9, 2016.

Sampling Quality Control Assessment

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

Sampling Protocol

As per Program Directive SHL-2015-02, wells were *not* sampled using low-flow criteria. Wells MV-1, MV-2, MV-3, MV-4, MV-5, HC-2d, HC-4, HC-5, HC-7, HC-8, and HS-1 were sampled using a dedicated high-flow submersible pump, and wells H-3, HC-1, HC-3, and HC-6 were sampled with a depth specific bailer. At all high-flow wells, the field parameters specified in the directive met the required stability criteria over the final three readings.

Equipment Blank Assessment

Equipment blanks are prepared and analyzed to document contamination attributable to the sample collection process. One equipment blank was submitted with these samples. Gross beta and uranium-234 were detected in this blank. Associated sample results that are less than 5 times the blank concentration are qualified with a “J” flag as estimated values.

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 MV-2. For non-radiochemical measurements, the relative percent difference for duplicate results that are greater than 5 times the practical quantitation limit (PQL) should be less than 20 percent. For results less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical measurements, the relative error ratio (the ratio of the absolute difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. All duplicate results met these criteria demonstrating acceptable precision.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Equipment/Trip Blanks

RIN: 15057042 Lab Code: PAR Project: Shoal Site Validation Date: 08/13/2015

Blank Data							
Blank Type	Lab Sample ID	Lab Method	Analyte Name	Result	Qualifier	MDL	Units
Equipment Blank	1506099-1	724R11	GROSS BETA	1.58		1.4	pCi/L

Sample ID	Sample Ticket	Location	Result	Dilution Factor	Lab Qualifier	Validation Qualifier
1506099-4	NGQ 715	HC-1	4.53	1		J
1506099-6	NGQ 717	HC-3	5.12	1		J
1506099-9	NGQ 720	HC-6	12.1	1		

Blank Data							
Blank Type	Lab Sample ID	Lab Method	Analyte Name	Result	Qualifier	MDL	Units
Equipment Blank	1506099-1	714R12	U-234	0.07		0.036	pCi/L

Sample ID	Sample Ticket	Location	Result	Dilution Factor	Lab Qualifier	Validation Qualifier
1506099-4	NGQ 715	HC-1	0.353	1		
1506099-6	NGQ 717	HC-3	0.101	1		J
1506099-9	NGQ 720	HC-6	15.3	1		

SAMPLE MANAGEMENT SYSTEM
Validation Report: Field Duplicates

RIN: 15057042 Lab Code: PAR Project: Shoal Site Validation Date: 08/13/2015

Duplicate: 2724

Sample: MV-2

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
BROMIDE	0.2	U		1	0.2	U		1			MG/L
GROSS ALPHA	15		2.7	1	14		2.86	1	6.90	0.5	pCi/L
GROSS BETA	10.5		2.08	1	8.13		1.89	1		1.7	pCi/L
H-3	-209	U	219	1	-216	U	217	1		0	pCi/L
U-234	8.37		1.43	1	7.73		1.33	1	7.95	0.6	pCi/L
Uranium	22			10	23			10	4.44		UG/L
Uranium-235	0.434		0.124	1	0.317		0.101	1	31.16	1.4	pCi/L
Uranium-238	7.15		1.23	1	6.44		1.11	1	10.45	0.8	pCi/L

Certification

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

Laboratory Coordinator: Stephen Donivan 3-9-2016
Date

Data Validation Lead: Stephen Donivan 3-9-2016
Date

Attachment 1

Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

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

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

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

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

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

Data Validation Outliers Report - No Field Parameters

Comparison: All historical Data Beginning 01/01/2005

Laboratory: ALS Laboratory Group

RIN: 15057042

Report Date: 02/17/2016

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current	Qualifiers		Historical Maximum			Historical Minimum			Number of Data Points		Statistical Outlier
					Result	Lab	Data	Result	Lab	Data	Result	Lab	Data	N	N Below Detect	
SHL01	HC-1	0001	05/26/2015	Uranium-234	0.353			1.84			0.373			9	0	No
SHL01	HC-3	0001	05/26/2015	Uranium-234	0.101		J	7.84			0.102			7	0	No
SHL01	HC-3	0001	05/26/2015	Uranium-238	0.0784		J	7.73			0.106		J	7	0	No
SHL01	HC-4	0001	05/27/2015	Gross Alpha	60.6			35.1			0.809		U	12	2	NA
SHL01	HC-4	0001	05/27/2015	Gross Beta	24.2			14.9			4.18		J	12	0	NA
SHL01	HC-4	0001	05/27/2015	Uranium	0.110			0.0620			0.00069			12	0	NA
SHL01	HC-4	0001	05/27/2015	Uranium-234	31.2			22.0			0.293			12	0	NA
SHL01	HC-4	0001	05/27/2015	Uranium-235	1.60			1.11			0.00141		U	12	5	No
SHL01	HC-4	0001	05/27/2015	Uranium-238	32.9			21.5			0.305			12	0	NA
SHL01	HC-5	N001	05/28/2015	Uranium	0.00053			0.00049			0.00033			5	0	No
SHL01	HC-5	N001	05/28/2015	Uranium-234	0.392			0.295			0.227			5	0	No
SHL01	HC-5	N001	05/28/2015	Uranium-238	0.307			0.173			0.117			5	0	No
SHL01	HC-6	N001	05/26/2015	Gross Alpha	28.7			25.7			14.1			5	0	No
SHL01	HC-6	N001	05/26/2015	Uranium	0.0410			0.0390			0.0350			5	0	No
SHL01	HS-1	N001	05/27/2015	Tritium	-233		U	89.6		U	-78.7			5	2	No
SHL01	MV-1	N001	05/29/2015	Gross Beta	6.66			22.0			7.32		J	12	0	NA
SHL01	MV-2	N002	05/29/2015	Uranium-234	7.73			13.6			7.90			10	0	No
SHL01	MV-2	N002	05/29/2015	Uranium-238	6.44			11.7			6.70			10	0	No

STATISTICAL TESTS:

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

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

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

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

NA: Data are not normally or lognormally distributed.

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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 SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: H-3 WELL

Parameter	Units	Sample		Depth Range	(Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID				Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/28/2015	0001	14232.38 - 14232.38		20			#		
Dissolved Oxygen	mg/L	05/28/2015	N001	14232.38 - 14232.38		4.4			#		
Oxidation Reduction Potential	mV	05/28/2015	N001	14232.38 - 14232.38		75.7			#		
pH	s.u.	05/28/2015	N001	14232.38 - 14232.38		8.73			#		
Specific Conductance	umhos/cm	05/28/2015	N001	14232.38 - 14232.38		5677			#		
Temperature	C	05/28/2015	N001	14232.38 - 14232.38		20.46			#		
Tritium	pCi/L	05/28/2015	0001	14232.38 - 14232.38		-196	U		#	370	216
Turbidity	NTU	05/28/2015	N001	14232.38 - 14232.38		68			#		

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-1 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/26/2015	0001	1215	-	1215			#		
Bromide	mg/L	05/26/2015	0001	1215	-	1215			#	0.2	
Carbon-14	pMC	05/26/2015	N003	1094	-	1324.8			#		0.18
Dissolved Oxygen	mg/L	05/26/2015	N001	1215	-	1215			#		
Gross Alpha	pCi/L	05/26/2015	0001	1215	-	1215		J	#	1.2	0.903
Gross Beta	pCi/L	05/26/2015	0001	1215	-	1215		J	#	2.1	1.53
Iodine-129	pCi/L	05/26/2015	N002	1094	-	1324.8	0.000000000131		#		0.00000000001
Oxidation Reduction Potential	mV	05/26/2015	N001	1215	-	1215	37.9		#		
pH	s.u.	05/26/2015	N001	1215	-	1215	7.56		#		
Specific Conductance	umhos/cm	05/26/2015	N001	1215	-	1215	401		#		
Temperature	C	05/26/2015	N001	1215	-	1215	28.94		#		
Tritium	pCi/L	05/26/2015	0001	1215	-	1215	-54.4	U	#	380	221
Turbidity	NTU	05/26/2015	N001	1215	-	1215	71.9		#		
Uranium	mg/L	05/26/2015	0001	1215	-	1215	0.00087		#	0.000029	
Uranium-234	pCi/L	05/26/2015	0001	1215	-	1215	0.353		#	0.051	0.111
Uranium-235	pCi/L	05/26/2015	0001	1215	-	1215	0.0448	U	#	0.043	0.0392
Uranium-238	pCi/L	05/26/2015	0001	1215	-	1215	0.264		#	0.048	0.093

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-2d WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/29/2015	0001	1100	-	1100			#		
Bromide	mg/L	05/29/2015	0001	1100	-	1100			#	0.2	
Carbon-14	pMC	05/29/2015	N003	1417	-	1657			#		0.12
Dissolved Oxygen	mg/L	05/29/2015	N001	1100	-	1100			#		
Gross Alpha	pCi/L	05/29/2015	0001	1100	-	1100			#	1.3	1.99
Gross Beta	pCi/L	05/29/2015	0001	1100	-	1100			#	1.6	1.39
Iodine-129	pCi/L	05/29/2015	N002	1417	-	1657	0.00000000014		#		
Oxidation Reduction Potential	mV	05/29/2015	N001	1100	-	1100	-223.7		#		
pH	s.u.	05/29/2015	N001	1100	-	1100	8.24		#		
Specific Conductance	umhos/cm	05/29/2015	N001	1100	-	1100	624		#		
Temperature	C	05/29/2015	N001	1100	-	1100	21.81		#		
Tritium	pCi/L	05/29/2015	0001	1100	-	1100	-12.8	U	#	380	223
Turbidity	NTU	05/29/2015	N001	1100	-	1100	21		#		
Uranium	mg/L	05/29/2015	0001	1100	-	1100	0.0032		#	0.000029	
Uranium-234	pCi/L	05/29/2015	0001	1100	-	1100	1.35		#	0.064	0.297
Uranium-235	pCi/L	05/29/2015	0001	1100	-	1100	0.195	J	#	0.066	0.0891
Uranium-238	pCi/L	05/29/2015	0001	1100	-	1100	1.14		#	0.062	0.261

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-3 WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/26/2015	N001	1190	-	1190	40			#		
Bromide	mg/L	05/26/2015	0001	1190	-	1190	2.3			#	0.2	
Carbon-14	pMC	05/26/2015	N003	1183	-	1203.5	26.06			#		0.13
Dissolved Oxygen	mg/L	05/26/2015	N001	1190	-	1190	6.32			#		
Gross Alpha	pCi/L	05/26/2015	0001	1190	-	1190	0.937	U		#	1.2	0.78
Gross Beta	pCi/L	05/26/2015	0001	1190	-	1190	5.12		J	#	1.4	1.28
Iodine-129	pCi/L	05/26/2015	N002	1183	-	1203.5	0.00000000023			#		
Oxidation Reduction Potential	mV	05/26/2015	N001	1190	-	1190	132.5			#		
pH	s.u.	05/26/2015	N001	1190	-	1190	7.65			#		
Specific Conductance	umhos/cm	05/26/2015	N001	1190	-	1190	640			#		
Temperature	C	05/26/2015	N001	1190	-	1190	28.21			#		
Tritium	pCi/L	05/26/2015	0001	1190	-	1190	-22.6	U		#	380	223
Turbidity	NTU	05/26/2015	N001	1190	-	1190	216			#		
Uranium	mg/L	05/26/2015	0001	1190	-	1190	0.00026			#	0.000029	
Uranium-234	pCi/L	05/26/2015	0001	1190	-	1190	0.101		J	#	0.063	0.0559
Uranium-235	pCi/L	05/26/2015	0001	1190	-	1190	0.00833	U		#	0.05	0.0251
Uranium-238	pCi/L	05/26/2015	0001	1190	-	1190	0.0784		J	#	0.038	0.0437

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-4 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers			Detection Limit	Uncertainty
								Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/27/2015	0001	1013	-	1294	124			#		
Bromide	mg/L	05/27/2015	0001	1013	-	1294	0.54			#	0.2	
Carbon-14	pMC	05/27/2015	N003	1013	-	1294	12411			#		36
Dissolved Oxygen	mg/L	05/27/2015	N001	1013	-	1294	0.41			#		
Gross Alpha	pCi/L	05/27/2015	0001	1013	-	1294	60.6			#	1.5	10.3
Gross Beta	pCi/L	05/27/2015	0001	1013	-	1294	24.2			#	1.8	4.21
Iodine-129	pCi/L	05/27/2015	N002	1013	-	1294	0.000000000335			#		0.000000000037
Oxidation Reduction Potential	mV	05/27/2015	N001	1013	-	1294	198.9			#		
pH	s.u.	05/27/2015	N001	1013	-	1294	7.69			#		
Specific Conductance	umhos/cm	05/27/2015	N001	1013	-	1294	758			#		
Temperature	C	05/27/2015	N001	1013	-	1294	23.34			#		
Tritium	pCi/L	05/27/2015	0001	1013	-	1294	731			#	380	268
Turbidity	NTU	05/27/2015	N001	1013	-	1294	18.2			#		
Uranium	mg/L	05/27/2015	0001	1013	-	1294	0.11			#	0.000029	
Uranium-234	pCi/L	05/27/2015	0001	1013	-	1294	31.2			#	0.067	5.2
Uranium-235	pCi/L	05/27/2015	0001	1013	-	1294	1.6			#	0.043	0.328
Uranium-238	pCi/L	05/27/2015	0001	1013	-	1294	32.9			#	0.037	5.47

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-5 WELL

Parameter	Units	Sample		Depth Range		Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft	BLS)		Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/28/2015	N001	3385.03	- 3530.63	64			#		
Bromide	mg/L	05/28/2015	N001	3385.03	- 3530.63	0.26			#	0.2	
Carbon-14	pMC	05/28/2015	N003	3385.03	- 3530.63	9.14			#		0.1
Dissolved Oxygen	mg/L	05/28/2015	N001	3385.03	- 3530.63	0.23			#		
Gross Alpha	pCi/L	05/28/2015	N001	3385.03	- 3530.63	0.876	U		#	1.7	1.07
Gross Beta	pCi/L	05/28/2015	N001	3385.03	- 3530.63	1.65	U		#	2	1.27
Iodine-129	pCi/L	05/28/2015	N002	3385.03	- 3530.63	0.000000000032			#		0.000000000 005
Oxidation Reduction Potential	mV	05/28/2015	N001	3385.03	- 3530.63	-22.8			#		
pH	s.u.	05/28/2015	N001	3385.03	- 3530.63	8.47			#		
Specific Conductance	umhos /cm	05/28/2015	N001	3385.03	- 3530.63	990			#		
Temperature	C	05/28/2015	N001	3385.03	- 3530.63	25.99			#		
Tritium	pCi/L	05/28/2015	N001	3385.03	- 3530.63	-247	U		#	380	219
Turbidity	NTU	05/28/2015	N001	3385.03	- 3530.63	1.59			#		
Uranium	mg/L	05/28/2015	N001	3385.03	- 3530.63	0.00053			#	0.000029	
Uranium-234	pCi/L	05/28/2015	N001	3385.03	- 3530.63	0.392			#	0.075	0.128
Uranium-235	pCi/L	05/28/2015	N001	3385.03	- 3530.63	0.0287	U		#	0.059	0.0381
Uranium-238	pCi/L	05/28/2015	N001	3385.03	- 3530.63	0.307			#	0.057	0.108

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-6 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range		(Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
				Lab	Data			QA				
Alkalinity, Total (as CaCO ₃)	mg/L	05/26/2015	N001	1175	-	1175	116			#		
Bromide	mg/L	05/26/2015	N001	1175	-	1175	6.9			#	0.2	
Carbon-14	pMC	05/26/2015	N003	1115.98	-	1232.3	16.33			#		0.1
Dissolved Oxygen	mg/L	05/26/2015	N001	1175	-	1175	7.67			#		
Gross Alpha	pCi/L	05/26/2015	N001	1175	-	1175	28.7			#	1.7	5.02
Gross Beta	pCi/L	05/26/2015	N001	1175	-	1175	12.1			#	2	2.35
Iodine-129	pCi/L	05/26/2015	N002	1115.98	-	1232.3	0.000000000055			#		0.000000000006
Oxidation Reduction Potential	mV	05/26/2015	N001	1175	-	1175	36.5			#		
pH	s.u.	05/26/2015	N001	1175	-	1175	7.44			#		
Specific Conductance	umhos/cm	05/26/2015	N001	1175	-	1175	1154			#		
Temperature	C	05/26/2015	N001	1175	-	1175	25.81			#		
Tritium	pCi/L	05/26/2015	N001	1175	-	1175	-124	U		#	370	218
Turbidity	NTU	05/26/2015	N001	1175	-	1175	9.92			#		
Uranium	mg/L	05/26/2015	N001	1175	-	1175	0.041			#	0.000029	
Uranium-234	pCi/L	05/26/2015	N001	1175	-	1175	15.3			#	0.043	2.56
Uranium-235	pCi/L	05/26/2015	N001	1175	-	1175	0.719			#	0.041	0.184
Uranium-238	pCi/L	05/26/2015	N001	1175	-	1175	13			#	0.039	2.19

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-7 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range		(Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
				Lab	Data			QA				
Alkalinity, Total (as CaCO ₃)	mg/L	05/27/2015	N001	1106.47	-	1223.6	108			#		
Bromide	mg/L	05/27/2015	N001	1106.47	-	1223.6	0.81			#	0.2	
Carbon-14	pMC	05/27/2015	N003	1106.47	-	1223.6	10			#		0.1
Dissolved Oxygen	mg/L	05/27/2015	N001	1106.47	-	1223.6	0.04			#		
Gross Alpha	pCi/L	05/27/2015	N001	1106.47	-	1223.6	13.3			#	2.5	3.02
Gross Beta	pCi/L	05/27/2015	N001	1106.47	-	1223.6	8.43		J	#	3.8	2.77
Iodine-129	pCi/L	05/27/2015	N002	1106.47	-	1223.6	0.00000000013			#		
Oxidation Reduction Potential	mV	05/27/2015	N001	1106.47	-	1223.6	-215.5			#		
pH	s.u.	05/27/2015	N001	1106.47	-	1223.6	7.93			#		
Specific Conductance	umhos/cm	05/27/2015	N001	1106.47	-	1223.6	1408			#		
Temperature	C	05/27/2015	N001	1106.47	-	1223.6	21.57			#		
Tritium	pCi/L	05/27/2015	N001	1106.47	-	1223.6	-183	U		#	370	217
Turbidity	NTU	05/27/2015	N001	1106.47	-	1223.6	1.65			#		
Uranium	mg/L	05/27/2015	N001	1106.47	-	1223.6	0.016			#	0.000029	
Uranium-234	pCi/L	05/27/2015	N001	1106.47	-	1223.6	5.65			#	0.028	0.975
Uranium-235	pCi/L	05/27/2015	N001	1106.47	-	1223.6	0.312			#	0.028	0.0976
Uranium-238	pCi/L	05/27/2015	N001	1106.47	-	1223.6	4.72			#	0.028	0.825

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HC-8 WELL

Parameter	Units	Sample		Depth Range		(Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	Lab	Data			QA				
Alkalinity, Total (as CaCO ₃)	mg/L	05/28/2015	N001	2294.44	-	2410.92	54			#		
Bromide	mg/L	05/28/2015	N001	2294.44	-	2410.92	0.35			#	0.2	
Carbon-14	pMC	05/28/2015	N003	2294.44	-	2410.92	20.34			#		0.17
Dissolved Oxygen	mg/L	05/28/2015	N001	2294.44	-	2410.92	0.1			#		
Gross Alpha	pCi/L	05/28/2015	N001	2294.44	-	2410.92	2.13		J	#	1.7	1.14
Gross Beta	pCi/L	05/28/2015	N001	2294.44	-	2410.92	4.34		J	#	2.8	1.87
Iodine-129	pCi/L	05/28/2015	N002	2294.44	-	2410.92	0.00000000015			#		0.000000000 006
Oxidation Reduction Potential	mV	05/28/2015	N001	2294.44	-	2410.92	-25.5			#		
pH	s.u.	05/28/2015	N001	2294.44	-	2410.92	8.32			#		
Specific Conductance	umhos/cm	05/28/2015	N001	2294.44	-	2410.92	846			#		
Temperature	C	05/28/2015	N001	2294.44	-	2410.92	29.51			#		
Tritium	pCi/L	05/28/2015	N001	2294.44	-	2410.92	-157	U		#	380	221
Turbidity	NTU	05/28/2015	N001	2294.44	-	2410.92	2.13			#		
Uranium	mg/L	05/28/2015	N001	2294.44	-	2410.92	0.00023			#	0.000029	
Uranium-234	pCi/L	05/28/2015	N001	2294.44	-	2410.92	0.155			#	0.024	0.0604
Uranium-235	pCi/L	05/28/2015	N001	2294.44	-	2410.92	0.00717	U		#	0.033	0.0206
Uranium-238	pCi/L	05/28/2015	N001	2294.44	-	2410.92	0.0724		J	#	0.037	0.0417

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: HS-1 WELL

Parameter	Units	Sample		Depth Range	(Ft BLS)	Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID				Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/27/2015	N001	14241.78 - 14241.78		114			#		
Dissolved Oxygen	mg/L	05/27/2015	N001	14241.78 - 14241.78		7.09			#		
Oxidation Reduction Potential	mV	05/27/2015	N001	14241.78 - 14241.78		31.1			#		
pH	s.u.	05/27/2015	N001	14241.78 - 14241.78		7.87			#		
Specific Conductance	umhos/cm	05/27/2015	N001	14241.78 - 14241.78		453			#		
Temperature	C	05/27/2015	N001	14241.78 - 14241.78		25.49			#		
Tritium	pCi/L	05/27/2015	N001	14241.78 - 14241.78		-233	U		#	370	217
Turbidity	NTU	05/27/2015	N001	14241.78 - 14241.78		2.88			#		

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-1 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
				Lab	Data		QA				
Alkalinity, Total (as CaCO ₃)	mg/L	05/29/2015	N001	1572.73	- 1726.54	77			#		
Bromide	mg/L	05/29/2015	N001	1572.73	- 1726.54	0.55			#	0.2	
Carbon-14	pMC	05/29/2015	N003	1572.73	- 1726.54	21.74			#		0.12
Dissolved Oxygen	mg/L	05/29/2015	N001	1572.73	- 1726.54	-27			#		
Gross Alpha	pCi/L	05/29/2015	N001	1572.73	- 1726.54	12.8			#	1.5	2.53
Gross Beta	pCi/L	05/29/2015	N001	1572.73	- 1726.54	6.66		J	#	2.6	1.97
Iodine-129	pCi/L	05/29/2015	N002	1572.73	- 1726.54	0.00000000016			#		0.000000000003
Oxidation Reduction Potential	mV	05/29/2015	N001	1572.73	- 1726.54	-121			#		
pH	s.u.	05/29/2015	N001	1572.73	- 1726.54	8.17			#		
Specific Conductance	umhos/cm	05/29/2015	N001	1572.73	- 1726.54	708			#		
Temperature	C	05/29/2015	N001	1572.73	- 1726.54	22.71			#		
Tritium	pCi/L	05/29/2015	N001	1572.73	- 1726.54	27.9	U		#	380	223
Turbidity	NTU	05/29/2015	N001	1572.73	- 1726.54	1.92			#		
Uranium	mg/L	05/29/2015	N001	1572.73	- 1726.54	0.021			#	0.000029	
Uranium-234	pCi/L	05/29/2015	N001	1572.73	- 1726.54	8.52			#	0.029	1.45
Uranium-235	pCi/L	05/29/2015	N001	1572.73	- 1726.54	0.343			#	0.041	0.106
Uranium-238	pCi/L	05/29/2015	N001	1572.73	- 1726.54	7.2			#	0.032	1.23

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers		Detection Limit	Uncertainty
							Lab	Data QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/29/2015	N001	1819.87	- 1990.64	118		#		
Bromide	mg/L	05/29/2015	N001	1819.87	- 1990.64	0.2	U	#	0.2	
Bromide	mg/L	05/29/2015	N002	1819.87	- 1990.64	0.2	U	#	0.2	
Carbon-14	pMC	05/29/2015	N004	1819.87	- 1990.64	33.49		#		0.15
Dissolved Oxygen	mg/L	05/29/2015	N001	1819.87	- 1990.64	-.16		#		
Gross Alpha	pCi/L	05/29/2015	N001	1819.87	- 1990.64	15		#	1.1	2.7
Gross Alpha	pCi/L	05/29/2015	N002	1819.87	- 1990.64	14		#	1.4	2.86
Gross Beta	pCi/L	05/29/2015	N001	1819.87	- 1990.64	10.5		#	1.8	2.08
Gross Beta	pCi/L	05/29/2015	N002	1819.87	- 1990.64	8.13		#	1.9	1.89
Iodine-129	pCi/L	05/29/2015	N003	1819.87	- 1990.64	0.000000000016		#		0.000000000005
Oxidation Reduction Potential	mV	05/29/2015	N001	1819.87	- 1990.64	-65.1		#		
pH	s.u.	05/29/2015	N001	1819.87	- 1990.64	8.27		#		
Specific Conductance	umhos/cm	05/29/2015	N001	1819.87	- 1990.64	474		#		
Temperature	C	05/29/2015	N001	1819.87	- 1990.64	23.85		#		
Tritium	pCi/L	05/29/2015	N001	1819.87	- 1990.64	-209	U	#	380	219
Tritium	pCi/L	05/29/2015	N002	1819.87	- 1990.64	-216	U	#	370	217
Turbidity	NTU	05/29/2015	N001	1819.87	- 1990.64	1.06		#		
Uranium	mg/L	05/29/2015	N001	1819.87	- 1990.64	0.022		#	0.000029	

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Uranium	mg/L	05/29/2015	N002	1819.87	-	1990.64			#	0.000029	
Uranium-234	pCi/L	05/29/2015	N001	1819.87	-	1990.64			#	0.03	1.43
Uranium-234	pCi/L	05/29/2015	N002	1819.87	-	1990.64			#	0.052	1.33
Uranium-235	pCi/L	05/29/2015	N001	1819.87	-	1990.64			#	0.03	0.124
Uranium-235	pCi/L	05/29/2015	N002	1819.87	-	1990.64			#	0.016	0.101
Uranium-238	pCi/L	05/29/2015	N001	1819.87	-	1990.64			#	0.037	1.23
Uranium-238	pCi/L	05/29/2015	N002	1819.87	-	1990.64			#	0.039	1.11

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-3 WELL

Parameter	Units	Sample		Depth Range		Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft	BLS)		Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/28/2015	N001	1463.59	- 1634.75	67			#		
Bromide	mg/L	05/28/2015	N001	1463.59	- 1634.75	0.87			#	0.2	
Carbon-14	pMC	05/28/2015	N003	1463.59	- 1634.75	23.91			#		0.12
Dissolved Oxygen	mg/L	05/28/2015	N001	1463.59	- 1634.75	-.15			#		
Gross Alpha	pCi/L	05/28/2015	N001	1463.59	- 1634.75	4.61			#	1.5	1.34
Gross Beta	pCi/L	05/28/2015	N001	1463.59	- 1634.75	5.85		J	#	2.6	1.92
Iodine-129	pCi/L	05/28/2015	N002	1463.59	- 1634.75	0.0000000002			#		0.000000000 002
Oxidation Reduction Potential	mV	05/28/2015	N001	1463.59	- 1634.75	-76.6			#		
pH	s.u.	05/28/2015	N001	1463.59	- 1634.75	8.34			#		
Specific Conductance	umhos /cm	05/28/2015	N001	1463.59	- 1634.75	744			#		
Temperature	C	05/28/2015	N001	1463.59	- 1634.75	22.06			#		
Tritium	pCi/L	05/28/2015	N001	1463.59	- 1634.75	-123	U		#	370	218
Turbidity	NTU	05/28/2015	N001	1463.59	- 1634.75	2.72			#		
Uranium	mg/L	05/28/2015	N001	1463.59	- 1634.75	0.01			#	0.000029	
Uranium-234	pCi/L	05/28/2015	N001	1463.59	- 1634.75	3.54			#	0.03	0.637
Uranium-235	pCi/L	05/28/2015	N001	1463.59	- 1634.75	0.192			#	0.03	0.0747
Uranium-238	pCi/L	05/28/2015	N001	1463.59	- 1634.75	2.93			#	0.037	0.537

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-4 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers			Detection Limit	Uncertainty
							Lab	Data	QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/29/2015	N001	1400	-	1560			#		
Bromide	mg/L	05/29/2015	0001	1400	-	1560			#	0.2	
Carbon-14	pMC	05/29/2015	N003	1400	-	1560			#		0.17
Dissolved Oxygen	mg/L	05/29/2015	N001	1400	-	1560			#		
Gross Alpha	pCi/L	05/29/2015	0001	1400	-	1560			#	1.6	6.6
Gross Beta	pCi/L	05/29/2015	0001	1400	-	1560			#	1.9	2.91
Iodine-129	pCi/L	05/29/2015	N002	1400	-	1560	0.000000000005		#		0.000000000004
Oxidation Reduction Potential	mV	05/29/2015	N001	1400	-	1560	-241.5		#		
pH	s.u.	05/29/2015	N001	1400	-	1560	8.17		#		
Specific Conductance	umhos/cm	05/29/2015	N001	1400	-	1560	780		#		
Temperature	C	05/29/2015	N001	1400	-	1560	20.47		#		
Tritium	pCi/L	05/29/2015	0001	1400	-	1560	-2.81	U	#	370	220
Turbidity	NTU	05/29/2015	N001	1400	-	1560	10.8		#		
Uranium	mg/L	05/29/2015	0001	1400	-	1560	0.063		#	0.000029	
Uranium-234	pCi/L	05/29/2015	0001	1400	-	1560	20.4		#	0.025	3.41
Uranium-235	pCi/L	05/29/2015	0001	1400	-	1560	0.888		#	0.03	0.205
Uranium-238	pCi/L	05/29/2015	0001	1400	-	1560	18.8		#	0.014	3.14

Groundwater Quality Data by Location (USEE100) FOR SITE SHL01, Shoal Site

REPORT DATE: 02/24/2016

Location: MV-5 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)		Result	Qualifiers		Detection Limit	Uncertainty
							Lab	Data QA		
Alkalinity, Total (as CaCO ₃)	mg/L	05/28/2015	N001	1325	- 1565	293		#		
Bromide	mg/L	05/28/2015	N001	1325	- 1565	4.3		#	0.4	
Carbon-14	pMC	05/28/2015	N003	1325	- 1565	54.51		#		0.21
Dissolved Oxygen	mg/L	05/28/2015	N001	1325	- 1565	3.4		#		
Gross Alpha	pCi/L	05/28/2015	N001	1325	- 1565	0.499	U	#	1.4	0.827
Gross Beta	pCi/L	05/28/2015	N001	1325	- 1565	5.64		#	1.3	1.25
Iodine-129	pCi/L	05/28/2015	N002	1325	- 1565	0.000000000125		#		0.000000000017
Oxidation Reduction Potential	mV	05/28/2015	N001	1325	- 1565	-56.6		#		
pH	s.u.	05/28/2015	N001	1325	- 1565	11.61		#		
Specific Conductance	umhos/cm	05/28/2015	N001	1325	- 1565	1786		#		
Temperature	C	05/28/2015	N001	1325	- 1565	20.3		#		
Tritium	pCi/L	05/28/2015	N001	1325	- 1565	-155	U	#	370	215
Turbidity	NTU	05/28/2015	N001	1325	- 1565	0.77		#		
Uranium	mg/L	05/28/2015	N001	1325	- 1565	0.00023		#	0.000029	
Uranium-234	pCi/L	05/28/2015	N001	1325	- 1565	0.119		#	0.028	0.052
Uranium-235	pCi/L	05/28/2015	N001	1325	- 1565	0.00354	U	#	0.028	0.0204
Uranium-238	pCi/L	05/28/2015	N001	1325	- 1565	0.0642		J #	0.024	0.0369

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.

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Equipment Blank Data

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BLANKS REPORT

LAB: PARAGON/ALS LABORATORY GROUP (Fort Collins, CO)

RIN: 15057042

Report Date: 02/17/2016

Parameter	Site Code	Location ID	Sample		Units	Result	Qualifiers		Detection Limit	Uncertainty	Sample Type
			Date	ID			Lab	Data			
Bromide	SHL01	0999	05/26/2015	N001	mg/L	0.2	U		0.2		E
Gross Alpha	SHL01	0999	05/26/2015	N001	pCi/L	0.644	U		1	0.645	E
Gross Beta	SHL01	0999	05/26/2015	N001	pCi/L	1.58		J	1.4	0.916	E
Tritium	SHL01	0999	05/26/2015	N001	pCi/L	-157	U		370	216	E
Uranium	SHL01	0999	05/26/2015	N001	mg/L	0.000029	U		0.000029		E
Uranium-234	SHL01	0999	05/26/2015	N001	pCi/L	0.07		J	0.036	0.0427	E
Uranium-235	SHL01	0999	05/26/2015	N001	pCi/L	-.0023	U		0.032	0.0235	E
Uranium-238	SHL01	0999	05/26/2015	N001	pCi/L	0.0252	U		0.027	0.0249	E

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

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- > Result above upper detection limit.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- 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).
- U Analytical result below detection limit.

DATA QUALIFIERS:

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

SAMPLE TYPES:

- E Equipment Blank.

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Static Water Level Data

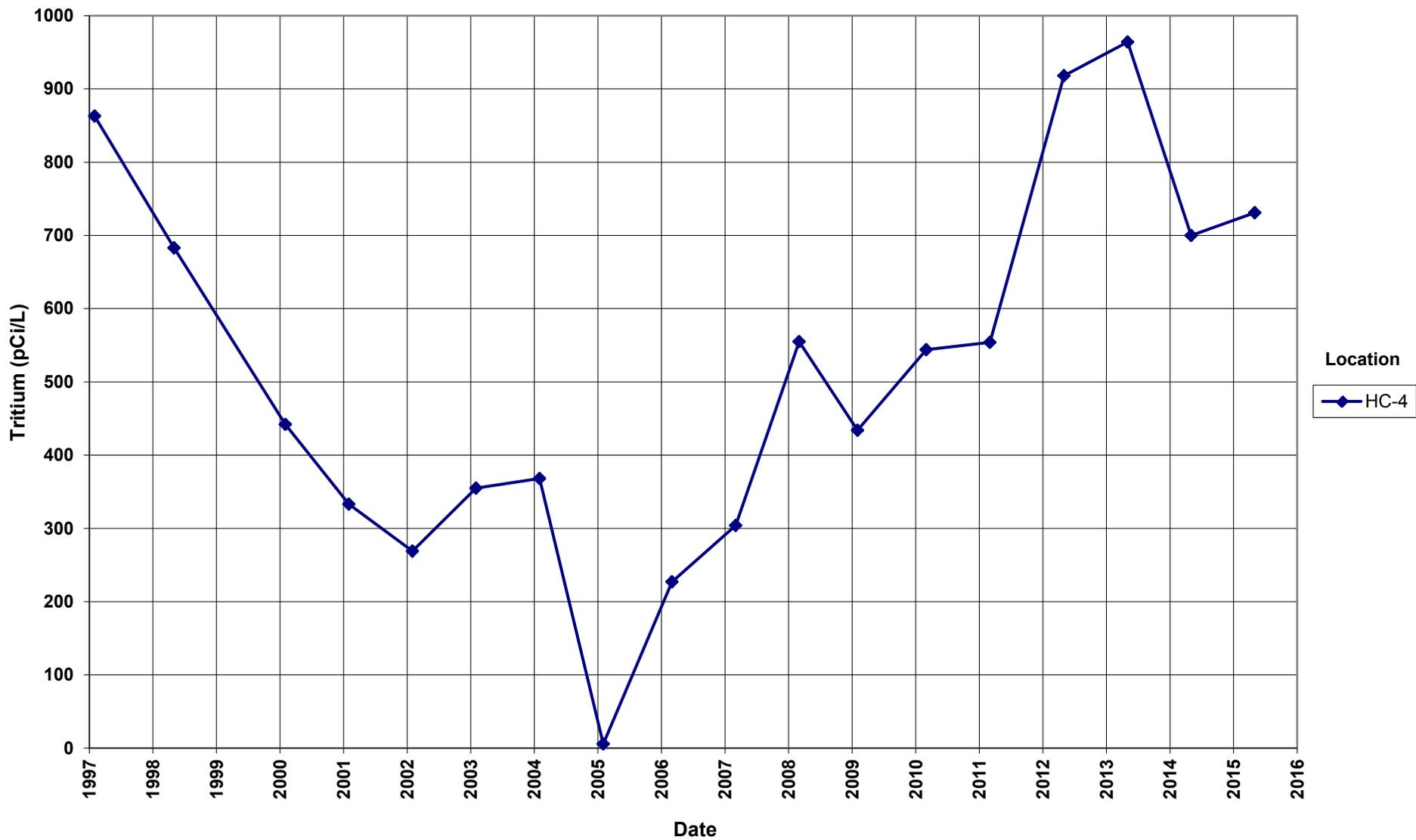
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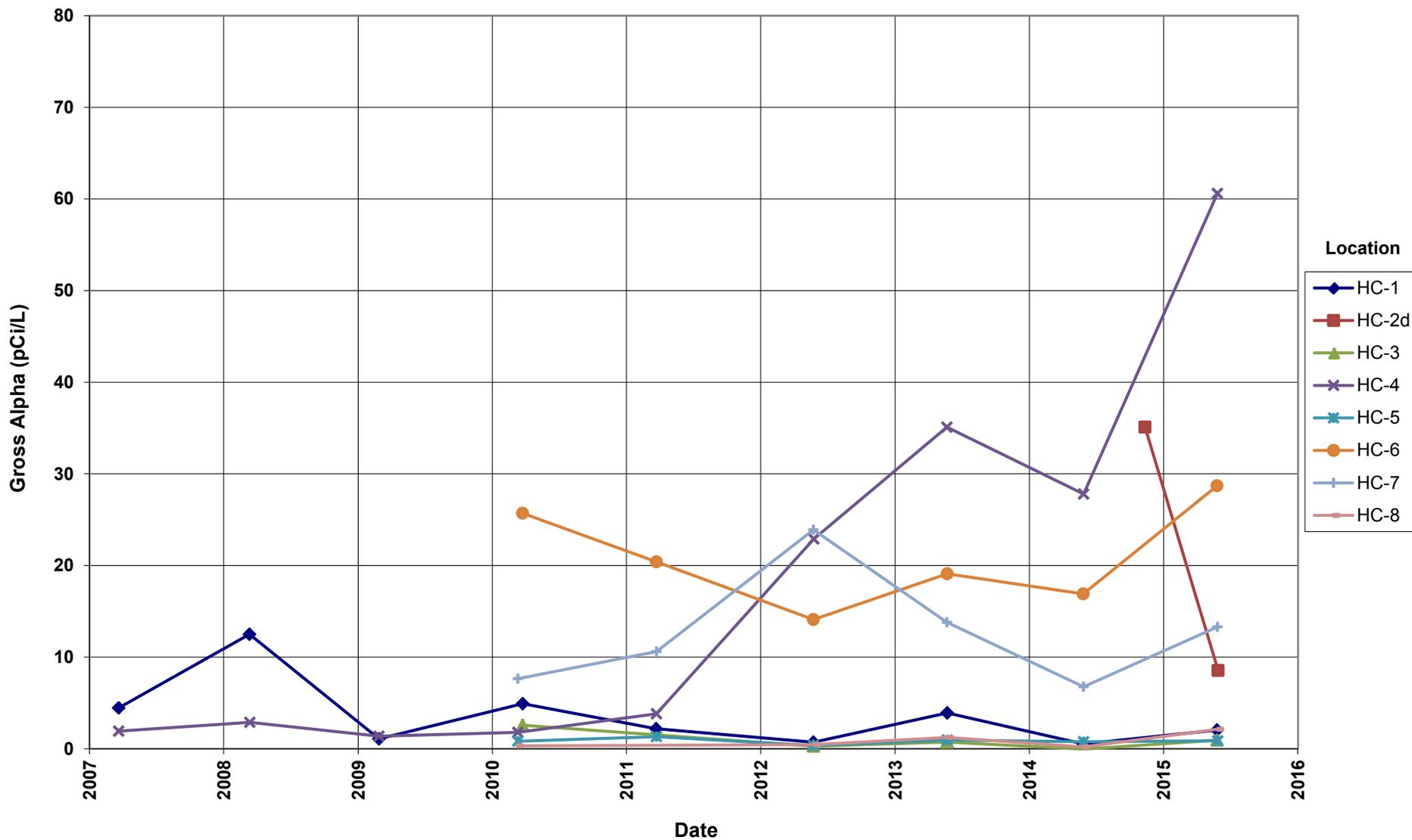
Time-Concentration Graphs

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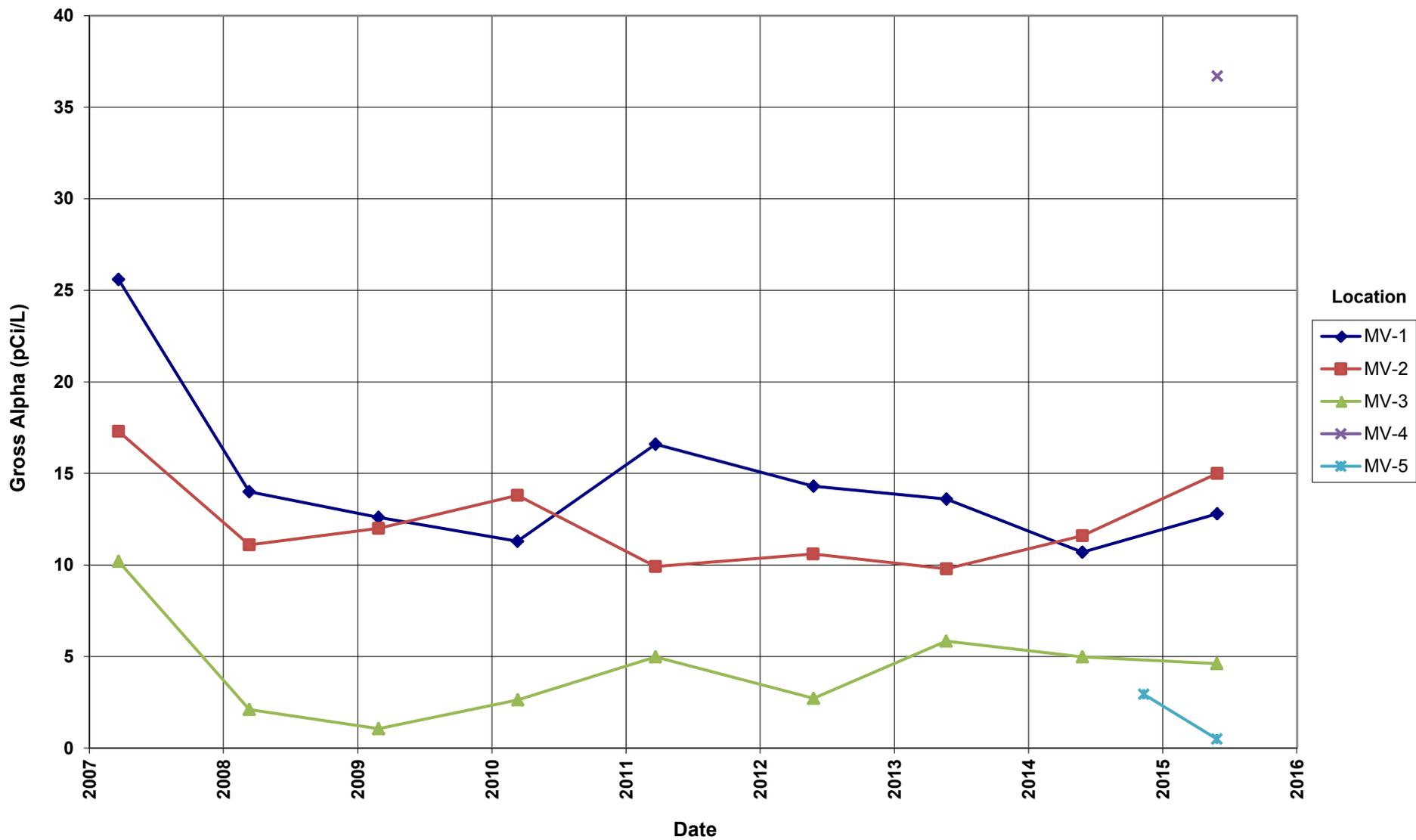
Shoal Site Tritium Concentration



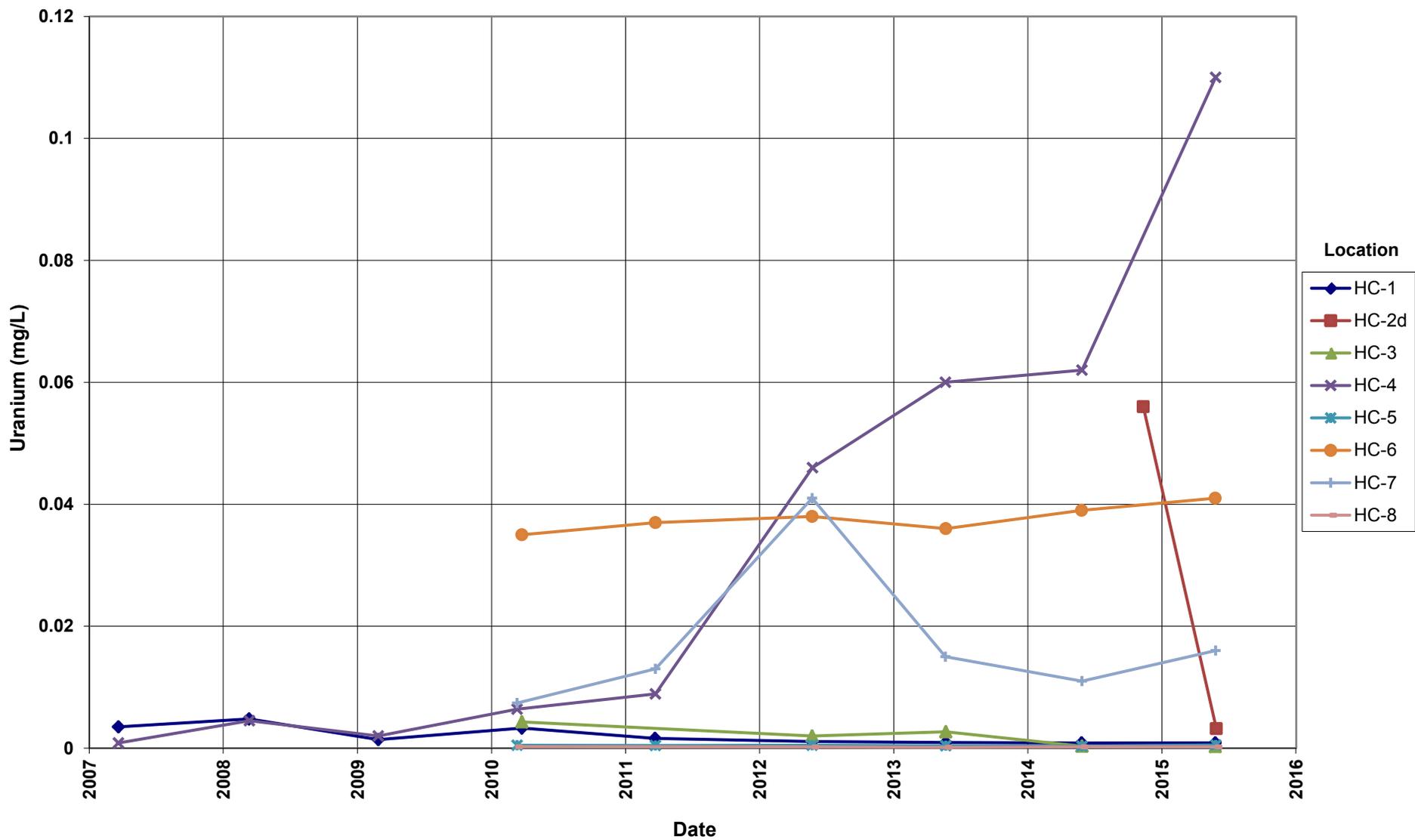
Shoal Site Gross Alpha Concentration



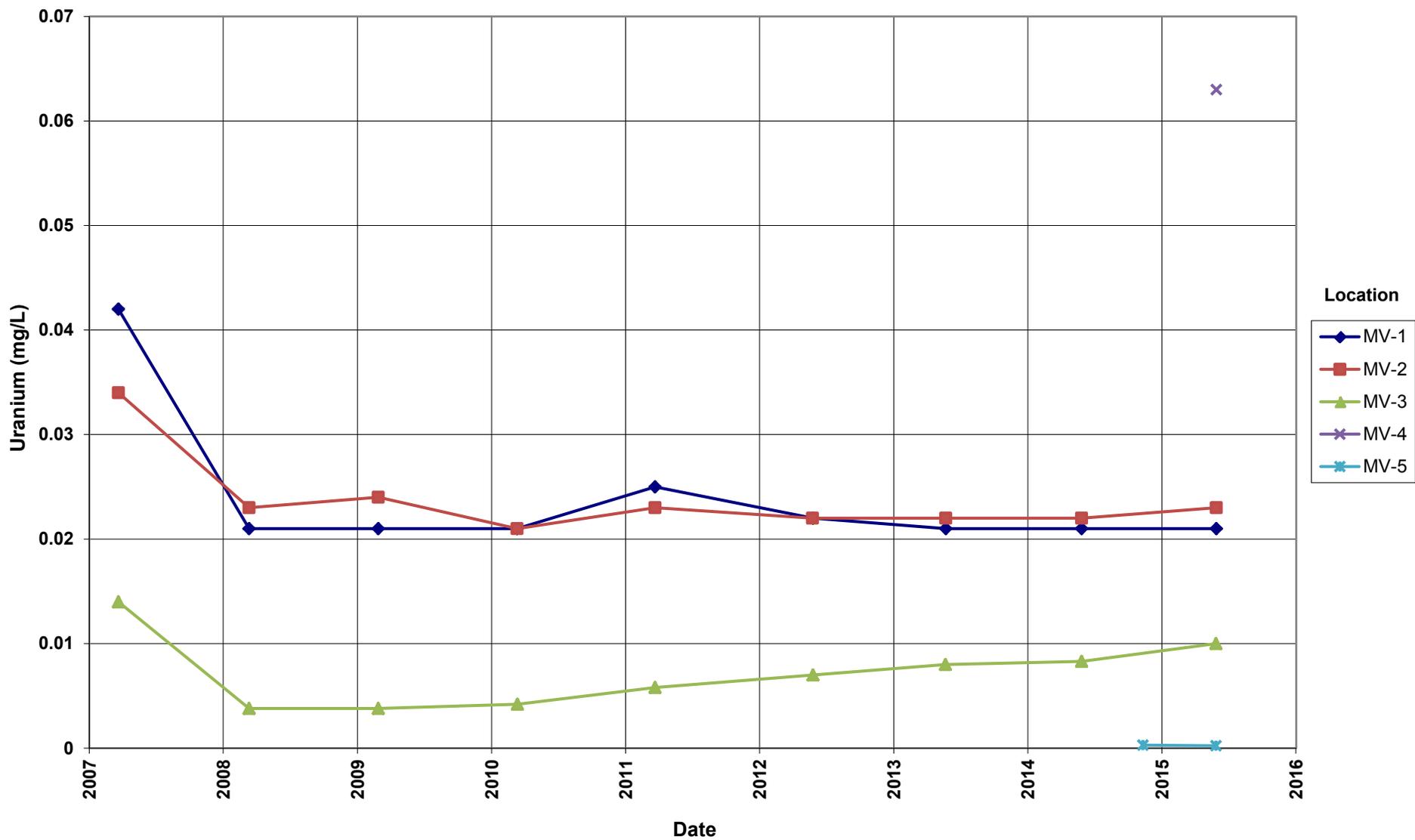
Shoal Site Gross Alpha Concentration



Shoal Site Uranium Concentration



Shoal Site Uranium Concentration



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Attachment 3

Sampling and Analysis Work Order

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Stoller Newport News Nuclear

May 4, 2015

Task Assignment 104
Control Number 15-0513

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

SUBJECT: Contract No. DE-LM0000415, Stoller Newport News Nuclear, Inc. (SN3),
a wholly owned subsidiary of Huntington Ingalls Industries, Inc.
Task Assignment 104 LTS&M - Nevada Offsites and Monticello
May 2015 Environmental Sampling at the Shoal, Nevada, Site

REFERENCE: Task Assignment 104, 3-104-1-07-621, Shoal, Nevada, Site

Dear Mr. Kautsky:

The purpose of this letter is to inform you of the upcoming monitoring event at the Shoal, Nevada, Site. It is also to provide details on the sampling activities, hydraulic head monitoring, and supplemental activities that are not part of our typical annual monitoring. The annual sampling activities, as typically performed, will include the analyses of samples from select wells for tritium, uranium isotopes, gross alpha, mass concentrations of uranium, iodine-129, and carbon-14, as specified in the Corrective Action Decision Document/Corrective Action Plan and most recent short-term data acquisition plan completed in 2014. Supplemental activities for this monitoring event will include the collection of samples from wells H-3 and HS-1 for tritium analysis. Enclosed are a map and tables that specify the sample locations and analytes for the annual monitoring event. This monitoring event is scheduled to begin the week of May 25, 2015.

The following locations are scheduled for sampling during this event:

- **Wells**
 - HC-1, HC-2d, HC-3, HC-4, HC-5, HC-6, HC-7, HC-8, MV-1, MV-2, MV-3, MV-4, MV-5, H-3, and HS-1

Samples will be collected from wells HC-1 and HC-6 using a depth-specific bailer because these wells are not completed with dedicated submersible pumps. The samples from these locations will be collected from the approximate middle of the open interval. Wells HC-3 and H-3 will be sampled using a bailer that collects the sample from the top of the water column. These wells are also not completed with dedicated submersible pumps and have limited access or limited water in the well column. Wells HC-2d, HC-4, HC-5, HC-7, HC-8, MV-1, MV-2, MV-3, MV-4, MV-5, and HS-1 will be sampled using the dedicated submersible pumps. At least one well volume will be removed, and field parameters (temperature, pH, and specific conductance) will be

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allowed to stabilize before samples are collected. Before samples are collected from the wells, the transducer will be removed and downloaded, and a water level will be determined. All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* ([http://www.lm.doe.gov/Long-Term Surveillance and Maintenance.aspx#](http://www.lm.doe.gov/Long-Term%20Surveillance%20and%20Maintenance.aspx#)). Table 1 provides a list of the sample locations and Table 2 provides the required analyses.

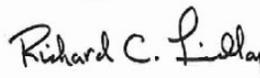
Supplemental Activities

The following supplemental activities are associated with this monitoring event:

- **Wells H-3 and HS-1:** The monitoring well network will be enhanced for this sampling event to include the collection of samples from wells H-3 and HS-1. Well H-3 is in Fourmile Flat approximately 2-miles west of surface ground zero and well HS-1 is in Fairview Valley approximately 4-miles east of surface ground zero (Figure 1 – Planned Sampling Map). Samples collected from these wells will be analyzed for tritium. Table 2 provides the analytical suite for the sampling event.

If you have questions or need additional information, please contact me at (970) 248-6419.

Sincerely,



Rick C. Findlay
2015.05.04 13:24:44
-06'00'

Richard C. Findlay
Site Lead

RF/lcg/bkb

Enclosures (3)

cc: (electronic)
Christina Pennal, DOE
Steve Donivan, SN3
Rick Findlay, SN3
Lauren Goodknight, SN3
Diana Osborne, SN3
EDD delivery
rc-grand.junction
File: SHL 400.02

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Table 1 - Sampling Frequencies for Locations at Shoal, Nevada

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
H-2					X	Download transducers
H-3			X			Download transducers
HC-1			X			Download transducers
HC-2d			X			Download transducers
HC-3			X			Download transducers
HC-4			X			Download transducers
HC-5			X			Download transducers
HC-6			X			Download transducers
HC-7			X			Download transducers
HC-8			X			Download transducers
MV-1			X			Download transducers
MV-2			X			Download transducers
MV-3			X			Download transducers
MV-4			X			Download transducers
MV-5			X			Download transducers
Piezometers						
MV-1PZ					X	Download transducers
MV-2PZ					X	Download transducers
MV-3PZ					X	Download transducers
MV-4PZ					X	Download transducers
MV-5PZ					X	Download transducers
Water Supply Well (used by Rancher for cattle)						
HS-1			X			

Sampling conducted in May 2015

Table 2 - Constituent Sampling Breakdown for Shoal, Nevada

Analyte	Measurements by Location Type		Laboratory Requirements		
	Groundwater Monitoring Wells	Supplemental Sampling Locations (H-3 and HS-1)	Required Detection Limit	Analytical Method	Line Item Code
Approx. No. Samples/yr	13	2			
Field Measurements					
Alkalinity	X	X			
Dissolved Oxygen	X	X			
Redox Potential	X	X			
pH	X	X			
Specific Conductance	X	X			
Turbidity	X	X			
Temperature	X	X			
Laboratory Measurements					
Aluminum					
Ammonia as N (NH3-N)					
Bicarbonates					
Bromide	X		0.5 mg/L	SW-846 9056	MIS-A-045
Calcium					
Carbon-14 (Dissolved Inorganic Carbon)	X		NA	Accelerator Mass Spectrometry	LMR-16
Chloride					
Chromium					
Gamma Spec					
Gross Alpha	X		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta					
Iodine-129	X		NA	Accelerator Mass Spectrometry	LMR-17
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Stable Isotopes (Oxygen and Hydrogen)					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched					
Uranium-234, -235, -238	X		1 pCi/L	Alpha Spectrometry	ASP-A-024
Uranium	X		0.0001 mg/L	SW-846 6020	LMM-02
Vanadium					
Zinc					
Total No. of Analytes	7	1			

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

Attachment 4

Trip Report

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Memorandum

DATE: July 22, 2015

TO: Rick Findlay

FROM: Jeff Price

SUBJECT: Trip Report

Site: Shoal, Nevada

Dates of Sampling Event: May 26 – 30, 2015

Team Members: Alison Kuhlman and Jeff Price

Number of Locations Sampled: Samples were collected from all 15 of the locations identified on the sampling notification letter.

Locations Not Sampled/Reason: All scheduled locations were sampled.

Location Specific Information: The pH value on MV-5 was greater than 11. Also, samplers on future sampling events should consult the field data sheets for well purge time information.

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

False ID	Ticket Number	True ID	Sample Type	Associated Matrix	Associated Samples
2723	NGQ730		Equipment Blank	Groundwater	All except for H-3
2724	NGQ731	MV-2	Duplicate	Groundwater	All

Requisition Index Number (RIN) Assigned: Samples were assigned to RIN 15057042 and 15057043. Field data sheets can be found in \\crow\RAApps\SMS\15057042\FieldData.

Sample Shipment: Samples were shipped overnight via FedEx from Grand Junction to ALS Lab and University of Arizona on June 3, 2015.

Water Level Measurements: Water levels were measured in all sampled wells and piezometers. The following table provides the measured water levels:

WELL	DATE	TIME	WATER LEVEL
H-3	5/25/2015	15:20	325.58
HC-1	5/25/2015	11:05	1059.68
HC-2d	5/25/2015	14:25	1101.15
HC-3	5/25/2015	13:15	1179.85
HC-4	5/25/2015	10:35	1003.77
HC-5	5/25/2015	09:00	1369.17
HC-6	5/25/2015	09:30	961.88
HC-7	5/25/2015	10:15	961.90
HC-8	5/25/2015	08:20	1371.98
MV-1	5/25/2015	12:10	988.95
MV-2	5/25/2015	13:45	998.25
MV-3	5/25/2015	11:25	967.98
MV-4	5/25/2015	13:25	1083.30
MV-5	5/25/2015	15:10	1051.10
HS-1	5/25/2015	Not Measured	Not Measured
MV-1PZ	5/25/2015	12:25	970.17
MV-2PZ	5/25/2015	14:00	982.22
MV-3PZ	5/25/2015	11:45	967.63
MV-4PZ	5/25/2015	12:45	1081.72
MV-5PZ	5/25/2015	15:30	1051.25
H-2	5/25/2015	15:50	110.06

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)* and Program Directive SHL-2015-02.

Field Variance: Samples were collected according to the SAP and Program Directive. Samples from the following wells were filtered: H-3, HC-1, HC-2d, HC-3, HC-4, and MV-4.

Equipment: All equipment functioned properly.

Dataloggers: Dataloggers were downloaded by Rick Findlay and Rex Hodges.

Stakeholder/Regulatory/DOE: Nothing to note.

Institutional Controls:

Fences, Gates, and Locks: N/A

Signs: No issues were observed.

Trespassing/Site Disturbances: None observed

Disposal Cell/Drainage Structure Integrity: N/A

Safety Issues: One rattlesnake was seen.

Access Issues: The dirt road (GZ Canyon Road) leading to the site was badly eroded from a recent rain event. However, the road was repaired on May 28th.

A SUBSIDIARY OF HUNTINGTON INGALLS INDUSTRIES

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Rick Findlay
July 22, 2015
Page 3

General Information: Nothing to note.

Immediate Actions Taken: None.

Future Actions Required or Suggested: None.

(JP/lcg)

cc: (electronic)
Mark Kautsky, DOE
Paul Darr, SN3
Steve Donovan, SN3
Rick Findlay, SN3
Rex Hodges, SN3
EDD Delivery

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