Data Validation Package

June 2014
Groundwater Sampling at the Hallam, Nebraska, Decommissioned Reactor Site

September 2014

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Sampling Event Summary

Site: Hallam, Nebraska, Decommissioned Reactor Site

Sampling Period: June 3–4, 2014

The 2008 *Long-Term Surveillance Plan* [LTSP] *for the Decommissioned Hallam Nuclear Power Facility, Hallam, Nebraska* requires groundwater monitoring once every 2 years. Seventeen monitoring wells at the Hallam site were sampled during this event as specified in the plan. Water levels were measured at all sampled wells and at two additional wells (6A and 6B) prior to the start of sampling. Additionally, water levels of each sampled well were measured at the beginning of sampling. Sampling and analysis were conducted as specified in *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated).

Gross alpha and gross beta are the only parameters that were detected at statistically significant concentrations. Time/concentration graphs of the gross alpha and gross beta data are presented in this report. The gross alpha and gross beta activity concentrations observed are consistent with values previously observed and are attributed to naturally occurring radionuclides (e.g., uranium and uranium decay chain products) in the groundwater.

Michele L. Miller
2014.09.04 10:09:01 -04'00'

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

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Hallam, Nebraska, Sample Location Map

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Data Assessment Summary

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Water Sampling Field Activities Verification Checklist

Project	Hallam, Nebraska	**Date(s) of Water Sampling**	June 3–4, 2014
Date(s) of Verification	August 5, 2014	**Name of Verifier**	Stephen Donivan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures?	Yes	
List any Program Directives or other documents, SOPs, instructions.		Work Order letter dated May 15, 2014.
2. Were the sampling locations specified in the planning documents sampled?	Yes	
3. Were calibrations conducted as specified in the above-named documents?	Yes	Calibrations were performed May 29, 2014.
4. Was an operational check of the field equipment conducted daily?	Yes	
Did the operational checks meet criteria?	Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	No	Alkalinity measurements were not performed.
6. Were wells categorized correctly?	Yes	
7. Were the following conditions met when purging a Category I well:		
Was one pump/tubing volume purged prior to sampling?	Yes	
Did the water level stabilize prior to sampling?	Yes	
Did pH, specific conductance, and turbidity measurements meet criteria prior to sampling?	Yes	
Was the flow rate less than 500 mL/min?	Yes	

Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well:		
Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	No	Wells 7B, 7C, and 2C2 ran dry during purging. These wells were allowed to recharge and then were sampled the following day.
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected form location 3B.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	NA	An equipment blank was not required.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were the true identities of the QC samples documented?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
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 Number (RIN): 14056211
Sample Event: June 3–4, 2014
Site(s): Hallam, Nebraska
Laboratory: ALS Laboratory Group, Fort Collins, Colorado
Work Order No.: 1406170
Analysis: Radiochemistry
Validator: Stephen Donivan
Review Date: August 4, 2014

This validation was performed according to the *Environmental Procedures Catalog* (LMS/POL/S04325, continually updated), "Standard Practice for Validation of Environmental Data." The procedure was applied at Level 3, Data Validation. See attached Data Validation Worksheets for supporting documentation on the data review and validation. All analyses were successfully completed. The samples were prepared and analyzed using accepted procedures based on methods specified by line item codes, which are listed in Table 1.

Table 1. Analytes and Methods

Analyte	Line Item Code	Preparation Method	Analytical Method
Gamma Spectrometry	GAM-A-001	SOP713R11	SOP713R11
Gross Alpha/Beta	GPC-A-001	SOP702R19	SOP724R10
Tritium	LSC-A-001	SOP700R10	SOP704R9
Nickel-63	LSC-A-009	SOP774R1	SOP704R9

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 Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1406170-1	1A	Gross Alpha	J	Result less than the determination limit
1406170-1	1A	Gross Beta	J	Result less than the determination limit
1406170-2	1B	Actinium-228	U	Nuclide identification criteria
1406170-3	3B Duplicate	Gross Alpha	J	Result less than the determination limit
1406170-3	3B Duplicate	Gross Beta	J	Result less than the determination limit
1406170-4	2A	Actinium-228	U	Nuclide identification criteria
1406170-4	2A	Yttrium-88	U	Nuclide identification criteria
1406170-6	2B2	Gross Alpha	J	Result less than the determination limit
1406170-8	3A	Gross Alpha	J	Result less than the determination limit
1406170-8	3A	Gross Beta	J	Result less than the determination limit

Table 2 (continued). Data Qualifiers

Sample Number	Location	Analyte	Flag	Reason
1406170-9	3B	Actinium-228	U	Nuclide identification criteria
1406170-9	3B	Gross Alpha	J	Result less than the determination limit
1406170-9	3B	Gross Beta	J	Result less than the determination limit
1406170-10	4A	Actinium-228	U	Nuclide identification criteria
1406170-10	4A	Gross Alpha	J	Result less than the determination limit
1406170-10	4A	Gross Beta	J	Result less than the determination limit
1406170-11	4B	Actinium-228	U	Nuclide identification criteria
1406170-13	5A	Actinium-228	U	Nuclide identification criteria
1406170-13	5A	Gross Beta	J	Result less than the determination limit
1406170-15	7B	Actinium-228	U	Nuclide identification criteria
1406170-16	7C	Actinium-228	U	Nuclide identification criteria
1406170-17	8B	Yttrium-88	U	Nuclide identification criteria

Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received 18 samples on June 10, 2014, accompanied by a Chain of Custody (COC) form. The COC form was checked to confirm that all of the samples were listed on the form 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 form and the sample tickets had no errors or omissions.

Holding Times and Preservation

The sample shipments were received intact at ambient temperature. All samples were received in the correct container types and had been preserved correctly for the requested analyses, and all samples were analyzed within the applicable holding times.

Detection and Quantitation Limits

Radiochemical 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 the U.S. Department of Energy *Quality Systems for Analytical Services* document. 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 MDCs for radiochemical analytes demonstrate compliance with contractual requirements.

Laboratory Instrument Calibration

Compliance requirements for satisfactory instrument calibration are established to ensure that an 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.

Gamma Spectrometry

Activity concentrations above the MDC were reported in some instances where minimum nuclide identification criteria were not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the "diagnostic" peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Sample results for gamma-emitting radionuclides that do not meet both of those identification criteria are qualified with a "U" flag as not detected.

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 blank results were below the MDC.

Matrix Spike Analysis

Matrix spike and matrix spike duplicate samples were analyzed for gross alpha, gross beta, and tritium as a measure of method performance in the sample matrix. All spike results were within the acceptance range.

Laboratory Duplicate Analysis

The laboratory replicate sample results demonstrated acceptable laboratory precision with relative error ratios less than 3 for all duplicate sample results.

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. The laboratory control samples results were acceptable for all analytes.

Completeness

Results were reported in the correct units for all analytes requested using contract-required laboratory qualifiers.

Electronic Data Deliverable (EDD) File

The EDD files arrived on July 21, 2014. The Sample Management System EDD validation module was used to verify that the EDD files were complete and in compliance with requirements. The module compares the contents of the file to the requested analyses to ensure that all of 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: 14056211 **Lab Code:** PAR **Validator:** Stephen Donivan **Validation Date:** 08/04/2014

Project: Hallam **Analysis Type:** ☐ Metals ☐ General Chem ☑ Rad ☐ Organics

# of Samples: 18 **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	All analyses were completed within the applicable holding times.
☑ Detection Limits	There are 0 detection limit failures.
☐ Field/Trip Blanks	
☑ Field Duplicates	There was 1 duplicate evaluated.

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 14056211 **Lab Code:** PAR **Date Due:** 07/08/2014

Matrix: Water **Site Code:** HAL01 **Date Completed:** 07/22/2014

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
1A	Actinium-228	06/28/2014						0.07
1A	Americium-241	06/28/2014						0.34
Blank_Spike	Americium-241	06/30/2014				97.50		
1A	Antimony-125	06/28/2014						1.26
1A	Cerium-144	06/28/2014						0.15
1A	Cesium-134	06/28/2014						1.52
1A	Cesium-137	06/28/2014						0.95
Blank_Spike	Cesium-137	06/30/2014				101.00		
1A	Cobalt-60	06/28/2014						0.74
Blank_Spike	Cobalt-60	06/30/2014				98.20		
1A	Europium-152	06/28/2014						0.64
1A	Europium-154	06/28/2014						1.54
1A	Europium-155	06/28/2014						1.27
2A	GROSS ALPHA	06/29/2014						0.15
Blank_Spike	GROSS ALPHA	06/30/2014				85.00		
8C	GROSS ALPHA	06/30/2014					84.5	
Blank	GROSS ALPHA	06/30/2014	0.1730	U				
2A	GROSS BETA	06/29/2014						0.42
Blank_Spike	GROSS BETA	06/30/2014				96.20		
8C	GROSS BETA	06/30/2014					99.1	
Blank	GROSS BETA	06/30/2014	0.2370	U				
2A	H-3	06/20/2014						0.35
Blank_Spike	H-3	06/21/2014				105.00		
Blank	H-3	06/21/2014	0.2580	U				
8C	H-3	06/23/2014					111.0	
1A	Lead-212	06/28/2014						1.45
1A	Nickel-63	07/11/2014			93.0			
1B	Nickel-63	07/11/2014			88.2			
2628	Nickel-63	07/11/2014			88.6			
2A	Nickel-63	07/12/2014			88.2			
2B	Nickel-63	07/12/2014			79.1			
2B2	Nickel-63	07/12/2014			90.4			

SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

RIN: 14056211 **Lab Code:** PAR **Date Due:** 07/08/2014

Matrix: Water **Site Code:** HAL01 **Date Completed:** 07/22/2014

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
2C2	Nickel-63	07/12/2014			83.0			
4A	Nickel-63	07/12/2014			92.4			
4B	Nickel-63	07/12/2014			84.9			
4C	Nickel-63	07/12/2014			82.5			
5A	Nickel-63	07/12/2014			82.2			
5B	Nickel-63	07/12/2014			88.3			
7B	Nickel-63	07/12/2014			88.0			
7C	Nickel-63	07/12/2014			87.6			
8B	Nickel-63	07/12/2014			77.4			
8C	Nickel-63	07/12/2014			85.3			
2A	Nickel-63	07/12/2014			78.5			0.06
2B	Nickel-63	07/12/2014			90.9		103.0	
Blank	Nickel-63	07/12/2014	2.7500	U	83.8			
3A	Nickel-63	07/14/2014			75.3			
3B	Nickel-63	07/14/2014			81.2			
Blank_Spike	Nickel-63	07/14/2014			89.2	99.30		
1A	Potassium-40	06/28/2014						0.60
1A	Promethium-144	06/28/2014						0.62
1A	Promethium-146	06/28/2014						1.68
1A	Ruthenium-106	06/28/2014						0.82
1A	Thorium-234	06/28/2014						0.77
1A	Uranium-235	06/28/2014						0.72
1A	Yttrium-88	06/28/2014						0.11

Sampling Quality Control Assessment

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

Sampling Protocol

All monitoring wells were purged and sampled using Category I or II low-flow sampling methods with the following exceptions. Wells 2C2, 7B, and 7C ran out of water during initial sampling due to the limitations associated with using a peristaltic pump. These wells were allowed to recharge and were sampled the following day. The sample results from all Category I and II wells are qualified with a "F" flag indicating that the wells were sampled using the low-flow technique. With the exception of well 1A, the data were further qualified with a "Q" flag as estimated values because these are Category II wells.

Equipment Blank Assessment

An equipment blank was not collected because dedicated tubing was used to sample all wells.

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 3B. 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 calculated from the 1-sigma uncertainties should be less than 3. All duplicate results met these criteria, which demonstrated acceptable precision.

SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 14056211 **Lab Code:** PAR **Project:** Hallam **Validation Date:** 08/04/2014

Duplicate: 2628 **Sample:** 3B

Analyte	Sample Result	Sample Flag	Sample Error	Sample Dilution	Duplicate Result	Duplicate Flag	Duplicate Error	Duplicate Dilution	RPD	RER	Units
Actinium-228	16.5		6.64	1	17.4	U	12.9	1		0.1	pCi/L
Americium-241	20.8	U	81.8	1	-14.8	U	26.7	1		0.8	pCi/L
Antimony-125	2.29	U	5.8	1	9.09	U	6.84	1		1.5	pCi/L
Cerium-144	-1.38	U	14.2	1	13.9	U	13.5	1		1.5	pCi/L
Cesium-134	0.338	U	2.42	1	-1.82	U	2.98	1		1.1	pCi/L
Cesium-137	-1.98	U	2.24	1	0.305	U	2.77	1		1.3	pCi/L
Cobalt-60	0.0777	U	2.23	1	-1.92	U	2.78	1		1.1	pCi/L
Europium-152	-1.97	U	11.6	1	6.77	U	14.4	1		0.9	pCi/L
Europium-154	-10.4	U	12	1	-4.44	U	16.4	1		0.6	pCi/L
Europium-155	-1.7	U	9.63	1	6.21	U	7.78	1		1.3	pCi/L
GROSS ALPHA	5.72		2.21	1	7.38		2.39	1		1.0	pCi/L
GROSS BETA	4.89		2.55	1	9.06		3.01	1		2.1	pCi/L
H-3	-31.7	U	213	1	-324	U	208	1		1.9	pCi/L
Lead-212	0.852	U	5.92	1	2.4	U	7.48	1		0.3	pCi/L
Nickel-63	1.05	U	4.23	1	-0.0324	U	3.71	1		0.4	pCi/L
Potassium-40	20.9	U	72.8	1	72.9	U	99.5	1		0.8	pCi/L
Promethium-144	0.507	U	2.39	1	-0.415	U	3.36	1		0.4	pCi/L
Promethium-146	-2.41	U	2.74	1	2.23	U	3.26	1		2.1	pCi/L
Ruthenium-106	-13.7	U	21.4	1	-12.7	U	26.6	1		0.1	pCi/L
Thorium-234	9.58	U	123	1	-9.82	U	77.1	1		0.3	pCi/L
Uranium-235	-6.64	U	27.4	1	14.5	U	14.3	1		1.3	pCi/L
Yttrium-88	3.71	U	2.81	1	1.17	U	3.77	1		1.1	pCi/L

Certification

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

Laboratory Coordinator: _____ _____
Stephen Donivan Date

Stephen E. Donivan
2014.09.03 11:09:22
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Data Validation Lead: _____ _____
Stephen Donivan Date

Stephen E. Donivan
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Attachment 1
Assessment of Anomalous Data

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Potential Outliers Report

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Potential Outliers Report

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

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

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

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

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 01/01/2004

Laboratory: ALS Laboratory Group

RIN: 14056211

Report Date: 08/05/2014

Site Code	Location Code	Sample ID	Sample Date	Analyte	Current	Qualifiers		Historical Maximum	Qualifiers		Historical Minimum	Qualifiers		Number of Data Points		Statistical Outlier
					Result	*Lab*	*Data*	Result	*Lab*	*Data*	Result	*Lab*	*Data*	N	N Below Detect	
HAL01	2B2	0001	06/04/2014	Gross Alpha	3.68		FQJ	16.7		FQ	4.54		FQJ	7	1	No
HAL01	3B	N001	06/04/2014	Actinium-228	16.5		UFQ	47.4	U	FQ	17.9		FQJ	7	6	No
HAL01	3B	N001	06/04/2014	Gross Alpha	5.72		FQJ	27.7	U	FQ	6.31		FQJ	7	1	No
HAL01	3B	N001	06/04/2014	Gross Beta	4.89		FQJ	13.0		FQ	5.40		FQJ	7	2	No
HAL01	8B	N001	06/03/2014	Gross Beta	8.62		FQ	8.44		FQ	2.60	J	FQJ	7	1	No
HAL01	8C	N001	06/03/2014	Gross Beta	8.50		FQ	7.85		FQ	5.10		FQJ	7	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.

Attachment 2
Data Presentation

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Groundwater Quality Data

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Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 1A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	16	-	23.5	18	U	F	#	18	11.5
Americium-241	pCi/L	06/04/2014	N001	16	-	23.5	9.8	U	F	#	9.8	5.82
Antimony-125	pCi/L	06/04/2014	N001	16	-	23.5	12	U	F	#	12	6.22
Cerium-144	pCi/L	06/04/2014	N001	16	-	23.5	18	U	F	#	18	10.8
Cesium-134	pCi/L	06/04/2014	N001	16	-	23.5	4.8	U	F	#	4.8	2.81
Cesium-137	pCi/L	06/04/2014	N001	16	-	23.5	4.7	U	F	#	4.7	2.82
Cobalt-60	pCi/L	06/04/2014	N001	16	-	23.5	5.6	U	F	#	5.6	3.04
Europium-152	pCi/L	06/04/2014	N001	16	-	23.5	7.2	U	F	#	7.2	4.21
Europium-154	pCi/L	06/04/2014	N001	16	-	23.5	27	U	F	#	27	16.1
Europium-155	pCi/L	06/04/2014	N001	16	-	23.5	7.2	U	F	#	7.2	4.12
Gross Alpha	pCi/L	06/04/2014	N001	16	-	23.5	2.3		FJ	#	1.9	1.29
Gross Beta	pCi/L	06/04/2014	N001	16	-	23.5	5.03		FJ	#	3	2.07
Lead-212	pCi/L	06/04/2014	N001	16	-	23.5	11	U	F	#	11	6.46
Nickel-63	pCi/L	06/04/2014	N001	16	-	23.5	12	U	F	#	12	3.57
Oxidation Reduction Potential	mV	06/04/2014	N001	16	-	23.5	282.2		F	#		
pH	s.u.	06/04/2014	N001	16	-	23.5	6.92		F	#		
Potassium-40	pCi/L	06/04/2014	N001	16	-	23.5	110	U	F	#	110	63.6
Promethium-144	pCi/L	06/04/2014	N001	16	-	23.5	5.3	U	F	#	5.3	3.1

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 1A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	16	-	23.5	5.3	U	F	#	5.3	3.09
Ruthenium-106	pCi/L	06/04/2014	N001	16	-	23.5	45	U	F	#	45	25.6
Specific Conductance	umhos /cm	06/04/2014	N001	16	-	23.5	1804		F	#		
Temperature	C	06/04/2014	N001	16	-	23.5	17.97		F	#		
Thorium-234	pCi/L	06/04/2014	N001	16	-	23.5	77	U	F	#	77	37.8
Tritium	pCi/L	06/04/2014	N001	16	-	23.5	360	U	F	#	360	207
Turbidity	NTU	06/04/2014	N001	16	-	23.5	1.57		F	#		
Uranium-235	pCi/L	06/04/2014	N001	16	-	23.5	26	U	F	#	26	13.5
Yttrium-88	pCi/L	06/04/2014	N001	16	-	23.5	12	U	F	#	12	6.92

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 1B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	39	-	49	22.7		UFQ	#	18	10.5
Americium-241	pCi/L	06/04/2014	N001	39	-	49	30	U	FQ	#	30	16.9
Antimony-125	pCi/L	06/04/2014	N001	39	-	49	12	U	FQ	#	12	7.16
Cerium-144	pCi/L	06/04/2014	N001	39	-	49	23	U	FQ	#	23	13.7
Cesium-134	pCi/L	06/04/2014	N001	39	-	49	5.7	U	FQ	#	5.7	3.24
Cesium-137	pCi/L	06/04/2014	N001	39	-	49	6.1	U	FQ	#	6.1	3.45
Cobalt-60	pCi/L	06/04/2014	N001	39	-	49	5.8	U	FQ	#	5.8	3.59
Europium-152	pCi/L	06/04/2014	N001	39	-	49	30	U	FQ	#	30	17.4
Europium-154	pCi/L	06/04/2014	N001	39	-	49	31	U	FQ	#	31	18.8
Europium-155	pCi/L	06/04/2014	N001	39	-	49	16	U	FQ	#	16	9.53
Gross Alpha	pCi/L	06/04/2014	N001	39	-	49	6.83		FQ	#	1.2	1.54
Gross Beta	pCi/L	06/04/2014	N001	39	-	49	9.39		FQ	#	1.9	1.97
Lead-212	pCi/L	06/04/2014	N001	39	-	49	14	U	FQ	#	14	8.26
Nickel-63	pCi/L	06/04/2014	N001	39	-	49	13	U	FQ	#	13	3.75
Oxidation Reduction Potential	mV	06/04/2014	N001	39	-	49	282.4		FQ	#		
pH	s.u.	06/04/2014	N001	39	-	49	6.96		FQ	#		
Potassium-40	pCi/L	06/04/2014	N001	39	-	49	120	U	FQ	#	120	72.3
Promethium-144	pCi/L	06/04/2014	N001	39	-	49	6.1	U	FQ	#	6.1	3.76

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 1B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	39	-	49	5.9	U	FQ	#	5.9	3.46
Ruthenium-106	pCi/L	06/04/2014	N001	39	-	49	48	U	FQ	#	48	28.4
Specific Conductance	umhos /cm	06/04/2014	N001	39	-	49	1110		FQ	#		
Temperature	C	06/04/2014	N001	39	-	49	17.71		FQ	#		
Thorium-234	pCi/L	06/04/2014	N001	39	-	49	130	U	FQ	#	130	78.3
Tritium	pCi/L	06/04/2014	N001	39	-	49	360	U	FQ	#	360	209
Turbidity	NTU	06/04/2014	N001	39	-	49	9.92		FQ	#		
Uranium-235	pCi/L	06/04/2014	N001	39	-	49	22	U	FQ	#	22	13.2
Yttrium-88	pCi/L	06/04/2014	N001	39	-	49	6.3	U	FQ	#	6.3	4

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	20	-	25	16.4		UFQ	#	16	8.39
Americium-241	pCi/L	06/04/2014	N001	20	-	25	100	U	FQ	#	100	62.3
Antimony-125	pCi/L	06/04/2014	N001	20	-	25	11	U	FQ	#	11	6.23
Cerium-144	pCi/L	06/04/2014	N001	20	-	25	24	U	FQ	#	24	14.6
Cesium-134	pCi/L	06/04/2014	N001	20	-	25	4.7	U	FQ	#	4.7	2.77
Cesium-137	pCi/L	06/04/2014	N001	20	-	25	4.4	U	FQ	#	4.4	2.57
Cobalt-60	pCi/L	06/04/2014	N001	20	-	25	4.2	U	FQ	#	4.2	2.44
Europium-152	pCi/L	06/04/2014	N001	20	-	25	23	U	FQ	#	23	13
Europium-154	pCi/L	06/04/2014	N001	20	-	25	25	U	FQ	#	25	14.2
Europium-155	pCi/L	06/04/2014	N001	20	-	25	14	U	FQ	#	14	8.84
Gross Alpha	pCi/L	06/04/2014	N001	20	-	25	9.44		FQ	#	1.7	2.11
Gross Beta	pCi/L	06/04/2014	N001	20	-	25	7.52		FQ	#	2.4	1.95
Lead-212	pCi/L	06/04/2014	N001	20	-	25	14	U	FQ	#	14	8.58
Nickel-63	pCi/L	06/04/2014	N001	20	-	25	13	U	FQ	#	13	3.8
Oxidation Reduction Potential	mV	06/04/2014	N001	20	-	25	266.5		FQ	#		
pH	s.u.	06/04/2014	N001	20	-	25	7.17		FQ	#		
Potassium-40	pCi/L	06/04/2014	N001	20	-	25	120	U	FQ	#	120	71.4
Promethium-144	pCi/L	06/04/2014	N001	20	-	25	4.6	U	FQ	#	4.6	2.76

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	20	-	25	4.8	U	FQ	#	4.8	2.87
Ruthenium-106	pCi/L	06/04/2014	N001	20	-	25	41	U	FQ	#	41	24.4
Specific Conductance	umhos /cm	06/04/2014	N001	20	-	25	1301		FQ	#		
Temperature	C	06/04/2014	N001	20	-	25	15.26		FQ	#		
Thorium-234	pCi/L	06/04/2014	N001	20	-	25	220	U	FQ	#	220	131
Tritium	pCi/L	06/04/2014	N001	20	-	25	360	U	FQ	#	360	208
Turbidity	NTU	06/04/2014	N001	20	-	25	2.32		FQ	#		
Uranium-235	pCi/L	06/04/2014	N001	20	-	25	39	U	FQ	#	39	23.3
Yttrium-88	pCi/L	06/04/2014	N001	20	-	25	4.73		UFQ	#	4.7	3

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	43	-	53	56	U	FQ	#	56	33
Americium-241	pCi/L	06/04/2014	N001	43	-	53	32	U	FQ	#	32	19.6
Antimony-125	pCi/L	06/04/2014	N001	43	-	53	26	U	FQ	#	26	13.4
Cerium-144	pCi/L	06/04/2014	N001	43	-	53	28	U	FQ	#	28	16.7
Cesium-134	pCi/L	06/04/2014	N001	43	-	53	7.2	U	FQ	#	7.2	4.16
Cesium-137	pCi/L	06/04/2014	N001	43	-	53	7.5	U	FQ	#	7.5	4.28
Cobalt-60	pCi/L	06/04/2014	N001	43	-	53	10	U	FQ	#	10	5.89
Europium-152	pCi/L	06/04/2014	N001	43	-	53	46	U	FQ	#	46	25.9
Europium-154	pCi/L	06/04/2014	N001	43	-	53	43	U	FQ	#	43	25.2
Europium-155	pCi/L	06/04/2014	N001	43	-	53	16	U	FQ	#	16	9.5
Gross Alpha	pCi/L	06/04/2014	N001	43	-	53	17.2		FQ	#	2.2	3.53
Gross Beta	pCi/L	06/04/2014	N001	43	-	53	15.9		FQ	#	2.4	3.04
Lead-212	pCi/L	06/04/2014	N001	43	-	53	14	U	FQ	#	14	8.43
Nickel-63	pCi/L	06/04/2014	N001	43	-	53	14	U	FQ	#	14	4.18
Oxidation Reduction Potential	mV	06/04/2014	N001	43	-	53	122.6		FQ	#		
pH	s.u.	06/04/2014	N001	43	-	53	7		FQ	#		
Potassium-40	pCi/L	06/04/2014	N001	43	-	53	180	U	FQ	#	180	105
Promethium-144	pCi/L	06/04/2014	N001	43	-	53	8.3	U	FQ	#	8.3	4.94

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	43	-	53	7.3	U	FQ	#	7.3	4.48
Ruthenium-106	pCi/L	06/04/2014	N001	43	-	53	72	U	FQ	#	72	41.1
Specific Conductance	umhos /cm	06/04/2014	N001	43	-	53	1428		FQ	#		
Temperature	C	06/04/2014	N001	43	-	53	14.95		FQ	#		
Thorium-234	pCi/L	06/04/2014	N001	43	-	53	160	U	FQ	#	160	94.9
Tritium	pCi/L	06/04/2014	N001	43	-	53	360	U	FQ	#	360	207
Turbidity	NTU	06/04/2014	N001	43	-	53	1.47		FQ	#		
Uranium-235	pCi/L	06/04/2014	N001	43	-	53	47	U	FQ	#	47	28.1
Yttrium-88	pCi/L	06/04/2014	N001	43	-	53	8.8	U	FQ	#	8.8	5.54

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2B2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	0001	-	20	U	FQ	#	20	10.6
Americium-241	pCi/L	06/04/2014	0001	-	9.9	U	FQ	#	9.9	5.84
Antimony-125	pCi/L	06/04/2014	0001	-	12	U	FQ	#	12	6.36
Cerium-144	pCi/L	06/04/2014	0001	-	12	U	FQ	#	12	7.65
Cesium-134	pCi/L	06/04/2014	0001	-	4.9	U	FQ	#	4.9	2.8
Cesium-137	pCi/L	06/04/2014	0001	-	4.9	U	FQ	#	4.9	2.9
Cobalt-60	pCi/L	06/04/2014	0001	-	4.7	U	FQ	#	4.7	2.81
Europium-152	pCi/L	06/04/2014	0001	-	25	U	FQ	#	25	14.9
Europium-154	pCi/L	06/04/2014	0001	-	31	U	FQ	#	31	17.1
Europium-155	pCi/L	06/04/2014	0001	-	7	U	FQ	#	7	4.36
Gross Alpha	pCi/L	06/04/2014	0001	-	3.68		FQJ	#	1.6	1.31
Gross Beta	pCi/L	06/04/2014	0001	-	8.1		FQ	#	2	1.83
Lead-212	pCi/L	06/04/2014	0001	-	11	U	FQ	#	11	6.7
Nickel-63	pCi/L	06/04/2014	0001	-	12	U	FQ	#	12	3.59
Oxidation Reduction Potential	mV	06/04/2014	N001	-	239.9		FQ	#		
pH	s.u.	06/04/2014	N001	-	6.97		FQ	#		
Potassium-40	pCi/L	06/04/2014	0001	-	110	U	FQ	#	110	64
Promethium-144	pCi/L	06/04/2014	0001	-	5.1	U	FQ	#	5.1	2.99

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2B2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	0001	-	5.4	U	FQ	#	5.4	3.11
Ruthenium-106	pCi/L	06/04/2014	0001	-	44	U	FQ	#	44	24.7
Specific Conductance	umhos /cm	06/04/2014	N001	-	1170		FQ	#		
Temperature	C	06/04/2014	N001	-	15.79		FQ	#		
Thorium-234	pCi/L	06/04/2014	0001	-	75	U	FQ	#	75	44.9
Tritium	pCi/L	06/04/2014	0001	-	360	U	FQ	#	360	209
Turbidity	NTU	06/04/2014	N001	-	22.9		FQ	#		
Uranium-235	pCi/L	06/04/2014	0001	-	27	U	FQ	#	27	16
Yttrium-88	pCi/L	06/04/2014	0001	-	12	U	FQ	#	12	7.02

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2C2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	-	40	U		#	40	23.7
Americium-241	pCi/L	06/04/2014	N001	-	28	U		#	28	16.6
Antimony-125	pCi/L	06/04/2014	N001	-	13	U		#	13	7.45
Cerium-144	pCi/L	06/04/2014	N001	-	23	U		#	23	13.7
Cesium-134	pCi/L	06/04/2014	N001	-	5.7	U		#	5.7	3.31
Cesium-137	pCi/L	06/04/2014	N001	-	6	U		#	6	3.4
Cobalt-60	pCi/L	06/04/2014	N001	-	6.8	U		#	6.8	3.75
Europium-152	pCi/L	06/04/2014	N001	-	28	U		#	28	16.3
Europium-154	pCi/L	06/04/2014	N001	-	31	U		#	31	17.5
Europium-155	pCi/L	06/04/2014	N001	-	16	U		#	16	9.58
Gross Alpha	pCi/L	06/04/2014	N001	-	4.02			#	1.1	1.14
Gross Beta	pCi/L	06/04/2014	N001	-	5.38			#	1.5	1.31
Lead-212	pCi/L	06/04/2014	N001	-	14	U		#	14	8.16
Nickel-63	pCi/L	06/04/2014	N001	-	14	U		#	14	3.98
Oxidation Reduction Potential	mV	06/04/2014	N001	-	304.8			#		
pH	s.u.	06/04/2014	N001	-	7			#		
Potassium-40	pCi/L	06/04/2014	N001	-	120	U		#	120	71.4
Promethium-144	pCi/L	06/04/2014	N001	-	6.3	U		#	6.3	3.79

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 2C2 WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	-	5.7	U		#	5.7	3.29
Ruthenium-106	pCi/L	06/04/2014	N001	-	50	U		#	50	29.9
Specific Conductance	umhos /cm	06/04/2014	N001	-	977			#		
Temperature	C	06/04/2014	N001	-	16.07			#		
Thorium-234	pCi/L	06/04/2014	N001	-	130	U		#	130	78.8
Tritium	pCi/L	06/04/2014	N001	-	360	U		#	360	208
Turbidity	NTU	06/04/2014	N001	-	0.75			#		
Uranium-235	pCi/L	06/04/2014	N001	-	22	U		#	22	13
Yttrium-88	pCi/L	06/04/2014	N001	-	6.7	U		#	6.7	3.94

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 3A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	19	-	24	23	U	FQ	#	23	14
Americium-241	pCi/L	06/04/2014	N001	19	-	24	25	U	FQ	#	25	15.4
Antimony-125	pCi/L	06/04/2014	N001	19	-	24	14	U	FQ	#	14	7.18
Cerium-144	pCi/L	06/04/2014	N001	19	-	24	22	U	FQ	#	22	13.4
Cesium-134	pCi/L	06/04/2014	N001	19	-	24	5.6	U	FQ	#	5.6	3.26
Cesium-137	pCi/L	06/04/2014	N001	19	-	24	5.7	U	FQ	#	5.7	3.3
Cobalt-60	pCi/L	06/04/2014	N001	19	-	24	6.8	U	FQ	#	6.8	4.24
Europium-152	pCi/L	06/04/2014	N001	19	-	24	32	U	FQ	#	32	18.2
Europium-154	pCi/L	06/04/2014	N001	19	-	24	34	U	FQ	#	34	20
Europium-155	pCi/L	06/04/2014	N001	19	-	24	13	U	FQ	#	13	7.58
Gross Alpha	pCi/L	06/04/2014	N001	19	-	24	6.43		FQJ	#	5.6	3.78
Gross Beta	pCi/L	06/04/2014	N001	19	-	24	12.5		FQJ	#	4.9	3.72
Lead-212	pCi/L	06/04/2014	N001	19	-	24	13	U	FQ	#	13	8.01
Nickel-63	pCi/L	06/04/2014	N001	19	-	24	15	U	FQ	#	15	4.48
Oxidation Reduction Potential	mV	06/04/2014	N001	19	-	24	273.1		FQ	#		
pH	s.u.	06/04/2014	N001	19	-	24	6.91		FQ	#		
Potassium-40	pCi/L	06/04/2014	N001	19	-	24	160	U	FQ	#	160	93.3
Promethium-144	pCi/L	06/04/2014	N001	19	-	24	6.1	U	FQ	#	6.1	3.58

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 3A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/04/2014	N001	19	-	24	5.9	U	FQ	#	5.9	3.47
Ruthenium-106	pCi/L	06/04/2014	N001	19	-	24	53	U	FQ	#	53	32.2
Specific Conductance	umhos /cm	06/04/2014	N001	19	-	24	3290		FQ	#		
Temperature	C	06/04/2014	N001	19	-	24	16.15		FQ	#		
Thorium-234	pCi/L	06/04/2014	N001	19	-	24	150	U	FQ	#	150	90.6
Tritium	pCi/L	06/04/2014	N001	19	-	24	360	U	FQ	#	360	209
Turbidity	NTU	06/04/2014	N001	19	-	24	1.97		FQ	#		
Uranium-235	pCi/L	06/04/2014	N001	19	-	24	21	U	FQ	#	21	11
Yttrium-88	pCi/L	06/04/2014	N001	19	-	24	7.6	U	FQ	#	7.6	4.43

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 3B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/04/2014	N001	43	-	53	16.5		UFQ	#	13	6.64
Actinium-228	pCi/L	06/04/2014	N002	43	-	53	23	U	FQ	#	23	12.9
Americium-241	pCi/L	06/04/2014	N001	43	-	53	140	U	FQ	#	140	81.8
Americium-241	pCi/L	06/04/2014	N002	43	-	53	45	U	FQ	#	45	26.7
Antimony-125	pCi/L	06/04/2014	N001	43	-	53	10	U	FQ	#	10	5.8
Antimony-125	pCi/L	06/04/2014	N002	43	-	53	12	U	FQ	#	12	6.84
Cerium-144	pCi/L	06/04/2014	N001	43	-	53	24	U	FQ	#	24	14.2
Cerium-144	pCi/L	06/04/2014	N002	43	-	53	22	U	FQ	#	22	13.5
Cesium-134	pCi/L	06/04/2014	N001	43	-	53	4.1	U	FQ	#	4.1	2.42
Cesium-134	pCi/L	06/04/2014	N002	43	-	53	5.1	U	FQ	#	5.1	2.98
Cesium-137	pCi/L	06/04/2014	N001	43	-	53	3.9	U	FQ	#	3.9	2.24
Cesium-137	pCi/L	06/04/2014	N002	43	-	53	4.7	U	FQ	#	4.7	2.77
Cobalt-60	pCi/L	06/04/2014	N001	43	-	53	3.8	U	FQ	#	3.8	2.23
Cobalt-60	pCi/L	06/04/2014	N002	43	-	53	5	U	FQ	#	5	2.78
Europium-152	pCi/L	06/04/2014	N001	43	-	53	20	U	FQ	#	20	11.6
Europium-152	pCi/L	06/04/2014	N002	43	-	53	24	U	FQ	#	24	14.4
Europium-154	pCi/L	06/04/2014	N001	43	-	53	21	U	FQ	#	21	12
Europium-154	pCi/L	06/04/2014	N002	43	-	53	28	U	FQ	#	28	16.4

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 3B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Europium-155	pCi/L	06/04/2014	N001	43	-	53	16	U	FQ	#	16	9.63
Europium-155	pCi/L	06/04/2014	N002	43	-	53	13	U	FQ	#	13	7.78
Gross Alpha	pCi/L	06/04/2014	N001	43	-	53	5.72		FQJ	#	2.8	2.21
Gross Alpha	pCi/L	06/04/2014	N002	43	-	53	7.38		FQJ	#	2.8	2.39
Gross Beta	pCi/L	06/04/2014	N001	43	-	53	4.89		FQJ	#	3.9	2.55
Gross Beta	pCi/L	06/04/2014	N002	43	-	53	9.06		FQJ	#	4.2	3.01
Lead-212	pCi/L	06/04/2014	N001	43	-	53	9.9	U	FQ	#	9.9	5.92
Lead-212	pCi/L	06/04/2014	N002	43	-	53	12	U	FQ	#	12	7.48
Nickel-63	pCi/L	06/04/2014	N001	43	-	53	14	U	FQ	#	14	4.23
Nickel-63	pCi/L	06/04/2014	N002	43	-	53	13	U	FQ	#	13	3.71
Oxidation Reduction Potential	mV	06/04/2014	N001	43	-	53	282.1		FQ	#		
pH	s.u.	06/04/2014	N001	43	-	53	7.03		FQ	#		
Potassium-40	pCi/L	06/04/2014	N001	43	-	53	120	U	FQ	#	120	72.8
Potassium-40	pCi/L	06/04/2014	N002	43	-	53	160	U	FQ	#	160	99.5
Promethium-144	pCi/L	06/04/2014	N001	43	-	53	4	U	FQ	#	4	2.39
Promethium-144	pCi/L	06/04/2014	N002	43	-	53	5.7	U	FQ	#	5.7	3.36
Promethium-146	pCi/L	06/04/2014	N001	43	-	53	4.7	U	FQ	#	4.7	2.74
Promethium-146	pCi/L	06/04/2014	N002	43	-	53	5.4	U	FQ	#	5.4	3.26

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 3B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Ruthenium-106	pCi/L	06/04/2014	N001	43	-	53	37	U	FQ	#	37	21.4
Ruthenium-106	pCi/L	06/04/2014	N002	43	-	53	46	U	FQ	#	46	26.6
Specific Conductance	umhos /cm	06/04/2014	N001	43	-	53	2295		FQ	#		
Temperature	C	06/04/2014	N001	43	-	53	16.1		FQ	#		
Thorium-234	pCi/L	06/04/2014	N001	43	-	53	200	U	FQ	#	200	123
Thorium-234	pCi/L	06/04/2014	N002	43	-	53	130	U	FQ	#	130	77.1
Tritium	pCi/L	06/04/2014	N001	43	-	53	360	U	FQ	#	360	213
Tritium	pCi/L	06/04/2014	N002	43	-	53	360	U	FQ	#	360	208
Turbidity	NTU	06/04/2014	N001	43	-	53	1.19		FQ	#		
Uranium-235	pCi/L	06/04/2014	N001	43	-	53	46	U	FQ	#	46	27.4
Uranium-235	pCi/L	06/04/2014	N002	43	-	53	23	U	FQ	#	23	14.3
Yttrium-88	pCi/L	06/04/2014	N001	43	-	53	4.5	U	FQ	#	4.5	2.81
Yttrium-88	pCi/L	06/04/2014	N002	43	-	53	6.3	U	FQ	#	6.3	3.77

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	19	-	24	22		UFQ	#	15	9.93
Americium-241	pCi/L	06/03/2014	N001	19	-	24	26	U	FQ	#	26	15.3
Antimony-125	pCi/L	06/03/2014	N001	19	-	24	10	U	FQ	#	10	5.56
Cerium-144	pCi/L	06/03/2014	N001	19	-	24	20	U	FQ	#	20	12.2
Cesium-134	pCi/L	06/03/2014	N001	19	-	24	4.9	U	FQ	#	4.9	2.82
Cesium-137	pCi/L	06/03/2014	N001	19	-	24	3.9	U	FQ	#	3.9	2.32
Cobalt-60	pCi/L	06/03/2014	N001	19	-	24	4.5	U	FQ	#	4.5	2.67
Europium-152	pCi/L	06/03/2014	N001	19	-	24	24	U	FQ	#	24	13.7
Europium-154	pCi/L	06/03/2014	N001	19	-	24	24	U	FQ	#	24	14.2
Europium-155	pCi/L	06/03/2014	N001	19	-	24	9.7	U	FQ	#	9.7	5.99
Gross Alpha	pCi/L	06/03/2014	N001	19	-	24	6.58		FQJ	#	2.2	1.96
Gross Beta	pCi/L	06/03/2014	N001	19	-	24	7.95		FQJ	#	3.3	2.43
Lead-212	pCi/L	06/03/2014	N001	19	-	24	12	U	FQ	#	12	7.19
Nickel-63	pCi/L	06/03/2014	N001	19	-	24	12	U	FQ	#	12	3.48
Oxidation Reduction Potential	mV	06/03/2014	N001	19	-	24	316.3		FQ	#		
pH	s.u.	06/03/2014	N001	19	-	24	6.57		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	19	-	24	120	U	FQ	#	120	69.3
Promethium-144	pCi/L	06/03/2014	N001	19	-	24	4.7	U	FQ	#	4.7	2.78

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	19	-	24	4.9	U	FQ	#	4.9	2.83
Ruthenium-106	pCi/L	06/03/2014	N001	19	-	24	39	U	FQ	#	39	23.3
Specific Conductance	umhos /cm	06/03/2014	N001	19	-	24	2054		FQ	#		
Temperature	C	06/03/2014	N001	19	-	24	15.05		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	19	-	24	130	U	FQ	#	130	79.3
Tritium	pCi/L	06/03/2014	N001	19	-	24	360	U	FQ	#	360	208
Turbidity	NTU	06/03/2014	N001	19	-	24	2.03		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	19	-	24	32	U	FQ	#	32	19.3
Yttrium-88	pCi/L	06/03/2014	N001	19	-	24	4.6	U	FQ	#	4.6	2.86

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	44	-	54	20.6		UFQ	#	13	8.95
Americium-241	pCi/L	06/03/2014	N001	44	-	54	9.1	U	FQ	#	9.1	5.48
Antimony-125	pCi/L	06/03/2014	N001	44	-	54	8.6	U	FQ	#	8.6	5.07
Cerium-144	pCi/L	06/03/2014	N001	44	-	54	14	U	FQ	#	14	8.32
Cesium-134	pCi/L	06/03/2014	N001	44	-	54	3.8	U	FQ	#	3.8	2.22
Cesium-137	pCi/L	06/03/2014	N001	44	-	54	3.8	U	FQ	#	3.8	2.17
Cobalt-60	pCi/L	06/03/2014	N001	44	-	54	4	U	FQ	#	4	2.36
Europium-152	pCi/L	06/03/2014	N001	44	-	54	20	U	FQ	#	20	12.3
Europium-154	pCi/L	06/03/2014	N001	44	-	54	20	U	FQ	#	20	8.76
Europium-155	pCi/L	06/03/2014	N001	44	-	54	5.5	U	FQ	#	5.5	3.32
Gross Alpha	pCi/L	06/03/2014	N001	44	-	54	15.4		FQ	#	1.6	3.03
Gross Beta	pCi/L	06/03/2014	N001	44	-	54	11.9		FQ	#	2.9	2.69
Lead-212	pCi/L	06/03/2014	N001	44	-	54	10	U	FQ	#	10	6.11
Nickel-63	pCi/L	06/03/2014	N001	44	-	54	13	U	FQ	#	13	4.01
Oxidation Reduction Potential	mV	06/03/2014	N001	44	-	54	191		FQ	#		
pH	s.u.	06/03/2014	N001	44	-	54	6.99		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	44	-	54	100	U	FQ	#	100	61.4
Promethium-144	pCi/L	06/03/2014	N001	44	-	54	5.5	U	FQ	#	5.5	3.36

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	44	-	54	4.2	U	FQ	#	4.2	2.49
Ruthenium-106	pCi/L	06/03/2014	N001	44	-	54	35	U	FQ	#	35	20.6
Specific Conductance	umhos /cm	06/03/2014	N001	44	-	54	1616		FQ	#		
Temperature	C	06/03/2014	N001	44	-	54	15.02		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	44	-	54	71	U	FQ	#	71	43.1
Tritium	pCi/L	06/03/2014	N001	44	-	54	360	U	FQ	#	360	211
Turbidity	NTU	06/03/2014	N001	44	-	54	1.85		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	44	-	54	13	U	FQ	#	13	7.65
Yttrium-88	pCi/L	06/03/2014	N001	44	-	54	11	U	FQ	#	11	6.74

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	64	-	74	15	U	FQ	#	15	9.35
Americium-241	pCi/L	06/03/2014	N001	64	-	74	23	U	FQ	#	23	13.3
Antimony-125	pCi/L	06/03/2014	N001	64	-	74	9.8	U	FQ	#	9.8	5.45
Cerium-144	pCi/L	06/03/2014	N001	64	-	74	18	U	FQ	#	18	10.7
Cesium-134	pCi/L	06/03/2014	N001	64	-	74	4.3	U	FQ	#	4.3	2.54
Cesium-137	pCi/L	06/03/2014	N001	64	-	74	4.5	U	FQ	#	4.5	2.62
Cobalt-60	pCi/L	06/03/2014	N001	64	-	74	4.8	U	FQ	#	4.8	2.74
Europium-152	pCi/L	06/03/2014	N001	64	-	74	23	U	FQ	#	23	13
Europium-154	pCi/L	06/03/2014	N001	64	-	74	24	U	FQ	#	24	14.4
Europium-155	pCi/L	06/03/2014	N001	64	-	74	14	U	FQ	#	14	8.23
Gross Alpha	pCi/L	06/03/2014	N001	64	-	74	21		FQ	#	1.4	3.83
Gross Beta	pCi/L	06/03/2014	N001	64	-	74	14.4		FQ	#	2.6	2.91
Lead-212	pCi/L	06/03/2014	N001	64	-	74	13	U	FQ	#	13	8.04
Nickel-63	pCi/L	06/03/2014	N001	64	-	74	13	U	FQ	#	13	3.93
Oxidation Reduction Potential	mV	06/03/2014	N001	64	-	74	7.9		FQ	#		
pH	s.u.	06/03/2014	N001	64	-	74	7.04		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	64	-	74	110	U	FQ	#	110	67.9
Promethium-144	pCi/L	06/03/2014	N001	64	-	74	4.7	U	FQ	#	4.7	2.96

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 4C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	64	-	74	4.6	U	FQ	#	4.6	2.71
Ruthenium-106	pCi/L	06/03/2014	N001	64	-	74	40	U	FQ	#	40	23.1
Specific Conductance	umhos /cm	06/03/2014	N001	64	-	74	1401		FQ	#		
Temperature	C	06/03/2014	N001	64	-	74	18.51		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	64	-	74	120	U	FQ	#	120	73.2
Tritium	pCi/L	06/03/2014	N001	64	-	74	360	U	FQ	#	360	209
Turbidity	NTU	06/03/2014	N001	64	-	74	0.83		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	64	-	74	19	U	FQ	#	19	11.9
Yttrium-88	pCi/L	06/03/2014	N001	64	-	74	5	U	FQ	#	5	3.14

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 5A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	19	-	24	19.6		UFQ	#	18	9.76
Americium-241	pCi/L	06/03/2014	N001	19	-	24	45	U	FQ	#	45	26.7
Antimony-125	pCi/L	06/03/2014	N001	19	-	24	11	U	FQ	#	11	6.12
Cerium-144	pCi/L	06/03/2014	N001	19	-	24	23	U	FQ	#	23	13.2
Cesium-134	pCi/L	06/03/2014	N001	19	-	24	4.9	U	FQ	#	4.9	2.88
Cesium-137	pCi/L	06/03/2014	N001	19	-	24	5.1	U	FQ	#	5.1	2.89
Cobalt-60	pCi/L	06/03/2014	N001	19	-	24	4.8	U	FQ	#	4.8	2.75
Europium-152	pCi/L	06/03/2014	N001	19	-	24	25	U	FQ	#	25	14.6
Europium-154	pCi/L	06/03/2014	N001	19	-	24	26	U	FQ	#	26	15.2
Europium-155	pCi/L	06/03/2014	N001	19	-	24	12	U	FQ	#	12	7.57
Gross Alpha	pCi/L	06/03/2014	N001	19	-	24	6.76		FQ	#	1.5	1.68
Gross Beta	pCi/L	06/03/2014	N001	19	-	24	5.26		FQJ	#	2.2	1.65
Lead-212	pCi/L	06/03/2014	N001	19	-	24	12	U	FQ	#	12	7.52
Nickel-63	pCi/L	06/03/2014	N001	19	-	24	14	U	FQ	#	14	3.95
Oxidation Reduction Potential	mV	06/03/2014	N001	19	-	24	232.5		FQ	#		
pH	s.u.	06/03/2014	N001	19	-	24	7.37		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	19	-	24	160	U	FQ	#	160	99.6
Promethium-144	pCi/L	06/03/2014	N001	19	-	24	5.2	U	FQ	#	5.2	3.19

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 5A WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	19	-	24	5.3	U	FQ	#	5.3	3.14
Ruthenium-106	pCi/L	06/03/2014	N001	19	-	24	45	U	FQ	#	45	27.2
Specific Conductance	umhos /cm	06/03/2014	N001	19	-	24	1277		FQ	#		
Temperature	C	06/03/2014	N001	19	-	24	16.85		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	19	-	24	65	U	FQ	#	65	40.7
Tritium	pCi/L	06/03/2014	N001	19	-	24	360	U	FQ	#	360	208
Turbidity	NTU	06/03/2014	N001	19	-	24	1.95		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	19	-	24	23	U	FQ	#	23	13.9
Yttrium-88	pCi/L	06/03/2014	N001	19	-	24	6.3	U	FQ	#	6.3	3.71

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 5B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	39	-	49	33	U	FQ	#	33	19.9
Americium-241	pCi/L	06/03/2014	N001	39	-	49	100	U	FQ	#	100	60.7
Antimony-125	pCi/L	06/03/2014	N001	39	-	49	11	U	FQ	#	11	6.35
Cerium-144	pCi/L	06/03/2014	N001	39	-	49	25	U	FQ	#	25	14.7
Cesium-134	pCi/L	06/03/2014	N001	39	-	49	4.7	U	FQ	#	4.7	2.73
Cesium-137	pCi/L	06/03/2014	N001	39	-	49	4.4	U	FQ	#	4.4	2.58
Cobalt-60	pCi/L	06/03/2014	N001	39	-	49	4.4	U	FQ	#	4.4	2.47
Europium-152	pCi/L	06/03/2014	N001	39	-	49	20	U	FQ	#	20	12
Europium-154	pCi/L	06/03/2014	N001	39	-	49	25	U	FQ	#	25	14.3
Europium-155	pCi/L	06/03/2014	N001	39	-	49	14	U	FQ	#	14	8.64
Gross Alpha	pCi/L	06/03/2014	N001	39	-	49	15.1		FQ	#	0.98	2.69
Gross Beta	pCi/L	06/03/2014	N001	39	-	49	11.6		FQ	#	1.5	2.12
Lead-212	pCi/L	06/03/2014	N001	39	-	49	14	U	FQ	#	14	8.64
Nickel-63	pCi/L	06/03/2014	N001	39	-	49	13	U	FQ	#	13	3.67
Oxidation Reduction Potential	mV	06/03/2014	N001	39	-	49	228.6		FQ	#		
pH	s.u.	06/03/2014	N001	39	-	49	7.21		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	39	-	49	120	U	FQ	#	120	69.8
Promethium-144	pCi/L	06/03/2014	N001	39	-	49	4.7	U	FQ	#	4.7	2.77

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 5B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)			Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	39	-	49	4.8	U	FQ	#	4.8	2.86
Ruthenium-106	pCi/L	06/03/2014	N001	39	-	49	44	U	FQ	#	44	25.3
Specific Conductance	umhos /cm	06/03/2014	N001	39	-	49	736		FQ	#		
Temperature	C	06/03/2014	N001	39	-	49	17.99		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	39	-	49	220	U	FQ	#	220	130
Tritium	pCi/L	06/03/2014	N001	39	-	49	360	U	FQ	#	360	210
Turbidity	NTU	06/03/2014	N001	39	-	49	1.97		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	39	-	49	39	U	FQ	#	39	23.1
Yttrium-88	pCi/L	06/03/2014	N001	39	-	49	5	U	FQ	#	5	3.04

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 7B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	-	23.5		U	#	16	10.7
Americium-241	pCi/L	06/03/2014	N001	-	38	U		#	38	22.9
Antimony-125	pCi/L	06/03/2014	N001	-	10	U		#	10	5.95
Cerium-144	pCi/L	06/03/2014	N001	-	22	U		#	22	13
Cesium-134	pCi/L	06/03/2014	N001	-	6.8	U		#	6.8	3.98
Cesium-137	pCi/L	06/03/2014	N001	-	4.7	U		#	4.7	2.72
Cobalt-60	pCi/L	06/03/2014	N001	-	5.5	U		#	5.5	3.18
Europium-152	pCi/L	06/03/2014	N001	-	25	U		#	25	14.4
Europium-154	pCi/L	06/03/2014	N001	-	26	U		#	26	14.6
Europium-155	pCi/L	06/03/2014	N001	-	13	U		#	13	7.48
Gross Alpha	pCi/L	06/03/2014	N001	-	5.86			#	1.4	1.49
Gross Beta	pCi/L	06/03/2014	N001	-	9.61			#	1.6	1.9
Lead-212	pCi/L	06/03/2014	N001	-	12	U		#	12	7.55
Nickel-63	pCi/L	06/03/2014	N001	-	13	U		#	13	3.86
Oxidation Reduction Potential	mV	06/03/2014	N001	-	207.5			#		
pH	s.u.	06/03/2014	N001	-	7.68			#		
Potassium-40	pCi/L	06/03/2014	N001	-	130	U		#	130	76.8
Promethium-144	pCi/L	06/03/2014	N001	-	5	U		#	5	2.95

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 7B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	-	5.4	U		#	5.4	3.13
Ruthenium-106	pCi/L	06/03/2014	N001	-	45	U		#	45	25.7
Specific Conductance	umhos /cm	06/03/2014	N001	-	695			#		
Temperature	C	06/03/2014	N001	-	20.07			#		
Thorium-234	pCi/L	06/03/2014	N001	-	150	U		#	150	89.3
Tritium	pCi/L	06/03/2014	N001	-	360	U		#	360	206
Turbidity	NTU	06/03/2014	N001	-	4.58			#		
Uranium-235	pCi/L	06/03/2014	N001	-	20	U		#	20	12.6
Yttrium-88	pCi/L	06/03/2014	N001	-	16	U		#	16	9.3

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 7C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	-	21.6		U	#	21	13.4
Americium-241	pCi/L	06/03/2014	N001	-	25	U		#	25	14.8
Antimony-125	pCi/L	06/03/2014	N001	-	13	U		#	13	7.31
Cerium-144	pCi/L	06/03/2014	N001	-	22	U		#	22	13.2
Cesium-134	pCi/L	06/03/2014	N001	-	5.5	U		#	5.5	3.2
Cesium-137	pCi/L	06/03/2014	N001	-	5.9	U		#	5.9	3.36
Cobalt-60	pCi/L	06/03/2014	N001	-	7.6	U		#	7.6	4.33
Europium-152	pCi/L	06/03/2014	N001	-	34	U		#	34	19.6
Europium-154	pCi/L	06/03/2014	N001	-	33	U		#	33	19.6
Europium-155	pCi/L	06/03/2014	N001	-	12	U		#	12	7.48
Gross Alpha	pCi/L	06/03/2014	N001	-	6.15			#	1.3	1.5
Gross Beta	pCi/L	06/03/2014	N001	-	6.44			#	1.5	1.42
Lead-212	pCi/L	06/03/2014	N001	-	15	U		#	15	8.96
Nickel-63	pCi/L	06/03/2014	N001	-	13	U		#	13	3.69
Oxidation Reduction Potential	mV	06/03/2014	N001	-	223.5			#		
pH	s.u.	06/03/2014	N001	-	7.34			#		
Potassium-40	pCi/L	06/03/2014	N001	-	150	U		#	150	91.4
Promethium-144	pCi/L	06/03/2014	N001	-	6.9	U		#	6.9	4.29

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 7C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	-	5.8	U		#	5.8	3.4
Ruthenium-106	pCi/L	06/03/2014	N001	-	55	U		#	55	32.1
Specific Conductance	umhos /cm	06/03/2014	N001	-	741			#		
Temperature	C	06/03/2014	N001	-	19.3			#		
Thorium-234	pCi/L	06/03/2014	N001	-	150	U		#	150	84.8
Tritium	pCi/L	06/03/2014	N001	-	360	U		#	360	208
Turbidity	NTU	06/03/2014	N001	-	4.58			#		
Uranium-235	pCi/L	06/03/2014	N001	-	40	U		#	40	17.9
Yttrium-88	pCi/L	06/03/2014	N001	-	7.2	U		#	7.2	4.28

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 8B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	-	32	U	FQ	#	32	19
Americium-241	pCi/L	06/03/2014	N001	-	140	U	FQ	#	140	79.9
Antimony-125	pCi/L	06/03/2014	N001	-	9.8	U	FQ	#	9.8	5.7
Cerium-144	pCi/L	06/03/2014	N001	-	24	U	FQ	#	24	14.1
Cesium-134	pCi/L	06/03/2014	N001	-	4.3	U	FQ	#	4.3	2.49
Cesium-137	pCi/L	06/03/2014	N001	-	3.8	U	FQ	#	3.8	2.19
Cobalt-60	pCi/L	06/03/2014	N001	-	3.8	U	FQ	#	3.8	2.22
Europium-152	pCi/L	06/03/2014	N001	-	21	U	FQ	#	21	11.9
Europium-154	pCi/L	06/03/2014	N001	-	21	U	FQ	#	21	12.1
Europium-155	pCi/L	06/03/2014	N001	-	16	U	FQ	#	16	9.16
Gross Alpha	pCi/L	06/03/2014	N001	-	9.23		FQ	#	1.8	2.13
Gross Beta	pCi/L	06/03/2014	N001	-	8.62		FQ	#	1.8	1.84
Lead-212	pCi/L	06/03/2014	N001	-	10	U	FQ	#	10	6.15
Nickel-63	pCi/L	06/03/2014	N001	-	14	U	FQ	#	14	4.22
Oxidation Reduction Potential	mV	06/03/2014	N001	-	223.2		FQ	#		
pH	s.u.	06/03/2014	N001	-	7.03		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	-	120	U	FQ	#	120	71.2
Promethium-144	pCi/L	06/03/2014	N001	-	3.9	U	FQ	#	3.9	2.37

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 8B WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	-	4.8	U	FQ	#	4.8	2.79
Ruthenium-106	pCi/L	06/03/2014	N001	-	37	U	FQ	#	37	21.5
Specific Conductance	umhos /cm	06/03/2014	N001	-	908		FQ	#		
Temperature	C	06/03/2014	N001	-	15.92		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	-	200	U	FQ	#	200	122
Tritium	pCi/L	06/03/2014	N001	-	360	U	FQ	#	360	207
Turbidity	NTU	06/03/2014	N001	-	1.37		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	-	46	U	FQ	#	46	27.4
Yttrium-88	pCi/L	06/03/2014	N001	-	4.66		UFQ	#	4.3	2.79

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 8C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	06/03/2014	N001	-	13	U	FQ	#	13	6.4
Americium-241	pCi/L	06/03/2014	N001	-	9.1	U	FQ	#	9.1	5.43
Antimony-125	pCi/L	06/03/2014	N001	-	8.8	U	FQ	#	8.8	5.17
Cerium-144	pCi/L	06/03/2014	N001	-	14	U	FQ	#	14	8.25
Cesium-134	pCi/L	06/03/2014	N001	-	3.7	U	FQ	#	3.7	2.16
Cesium-137	pCi/L	06/03/2014	N001	-	3.5	U	FQ	#	3.5	2.02
Cobalt-60	pCi/L	06/03/2014	N001	-	3.7	U	FQ	#	3.7	2.28
Europium-152	pCi/L	06/03/2014	N001	-	20	U	FQ	#	20	11.7
Europium-154	pCi/L	06/03/2014	N001	-	22	U	FQ	#	22	12.2
Europium-155	pCi/L	06/03/2014	N001	-	5.5	U	FQ	#	5.5	3.22
Gross Alpha	pCi/L	06/03/2014	N001	-	7.54		FQ	#	2.2	2.09
Gross Beta	pCi/L	06/03/2014	N001	-	8.5		FQ	#	2.7	2.21
Lead-212	pCi/L	06/03/2014	N001	-	10	U	FQ	#	10	6.24
Nickel-63	pCi/L	06/03/2014	N001	-	13	U	FQ	#	13	3.81
Oxidation Reduction Potential	mV	06/03/2014	N001	-	-38.2		FQ	#		
pH	s.u.	06/03/2014	N001	-	7.03		FQ	#		
Potassium-40	pCi/L	06/03/2014	N001	-	100	U	FQ	#	100	60.1
Promethium-144	pCi/L	06/03/2014	N001	-	2.1	U	FQ	#	2.1	1.13

Groundwater Quality Data by Location (USEE100) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014
Location: 8C WELL

Parameter	Units	Sample Date	Sample ID	Depth Range (Ft BLS)	Result	Qualifiers Lab	Qualifiers Data	Qualifiers QA	Detection Limit	Uncertainty
Promethium-146	pCi/L	06/03/2014	N001	-	4	U	FQ	#	4	2.38
Ruthenium-106	pCi/L	06/03/2014	N001	-	34	U	FQ	#	34	19.9
Specific Conductance	umhos /cm	06/03/2014	N001	-	814		FQ	#		
Temperature	C	06/03/2014	N001	-	15.71		FQ	#		
Thorium-234	pCi/L	06/03/2014	N001	-	70	U	FQ	#	70	34.7
Tritium	pCi/L	06/03/2014	N001	-	360	U	FQ	#	360	209
Turbidity	NTU	06/03/2014	N001	-	0.76		FQ	#		
Uranium-235	pCi/L	06/03/2014	N001	-	13	U	FQ	#	13	7.74
Yttrium-88	pCi/L	06/03/2014	N001	-	11	U	FQ	#	11	6.8

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

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

DATA QUALIFIERS:

F Low flow sampling method used.
L Less than 3 bore volumes purged prior to sampling.
U Parameter analyzed for but was not detected.
G Possible grout contamination, pH > 9.
J Estimated value.
Q Qualitative result due to sampling technique.
R Unusable result.
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 HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)
1A	N	1440.35	06/04/2014	11:31:04	4.43	1435.92
1A	N	1440.35	06/04/2014	14:49:00	4.58	1435.77
1B	N	1440.5	06/04/2014	12:13:29	5	1435.5
1B	N	1440.5	06/04/2014	14:50:00	13.54	1426.96
2A	N	1441.02	06/04/2014	09:55:39	5.63	1435.39
2A	N	1441.02	06/04/2014	14:46:00	11.28	1429.74
2B	N	1441.29	06/04/2014	10:20:02	5.12	1436.17
2B	N	1441.29	06/04/2014	14:47:00	7	1434.29
2B2	N	1442.62	06/04/2014	09:28:53	3.58	1439.04
2B2	N	1442.62	06/04/2014	14:45:00	3.99	1438.63
2C2	N	1442.61	06/04/2014	09:00:17	4.05	1438.56
2C2	N	1442.61	06/04/2014	14:44:00	18.25	1424.36
3A	N	1439.03	06/04/2014	14:03:18	5.47	1433.56
3A	N	1439.03	06/04/2014	15:12:00	18.15	1420.88
3B	N	1439.39	06/04/2014	14:32:40	3.47	1435.92
3B	N	1439.39	06/04/2014	15:13:00	12.25	1427.14
4A	N	1438.5	06/03/2014	09:44:23	4.22	1434.28
4A	N	1438.5	06/04/2014	15:56:00	4.13	1434.37
4B	N	1438.61	06/03/2014	10:13:10	4.1	1434.51
4B	N	1438.61	06/04/2014	15:57:00	4	1434.61
4C	N	1439.77	06/03/2014	11:00:56	22.9	1416.87
4C	N	1439.77	06/04/2014	15:58:00	30.42	1409.35
5A	N	1437.63	06/03/2014	14:20:44	10.11	1427.52
5A	N	1437.63	06/04/2014	15:44:00	9.91	1427.72
5B	N	1437.95	06/03/2014	15:01:49	10.76	1427.19
5B	N	1437.95	06/04/2014	15:45:00	10.64	1427.31
6A	N	1438.13	06/04/2014	15:00:00	6.52	1431.61
6B	N	1438.15	06/04/2014	15:01:00	7.51	1430.64

STATIC WATER LEVELS (USEE700) FOR SITE HAL01, Hallam Decommissioned Reactor Site
REPORT DATE: 08/05/2014

Location Code	Flow Code	Top of Casing Elevation (Ft)	Measurement Date	Measurement Time	Depth From Top of Casing (Ft)	Water Elevation (Ft)
7B	N	1443.11	06/03/2014	13:19:49	11.45	1431.66
7B	N	1443.11	06/04/2014	14:35:00	23.2	1419.91
7C	N	1443.23	06/03/2014	13:02:56	11.5	1431.73
7C	N	1443.23	06/04/2014	14:37:00	12.18	1431.05
8B	N	1440.97	06/03/2014	11:56:01	9.05	1431.92
8B	N	1440.97	06/04/2014	15:16:00	8.7	1432.27
8C	N	1441.03	06/03/2014	12:23:55	12.22	1428.81
8C	N	1441.03	06/04/2014	15:17:00	8.79	1432.24

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

Time-Concentration Graphs

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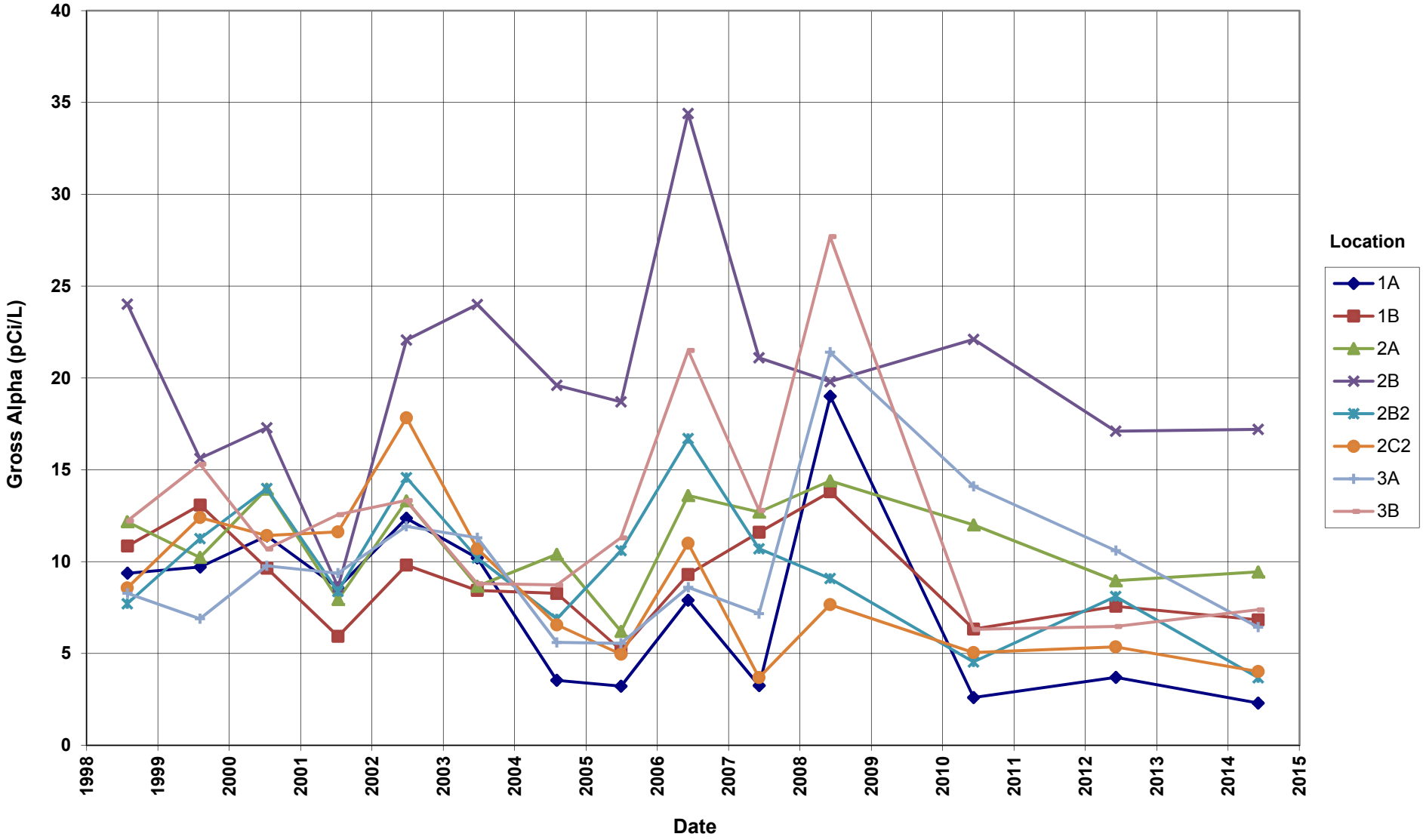
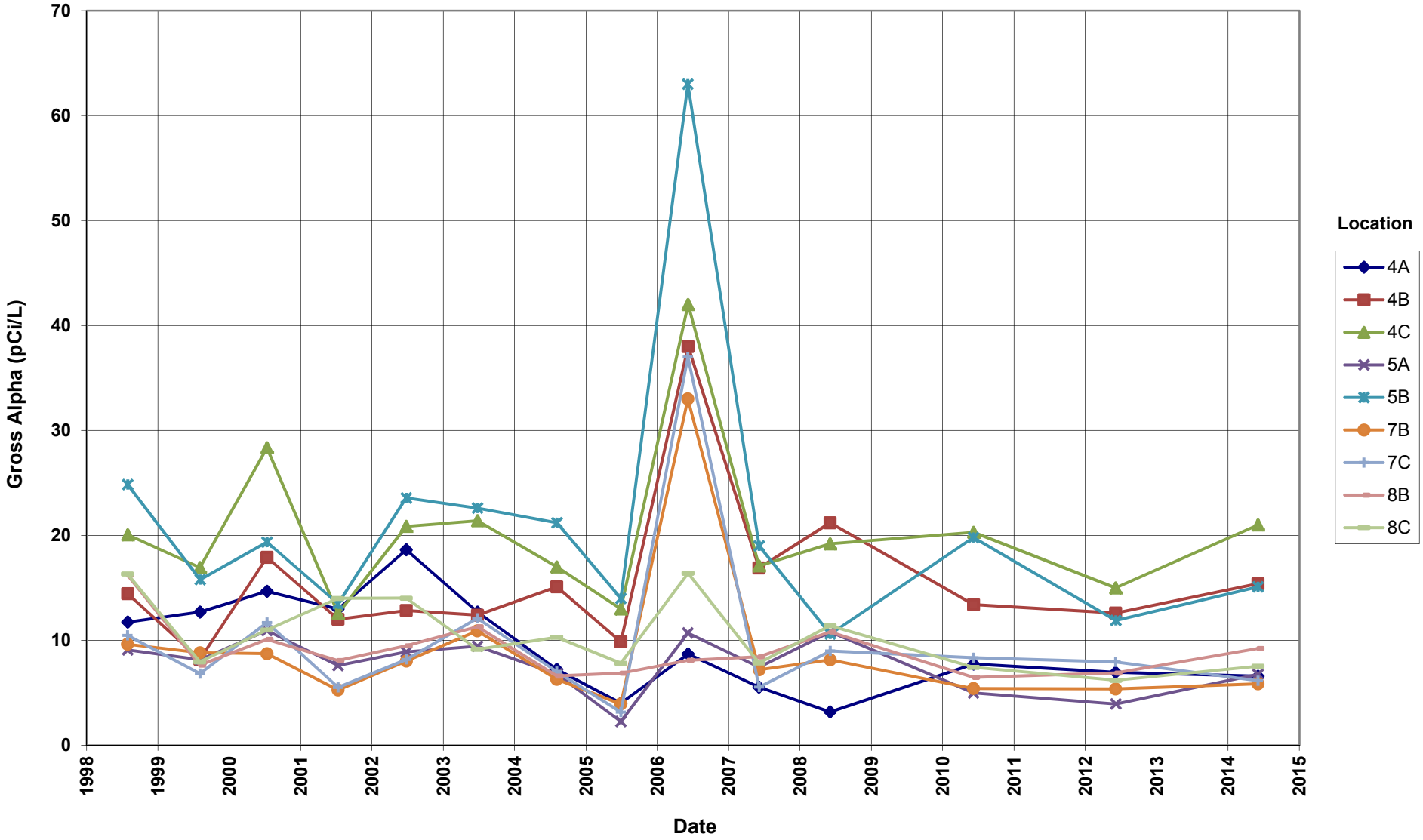
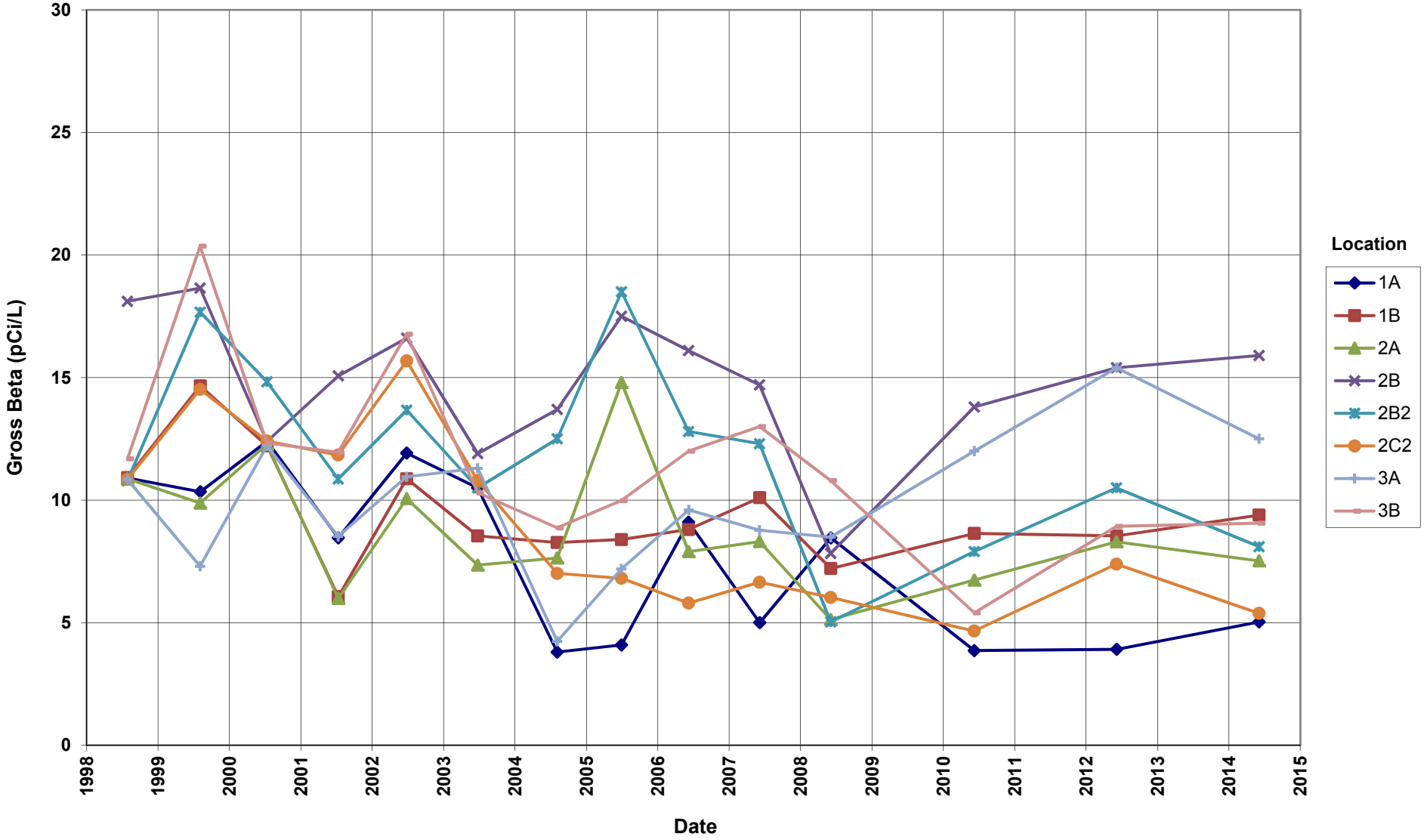
Hallam Decommissioned Reactor Site
Gross Alpha Concentration



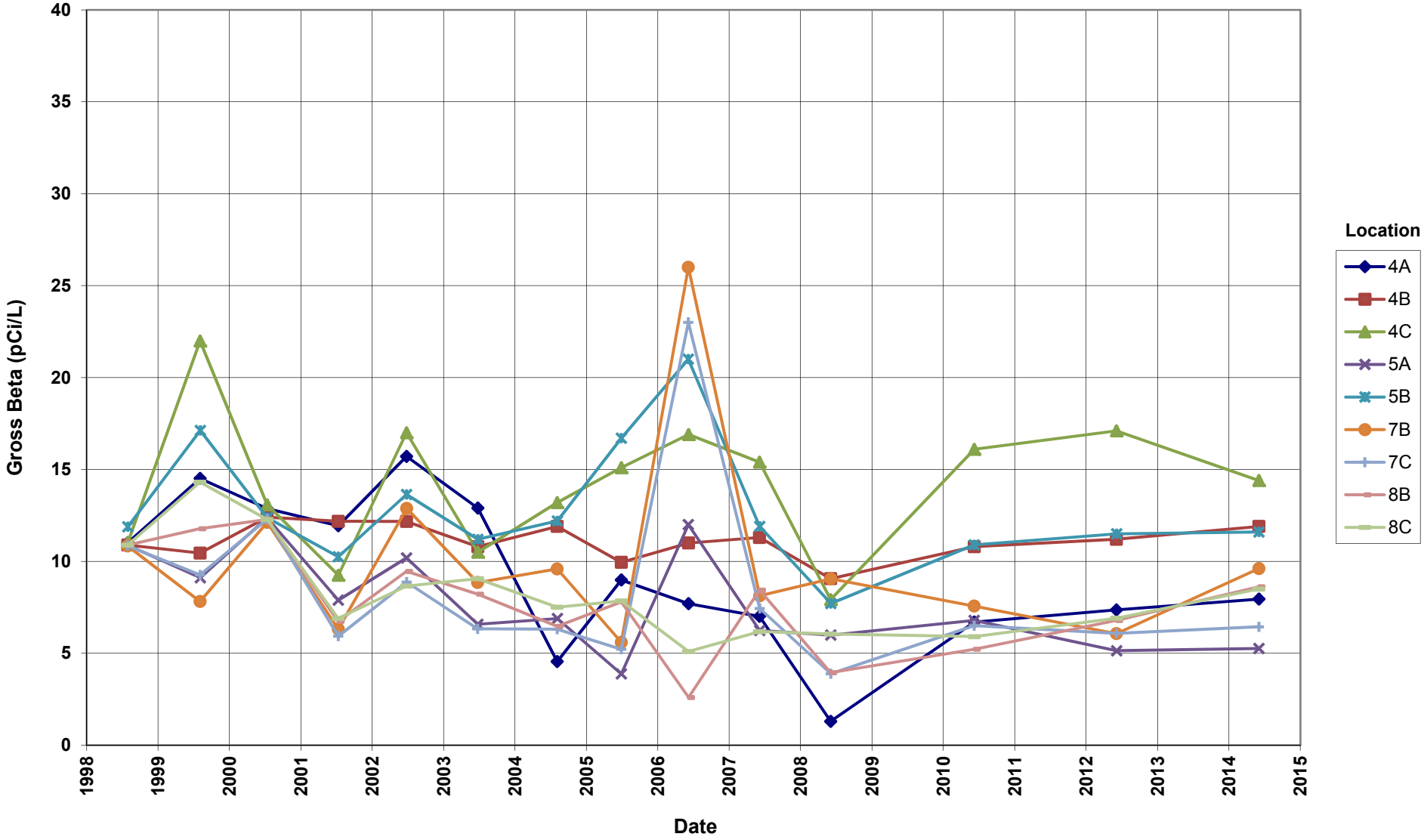
Hallam Decommissioned Reactor Site
Gross Alpha Concentration



Hallam Decommissioned Reactor Site
Gross Beta Concentration



Hallam Decommissioned Reactor Site
Gross Beta Concentration



Attachment 3
Sampling and Analysis Work Order

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Stoller

May 15, 2014

Task Order LM00-501
Control Number 14-0564

U.S. Department of Energy
Office of Legacy Management
ATTN: Christopher Clayton
Site Manager
Forrestal Building
1000 Independence Ave., SW
Washington, DC 20585

SUBJECT: Contract No. DE-AM01-07LM00060, The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller)
June 2014 Environmental Sampling at the Hallam, Nebraska, Decommissioned Reactor Site

REFERENCE: Task Order LM00-501-04-303-402, Hallam, Nebraska, Site

Dear Mr. Clayton:

The purpose of this letter is to inform you of the upcoming sampling event at the Hallam, Nebraska Decommissioned Reactor Site. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the Hallam site. Water quality data will be collected at this site as part of the routine environmental sampling currently scheduled to begin the week of June 2, 2014.

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

Monitoring Wells (filtered)*

OBS1A Gt	OBS2B Gt	OBS3A Gt	OBS4B Gt	OBS5A Gt	OBS7B Gt	OBS8B Gt
OBS1B Gt	OBS2B2 Gt	OBS3B Gt	OBS4C Gt	OBS5B Gt	OBS7C Gt	OBS8C Gt
OBS2A Gt	OBS2C2 Gt	OBS4A Gt				

*NOTE: Gt = Glacial till

All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. Access agreements are being reviewed and are expected to be complete by the beginning of fieldwork.

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

Please contact me at (412) 818-7015 if you have any questions.

Sincerely,

Michele L. Miller
2014.05.15 09:51:01 -04'00'

Michele Miller
Project Manager

MM/lcg/lb

Enclosures (3)

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

Sampling Frequencies for Locations at Hallam, Nebraska

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
Monitoring Wells						
1A				X		Next in 6/2014
1B				X		Next in 6/2014
2A				X		Next in 6/2014
2B				X		Next in 6/2014
2B2				X		Next in 6/2014
2C2				X		Next in 6/2014
3A				X		Next in 6/2014
3B				X		Next in 6/2014
4A				X		Next in 6/2014
4B				X		Next in 6/2014
4C				X		Next in 6/2014
5A				X		Next in 6/2014
5B				X		Next in 6/2014
6A					X	Water level; micropurge if possible
6B					X	Water level; micropurge if possible
7B				X		Next in 6/2014
7C				X		Next in 6/2014
8B				X		Next in 6/2014
8C				X		Next in 6/2014

Sampling conducted in June

Based on LTSP dated June 2008

Constituent Sampling Breakdown

Site	Hallam				
Analyte	**Groundwater**	**Surface Water**	**Required Detection Limit (mg/L)**	**Analytical Method**	**Line Item Code**
Approx. No. Samples/yr	17	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 (NH_3-N)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X		10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha	X		2 pCi/L	EPA 900.0	GPC-A-001
Gross Beta	X		4 pCi/L	EPA 900.0	GPC-A-001
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nickel					
Nickel-63	X		700 pCi/L	Liquid Scintillation	LSC-A-009
Nitrate + Nitrite as N (NO_3+NO_2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
Total Organic Carbon					
Tritium	X		400 pCi/L	Liquid Scintillation	GPC-A-001
Uranium					
Vanadium					
Zinc					
Total No. of Analytes	5	0			

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

Attachment 4
Trip Report

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Stoller

Memorandum

DATE: July 23, 2014

TO: Michelle Miller

FROM: Chris Papinsick

SUBJECT: Trip Report

Site: Hallam, Nebraska

Dates of Sampling Event: June 2–5, 2014

Team Members: Tim Zirbes and Chris Papinsick

Number of Locations Sampled: 17 groundwater monitoring wells.

Locations Not Sampled/Reason: None.

Location-Specific Information: All monitoring wells were purged and sampled using Category II criteria with the exception of monitoring well 1A, which was purged and sampled using Category I criteria.

Field Variance: Wells 7B, 7C, and 2C2 ran out of water during initial sampling due to limitations of using a peristaltic pump. These wells were allowed to recharge until the following day when sufficient volume was available to complete sampling for all analyses. The second day's samples were not micropurged, and the recorded sample time and date is the time and date that sample collection began on the previous day. The final sampling times and dates were noted in the Comment sections for 7B, 7C, and 2C2. See field sheet comments for further information.

Filtered Samples: Location 2B2 had turbidity of 22.9 and, in accordance with the Sampling and Analysis Plan, is filtered with a 0.45µm filter. The tritium samples were not filtered, as required by the plan. Nickel, GAB, and Gamma Spec were all filtered for well 2B2.

Quality Control Samples: The following false identification was assigned to the quality control sample:

False ID	True ID	Sample Type	Ticket Number
2628	3B	Field Duplicate	MGT 178

Requisition Numbers Assigned: Samples were assigned to requisition identification number (RIN) 14056211.

Water Level Measurements: Water level was measured in each well before well purging began and again at all monitoring wells on June 4, 2014, after all sampling was completed. Results of these measurements are shown in the table below.

Location	WL 6/4/2014	WL at Sample Time	Total Depth
1A	4.58	4.43	--
1B	13.54	5.00	--
2A	11.28	5.63	--
2B	7.00	5.12	--
2B2	3.99	3.58	--
2C2	18.25	4.05	80.13
3A	18.15	5.47	--
3B	12.25	3.41	--
4A	4.13	4.22	25.16
4B	4.00	4.10	55.36
4C	30.42	22.90	77.33
5A	9.91	10.11	25.09
5B	10.64	10.76	50.5
6A	6.52	-	15.63
6B	7.51	-	50.14
7B	23.20	11.45	48.30
7C	12.18	11.50	--
8B	8.70	9.05	--
8C	8.79	12.22	70.66

Well Inspection Summary: An inspection was conducted in April for all well locations, and no corrective actions were deemed necessary at that time. All bollards, concrete pads, and well casings were in acceptable condition and presented no issues for sampling.

Equipment: All equipment functioned properly.

Stakeholder/Regulatory: Purge water from sampling was disposed of in accordance with requirements of the Nebraska Department of Environmental Quality.

Institutional Controls

Fences, Gates, Locks: No issues identified.
Signs: Not applicable
Trespassing/Site Disturbances: None noted. Hallam is a fenced, occupied site that is staffed 24 hours a day.

Site Issues: None

Disposal Cell/Drainage Structure Integrity: Not applicable.
Vegetation/Noxious Weed Concerns: Not applicable.
Maintenance Requirements: None.
Safety Issues: None.

Access Issues: None.

Corrective Actions Required/Taken:

Location	Corrective Action
1B	Fixed an air leak in the tubing and took additional readings to lower turbidity.
8B	Made tubing repair to fix air leak that prevented water to pump up the tube.
All	During next sampling event, consider scraping off old, chipping paint and repainting most well casings.

CP/lcg

cc: (electronic)
Scott Surovchak, DOE
Ken Broberg, Stoller
Steve Donivan, Stoller
Michele Miller, Stoller
EDD Delivery

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