

# Data Validation Package

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**May 2013**  
**Groundwater and Surface**  
**Water Sampling at the**  
**Rulison, Colorado, Site**

**October 2013**



**U.S. DEPARTMENT OF**  
**ENERGY**

Legacy  
Management

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# Sampling Event Summary

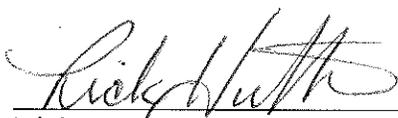
**Site:** Rulison, Colorado, Site

**Sampling Period:** May 13–14, 2013

Annual sampling was conducted at the Rulison, Colorado, site for the Long-Term Hydrologic Monitoring Program May 13–14, 2013, to monitor groundwater and surface water for potential radionuclide contamination. Sampling and analyses 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). A duplicate sample was collected from location “Cary Weldon House W.” Samples were analyzed by GEL Laboratories in Charleston, South Carolina. Samples were analyzed for gamma-emitting radionuclides by high-resolution gamma spectrometry, and for tritium using the conventional and enrichment methods.

Three sampling locations yielded a reportable value of tritium activity using the electrolytic enrichment tritium analysis method. The values ranged from 18.9 to 25.1 picocuries per liter (pCi/L). These results are consistent with background levels for tritium, well below the EPA drinking water standard for tritium of 20,000 pCi/L. The time-concentration graph for tritium concentrations obtained using the enrichment method show declining concentrations. All high-resolution gamma spectrometry results for gamma-emitting radionuclides were below detection limits.

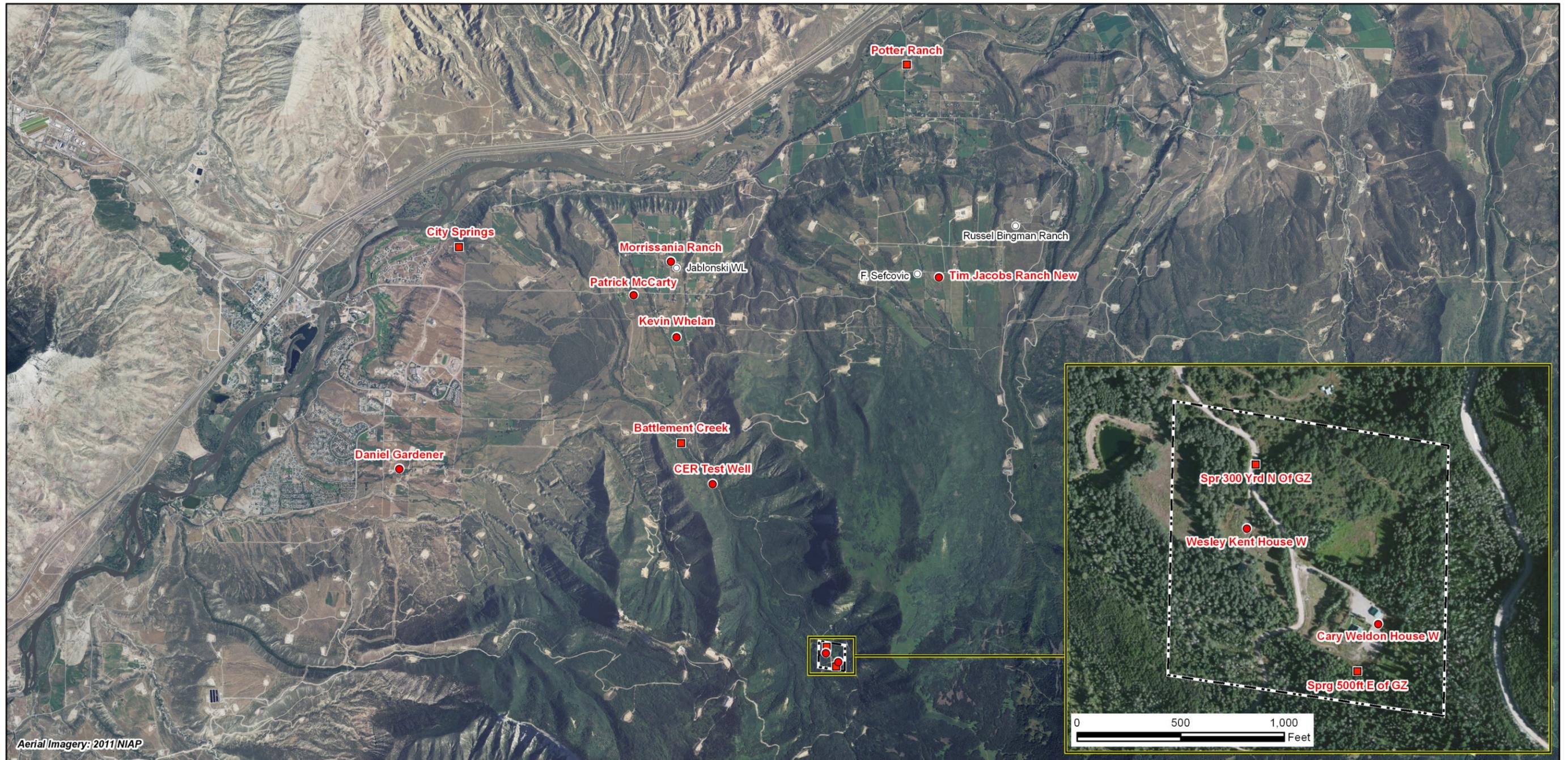
The results from this sampling event indicate that groundwater and surface water supplies in the area have not been impacted by detonation-related contaminants.



\_\_\_\_\_  
Rick Hutton  
Site Lead, S.M. Stoller Corporation

10-24-13  
\_\_\_\_\_  
Date

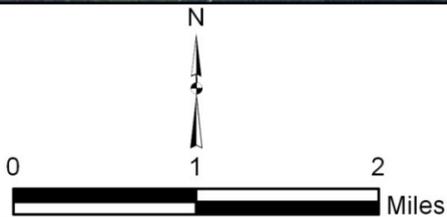
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Aerial Imagery: 2011 NIAP

**LEGEND**

- WELL TO BE SAMPLED
- SURFACE LOCATION TO BE SAMPLED
- EXISTING WELL
- SITE BOUNDARY



U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by <b>S.M. Stoller Corporation</b> Under DOE Contract No. DE-AM01-07LM00060
Planned Sampling Map Rulison, CO, Site April 2013	
DATE PREPARED: March 6, 2013	FILENAME: S0991200

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Rulison, Colorado, Site Sample Location Map

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# Data Assessment Summary

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### Water Sampling Field Activities Verification Checklist

<b>Project</b>	<u>Rulison, Colorado</u>	<b>Date(s) of Water Sampling</b>	<u>May 13–14, 2013</u>
<b>Date(s) of Verification</b>	<u>October 10, 2013</u>	<b>Name of Verifier</b>	<u>Stephen Donovan</u>

	<b>Response (Yes, No, NA)</b>	<b>Comments</b>
1. Is the SAP the primary document directing field procedures? List any Program Directives or other documents, SOPs, instructions.	<u>Yes</u>	<u>Work Order letter dated April 18, 2013.</u>
2. Were the sampling locations specified in the planning documents sampled?	<u>Yes</u>	
3. Were calibrations conducted as specified in the above-named documents?	<u>Yes</u>	<u>Calibrations were performed May 10, 2013.</u>
4. Was an operational check of the field equipment conducted daily? Did the operational checks meet criteria?	<u>Yes</u> <u>Yes</u>	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	<u>Yes</u>	
6. Were wells categorized correctly?	<u>Yes</u>	<u>CER Test Well was originally categorized as Category I, then sampled as Category II.</u>
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?	<u>NA</u>	

### Water Sampling Field Activities Verification Checklist (continued)

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well: Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected at location Cary Weldon House W
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	Location ID 2487 was used for the duplicate sample.
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 chilling 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): 13055300  
Sample Event: May 13–14, 2013  
Site(s): Rulison, Colorado, Site  
Laboratory: GEL Laboratories, Charleston, South Carolina  
Work Order No.: 326173  
Analysis: Radiochemistry  
Validator: Stephen Donovan  
Review Date: October 10, 2013

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

Table 1. Analytes and Methods

Analyte	Line Item Code	Prep Method	Analytical Method
Gamma Spectrometry	GAM-A-001	EPA 901.1	EPA 901.1
Tritium	LSC-A-001	EPA 906.0m	EPA 906.0m
Tritium, Enrichment Method	LMR-17	DOE EML HASL 300	DOE EML HASL 300

### Data Qualifier Summary

None of the sample results required additional qualification.

### Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received fourteen water samples on May 22, 2013, accompanied by a Chain of Custody form. 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 had 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

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 *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 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. 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.

## Radiochemical Analysis

### *Tritium by Distillation*

Instrument quench calibration curves were generated on July 30, 2012. Daily instrument checks performed on July 2, 2013, met the acceptance criteria.

### *Enriched Tritium*

Instrument quench calibration curves were generated on July 31, 2013. Daily instrument checks performed on September 2, 2013, met the acceptance criteria. The chemical recoveries were acceptable for all samples.

### *Gamma Spectrometry*

The gamma spectrometry efficiency calibrations were performed within a year prior to sample analysis. All daily calibration and background check results met the acceptance criteria.

## Method Blanks

Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. All method blank results associated with the samples were below the DLC for all analytes.

### Matrix Spike Analysis

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

### Laboratory Replicate Analysis

Laboratory replicate analyses are used to determine laboratory precision for each sample matrix. The relative error ratio for radiochemical replicate results (calculated using the one-sigma total propagated uncertainty) was less than three, 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.

### Completeness

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

### Electronic Data Deliverable (EDD) File

The EDD file arrived on September 11, 2013. 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 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: 13055300    Lab Code: GEN    Validator: Stephen Donovan    Validation Date: 10/10/2013  
Project: Rulison Site    Analysis Type:    Metals    General Chem    Rad    Organics  
# of Samples: 14    Matrix: Water    Requested Analysis Completed: Yes

### Chain of Custody

Present: OK    Signed: OK    Dated: OK

### Sample

Integrity: OK    Preservation: OK    Temperature: OK

### Select Quality Parameters

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

All analyses were completed within the applicable holding times.

The reported detection limits are equal to or below contract requirements.

There was 1 duplicate evaluated.

**SAMPLE MANAGEMENT SYSTEM**  
**Radiochemistry Data Validation Worksheet**

RIN: 13055300                      Lab Code: GEN                      Date Due: 08/20/2013  
 Matrix: Water                      Site Code: RUL01                      Date Completed: 09/09/2013

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
2487	Actinium-228	07/02/2013						0.56
2487	Americium-241	07/02/2013						1.13
Blank_Spike	Americium-241	07/03/2013				92.60		
2487	Antimony-125	07/02/2013						0.98
2487	Cerium-144	07/02/2013						0.95
Blank_Spike	Cerium-144	07/03/2013						
2487	Cesium-134	07/02/2013						0.88
2487	Cesium-137	07/02/2013						0.31
Blank_Spike	Cesium-137	07/03/2013				102.00		
2487	Cobalt-60	07/02/2013						0.06
Blank_Spike	Cobalt-60	07/03/2013				99.10		
2487	Europium-152	07/02/2013						0.51
2487	Europium-154	07/02/2013						0.79
Blank_Spike	Europium-154	07/03/2013						
2487	Europium-155	07/02/2013						2.62
2487	Lead-212	07/02/2013						0.01
Blank_Spike	Lead-212	07/03/2013						
2487	Potassium-40	07/02/2013						0.62
2487	Promethium-144	07/02/2013						1.79
Blank_Spike	Promethium-144	07/03/2013						
2487	Promethium-146	07/02/2013						0.88
2487	Ruthenium-106	07/02/2013						0.07
Blank_Spike	Ruthenium-106	07/03/2013						
2487	Thorium-234	07/02/2013						0.66
2487	Tritium	07/02/2013						0.46
Blank_Spike	Tritium	07/02/2013				98.70		
2487	Tritium	07/02/2013					97.6	
Blank	Tritium	07/02/2013	280.0000	U				
Blank	Tritium	08/30/2013	0	U	69.0			
CER Test Well	Tritium	09/02/2013			69.0			
Morrissania Rand	Tritium	09/02/2013			69.0			
Patrick McCarty	Tritium	09/02/2013			69.0			

**SAMPLE MANAGEMENT SYSTEM**  
**Radiochemistry Data Validation Worksheet**

**RIN:** 13055300                      **Lab Code:** GEN                      **Date Due:** 08/20/2013  
**Matrix:** Water                      **Site Code:** RUL01                      **Date Completed:** 09/09/2013

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate
Blank_Spike	Tritium	09/02/2013			69.0	95.00		
2487	Uranium-235	07/02/2013						1.16
Blank_Spike	Uranium-235	07/03/2013						
2487	Uranium-238	07/02/2013						0.66
2487	Yttrium-88	07/02/2013						0.14
Blank_Spike	Yttrium-88	07/03/2013						

## **Sampling Quality Control Assessment**

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

### Sampling Protocol

Location CER Test Well was sampled using a dedicated bladder pump as a Category I well. However, the well did not meet Category I water level criteria. Data from this well are qualified with the “FQ” flags in the database indicating the well was Category II, purged and sampled using the low-flow sampling method. All other sample locations were domestic wells or surface water locations.

### Equipment Blank Assessment

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

### Field Duplicate Analysis

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 Cary Weldon House W. The relative error ratio for the sample and duplicate was less than 3, indicating acceptable precision.

# SAMPLE MANAGEMENT SYSTEM

## Validation Report: Field Duplicates

Page 1 of 1

RIN: 13055300    Lab Code: GEN    Project: Rulison Site    Validation Date: 10/10/2013

Duplicate: 2487

Sample: Cary Weldon House W

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Actinium-228	0.863	U	7.55	1.00	-2.83	U	11.7	1.00		0.5	pCi/L
Americium-241	10.1	U	18.4	1.00	13.7	U	15.7	1.00		0.3	pCi/L
Antimony-125	-3.57	U	4.92	1.00	1.03	U	5.66	1.00		1.2	pCi/L
Cerium-144	12.4	U	13.5	1.00	1.72	U	15.8	1.00		1.0	pCi/L
Cesium-134	1.22	U	1.83	1.00	-2.78	U	2.81	1.00		2.3	pCi/L
Cesium-137	0.446	U	2.87	1.00	-1.15	U	3.01	1.00		0.8	pCi/L
Cobalt-60	0.775	U	2.18	1.00	0.521	U	2.13	1.00		0.2	pCi/L
Europium-152	1.38	U	4.74	1.00	6.39	U	7.33	1.00		1.1	pCi/L
Europium-154	0.402	U	4.75	1.00	0.315	U	5.57	1.00		0	pCi/L
Europium-155	3.06	U	6.71	1.00	-8.38	U	8.62	1.00		2.1	pCi/L
Lead-212	1.46	U	5.76	1.00	1.42	U	6.07	1.00		0	pCi/L
Potassium-40	12.0	U	22.1	1.00	15.8	U	41.9	1.00		0.2	pCi/L
Promethium-144	-0.907	U	1.86	1.00	1.76	U	2.34	1.00		1.7	pCi/L
Promethium-146	-1.1	U	2.19	1.00	-0.862	U	2.78	1.00		0.1	pCi/L
Ruthenium-106	7.21	U	17.3	1.00	11.8	U	19.9	1.00		0.3	pCi/L
Thorium-234	-167	U	149	1.00	57.3	U	185	1.00		1.9	pCi/L
Tritium	87.9	U	168	1.00	41.7	U	166	1.00		0.4	pCi/L
Uranium-235	6.89	U	14.2	1.00	8.45	U	20.7	1.00		0.1	pCi/L
Uranium-238	-167	U	149	1.00	57.3	U	185	1.00		1.9	pCi/L
Yttrium-88	-0.0814	U	2.35	1.00	-0.261	U	2.62	1.00		0.1	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 Donovan  
Stephen Donovan

10-23-2013  
Date

Data Validation Lead:

Stephen Donovan  
Stephen Donovan

10-23-2013  
Date

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**Attachment 1**  
**Assessment of Anomalous Data**

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# Potential Outliers Report

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## Potential Outliers Report

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

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

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

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

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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 RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: CER Test Well WELL CER Test Well

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/13/2013	0001	0	-	0	-5.52	U	FQ	#	13.8	9.28
Americium-241	pCi/L	05/13/2013	0001	0	-	0	1.88	U	FQ	#	22.8	13.6
Antimony-125	pCi/L	05/13/2013	0001	0	-	0	2.97	U	FQ	#	9.05	4.91
Cerium-144	pCi/L	05/13/2013	0001	0	-	0	-11	U	FQ	#	23.3	14.7
Cesium-134	pCi/L	05/13/2013	0001	0	-	0	0.21	U	FQ	#	3.59	1.88
Cesium-137	pCi/L	05/13/2013	0001	0	-	0	-.241	U	FQ	#	2.97	1.68
Cobalt-60	pCi/L	05/13/2013	0001	0	-	0	-.723	U	FQ	#	3.46	1.92
Europium-152	pCi/L	05/13/2013	0001	0	-	0	-1.36	U	FQ	#	9.34	5.24
Europium-154	pCi/L	05/13/2013	0001	0	-	0	-2.82	U	FQ	#	10.2	5.83
Europium-155	pCi/L	05/13/2013	0001	0	-	0	2.17	U	FQ	#	11.9	7.33
Lead-212	pCi/L	05/13/2013	0001	0	-	0	0.586	U	FQ	#	7.01	5.19
pH	s.u.	05/13/2013	N001	0	-	0	8.08		FQ	#		
Potassium-40	pCi/L	05/13/2013	0001	0	-	0	-4.82	U	FQ	#	52.5	30.5
Promethium-144	pCi/L	05/13/2013	0001	0	-	0	-.225	U	FQ	#	3.34	1.8
Promethium-146	pCi/L	05/13/2013	0001	0	-	0	-.712	U	FQ	#	3.33	1.92
Ruthenium-106	pCi/L	05/13/2013	0001	0	-	0	0.53	U	FQ	#	29.9	16.6
Specific Conductance	umhos/cm	05/13/2013	N001	0	-	0	360		FQ	#		
Temperature	C	05/13/2013	N001	0	-	0	11.63		FQ	#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: CER Test Well WELL CER Test Well

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Thorium-234	pCi/L	05/13/2013	0001	0	-	0	134	U	FQ	#	235	202
Tritium	pCi/L	05/13/2013	N001	0	-	0	23.4		FQ	#	2.38	8.72
Turbidity	NTU	05/13/2013	N001	0	-	0	39.9		FQ	#		
Uranium-235	pCi/L	05/13/2013	0001	0	-	0	-6.21	U	FQ	#	22.7	16.3
Uranium-238	pCi/L	05/13/2013	0001	0	-	0	134	U	FQ	#	235	202
Yttrium-88	pCi/L	05/13/2013	0001	0	-	0	-2.62	U	FQ	#	3.81	2.78

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Cary Weldon House W WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID			Lab	Data QA		
Actinium-228	pCi/L	05/13/2013	N001	0 - 0	0.863	U	#	12.4	7.55
Actinium-228	pCi/L	05/13/2013	N002	0 - 0	-2.83	U	#	17.3	11.7
Americium-241	pCi/L	05/13/2013	N001	0 - 0	10.1	U	#	22	18.4
Americium-241	pCi/L	05/13/2013	N002	0 - 0	13.7	U	#	24.6	15.7
Antimony-125	pCi/L	05/13/2013	N001	0 - 0	-3.57	U	#	7.63	4.92
Antimony-125	pCi/L	05/13/2013	N002	0 - 0	1.03	U	#	10.1	5.66
Cerium-144	pCi/L	05/13/2013	N001	0 - 0	12.4	U	#	22	13.5
Cerium-144	pCi/L	05/13/2013	N002	0 - 0	1.72	U	#	26.1	15.8
Cesium-134	pCi/L	05/13/2013	N001	0 - 0	1.22	U	#	3.42	1.83
Cesium-134	pCi/L	05/13/2013	N002	0 - 0	-2.78	U	#	3.99	2.81
Cesium-137	pCi/L	05/13/2013	N001	0 - 0	0.446	U	#	3.24	2.87
Cesium-137	pCi/L	05/13/2013	N002	0 - 0	-1.15	U	#	4.4	3.01
Cobalt-60	pCi/L	05/13/2013	N001	0 - 0	0.775	U	#	3.66	2.18
Cobalt-60	pCi/L	05/13/2013	N002	0 - 0	0.521	U	#	4.07	2.13
Europium-152	pCi/L	05/13/2013	N001	0 - 0	1.38	U	#	8.51	4.74
Europium-152	pCi/L	05/13/2013	N002	0 - 0	6.39	U	#	12.5	7.33
Europium-154	pCi/L	05/13/2013	N001	0 - 0	0.402	U	#	9.06	4.75
Europium-154	pCi/L	05/13/2013	N002	0 - 0	0.315	U	#	10.5	5.57

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Cary Weldon House W WELL

Parameter	Units	Sample		Depth Range (Ft BLS)	Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID			Lab	Data QA		
Europium-155	pCi/L	05/13/2013	N001	0 - 0	3.06	U	#	11.1	6.71
Europium-155	pCi/L	05/13/2013	N002	0 - 0	-8.38	U	#	12.8	8.62
Lead-212	pCi/L	05/13/2013	N001	0 - 0	1.46	U	#	6.64	5.76
Lead-212	pCi/L	05/13/2013	N002	0 - 0	1.42	U	#	7.55	6.07
pH	s.u.	05/13/2013	N001	0 - 0	7.34		#		
Potassium-40	pCi/L	05/13/2013	N001	0 - 0	12	U	#	30.6	22.1
Potassium-40	pCi/L	05/13/2013	N002	0 - 0	15.8	U	#	41.6	41.9
Promethium-144	pCi/L	05/13/2013	N001	0 - 0	-907	U	#	3.15	1.86
Promethium-144	pCi/L	05/13/2013	N002	0 - 0	1.76	U	#	4.22	2.34
Promethium-146	pCi/L	05/13/2013	N001	0 - 0	-1.1	U	#	3.57	2.19
Promethium-146	pCi/L	05/13/2013	N002	0 - 0	-862	U	#	4.68	2.78
Ruthenium-106	pCi/L	05/13/2013	N001	0 - 0	7.21	U	#	32	17.3
Ruthenium-106	pCi/L	05/13/2013	N002	0 - 0	11.8	U	#	36.7	19.9
Specific Conductance	umhos/cm	05/13/2013	N001	0 - 0	663		#		
Temperature	C	05/13/2013	N001	0 - 0	9.82		#		
Thorium-234	pCi/L	05/13/2013	N001	0 - 0	-167	U	#	181	149
Thorium-234	pCi/L	05/13/2013	N002	0 - 0	57.3	U	#	255	185
Tritium	pCi/L	05/13/2013	N001	0 - 0	87.9	U	#	290	168

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Cary Weldon House W WELL

Parameter	Units	Sample		Depth Range		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID	(Ft	BLS)		Lab	Data QA		
Tritium	pCi/L	05/13/2013	N002	0	- 0	41.7	U	#	292	166
Turbidity	NTU	05/13/2013	N001	0	- 0	1.01		#		
Uranium-235	pCi/L	05/13/2013	N001	0	- 0	6.89	U	#	20.1	14.2
Uranium-235	pCi/L	05/13/2013	N002	0	- 0	8.45	U	#	26.5	20.7
Uranium-238	pCi/L	05/13/2013	N001	0	- 0	-167	U	#	181	149
Uranium-238	pCi/L	05/13/2013	N002	0	- 0	57.3	U	#	255	185
Yttrium-88	pCi/L	05/13/2013	N001	0	- 0	-0.0814	U	#	4.57	2.35
Yttrium-88	pCi/L	05/13/2013	N002	0	- 0	-0.261	U	#	5.03	2.62

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Daniel Gardener WELL A Gardner Ranch loc 40 ft to Sou

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/13/2013	N001	0	-	0	7.13	U		#	16.6	10
Americium-241	pCi/L	05/13/2013	N001	0	-	0	7.33	U		#	32.7	18
Antimony-125	pCi/L	05/13/2013	N001	0	-	0	0.51	U		#	8.78	4.78
Cerium-144	pCi/L	05/13/2013	N001	0	-	0	3.34	U		#	23.5	13.3
Cesium-134	pCi/L	05/13/2013	N001	0	-	0	-472	U		#	3.63	1.99
Cesium-137	pCi/L	05/13/2013	N001	0	-	0	-681	U		#	3.01	1.68
Cobalt-60	pCi/L	05/13/2013	N001	0	-	0	0.378	U		#	3.7	1.82
Europium-152	pCi/L	05/13/2013	N001	0	-	0	-0.199	U		#	9.72	5.34
Europium-154	pCi/L	05/13/2013	N001	0	-	0	-3.14	U		#	10.3	5.91
Europium-155	pCi/L	05/13/2013	N001	0	-	0	2.21	U		#	12.8	7.19
Lead-212	pCi/L	05/13/2013	N001	0	-	0	1.75	U		#	5.66	6.3
pH	s.u.	05/13/2013	N001	0	-	0	7.59			#		
Potassium-40	pCi/L	05/13/2013	N001	0	-	0	-10.9	U		#	40.4	23.4
Promethium-144	pCi/L	05/13/2013	N001	0	-	0	-2.15	U		#	3.03	2.24
Promethium-146	pCi/L	05/13/2013	N001	0	-	0	-967	U		#	4.27	2.5
Ruthenium-106	pCi/L	05/13/2013	N001	0	-	0	-6.54	U		#	30	17.8
Specific Conductance	umhos/cm	05/13/2013	N001	0	-	0	780			#		
Temperature	C	05/13/2013	N001	0	-	0	13.64			#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Daniel Gardener WELL A Gardner Ranch loc 40 ft to Sou

Parameter	Units	Sample		Depth Range			Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data QA		
Thorium-234	pCi/L	05/13/2013	N001	0	-	0	-42.2	U	#	262	185
Tritium	pCi/L	05/13/2013	N001	0	-	0	-53.1	U	#	298	161
Turbidity	NTU	05/13/2013	N001	0	-	0	7.05		#		
Uranium-235	pCi/L	05/13/2013	N001	0	-	0	-4.53	U	#	22.5	16.3
Uranium-238	pCi/L	05/13/2013	N001	0	-	0	-42.2	U	#	262	185
Yttrium-88	pCi/L	05/13/2013	N001	0	-	0	0.672	U	#	5.25	2.51

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Kevin Whelan WELL Whelan Ranch Loc

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/14/2013	N001	0	-	0	0.243	U		#	15.8	9.49
Americium-241	pCi/L	05/14/2013	N001	0	-	0	1.99	U		#	23.6	14.9
Antimony-125	pCi/L	05/14/2013	N001	0	-	0	-5.72	U		#	9.92	6.7
Cerium-144	pCi/L	05/14/2013	N001	0	-	0	-15.1	U		#	27.2	18.2
Cesium-134	pCi/L	05/14/2013	N001	0	-	0	1.25	U		#	4.48	2.4
Cesium-137	pCi/L	05/14/2013	N001	0	-	0	-.512	U		#	3.48	1.96
Cobalt-60	pCi/L	05/14/2013	N001	0	-	0	-.672	U		#	3.64	2.04
Europium-152	pCi/L	05/14/2013	N001	0	-	0	0.53	U		#	11.3	7.28
Europium-154	pCi/L	05/14/2013	N001	0	-	0	2.41	U		#	12.2	6.25
Europium-155	pCi/L	05/14/2013	N001	0	-	0	4.81	U		#	14.5	8.5
Lead-212	pCi/L	05/14/2013	N001	0	-	0	-6.71	U		#	8.06	6.43
pH	s.u.	05/14/2013	N001	0	-	0	7.97			#		
Potassium-40	pCi/L	05/14/2013	N001	0	-	0	14.5	U		#	33.5	28.1
Promethium-144	pCi/L	05/14/2013	N001	0	-	0	-.212	U		#	3.92	2.18
Promethium-146	pCi/L	05/14/2013	N001	0	-	0	1.73	U		#	4.51	1.38
Ruthenium-106	pCi/L	05/14/2013	N001	0	-	0	-36.1	U		#	27.1	25.1
Specific Conductance	umhos/cm	05/14/2013	N001	0	-	0	336			#		
Temperature	C	05/14/2013	N001	0	-	0	11.32			#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Kevin Whelan WELL Whelan Ranch Loc

Parameter	Units	Sample		Depth Range			Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data QA		
Thorium-234	pCi/L	05/14/2013	N001	0	-	0	-130	U	#	202	166
Tritium	pCi/L	05/14/2013	N001	0	-	0	2.66	U	#	298	166
Turbidity	NTU	05/14/2013	N001	0	-	0	4.37		#		
Uranium-235	pCi/L	05/14/2013	N001	0	-	0	-13.7	U	#	25.6	19.2
Uranium-238	pCi/L	05/14/2013	N001	0	-	0	-130	U	#	202	166
Yttrium-88	pCi/L	05/14/2013	N001	0	-	0	-.616	U	#	6.58	3.54

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Morrissania Ranch WELL Formerly Glen Schwab Ranch/Robert Searcy Ranch; Sauter Douglas; Rothgery, Wayne an Debra; Douglas K. Sauter AP

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/14/2013	N001	0	-	0	3.72	U		#	15.2	8.01
Americium-241	pCi/L	05/14/2013	N001	0	-	0	-12	U		#	6.43	7.08
Antimony-125	pCi/L	05/14/2013	N001	0	-	0	0.283	U		#	9.22	5.02
Cerium-144	pCi/L	05/14/2013	N001	0	-	0	8.51	U		#	21.7	14.3
Cesium-134	pCi/L	05/14/2013	N001	0	-	0	1.28	U		#	4.54	2.73
Cesium-137	pCi/L	05/14/2013	N001	0	-	0	-2.54	U		#	3.09	2.32
Cobalt-60	pCi/L	05/14/2013	N001	0	-	0	0.943	U		#	3.87	2.19
Europium-152	pCi/L	05/14/2013	N001	0	-	0	2.67	U		#	9.83	5.74
Europium-154	pCi/L	05/14/2013	N001	0	-	0	-0.953	U		#	10.6	5.66
Europium-155	pCi/L	05/14/2013	N001	0	-	0	-1.51	U		#	8.89	5.28
Lead-212	pCi/L	05/14/2013	N001	0	-	0	1.42	U		#	6.73	4.31
pH	s.u.	05/14/2013	N001	0	-	0	8.19			#		
Potassium-40	pCi/L	05/14/2013	N001	0	-	0	9.91	U		#	46.4	32.3
Promethium-144	pCi/L	05/14/2013	N001	0	-	0	0.199	U		#	4.14	2.47
Promethium-146	pCi/L	05/14/2013	N001	0	-	0	2.36	U		#	4.41	2.48
Ruthenium-106	pCi/L	05/14/2013	N001	0	-	0	2.15	U		#	34.8	19.2
Specific Conductance	umhos/cm	05/14/2013	N001	0	-	0	476			#		
Temperature	C	05/14/2013	N001	0	-	0	12.14			#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Morrissania Ranch WELL Formerly Glen Schwab Ranch/Robert Searcy Ranch; Sauter Douglas; Rothgery, Wayne an Debra; Douglas K. Sauter AP

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Thorium-234	pCi/L	05/14/2013	N001	0	-	0	-14.1	U		#	89.8	51.7
Tritium	pCi/L	05/14/2013	N001	0	-	0	18.9			#	2.53	7.14
Turbidity	NTU	05/14/2013	N001	0	-	0	2.5			#		
Uranium-235	pCi/L	05/14/2013	N001	0	-	0	12.8	U		#	19.9	12.3
Uranium-238	pCi/L	05/14/2013	N001	0	-	0	-14.1	U		#	89.8	51.7
Yttrium-88	pCi/L	05/14/2013	N001	0	-	0	-1.27	U		#	5.92	3.3

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Patrick McCarty WELL McCarty Genetics 100 ft South (

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/14/2013	N001	0	-	0	-5.13	U		#	16.7	10.1
Americium-241	pCi/L	05/14/2013	N001	0	-	0	-.187	U		#	28.3	18.3
Antimony-125	pCi/L	05/14/2013	N001	0	-	0	-2.31	U		#	9.58	5.51
Cerium-144	pCi/L	05/14/2013	N001	0	-	0	-6.43	U		#	27.4	16.4
Cesium-134	pCi/L	05/14/2013	N001	0	-	0	-1.82	U		#	4.29	2.79
Cesium-137	pCi/L	05/14/2013	N001	0	-	0	-2.02	U		#	3.67	2.64
Cobalt-60	pCi/L	05/14/2013	N001	0	-	0	2.04	U		#	4.77	2.49
Europium-152	pCi/L	05/14/2013	N001	0	-	0	0.328	U		#	11.1	6.38
Europium-154	pCi/L	05/14/2013	N001	0	-	0	1.31	U		#	12.3	7.49
Europium-155	pCi/L	05/14/2013	N001	0	-	0	4.13	U		#	14.5	8.57
Lead-212	pCi/L	05/14/2013	N001	0	-	0	3.44	U		#	7.31	8.02
pH	s.u.	05/14/2013	N001	0	-	0	7.68			#		
Potassium-40	pCi/L	05/14/2013	N001	0	-	0	4.07	U		#	39	27.1
Promethium-144	pCi/L	05/14/2013	N001	0	-	0	2.57	U		#	4.37	2.5
Promethium-146	pCi/L	05/14/2013	N001	0	-	0	0.474	U		#	4.31	2.31
Ruthenium-106	pCi/L	05/14/2013	N001	0	-	0	1.08	U		#	33.4	18.3
Specific Conductance	umhos/cm	05/14/2013	N001	0	-	0	651			#		
Temperature	C	05/14/2013	N001	0	-	0	13.11			#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Patrick McCarty WELL McCarty Genetics 100 ft South (

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Thorium-234	pCi/L	05/14/2013	N001	0	-	0	89.3	U		#	273	189
Tritium	pCi/L	05/14/2013	N001	0	-	0	25.1			#	2.53	9.37
Turbidity	NTU	05/14/2013	N001	0	-	0	1.11			#		
Uranium-235	pCi/L	05/14/2013	N001	0	-	0	1.01	U		#	27.6	19
Uranium-238	pCi/L	05/14/2013	N001	0	-	0	89.3	U		#	273	189
Yttrium-88	pCi/L	05/14/2013	N001	0	-	0	2.09	U		#	7.04	3.53

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**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Tim Jacobs Ranch New WELL Jacobs Residence loc is 100 ft S

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/14/2013	N001	0	-	0	0	U		#	12.7	13.7
Americium-241	pCi/L	05/14/2013	N001	0	-	0	-23.8	U		#	21.8	17.1
Antimony-125	pCi/L	05/14/2013	N001	0	-	0	-193	U		#	11.2	6.25
Cerium-144	pCi/L	05/14/2013	N001	0	-	0	8.42	U		#	28.2	16.3
Cesium-134	pCi/L	05/14/2013	N001	0	-	0	-1.38	U		#	4.12	2.83
Cesium-137	pCi/L	05/14/2013	N001	0	-	0	-1.52	U		#	3.97	2.47
Cobalt-60	pCi/L	05/14/2013	N001	0	-	0	-227	U		#	4.08	2.26
Europium-152	pCi/L	05/14/2013	N001	0	-	0	1.75	U		#	11.7	6.45
Europium-154	pCi/L	05/14/2013	N001	0	-	0	-2.02	U		#	9.92	5.69
Europium-155	pCi/L	05/14/2013	N001	0	-	0	2.4	U		#	14.7	8.34
Lead-212	pCi/L	05/14/2013	N001	0	-	0	-7.7	U		#	7	6.01
pH	s.u.	05/14/2013	N001	0	-	0	8.1			#		
Potassium-40	pCi/L	05/14/2013	N001	0	-	0	3.74	U		#	45.9	24.6
Promethium-144	pCi/L	05/14/2013	N001	0	-	0	-3.77	U		#	3.55	3.29
Promethium-146	pCi/L	05/14/2013	N001	0	-	0	-1.86	U		#	4.71	2.89
Ruthenium-106	pCi/L	05/14/2013	N001	0	-	0	-2.46	U		#	33.3	20.9
Specific Conductance	umhos/cm	05/14/2013	N001	0	-	0	366			#		
Temperature	C	05/14/2013	N001	0	-	0	9.78			#		

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Tim Jacobs Ranch New WELL Jacobs Residence loc is 100 ft S

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Thorium-234	pCi/L	05/14/2013	N001	0	-	0	4.67	U		#	202	137
Tritium	pCi/L	05/14/2013	N001	0	-	0	29.2	U		#	297	167
Turbidity	NTU	05/14/2013	N001	0	-	0	0.64			#		
Uranium-235	pCi/L	05/14/2013	N001	0	-	0	16.6	U		#	24.5	18.1
Uranium-238	pCi/L	05/14/2013	N001	0	-	0	4.67	U		#	202	137
Yttrium-88	pCi/L	05/14/2013	N001	0	-	0	3.26	U		#	6.11	3.1

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Wesley Kent House W WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Actinium-228	pCi/L	05/13/2013	N001	0	-	0	-3.42	U		#	12.1	8.59
Americium-241	pCi/L	05/13/2013	N001	0	-	0	-.732	U		#	11.3	7.48
Antimony-125	pCi/L	05/13/2013	N001	0	-	0	0.344	U		#	7.39	4.16
Cerium-144	pCi/L	05/13/2013	N001	0	-	0	-4.64	U		#	19.6	12.9
Cesium-134	pCi/L	05/13/2013	N001	0	-	0	-.661	U		#	3.06	2.02
Cesium-137	pCi/L	05/13/2013	N001	0	-	0	-.457	U		#	3.25	2.12
Cobalt-60	pCi/L	05/13/2013	N001	0	-	0	1.28	U		#	3.37	1.83
Europium-152	pCi/L	05/13/2013	N001	0	-	0	2	U		#	8.25	4.61
Europium-154	pCi/L	05/13/2013	N001	0	-	0	-.957	U		#	7.58	4.07
Europium-155	pCi/L	05/13/2013	N001	0	-	0	2	U		#	10.1	5.59
Lead-212	pCi/L	05/13/2013	N001	0	-	0	1.72	U		#	5.29	5.4
pH	s.u.	05/13/2013	N001	0	-	0	7.66			#		
Potassium-40	pCi/L	05/13/2013	N001	0	-	0	3.44	U		#	26.8	20.1
Promethium-144	pCi/L	05/13/2013	N001	0	-	0	1.12	U		#	3.15	1.7
Promethium-146	pCi/L	05/13/2013	N001	0	-	0	0.447	U		#	3.38	1.88
Ruthenium-106	pCi/L	05/13/2013	N001	0	-	0	-.196	U		#	27.3	14.8
Specific Conductance	umhos/cm	05/13/2013	N001	0	-	0	639			#		
Temperature	C	05/13/2013	N001	0	-	0	20.09			#		

**Groundwater Quality Data by Location (USEE100) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Wesley Kent House W WELL

Parameter	Units	Sample		Depth Range			Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID	(Ft BLS)				Lab	Data	QA		
Thorium-234	pCi/L	05/13/2013	N001	0	-	0	41.7	U		#	103	82.4
Tritium	pCi/L	05/13/2013	N001	0	-	0	7.7	U		#	287	160
Turbidity	NTU	05/13/2013	N001	0	-	0	1.37			#		
Uranium-235	pCi/L	05/13/2013	N001	0	-	0	0.469	U		#	19.6	12.4
Uranium-238	pCi/L	05/13/2013	N001	0	-	0	41.7	U		#	103	82.4
Yttrium-88	pCi/L	05/13/2013	N001	0	-	0	-0.426	U		#	5.14	2.81

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.
- Q Qualitative result due to sampling technique.
- X Location is undefined.
- J Estimated value.
- R Unusable result.

**QA QUALIFIER:**

- # Validated according to quality assurance guidelines.

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## **Surface Water Quality Data**

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Battlement Creek SURFACE LOCATION Battlement Creek Loc.

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Actinium-228	pCi/L	05/13/2013	0001	-1.4	U	#	14.2	8.73
Americium-241	pCi/L	05/13/2013	0001	-8.11	U	#	27.8	18.8
Antimony-125	pCi/L	05/13/2013	0001	1.98	U	#	8.72	5.13
Cerium-144	pCi/L	05/13/2013	0001	5.5	U	#	25.4	14.9
Cesium-134	pCi/L	05/13/2013	0001	-3.8	U	#	3.18	2.91
Cesium-137	pCi/L	05/13/2013	0001	1.91	U	#	3.8	2.22
Cobalt-60	pCi/L	05/13/2013	0001	0.00284	U	#	3.55	1.97
Europium-152	pCi/L	05/13/2013	0001	-2.54	U	#	9.38	5.56
Europium-154	pCi/L	05/13/2013	0001	0.848	U	#	8.66	4.43
Europium-155	pCi/L	05/13/2013	0001	8.38	U	#	13.1	9.93
Lead-212	pCi/L	05/13/2013	0001	-3.23	U	#	6.78	4.92
pH	s.u.	05/13/2013	N001	8.48		#		
Potassium-40	pCi/L	05/13/2013	0001	-32.1	U	#	35.3	26.1
Promethium-144	pCi/L	05/13/2013	0001	-5.16	U	#	3.23	1.8
Promethium-146	pCi/L	05/13/2013	0001	-.322	U	#	4.19	2.39
Ruthenium-106	pCi/L	05/13/2013	0001	-3.05	U	#	29.4	17
Specific Conductance	umhos/cm	05/13/2013	N001	207		#		
Temperature	C	05/13/2013	N001	19.32		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Battlement Creek SURFACE LOCATION Battlement Creek Loc.

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Thorium-234	pCi/L	05/13/2013	0001	36.4	U	#	263	200
Tritium	pCi/L	05/13/2013	N001	56.3	U	#	301	172
Turbidity	NTU	05/13/2013	N001	22.1		#		
Uranium-235	pCi/L	05/13/2013	0001	-2.09	U	#	24.3	17.2
Uranium-238	pCi/L	05/13/2013	0001	36.4	U	#	263	200
Yttrium-88	pCi/L	05/13/2013	0001	2.03	U	#	5.19	1.94

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: City Springs SURFACE LOCATION Parachute Springs Loc in Bldg

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Actinium-228	pCi/L	05/13/2013	N001	-6.11	U	#	15.8	9.72
Americium-241	pCi/L	05/13/2013	N001	1.57	U	#	31.3	19.8
Antimony-125	pCi/L	05/13/2013	N001	2.83	U	#	9.85	5.42
Cerium-144	pCi/L	05/13/2013	N001	-11.4	U	#	24.7	16
Cesium-134	pCi/L	05/13/2013	N001	1.53	U	#	3.94	2.05
Cesium-137	pCi/L	05/13/2013	N001	-.157	U	#	3.53	1.9
Cobalt-60	pCi/L	05/13/2013	N001	-1.23	U	#	3.17	1.89
Europium-152	pCi/L	05/13/2013	N001	-.58	U	#	10.1	5.69
Europium-154	pCi/L	05/13/2013	N001	-3.71	U	#	9.81	6.11
Europium-155	pCi/L	05/13/2013	N001	8.21	U	#	14.2	8.7
Lead-212	pCi/L	05/13/2013	N001	2.24	U	#	7.97	5.66
pH	s.u.	05/13/2013	N001	7.82		#		
Potassium-40	pCi/L	05/13/2013	N001	20.9	U	#	37.3	31.6
Promethium-144	pCi/L	05/13/2013	N001	-.752	U	#	3.5	1.98
Promethium-146	pCi/L	05/13/2013	N001	0.952	U	#	4.31	2.36
Ruthenium-106	pCi/L	05/13/2013	N001	-2.94	U	#	32.6	17.7
Specific Conductance	umhos/cm	05/13/2013	N001	521		#		
Temperature	C	05/13/2013	N001	15.17		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: City Springs SURFACE LOCATION Parachute Springs Loc in Bldg

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Thorium-234	pCi/L	05/13/2013	N001	61.7	U	#	227	203
Tritium	pCi/L	05/13/2013	N001	7.77	U	#	290	162
Turbidity	NTU	05/13/2013	N001	1.45		#		
Uranium-235	pCi/L	05/13/2013	N001	-17	U	#	24.2	16
Uranium-238	pCi/L	05/13/2013	N001	61.7	U	#	227	203
Yttrium-88	pCi/L	05/13/2013	N001	-2.42	U	#	3.74	2.66

**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Potter Ranch SURFACE LOCATION Potter Ranch loc is 100 ft E

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Actinium-228	pCi/L	05/14/2013	N001	-6.35	U	#	13.1	8.53
Americium-241	pCi/L	05/14/2013	N001	2.33	U	#	14.2	9.17
Antimony-125	pCi/L	05/14/2013	N001	3.03	U	#	8.52	4.81
Cerium-144	pCi/L	05/14/2013	N001	2.52	U	#	22.3	12.4
Cesium-134	pCi/L	05/14/2013	N001	2.44	U	#	3.7	2.1
Cesium-137	pCi/L	05/14/2013	N001	-1.27	U	#	3.17	1.94
Cobalt-60	pCi/L	05/14/2013	N001	-1.13	U	#	3.03	1.82
Europium-152	pCi/L	05/14/2013	N001	-2.93	U	#	8.32	5.12
Europium-154	pCi/L	05/14/2013	N001	4.46	U	#	9.68	5.43
Europium-155	pCi/L	05/14/2013	N001	-.18	U	#	10.9	6.47
Lead-212	pCi/L	05/14/2013	N001	1.19	U	#	6.78	4.26
pH	s.u.	05/14/2013	N001	7.76		#		
Potassium-40	pCi/L	05/14/2013	N001	-21.1	U	#	39.1	24.1
Promethium-144	pCi/L	05/14/2013	N001	0.146	U	#	3.08	1.67
Promethium-146	pCi/L	05/14/2013	N001	1.61	U	#	3.6	2.03
Ruthenium-106	pCi/L	05/14/2013	N001	-1.86	U	#	29	16
Specific Conductance	umhos/cm	05/14/2013	N001	512		#		
Temperature	C	05/14/2013	N001	12.62		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Potter Ranch SURFACE LOCATION Potter Ranch loc is 100 ft E

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Thorium-234	pCi/L	05/14/2013	N001	65.7	U	#	130	104
Tritium	pCi/L	05/14/2013	N001	70.8	U	#	294	169
Turbidity	NTU	05/14/2013	N001	0.66		#		
Uranium-235	pCi/L	05/14/2013	N001	5.59	U	#	20.4	13
Uranium-238	pCi/L	05/14/2013	N001	65.7	U	#	130	104
Yttrium-88	pCi/L	05/14/2013	N001	-1.77	U	#	3.77	2.43

**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Spr 300 Yrd N Of GZ SURFACE LOCATION 500 Ft. East Spring loc (ERROR)

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Actinium-228	pCi/L	05/13/2013	N001	4.23	U	#	14.1	9.82
Americium-241	pCi/L	05/13/2013	N001	0.422	U	#	18	11.5
Antimony-125	pCi/L	05/13/2013	N001	-2.6	U	#	8.97	5.31
Cerium-144	pCi/L	05/13/2013	N001	-1.46	U	#	24.8	14.3
Cesium-134	pCi/L	05/13/2013	N001	1.61	U	#	3.79	2.01
Cesium-137	pCi/L	05/13/2013	N001	1.63	U	#	4.36	2.74
Cobalt-60	pCi/L	05/13/2013	N001	0.263	U	#	3.81	2.36
Europium-152	pCi/L	05/13/2013	N001	-2.3	U	#	9.51	5.52
Europium-154	pCi/L	05/13/2013	N001	5.27	U	#	10.8	5.66
Europium-155	pCi/L	05/13/2013	N001	12.1	U	#	12.8	10.7
Lead-212	pCi/L	05/13/2013	N001	1.25	U	#	6.94	5.71
pH	s.u.	05/13/2013	N001	7.69		#		
Potassium-40	pCi/L	05/13/2013	N001	-5.14	U	#	42.9	25.1
Promethium-144	pCi/L	05/13/2013	N001	-1.47	U	#	3.43	2.96
Promethium-146	pCi/L	05/13/2013	N001	3.69	U	#	3.89	3.8
Ruthenium-106	pCi/L	05/13/2013	N001	-16.7	U	#	29.5	19.6
Specific Conductance	umhos/cm	05/13/2013	N001	658		#		
Temperature	C	05/13/2013	N001	7.68		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Spr 300 Yrd N Of GZ SURFACE LOCATION 500 Ft. East Spring loc (ERROR)

Parameter	Units	Sample		Result	Qualifiers		Detection Limit	Uncertainty
		Date	ID		Lab	Data QA		
Thorium-234	pCi/L	05/13/2013	N001	18.3	U	#	174	131
Tritium	pCi/L	05/13/2013	N001	99.6	U	#	302	176
Turbidity	NTU	05/13/2013	N001	1.12		#		
Uranium-235	pCi/L	05/13/2013	N001	-14.1	U	#	22.1	17.9
Uranium-238	pCi/L	05/13/2013	N001	18.3	U	#	174	131
Yttrium-88	pCi/L	05/13/2013	N001	-.546	U	#	4.51	2.4

**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Sprg 500ft E of GZ SURFACE LOCATION Weldon Creek Loc 15 ft to South

Parameter	Units	Sample		Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID		Lab	Data	QA		
Actinium-228	pCi/L	05/13/2013	0001	1.5	U		#	14.5	11.3
Americium-241	pCi/L	05/13/2013	0001	1.7	U		#	17.6	10.6
Antimony-125	pCi/L	05/13/2013	0001	-3.47	U		#	8.89	5.45
Cerium-144	pCi/L	05/13/2013	0001	-1.51	U		#	22.4	12.8
Cesium-134	pCi/L	05/13/2013	0001	0.319	U		#	3.68	1.94
Cesium-137	pCi/L	05/13/2013	0001	-0.0996	U		#	3.28	1.86
Cobalt-60	pCi/L	05/13/2013	0001	1.47	U		#	4	2.03
Europium-152	pCi/L	05/13/2013	0001	0.585	U		#	10.1	5.55
Europium-154	pCi/L	05/13/2013	0001	3.41	U		#	10.3	5.12
Europium-155	pCi/L	05/13/2013	0001	4.59	U		#	12.3	7.02
Lead-212	pCi/L	05/13/2013	0001	-1.14	U		#	7.12	4.72
pH	s.u.	05/13/2013	N001	8.4			#		
Potassium-40	pCi/L	05/13/2013	0001	19	U		#	31	22
Promethium-144	pCi/L	05/13/2013	0001	1.02	U		#	3.55	1.87
Promethium-146	pCi/L	05/13/2013	0001	0.625	U		#	3.93	2.13
Ruthenium-106	pCi/L	05/13/2013	0001	6.01	U		#	32.4	20.2
Specific Conductance	umhos/cm	05/13/2013	N001	210			#		
Temperature	C	05/13/2013	N001	8.45			#		

**Surface Water Quality Data by Location (USEE102) FOR SITE RUL01, Rulison Site**

REPORT DATE: 10/10/2013

Location: Sprg 500ft E of GZ SURFACE LOCATION Weldon Creek Loc 15 ft to South

Parameter	Units	Sample		Result	Qualifiers			Detection Limit	Uncertainty
		Date	ID		Lab	Data	QA		
Thorium-234	pCi/L	05/13/2013	0001	-9.96	U		#	176	103
Tritium	pCi/L	05/13/2013	N001	102	U		#	294	172
Turbidity	NTU	05/13/2013	N001	34.9			#		
Uranium-235	pCi/L	05/13/2013	0001	0.0512	U		#	19.3	16.3
Uranium-238	pCi/L	05/13/2013	0001	-9.96	U		#	176	103
Yttrium-88	pCi/L	05/13/2013	0001	0.182	U		#	5.15	2.64

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.
- Q Qualitative result due to sampling technique.
- X Location is undefined.
- J Estimated value.
- R Unusable result.

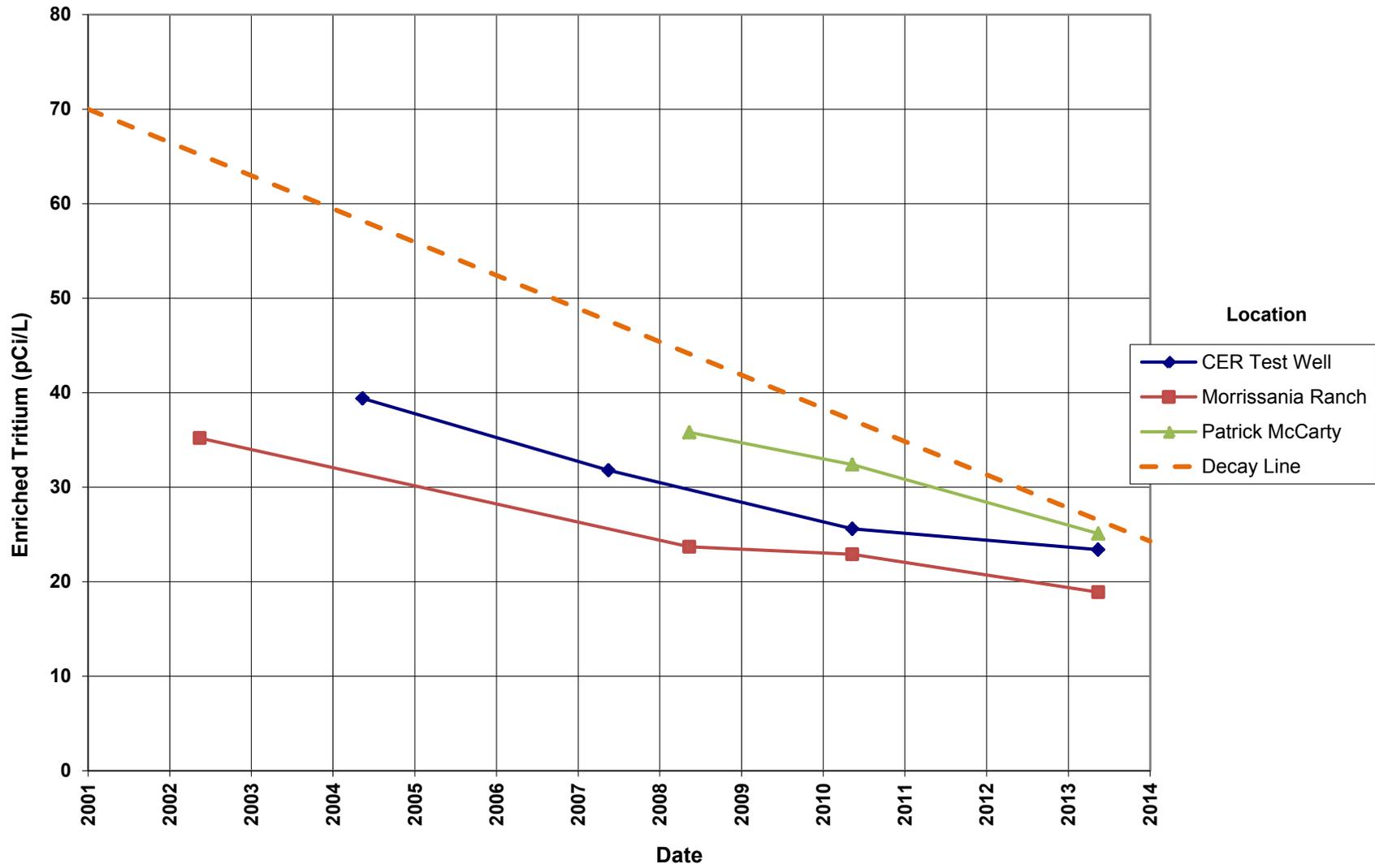
**QA QUALIFIER:**

- # Validated according to quality assurance guidelines.

## **Time-Concentration Graph**

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### Rulison Site Enriched Tritium Concentration



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**Attachment 3**  
**Sampling and Analysis Work Order**

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established 1959

Task Order LM00-502  
Control Number 13-0505

April 18, 2013

U. S. Department of Energy  
Office of Legacy Management  
ATTN: Mr. Art Kleinrath  
Site Lead  
2597 Legacy Way  
Grand Junction, CO 81503

SUBJECT: Contract No. DE-AM01-07LM00060, S. M. Stoller Corporation (Stoller)  
Task Order LM00-502 – Other Defense Activities – Other Sites  
May 2013 Environmental Sampling at Rio Blanco, Colorado

REFERENCE: LM-502-07-618 Rio Blanco, Colorado

Dear Mr. Kleinrath:

The purpose of this letter is to inform you of the upcoming sampling event at Rio Blanco, Colorado. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the Rio Blanco site. Water quality data will be collected from monitoring wells and surface locations at this site as part of the routine environmental sampling scheduled to begin the week of May 13, 2013.

The following lists show the locations scheduled for sampling during this event.

**Monitoring Wells**

On-site

RB-D-01      RB-D-03      RB-S-03      RB-W-01

Off-site

Johnson Artesian WL      Brennan Windmill

**Surface Water**

On-Site

Fawn Creek 500ft Dwn      Fawn Creek 500ft Ups

Off-Site

B-1 Equity Camp      CER #1 Black Sulphur      CER #4 Black Sulphur      Fawn Creek #1  
Fawn Creek #3      Fawn Creek 6800ft Up      Fawn Creek 8400ft Dw

All samples will be collected as directed in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites*. Notification for access to locations on private property will be conducted prior to the beginning of fieldwork.

---

The S.M. Stoller Corporation    2597 Legacy Way    Grand Junction, CO 81503    (970) 248-6000    Fax (970) 248-6040

Art Kleinrath  
Control Number 13-0505  
Page 2

Please contact me at (970) 248-6477 if you have any questions or concerns.

Sincerely,

**Rick Hutton**

Digitally signed by Rick Hutton  
DN: c=us, o=u.s. government, ou=department  
of energy, ou=Energy IT Services, ou=Legacy  
Management, ou=People, cn=Rick Hutton  
Date: 2013.04.19 10:07:16 -0600

Rick Hutton  
Site lead

RH/lcg/dc  
Enclosures (3)

cc: (electronic)  
Steve Donovan, Stoller  
Bev Gallagher, Stoller  
Lauren Goodknight, Stoller  
rc-grand.junction  
File: RBL 410.02(A)

### Sampling Frequencies for Locations at Rulison, Colorado

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
<b>Monitoring Wells</b>						
<b>Off-Site</b>						
CER Test Well			X			
Daniel Gardener			X			
Kevin Whelan			X			
Morrissania Ranch			X			
Patrick McCarty			X			
Tim Jacobs Ranch New			X			
<b>On-Site</b>						
Cary Weldon House W			X			
Wesley Kent House W			X			
<b>Municipal Water Supply</b>						
City Springs			X			
<b>Surface Locations</b>						
<b>On-Site</b>						
Spr 300 Yrd N Of GZ			X			
Sprg 500ft E of GZ			X			
<b>Off-Site</b>						
Battlement Creek			X			
Potter Ranch			X			

Sampling conducted in May

Constituent Sampling Breakdown					
Site	Rulison		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
Approx. No. Samples/yr	9	4			
<b>Field Measurements</b>					
Alkalinity					
Dissolved Oxygen					
Redox Potential					
pH	X	X			
Specific Conductance	X	X			
Turbidity	X				
Temperature	X	X			
<b>Laboratory Measurements</b>					
Aluminum					
Ammonia as N (NH3-N)					
Calcium					
Chloride					
Chromium					
Gamma Spec	X	X	10 pCi/L	Gamma Spectrometry	GAM-A-001
Gross Alpha					
Gross Beta					
Iron					
Lead					
Magnesium					
Manganese					
Molybdenum					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Selenium					
Silica					
Sodium					
Sulfate					
Total Organic Carbon					
Tritium	X	X	400 pCi/L	Liquid Scintillation	LSC-A-001
Tritium, enriched	25% of the samples	25% of the samples	10 pCi/L	Liquid Scintillation	LMR-15
Uranium					
Vanadium					
Zinc					
<b>Total No. of Analytes</b>	3	3			

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*

Control Number N/A

DATE: June 17, 2013  
TO: Rick Hutton  
FROM: Daniel Sellers  
SUBJECT: Trip Report (LTHMP Sampling) (REVISED)

**Site:** Rulison, CO

**Dates of Sampling Event:** May 13 and 14, 2013

**Team Members:** Kent Moe and Daniel Sellers.

**Number of Locations Sampled:** 7 wells and 6 surface water locations. All samples will be analyzed for tritium and gamma spec; a select set of sample locations (offsite private monitoring wells) will also be analyzed for enriched tritium (CER Test Well, Morrissania Ranch, and Patrick McCarty).

**Sampling Method:** Information about how samples were collected at each location can be viewed electronically from the FDACS found at \\crow\SMS\13055300\FieldData. Samples were collected according to the *Sampling and Analysis Plan for the U. S. Department of Energy Office of Legacy Management Sites* (LMS/PLN/S04351).

**Locations Not Sampled/Reason:** None.

**Site Specific Information:** At CER Test Well, trash accumulation was extensive. It appears that household goods are being dumped all around the well head.

Sampling was completed at the two properties (home sites) that were not sampled last year. There is one groundwater sample location at the Cary Weldon house property called "Cary Weldon House W," which is a well with a permanent submersible pump. There were two surface water sample locations at the Wesley Kent House property: (1) the "Wesley Kent House W," which is taken from the kitchen sink in the house and (2) "Sprg 500ft E of GZ," which is taken from the same surface creek but is near the Cary Weldon's house (~ 100 yards south of the house).

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

False Id	True Id	Sample Type	Associated Matrix	Ticket Number
2487	Cary Weldon House W	Duplicate	Groundwater	LGS 904

**Requisition Identification Number (RIN) Assigned:** Samples were assigned to RIN 13055300.

**Sample Shipment:** Samples were shipped overnight FedEx from Grand Junction, Colorado, to GEL Laboratories in Charleston, SC, on May 21, 2013.

**Water Level Measurements:** One water level measurement was taken at well location CER Test Well. The water level measurement was recorded in FDACS and uploaded to the SEEPro database. The water level was 31.80 feet below top casing - north side of casing where the iron seal lid opens.

**Well Inspection Summary:** The CER Test Well was in good condition.

**Institutional Controls:**

**Fences, Gates, Locks:** None. Gates to the two home sites were open. Arrangements were made prior to arrival to have them opened. The gates were then closed by the individual who had opened them both.

**Signs:** None.

**Trespassing/Site Disturbances:** N/A

**Site Issues:**

**Disposal Cell/Drainage Structure Integrity:** N/A

**Vegetation/Noxious Weed Concerns:** N/A

**Maintenance Requirements:** N/A

**Access Issues:** None.

**Safety Issues:** None.

A 5-year deficiency-based inspection of all real property assets in compliance with DOE Order 430.1B was conducted concurrently with the annual sampling trip. No maintenance or deferred maintenance needs of real property assets were identified.

**Monitoring Wells** – The visible portions of the well were in good condition, and no maintenance or deferred maintenance needs were identified for this real property asset.

**Site Marker** – DOE owns a permanent site marker on the property. It consists of a small concrete monument embedded with a brass plaque. No maintenance or deferred maintenance needs were identified for this real property asset.

(DLS/lcg)

cc: (electronic)

Art Kleinrath, DOE  
Steve Donivan, Stoller  
Rick Findlay, Stoller  
Bev Gallagher, Stoller

Rex Hodges, Stoller  
Rick Hutton, Stoller  
EDD Delivery