

# 2015 Long-Term Hydrologic Monitoring Program Sampling and Analysis Results at Rio Blanco, Colorado

December 2015

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## Abbreviations

DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
LTHMP	Long-Term Hydrologic Monitoring Program
pCi/L	picocuries per liter
SGZ	surface ground zero

## 1.0 Introduction

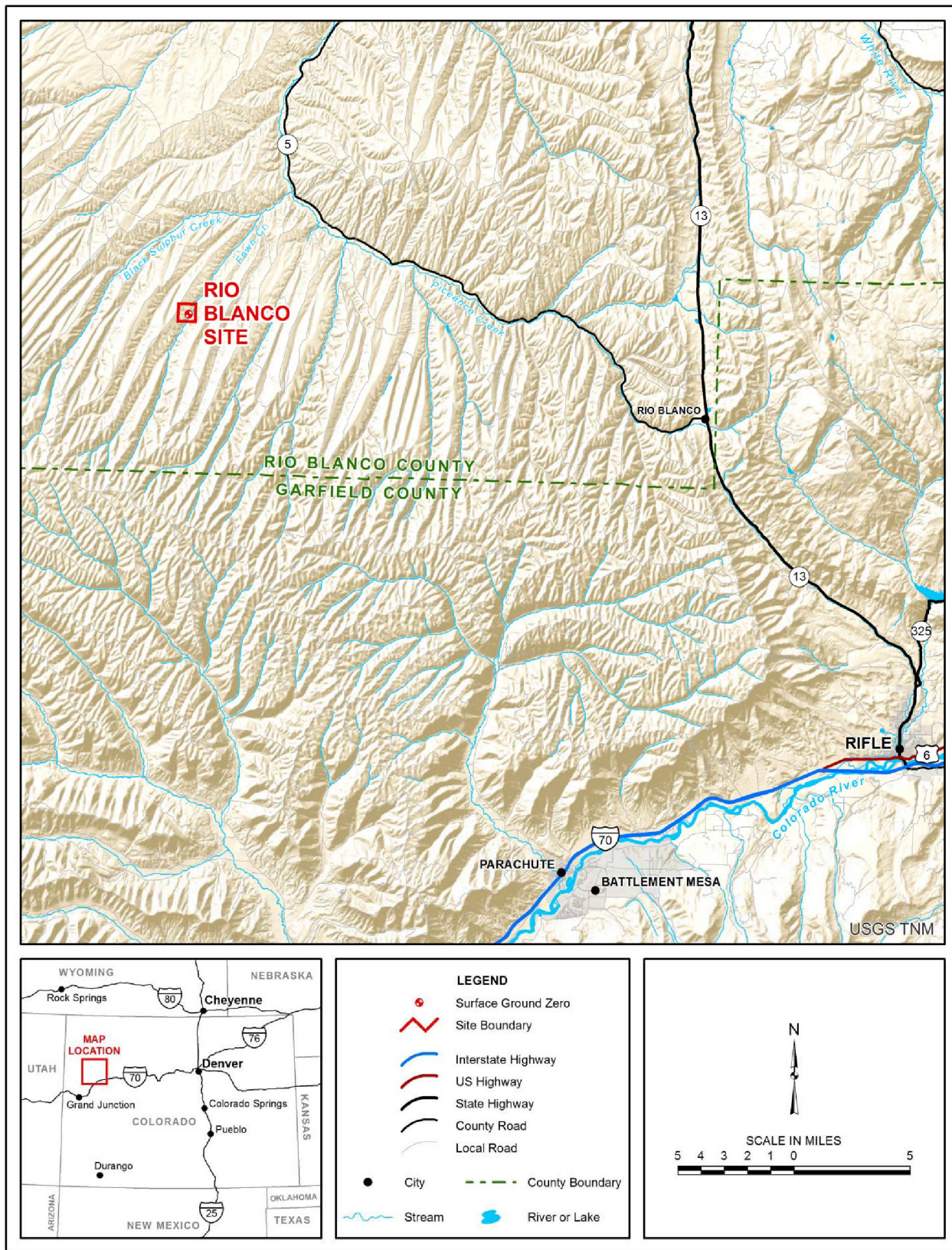
The U.S. Department of Energy (DOE) Office of Legacy Management conducted annual sampling at the Rio Blanco, Colorado, Site for the Long-Term Hydrologic Monitoring Program (LTHMP) on May 20–21, 2015. This report documents the analytical results of the Rio Blanco annual monitoring event, the trip report, and the data validation package. The groundwater and surface water monitoring samples were shipped to the GEL Group Inc. laboratories for conventional analysis of tritium and analysis of gamma-emitting radionuclides by high-resolution gamma spectrometry. A subset of water samples collected from wells near the Rio Blanco site was also sent to GEL Group Inc. for enriched tritium analysis. All requested analyses were successfully completed. Samples were collected from a total of four onsite wells, including two that are privately owned. Samples were also collected from two additional private wells at nearby locations and from nine surface water locations. Samples were analyzed for gamma-emitting radionuclides by high-resolution gamma spectrometry, and they were analyzed for tritium using the conventional method with a detection limit on the order of 400 picocuries per liter (pCi/L). Four locations (one well and three surface locations) were analyzed using the enriched tritium method, which has a detection limit on the order of 3 pCi/L. The enriched locations included the well at the Brennan Windmill and surface locations at CER-1, CER-4, and Fawn Creek 500 feet upstream.

## 2.0 Site Location and Background

The Rio Blanco site is located in Rio Blanco County in western Colorado (see Figure 1). The Rio Blanco test was designed and conducted to evaluate the use of nuclear detonations to fracture the tight, gas-bearing sandstone reservoirs in the Piceance Basin for enhanced natural gas production.

The test involved the simultaneous detonation of three nuclear devices stacked vertically to create a single elongate chimney.

Each of the three detonations had an estimated yield of 33 kilotons. The test was conducted on May 17, 1973, at depths of 5,838; 6,230; and 6,689 feet below ground surface in the upper portion of the Mesaverde Group and the lower portion of the Fort Union Formation. The test failed to create a single elongate chimney.



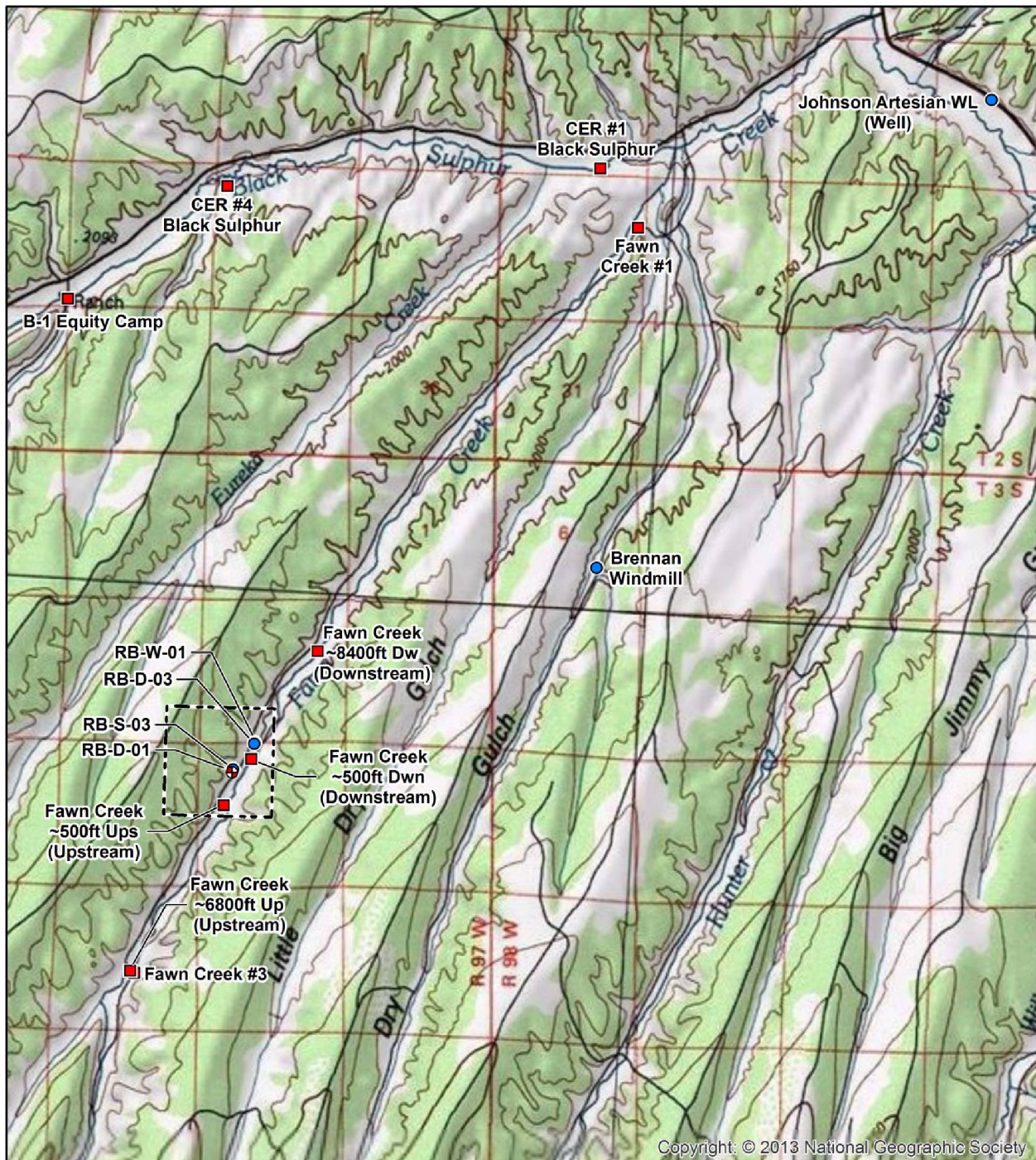
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Figure 1. Rio Blanco, Colorado, Site Location Map

Sampling locations (see Figure 2) are a combination of wells and surface water locations that range from approximately 100 feet from surface ground zero (SGZ) to 7 miles from SGZ. The U.S. Environmental Protection Agency (EPA) performed the LTHMP sampling from program inception at the Rio Blanco site in 1976 through 2007. Results of the historical monitoring at the Rio Blanco site have consistently shown that nuclear-test-related contamination has not affected groundwater and surface water at the sampling locations. DOE has evaluated the LTHMP and concluded that monitoring shallow groundwater and surface water at locations both near to and distant from SGZ was not an effective method to detect detonation-related contamination. The evaluation concluded that an updated monitoring program focused on detecting contaminant migration from the detonation zone was warranted. Natural gas production wells are considered the most likely pathway for transporting detonation-derived contaminants. Therefore, the updated monitoring program emphasizes the sampling of natural gas production wells in the vicinity of the Rio Blanco site, in addition to the ongoing LTHMP sampling and analysis. Results of the natural gas monitoring program are available online at [www.lm.doe.gov/Rio\\_Blanco/Documents.aspx](http://www.lm.doe.gov/Rio_Blanco/Documents.aspx), under the heading “Natural Gas Well Monitoring Results.”

### 3.0 Sample Analytical Results

Table 1 shows sample analysis results. The results demonstrate that none of the sampling locations are being impacted by detonation-related contaminants. Conventional tritium analytical results for all of the sampling locations were below detection limits. Each monitoring year, approximately 20 percent of the locations are analyzed using enriched analytical methods. In 2014, the percent of wells analyzed using the enriched tritium method increased to 67 percent because one of the wells was selected as a duplicate source. During the 2014 sampling event, no enriched tritium analysis was done for surface water samples. In 2015, enriched tritium analyses were conducted at one well and three surface locations. Figure 3 shows enriched tritium analysis values from wells near the site, and Figure 4 shows historical results plus the 2015 results of enriched tritium analyses from surface water locations. Both figures show the EPA drinking water standard for tritium (20,000 pCi/L) and the tritium decay line. The tritium decay line represents the tritium contamination in surface and near-surface water caused by fallout from earlier atmospheric nuclear testing in precipitation. The concentrations of the trend line are generalized for North America and are not site-specific concentrations or backgrounds for the Rio Blanco site. Figure 4 shows that very few of the historical sample results from surface water locations have exceeded the detection limit of the enriched tritium method. No other radionuclides commonly associated with the detonation were detected by the high-resolution gamma spectrometry analysis. Specific radionuclides that were tested using gamma spectrometry are listed in the data validation package.



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<p><b>LEGEND</b></p> <ul style="list-style-type: none"> <li><span style="color: red;">⊕</span> Surface Ground Zero</li> <li><span style="color: blue;">●</span> Well Location</li> <li><span style="border-bottom: 1px dashed black; width: 20px; display: inline-block;"></span> Site Boundary</li> <li><span style="color: red;">■</span> Surface Location</li> </ul> <p><i>NOTE: Surface Locations are approximate distance Upstream or Downstream from SGZ.</i></p>	<p>N</p> <p>SCALE IN MILES</p> <p>0 1/2 1</p>	<p>U.S. DEPARTMENT OF ENERGY OFFICE OF LEGACY MANAGEMENT</p>	<p>Work Performed by Navarro Research &amp; Engineering, Inc. Under DOE Contract Number DE-LM0000421</p>
		<p><b>LTHMP Sampling Locations</b> Rio Blanco, CO, Site</p>	
<p>DATE PREPARED: December 16, 2015</p>		<p>FILE NAME: S1368000</p>	

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Figure 2. LTHMP Sampling Locations, Rio Blanco, Colorado, Site



Table 1. Rio Blanco LTHMP Water Sample Analysis Results

Sample Location	Collection Date	Tritium <sup>a</sup> Conventional Analysis (pCi/L)	Tritium <sup>d</sup> Enriched Analysis (pCi/L)	Gamma Spectrometry <sup>b</sup> Analysis (pCi/L)
RB-D-01 (onsite well)	05/20/2015	ND		ND
RB-S-03 (onsite well)	05/20/2015	ND		ND
RB-D-03 (offsite <sup>c</sup> private well)	05/20/2015	ND		ND
RB-W-01 (offsite <sup>c</sup> private well)	05/20/2015	ND		ND
Johnson artesian well (offsite <sup>c</sup> private well)	05/20/2015	ND		ND
Brennan windmill (offsite <sup>c</sup> private well)	05/21/2015	ND	11.4 (J)	ND
Fawn Creek 500 ft downstream from SGZ (surface location)	05/20/2015	ND		ND
Fawn Creek 500 ft upstream from SGZ (surface location)	05/20/2015	ND	10.2 (J)	ND
B-1 Equity Camp (surface location)	05/21/2015	ND		ND
CER #1 Black Sulphur (surface location)	05/21/2015	ND	11.6	ND
CER #4 Black Sulphur (surface location)	05/21/2015	ND	11.6 (J)	ND
Fawn Creek #1 (surface location)	05/20/2015	ND		ND
Fawn Creek #3 (surface location)	05/20/2015	ND		ND
Fawn Creek 6800 ft upstream from SGZ (surface location)	05/20/2015	ND		ND
Fawn Creek 8400 ft downstream from SGZ (surface location)	05/20/2015	ND		ND

**Notes:**

<sup>a</sup> Conventional method tritium detection limits are about 400 pCi/L.

<sup>b</sup> Gamma spectrometry detection limits are nuclide-specific and sample-specific (see attached data validation package in Appendix A for a specific listing of radionuclides tested).

<sup>c</sup> Offsite = wells outside surface withdrawal boundary.

<sup>d</sup> Enriched tritium analysis result; the quantifiable detection limit is on the order of 3 pCi/L.

**Abbreviations:**

J = estimated

ND = not detected

## 4.0 Conclusions

Tritium and gamma-emitting radionuclide concentrations in water samples collected in 2015 at the Rio Blanco site are consistent with historical sample analysis results. The results continue to verify that groundwater and surface water supplies at the sampling locations have not been impacted by detonation-related contaminants.

## Rio Blanco Enriched Tritium Values from Wells

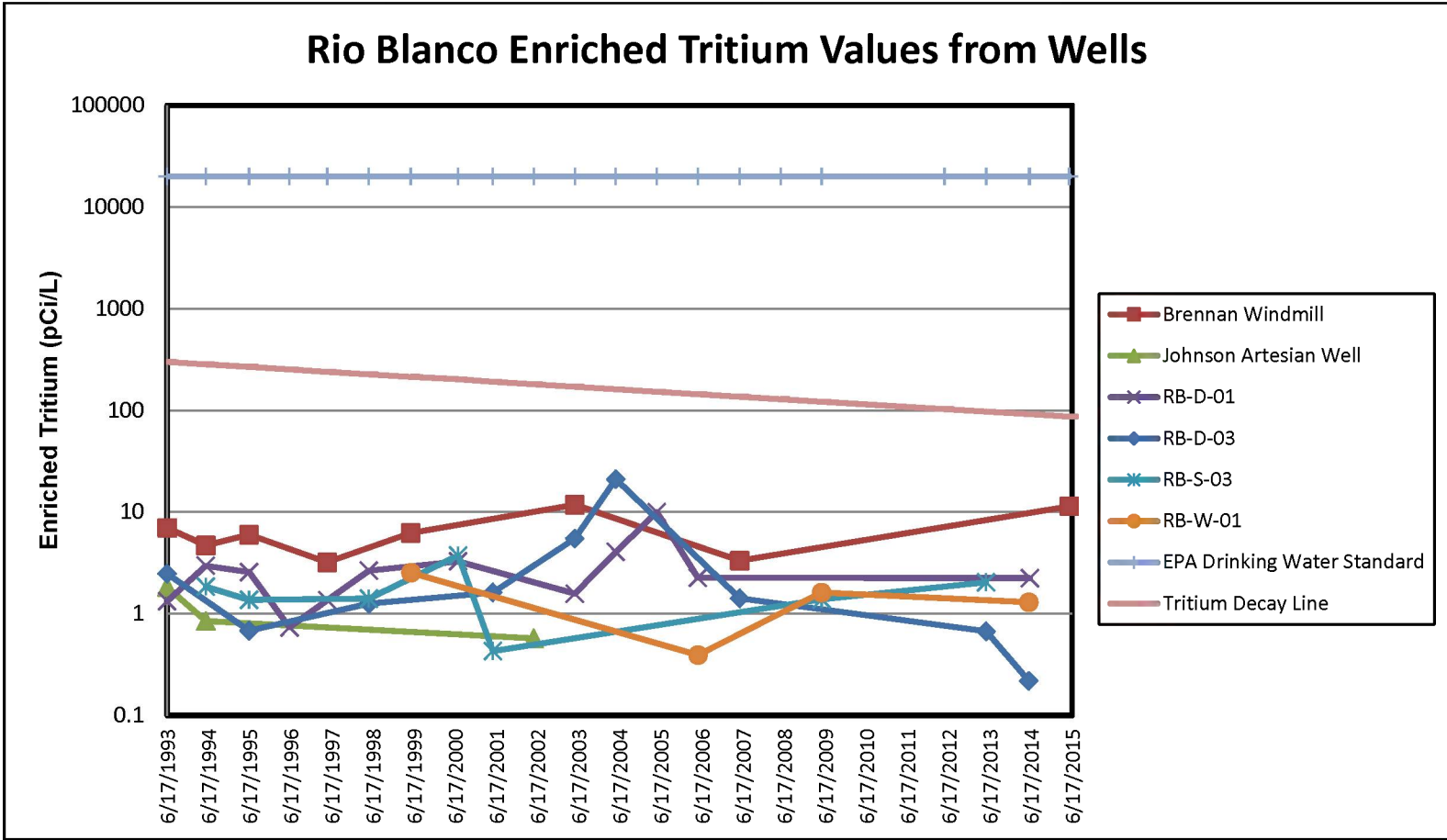


Figure 3. Tritium Concentrations Determined by Enriched Analysis from Wells Near the Rio Blanco, Colorado, Site  
 Note: Tritium decay line represents tritium fallout concentrations in precipitation from earlier atmospheric nuclear testing in surface and near-surface ground water (Brown, R.M., 1995. Monthly Tritium in Precipitation at Ottawa, Canada 1953–1995, Atomic Energy of Canada Limited, <http://www.science.uottawa.ca/~eih/ch77tritium.htm>)

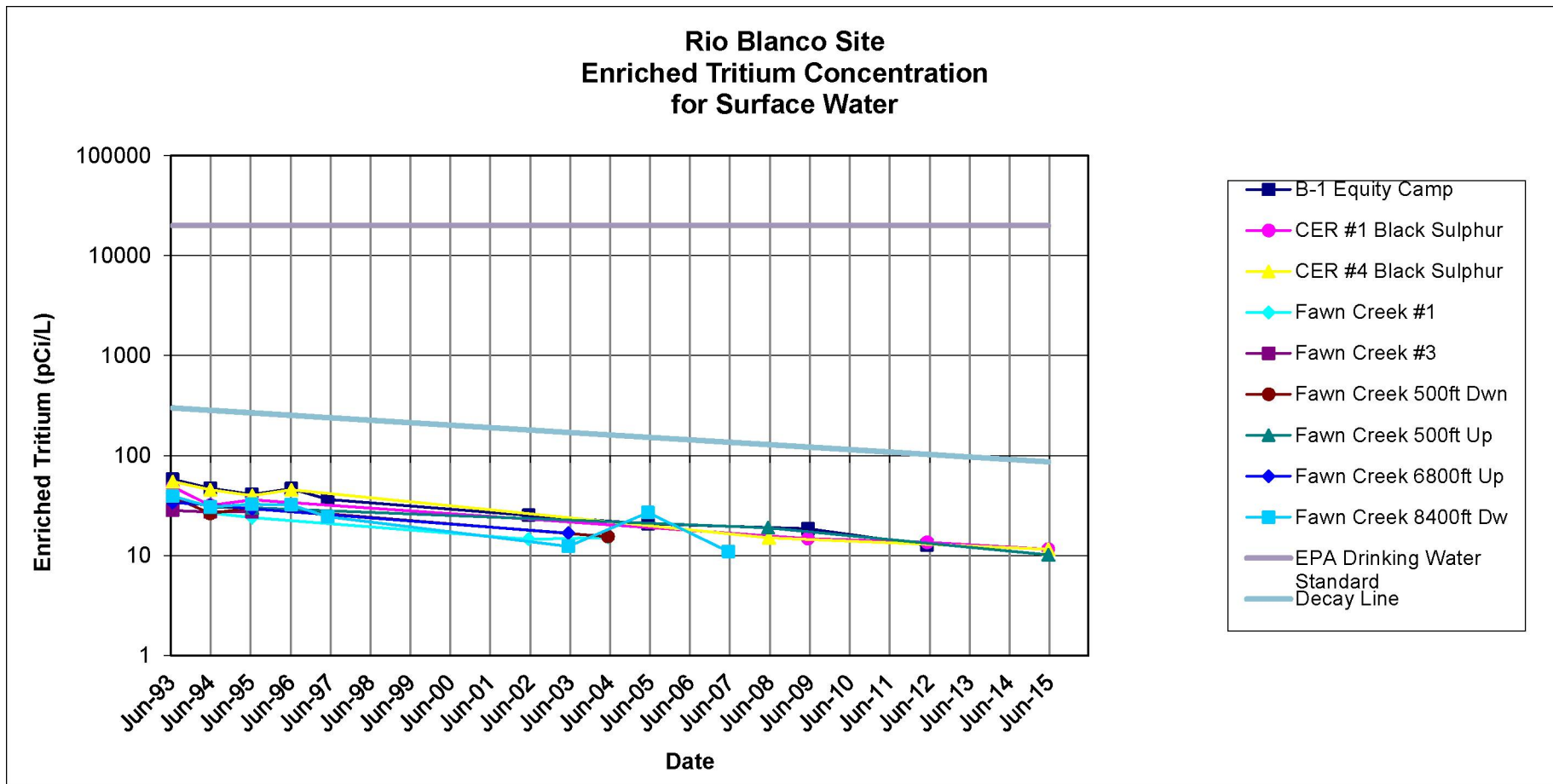


Figure 4. Tritium Concentrations Determined by Enriched Analysis for Surface Water Near the Rio Blanco, Colorado, Site  
 Note: Tritium decay line represents tritium fallout concentrations in precipitation from earlier atmospheric nuclear testing in surface and near-surface ground water (Brown, R.M., 1995. Monthly Tritium in Precipitation at Ottawa, Canada 1953–1995, Atomic Energy of Canada Limited, <http://www.science.uottawa.ca/~eih/ch77tritium.htm>)

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## **Appendix A**

### **Data Validation Package**

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# Data Validation Package

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**May 2015**  
**Groundwater and Surface Water**  
**Sampling at the**  
**Rio Blanco, Colorado, Site**

**October 2015**



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## **Attachment 1—Assessment of Anomalous Data**

Potential Outliers Report

## **Attachment 2—Data Presentation**

Groundwater Quality Data  
Surface Water Quality Data  
Equipment Blank Data

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

## **Attachment 4—Trip Report**

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# Sampling Event Summary

**Site:** Rio Blanco, Colorado, Site

**Sampling Period:** May 20–21, 2015

Annual sampling was conducted at the Rio Blanco, Colorado, site for the Long-Term Hydrologic Monitoring Program on May 20–21, 2015, to monitor groundwater and surface water for potential radionuclide contamination. Sampling and analyses were conducted as specified in the *Sampling and Analysis Plan for U.S. Department of Energy Office of Legacy Management Sites* (LMS/PRO/S04351, continually updated). A duplicate sample was collected from location B-1 Equity Camp. Samples were analyzed for gamma-emitting radionuclides by high-resolution gamma spectrometry and for tritium using the conventional and enrichment methods.

The electrolytic enrichment method for tritium analysis yielded positive results for the samples analyzed ranging from 10.2 to 11.6 picocuries per liter (pCi/L). These results are consistent with background levels for tritium and are well below the EPA drinking water standard for tritium of 20,000 pCi/L.

All high-resolution gamma spectrometry results were below detectable concentrations. The results from this sampling event indicate that groundwater and surface water supplies in the area have not been impacted by detonation-related contaminants.



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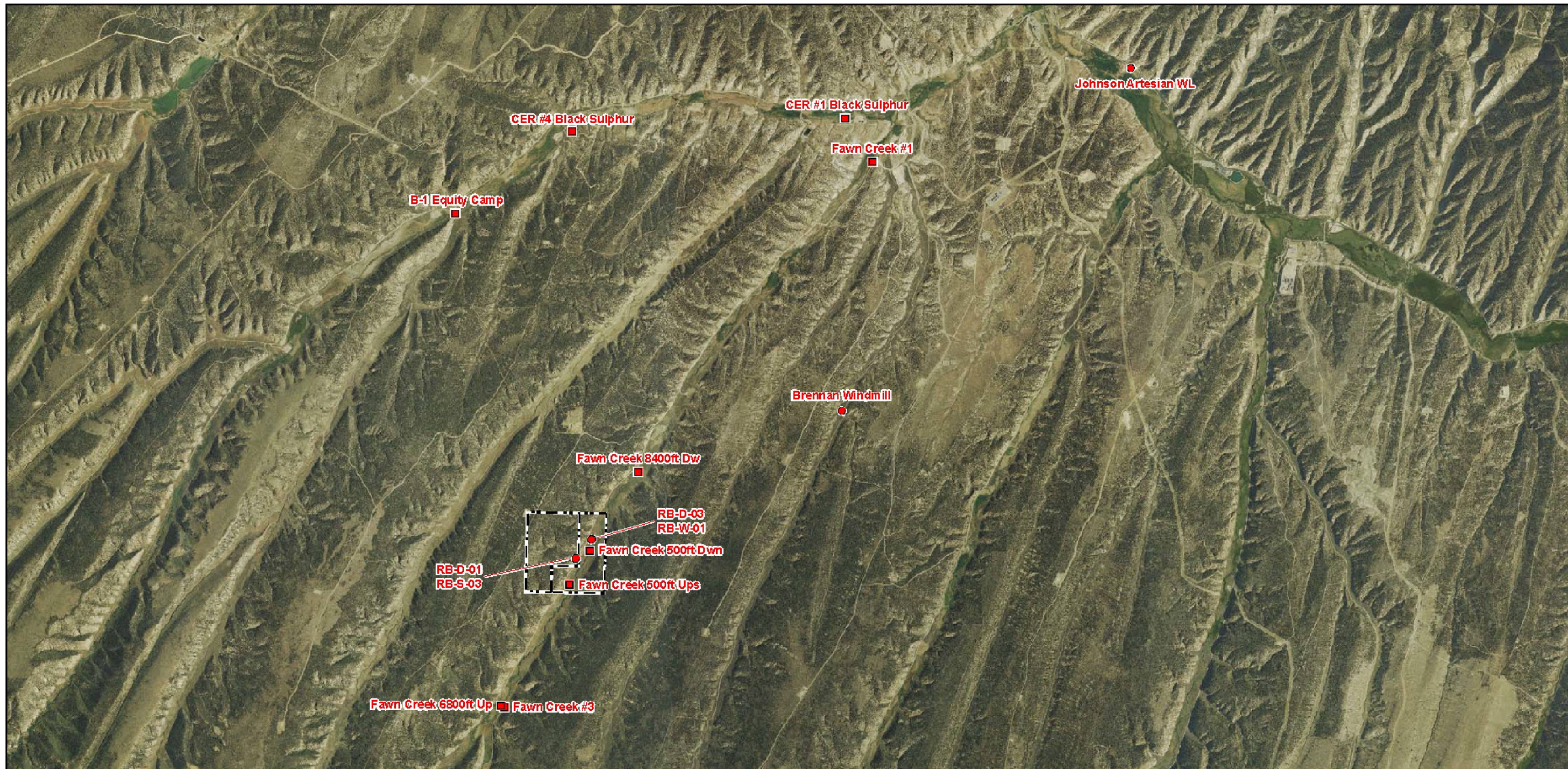
Rick Hutton, Site Lead  
Navarro Research and Engineering, Inc.

10-7-15

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Date

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**LEGEND**

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



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OFFICE OF LEGACY MANAGEMENT

Work Performed by  
Stoller Newport News Nuclear, Inc.  
Under DOE Contract Number DE-LM0000415

Planned Sampling Map  
Rio Blanco, CO, Site  
May 2015

DATE PREPARED:  
April 23, 2015

FILENAME:  
S1288500

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Rio Blanco, 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>	Rio Blanco, Colorado	<b>Date(s) of Water Sampling</b>	May 20–21, 2015
<b>Date(s) of Verification</b>	September 8, 2015	<b>Name of Verifier</b>	Stephen Donovan

	Response (Yes, No, NA)	Comments
1. Is the SAP the primary document directing field procedures? List any Program Directives or other documents, SOPs, instructions.	Yes	Work Order Letter dated April 24, 2015.
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 on May 15, 2015.
4. Was an operational check of the field equipment conducted daily? Did the operational checks meet criteria?	Yes Yes	
5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?	Yes	
6. Were wells categorized correctly?	Yes	
7. Were the following conditions met when purging a Category I well: Was one pump/tubing volume purged prior to sampling? Did the water level stabilize prior to sampling? Did pH, specific conductance, and turbidity measurements meet criteria prior to sampling? Was the flow rate less than 500 mL/min?	Yes Yes Yes Yes	

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

	Response (Yes, No, NA)	Comments
8. Were the following conditions met when purging a Category II well: Was the flow rate less than 500 mL/min?	Yes	
Was one pump/tubing volume removed prior to sampling?	Yes	
9. Were duplicates taken at a frequency of one per 20 samples?	Yes	A duplicate sample was collected at location B-1 Equity Camp.
10. Were equipment blanks taken at a frequency of one per 20 samples that were collected with non-dedicated equipment?	Yes	One equipment blank was collected.
11. Were trip blanks prepared and included with each shipment of VOC samples?	NA	
12. Were the true identities of the QC samples documented?	Yes	
13. Were samples collected in the containers specified?	Yes	
14. Were samples filtered and preserved as specified?	Yes	
15. Were the number and types of samples collected as specified?	Yes	
16. Were chain of custody records completed and was sample custody maintained?	Yes	
17. Was all pertinent information documented on the field data sheets?	Yes	
18. Was the presence or absence of ice in the cooler documented at every sample location?	NA	Sample cooling was not required.
19. Were water levels measured at the locations specified in the planning documents?	Yes	

## Laboratory Performance Assessment

### General Information

Report Number (RIN): 15057040  
Sample Event: May 20-21, 2015  
Site(s): Rio Blanco, Colorado, Site  
Laboratory: GEL Laboratories, Charleston, South Carolina  
Work Order No.: 374040  
Analysis: Radiochemistry  
Validator: Stephen Donivan  
Review Date: September 1, 2015

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/POL/S04325, continually updated) “Standard Practice for Validation of Laboratory 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, Enrichment Method	LMR-17	DOE HASL 300	DOE HASL 300
Tritium	LSC-A-001	EPA 906.0m	EPA 906.0m

### Data Qualifier Summary

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

*Table 2. Data Qualifier Summary*

Sample Number	Location	Analyte(s)	Flag	Reason
374040004	Brennan Windmill	Tritium	J	Less than the Determination Limit
374040006	CER #4 Black Sulphur	Tritium	J	Less than the Determination Limit
374040010	Fawn Creek 500ft Ups	Tritium	J	Less than the Determination Limit

### Sample Shipping/Receiving

GEL Laboratories in Charleston, South Carolina, received 17 water samples on May 29, 2015, accompanied by a Chain of Custody form. The Chain of Custody was checked to confirm that all the samples were listed with sample collection dates and times and that signatures and dates were

present to indicate 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. The sample aliquots were received in the correct container types and had been preserved correctly for the requested analyses. All analyses were completed 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 it is estimated as 3 times the 1-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 it 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*

Instrument quench calibration curves were generated on August 1, 2015. The daily instrument checks performed on August 14, 2015, met the acceptance criteria.

#### *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 1-sigma total propagated uncertainty) was less than three, which indicates 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 August 27, 2015. 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: 15057040    Lab Code: GEN    Validator: Stephen Donovan    Validation Date: 09/01/2015  
Project: Rio Blanco Site    Analysis Type:    Metals    General Chem    Rad    Organics  
# of Samples: 17    Matrix: Water    Requested Analysis Completed: Yes

### Chain of Custody

Present: OK    Signed: OK    Dated: OK

### Sample

Integrity: OK    Preservation: OK    Temperature: OK

### Select Quality Parameters

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

All analyses were completed within the applicable holding times.

There are 0 detection limit failures.

There was 1 trip/equipment blank evaluated.

There was 1 duplicate evaluated.

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

RIN: 15057040                      Lab Code: GEN                      Date Due: 08/27/2015  
 Matrix: Water                      Site Code: RBL01                      Date Completed: 08/27/2015

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
2489	Actinium-228	06/29/2015						1.00
Blank_Spike	Americium-241	06/26/2015				104.00		
2489	Americium-241	06/29/2015						1.52
2489	Antimony-125	06/29/2015						0.88
Blank_Spike	Cerium-144	06/26/2015						
2489	Cerium-144	06/29/2015						2.10
2489	Cesium-134	06/29/2015						0.38
Blank_Spike	Cesium-137	06/26/2015				102.00		
2489	Cesium-137	06/29/2015						0.42
Blank_Spike	Cobalt-60	06/26/2015				103.00		
2489	Cobalt-60	06/29/2015						0.06
2489	Europium-152	06/29/2015						0.85
Blank_Spike	Europium-154	06/26/2015						
2489	Europium-154	06/29/2015						0.30
2489	Europium-155	06/29/2015						1.23
Blank_Spike	Lead-212	06/26/2015						
2489	Lead-212	06/29/2015						2.35
2489	Potassium-40	06/29/2015						0.13
Blank_Spike	Promethium-144	06/26/2015						
2489	Promethium-144	06/29/2015						0.44
2489	Promethium-146	06/29/2015						0.64
Blank_Spike	Ruthenium-106	06/26/2015						
2489	Ruthenium-106	06/29/2015						0.62
2489	Thorium-234	06/29/2015						1.10
Brennan Windm	Tritium	08/14/2015			65.0			
2489	Tritium	08/14/2015						0.01
Blank	Tritium	08/14/2015	-97.0000	U				
2489	Tritium	08/14/2015					84.8	
Blank_Spike	Tritium	08/14/2015				92.50		
CER #1 Black S	Tritium	08/15/2015			65.0			
CER #4 Black S	Tritium	08/15/2015			65.0			
Fawn Creek 500	Tritium	08/15/2015			65.0			

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

**RIN:** 15057040                      **Lab Code:** GEN                      **Date Due:** 08/27/2015  
**Matrix:** Water                      **Site Code:** RBL01                      **Date Completed:** 08/27/2015

Sample	Analyte	Date Analyzed	Result	Flag	Tracer %R	LCS %R	MS %R	Duplicate RER
Blank_Spike	Tritium	08/15/2015			65.0	124.00		
Blank	Tritium	08/15/2015	0.4000	U	65.0			
Blank_Spike	Uranium-235	06/26/2015						
2489	Uranium-235	06/29/2015						0.80
2489	Uranium-238	06/29/2015						1.10
Blank_Spike	Yttrium-88	06/26/2015						
2489	Yttrium-88	06/29/2015						1.15



## Sampling Quality Control Assessment

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

### Sampling Protocol

Wells RB-D-01, RB-D-03, RB-S-03, and RB-W-01 were sampled using dedicated bladder pumps or a peristaltic pump with dedicated tubing. Data from these wells are qualified with an “F” flag in the database indicating the wells were purged and sampled using the low-flow sampling method. The data from well RB-W-01 were further qualified with a “Q” flag because this well was classified as Category II. All other sample locations were domestic wells or surface water locations.

### Equipment Blank

Equipment blanks were prepared and analyzed to document contamination attributable to the sample collection process. One equipment blank was submitted with these samples. There were no analytes detected in this blank.

### 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 B-1 Equity Camp. For radiochemical measurements, the relative error ratio (the ratio of the absolute difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. All duplicate results met this criteria demonstrating acceptable precision.

# SAMPLE MANAGEMENT SYSTEM

## Validation Report: Field Duplicates

Page 1 of 1

RIN: 15057040    Lab Code: GEN    Project: Rio Blanco Site    Validation Date: 09/01/2015

Duplicate: 2489

Sample: B-1 Equity Camp

Analyte	Sample				Duplicate				RPD	RER	Units
	Result	Flag	Error	Dilution	Result	Flag	Error	Dilution			
Actinium-228	-12.6	U	12.3	1.00	1.93	U	10.8	1.00		1.7	pCi/L
Americium-241	2.36	U	14.5	1.00	24.8	U	30.0	1.00		1.3	pCi/L
Antimony-125	3.50	U	7.59	1.00	-2.41	U	8.61	1.00		1.0	pCi/L
Cerium-144	-11.4	U	19.9	1.00	9.15	U	21.0	1.00		1.4	pCi/L
Cesium-134	-0.182	U	2.55	1.00	-1.37	U	2.83	1.00		0.6	pCi/L
Cesium-137	-0.0387	U	2.70	1.00	0.428	U	2.32	1.00		0.3	pCi/L
Cobalt-60	1.97	U	3.11	1.00	1.33	U	3.28	1.00		0.3	pCi/L
Europium-152	-5.51	U	7.32	1.00	-5.79	U	10.1	1.00		0	pCi/L
Europium-154	5.76	U	8.97	1.00	5.96	U	10.0	1.00		0	pCi/L
Europium-155	6.11	U	9.30	1.00	-1.43	U	10.5	1.00		1.1	pCi/L
Lead-212	0.161	U	8.33	1.00	9.73	U	7.87	1.00		1.6	pCi/L
Potassium-40	23.4	U	43.0	1.00	-24.5	U	47.3	1.00		1.5	pCi/L
Promethium-144	0.271	U	2.49	1.00	1.47	U	2.94	1.00		0.6	pCi/L
Promethium-146	-0.601	U	2.73	1.00	-0.969	U	3.60	1.00		0.2	pCi/L
Ruthenium-106	9.79	U	22.2	1.00	6.90	U	28.9	1.00		0.2	pCi/L
Thorium-234	170	U	209	1.00	171	U	236	1.00		0	pCi/L
Tritium	-183	U	167	1.00	1.88	U	175	1.00		1.5	pCi/L
Uranium-235	15.3	U	23.2	1.00	-5.7	U	23.6	1.00		1.2	pCi/L
Uranium-238	170	U	209	1.00	171	U	236	1.00		0	pCi/L
Yttrium-88	2.42	U	3.41	1.00	-0.204	U	3.84	1.00		1.0	pCi/L

## Certification

All laboratory analytical quality control criteria were met except as qualified in this report. The data qualifiers listed on the 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 10-7-2015  
Stephen Donovan Date

Data Validation Lead: Stephen Donovan 10-7-2015  
Stephen Donovan 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 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.

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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 RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Brennan Windmill WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/21/2015	N001	0 - 0	5.47	U	#	19.9	10.2
Americium-241	pCi/L	05/21/2015	N001	0 - 0	1.16	U	#	21.1	13
Antimony-125	pCi/L	05/21/2015	N001	0 - 0	0.19	U	#	11.2	6.02
Cerium-144	pCi/L	05/21/2015	N001	0 - 0	-0.364	U	#	29.2	16.7
Cesium-134	pCi/L	05/21/2015	N001	0 - 0	1.01	U	#	5.4	2.88
Cesium-137	pCi/L	05/21/2015	N001	0 - 0	-1.14	U	#	4.84	2.78
Cobalt-60	pCi/L	05/21/2015	N001	0 - 0	0.45	U	#	5.07	2.57
Europium-152	pCi/L	05/21/2015	N001	0 - 0	1.83	U	#	11.9	6.26
Europium-154	pCi/L	05/21/2015	N001	0 - 0	-0.47	U	#	12.7	6.63
Europium-155	pCi/L	05/21/2015	N001	0 - 0	4.34	U	#	15.8	8.93
Lead-212	pCi/L	05/21/2015	N001	0 - 0	4.55	U	#	9.13	5.49
Oxidation Reduction Potential	mV	05/21/2015	N001	0 - 0	110		#		
pH	s.u.	05/21/2015	N001	0 - 0	8.13		#		
Potassium-40	pCi/L	05/21/2015	N001	0 - 0	37.3	U	#	46.1	36.4
Promethium-144	pCi/L	05/21/2015	N001	0 - 0	-1.81	U	#	3.78	2.35
Promethium-146	pCi/L	05/21/2015	N001	0 - 0	0.169	U	#	5.16	2.77
Ruthenium-106	pCi/L	05/21/2015	N001	0 - 0	9.75	U	#	46.1	24.7
Specific Conductance	umhos/cm	05/21/2015	N001	0 - 0	1880		#		

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Brennan Windmill WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/21/2015	N001	0 - 0	11.08		#		
Thorium-234	pCi/L	05/21/2015	N001	0 - 0	0.254	U	#	198	142
Tritium	pCi/L	05/21/2015	N001	0 - 0	11.4		J #	3.83	3.33
Turbidity	NTU	05/21/2015	N001	0 - 0	2.29		#		
Uranium-235	pCi/L	05/21/2015	N001	0 - 0	7.83	U	#	30.4	19.7
Uranium-238	pCi/L	05/21/2015	N001	0 - 0	0.254	U	#	198	142
Yttrium-88	pCi/L	05/21/2015	N001	0 - 0	-4.09	U	#	4.96	4.59



**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Johnson Artesian WL WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	0 - 0	-8.5	U	#	23.3	14.2
Americium-241	pCi/L	05/20/2015	N001	0 - 0	17.5	U	#	42.8	26.6
Antimony-125	pCi/L	05/20/2015	N001	0 - 0	-2.45	U	#	14.5	8.06
Cerium-144	pCi/L	05/20/2015	N001	0 - 0	-11.2	U	#	42	24.3
Cesium-134	pCi/L	05/20/2015	N001	0 - 0	0.0864	U	#	7.3	3.81
Cesium-137	pCi/L	05/20/2015	N001	0 - 0	0.699	U	#	6.8	3.7
Cobalt-60	pCi/L	05/20/2015	N001	0 - 0	-1.89	U	#	4.38	2.67
Europium-152	pCi/L	05/20/2015	N001	0 - 0	-5.6	U	#	16.8	10.4
Europium-154	pCi/L	05/20/2015	N001	0 - 0	-6.23	U	#	17.9	10.9
Europium-155	pCi/L	05/20/2015	N001	0 - 0	-2.53	U	#	21.4	13
Lead-212	pCi/L	05/20/2015	N001	0 - 0	9.2	U	#	13.9	14.7
Oxidation Reduction Potential	mV	05/20/2015	N001	0 - 0	-160		#		
pH	s.u.	05/20/2015	N001	0 - 0	7.76		#		
Potassium-40	pCi/L	05/20/2015	N001	0 - 0	0.954	U	#	82.6	42.4
Promethium-144	pCi/L	05/20/2015	N001	0 - 0	-2.65	U	#	6.02	4.03
Promethium-146	pCi/L	05/20/2015	N001	0 - 0	-.499	U	#	7.35	3.99
Ruthenium-106	pCi/L	05/20/2015	N001	0 - 0	1.93	U	#	54.7	29.1
Specific Conductance	umhos/cm	05/20/2015	N001	0 - 0	2315		#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Johnson Artesian WL WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	0 - 0	11.38		#		
Thorium-234	pCi/L	05/20/2015	N001	0 - 0	200	U	#	418	249
Tritium	pCi/L	05/20/2015	N001	0 - 0	-92.9	U	#	310	171
Turbidity	NTU	05/20/2015	N001	0 - 0	3.36		#		
Uranium-235	pCi/L	05/20/2015	N001	0 - 0	-22.9	U	#	37.2	27.7
Uranium-238	pCi/L	05/20/2015	N001	0 - 0	200	U	#	418	249
Yttrium-88	pCi/L	05/20/2015	N001	0 - 0	3.54	U	#	10.2	4.62

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-D-01 WELL

Parameter	Units	Sample ID	Date	Depth Range	(Ft BLS)	Result	Qualifiers Data	QA	Lab	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	16628.77 - 16628.77		1.82	U	F	#	20.4	9.84
Americium-241	pCi/L	05/20/2015	N001	16628.77 - 16628.77		10.2	U	F	#	36.2	22.1
Antimony-125	pCi/L	05/20/2015	N001	16628.77 - 16628.77		-2.74	U	F	#	10.1	5.77
Cerium-144	pCi/L	05/20/2015	N001	16628.77 - 16628.77		4.14	U	F	#	30.8	16.6
Cesium-134	pCi/L	05/20/2015	N001	16628.77 - 16628.77		-0.0426	U	F	#	4.99	2.55
Cesium-137	pCi/L	05/20/2015	N001	16628.77 - 16628.77		0.246	U	F	#	4.32	2.25
Cobalt-60	pCi/L	05/20/2015	N001	16628.77 - 16628.77		0.117	U	F	#	5.04	2.45
Europium-152	pCi/L	05/20/2015	N001	16628.77 - 16628.77		-4.38	U	F	#	12.2	7.17
Europium-154	pCi/L	05/20/2015	N001	16628.77 - 16628.77		3.87	U	F	#	16.7	7.95
Europium-155	pCi/L	05/20/2015	N001	16628.77 - 16628.77		0.851	U	F	#	16.2	8.67
Lead-212	pCi/L	05/20/2015	N001	16628.77 - 16628.77		2.78	U	F	#	9.31	5.13
Oxidation Reduction Potential	mV	05/20/2015	N001	16628.77 - 16628.77		-155		F	#		
pH	s.u.	05/20/2015	N001	16628.77 - 16628.77		7.96		F	#		
Potassium-40	pCi/L	05/20/2015	N001	16628.77 - 16628.77		7.54	U	F	#	48.8	34.6
Promethium-144	pCi/L	05/20/2015	N001	16628.77 - 16628.77		1.95	U	F	#	5.08	2.76
Promethium-146	pCi/L	05/20/2015	N001	16628.77 - 16628.77		-1.79	U	F	#	5.64	3.33
Ruthenium-106	pCi/L	05/20/2015	N001	16628.77 - 16628.77		5.16	U	F	#	39.5	20.2
Specific Conductance	umhos/cm	05/20/2015	N001	16628.77 - 16628.77		1965		F	#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-D-01 WELL

Parameter	Units	Sample ID	Date	Depth Range	(Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty	
Temperature	C	05/20/2015	N001	16628.77	- 16628.77	11.91	F	#			
Thorium-234	pCi/L	05/20/2015	N001	16628.77	- 16628.77	113	U	F	#	371	221
Tritium	pCi/L	05/20/2015	N001	16628.77	- 16628.77	-116	U	F	#	309	170
Turbidity	NTU	05/20/2015	N001	16628.77	- 16628.77	0.67	F	#			
Uranium-235	pCi/L	05/20/2015	N001	16628.77	- 16628.77	6.74	U	F	#	31.5	22.2
Uranium-238	pCi/L	05/20/2015	N001	16628.77	- 16628.77	113	U	F	#	371	221
Yttrium-88	pCi/L	05/20/2015	N001	16628.77	- 16628.77	2.02	U	F	#	7	2.94

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-D-03 WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	0 - 0	-5.21	U	F #	19.1	10.2
Americium-241	pCi/L	05/20/2015	N001	0 - 0	0.963	U	F #	22.5	13.8
Antimony-125	pCi/L	05/20/2015	N001	0 - 0	-6.37	U	F #	10.6	7.22
Cerium-144	pCi/L	05/20/2015	N001	0 - 0	19.5	U	F #	33.4	19.8
Cesium-134	pCi/L	05/20/2015	N001	0 - 0	0.76	U	F #	4.79	2.37
Cesium-137	pCi/L	05/20/2015	N001	0 - 0	0.363	U	F #	4.92	4.85
Cobalt-60	pCi/L	05/20/2015	N001	0 - 0	-6.03	U	F #	4.94	2.61
Europium-152	pCi/L	05/20/2015	N001	0 - 0	6.09	U	F #	14.5	8.1
Europium-154	pCi/L	05/20/2015	N001	0 - 0	-2.59	U	F #	15	8.15
Europium-155	pCi/L	05/20/2015	N001	0 - 0	-2.38	U	F #	16	9.3
Lead-212	pCi/L	05/20/2015	N001	0 - 0	5.9	U	F #	8.34	7.7
Oxidation Reduction Potential	mV	05/20/2015	N001	0 - 0	-90		F #		
pH	s.u.	05/20/2015	N001	0 - 0	8.88		F #		
Potassium-40	pCi/L	05/20/2015	N001	0 - 0	-9.29	U	F #	60.6	34
Promethium-144	pCi/L	05/20/2015	N001	0 - 0	2.53	U	F #	5.21	3.14
Promethium-146	pCi/L	05/20/2015	N001	0 - 0	1.61	U	F #	6.01	3.2
Ruthenium-106	pCi/L	05/20/2015	N001	0 - 0	2	U	F #	46.9	24.5
Specific Conductance	umhos/cm	05/20/2015	N001	0 - 0	895		F #		

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-D-03 WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	0 - 0	10.67	F	#		
Thorium-234	pCi/L	05/20/2015	N001	0 - 0	12	U	F	187	131
Tritium	pCi/L	05/20/2015	N001	0 - 0	-154	U	F	309	168
Turbidity	NTU	05/20/2015	N001	0 - 0	1.69	F	#		
Uranium-235	pCi/L	05/20/2015	N001	0 - 0	-2.22	U	F	28.7	19.1
Uranium-238	pCi/L	05/20/2015	N001	0 - 0	12	U	F	187	131
Yttrium-88	pCi/L	05/20/2015	N001	0 - 0	4.6	U	F	9.47	4.47

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-S-03 WELL

Parameter	Units	Sample ID	Date	Depth Range	(Ft BLS)	Result	Qualifiers Data	QA	Lab	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-0.225	U	F	#	18.6	9.73
Americium-241	pCi/L	05/20/2015	N001	16628.75 - 16628.75		4.01	U	F	#	28.6	16.8
Antimony-125	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-0.756	U	F	#	13	7.17
Cerium-144	pCi/L	05/20/2015	N001	16628.75 - 16628.75		4.85	U	F	#	34.9	19.7
Cesium-134	pCi/L	05/20/2015	N001	16628.75 - 16628.75		5.23	U	F	#	6.21	3.58
Cesium-137	pCi/L	05/20/2015	N001	16628.75 - 16628.75		1.34	U	F	#	5.3	2.65
Cobalt-60	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-0.933	U	F	#	5.1	2.74
Europium-152	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-1.49	U	F	#	11.9	7.53
Europium-154	pCi/L	05/20/2015	N001	16628.75 - 16628.75		0.00898	U	F	#	16.3	8.22
Europium-155	pCi/L	05/20/2015	N001	16628.75 - 16628.75		3.8	U	F	#	17.6	10
Lead-212	pCi/L	05/20/2015	N001	16628.75 - 16628.75		2.04	U	F	#	10.5	5.89
Oxidation Reduction Potential	mV	05/20/2015	N001	16628.75 - 16628.75		-195		F	#		
pH	s.u.	05/20/2015	N001	16628.75 - 16628.75		8.37		F	#		
Potassium-40	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-1.85	U	F	#	54.8	27.9
Promethium-144	pCi/L	05/20/2015	N001	16628.75 - 16628.75		0.707	U	F	#	5.72	3.38
Promethium-146	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-3.1	U	F	#	5.44	3.65
Ruthenium-106	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-7.19	U	F	#	45.5	24.8
Specific Conductance	umhos/cm	05/20/2015	N001	16628.75 - 16628.75		905		F	#		

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**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-S-03 WELL

Parameter	Units	Sample ID	Date	Depth Range	(Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	16628.75 - 16628.75		12.91	F	#		
Thorium-234	pCi/L	05/20/2015	N001	16628.75 - 16628.75		44.4	U F	#	249	154
Tritium	pCi/L	05/20/2015	N001	16628.75 - 16628.75		-98.4	U F	#	313	173
Turbidity	NTU	05/20/2015	N001	16628.75 - 16628.75		2.32	F	#		
Uranium-235	pCi/L	05/20/2015	N001	16628.75 - 16628.75		8.17	U F	#	33.3	21.2
Uranium-238	pCi/L	05/20/2015	N001	16628.75 - 16628.75		44.4	U F	#	249	154
Yttrium-88	pCi/L	05/20/2015	N001	16628.75 - 16628.75		1.99	U F	#	7.23	3.03



**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-W-01 WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data QA	Lab	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	0 - 0	-8.55	U FQ	#	22.7	13.1
Americium-241	pCi/L	05/20/2015	N001	0 - 0	1.16	U FQ	#	45.3	25.3
Antimony-125	pCi/L	05/20/2015	N001	0 - 0	0.888	U FQ	#	14.4	7.81
Cerium-144	pCi/L	05/20/2015	N001	0 - 0	8.11	U FQ	#	40.1	23
Cesium-134	pCi/L	05/20/2015	N001	0 - 0	2.45	U FQ	#	5.73	2.88
Cesium-137	pCi/L	05/20/2015	N001	0 - 0	0.148	U FQ	#	4.85	2.46
Cobalt-60	pCi/L	05/20/2015	N001	0 - 0	-601	U FQ	#	5.27	2.83
Europium-152	pCi/L	05/20/2015	N001	0 - 0	6.66	U FQ	#	16.3	9.34
Europium-154	pCi/L	05/20/2015	N001	0 - 0	1.84	U FQ	#	14.4	7
Europium-155	pCi/L	05/20/2015	N001	0 - 0	-4.59	U FQ	#	19.1	11.5
Lead-212	pCi/L	05/20/2015	N001	0 - 0	1.08	U FQ	#	10.6	8.14
Oxidation Reduction Potential	mV	05/20/2015	N001	0 - 0	-80	FQ	#		
pH	s.u.	05/20/2015	N001	0 - 0	8.35	FQ	#		
Potassium-40	pCi/L	05/20/2015	N001	0 - 0	-37.5	U FQ	#	63.8	36.6
Promethium-144	pCi/L	05/20/2015	N001	0 - 0	0.958	U FQ	#	5.17	2.6
Promethium-146	pCi/L	05/20/2015	N001	0 - 0	-3.2	U FQ	#	5.53	3.73
Ruthenium-106	pCi/L	05/20/2015	N001	0 - 0	6.44	U FQ	#	49.2	26.2
Specific Conductance	umhos /cm	05/20/2015	N001	0 - 0	1520	FQ	#		

**Groundwater Quality Data by Location (USEE100) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: RB-W-01 WELL

Parameter	Units	Sample ID	Date	Depth Range (Ft BLS)	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	0 - 0	12.21	FQ	#		
Thorium-234	pCi/L	05/20/2015	N001	0 - 0	8.07	U	FQ #	399	251
Tritium	pCi/L	05/20/2015	N001	0 - 0	-2.85	U	FQ #	313	178
Turbidity	NTU	05/20/2015	N001	0 - 0	4.33	FQ	#		
Uranium-235	pCi/L	05/20/2015	N001	0 - 0	31.3	U	FQ #	34.2	36.6
Uranium-238	pCi/L	05/20/2015	N001	0 - 0	8.07	U	FQ #	399	251
Yttrium-88	pCi/L	05/20/2015	N001	0 - 0	2.06	U	FQ #	8.22	3.64

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.

## **Surface Water Quality Data**

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: B-1 Equity Camp SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/21/2015	N001	-12.6	U	#	15.2	12.3
Actinium-228	pCi/L	05/21/2015	N002	1.93	U	#	23	10.8
Americium-241	pCi/L	05/21/2015	N001	2.36	U	#	23.8	14.5
Americium-241	pCi/L	05/21/2015	N002	24.8	U	#	43.4	30
Antimony-125	pCi/L	05/21/2015	N001	3.5	U	#	12.8	7.59
Antimony-125	pCi/L	05/21/2015	N002	-2.41	U	#	12.8	8.61
Cerium-144	pCi/L	05/21/2015	N001	-11.4	U	#	32.3	19.9
Cerium-144	pCi/L	05/21/2015	N002	9.15	U	#	37.5	21
Cesium-134	pCi/L	05/21/2015	N001	-1.82	U	#	4.87	2.55
Cesium-134	pCi/L	05/21/2015	N002	-1.37	U	#	4.79	2.83
Cesium-137	pCi/L	05/21/2015	N001	-0.0387	U	#	4.71	2.7
Cesium-137	pCi/L	05/21/2015	N002	0.428	U	#	4.67	2.32
Cobalt-60	pCi/L	05/21/2015	N001	1.97	U	#	5.66	3.11
Cobalt-60	pCi/L	05/21/2015	N002	1.33	U	#	7	3.28
Europium-152	pCi/L	05/21/2015	N001	-5.51	U	#	11.7	7.32
Europium-152	pCi/L	05/21/2015	N002	-5.79	U	#	16.5	10.1
Europium-154	pCi/L	05/21/2015	N001	5.76	U	#	13.6	8.97
Europium-154	pCi/L	05/21/2015	N002	5.96	U	#	21.2	10

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: B-1 Equity Camp SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Europium-155	pCi/L	05/21/2015	N001	6.11	U	#	16.4	9.3
Europium-155	pCi/L	05/21/2015	N002	-1.43	U	#	18.6	10.5
Lead-212	pCi/L	05/21/2015	N001	0.161	U	#	9.56	8.33
Lead-212	pCi/L	05/21/2015	N002	9.73	U	#	12	7.87
Oxidation Reduction Potential	mV	05/21/2015	N001	72		#		
pH	s.u.	05/21/2015	N001	7.55		#		
Potassium-40	pCi/L	05/21/2015	N001	23.4	U	#	42.7	43
Potassium-40	pCi/L	05/21/2015	N002	-24.5	U	#	78.5	47.3
Promethium-144	pCi/L	05/21/2015	N001	0.271	U	#	4.56	2.49
Promethium-144	pCi/L	05/21/2015	N002	1.47	U	#	5.77	2.94
Promethium-146	pCi/L	05/21/2015	N001	-601	U	#	4.91	2.73
Promethium-146	pCi/L	05/21/2015	N002	-969	U	#	6.62	3.6
Ruthenium-106	pCi/L	05/21/2015	N001	9.79	U	#	42	22.2
Ruthenium-106	pCi/L	05/21/2015	N002	6.9	U	#	53.2	28.9
Specific Conductance	umhos/cm	05/21/2015	N001	1130		#		
Temperature	C	05/21/2015	N001	8.38		#		
Thorium-234	pCi/L	05/21/2015	N001	170	U	#	212	209
Thorium-234	pCi/L	05/21/2015	N002	171	U	#	318	236

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: B-1 Equity Camp SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Tritium	pCi/L	05/21/2015	N001	-183	U	#	310	167
Tritium	pCi/L	05/21/2015	N002	1.88	U	#	307	175
Turbidity	NTU	05/21/2015	N001	0.59		#		
Uranium-235	pCi/L	05/21/2015	N001	15.3	U	#	31.4	23.2
Uranium-235	pCi/L	05/21/2015	N002	-5.7	U	#	35.1	23.6
Uranium-238	pCi/L	05/21/2015	N001	170	U	#	212	209
Uranium-238	pCi/L	05/21/2015	N002	171	U	#	318	236
Yttrium-88	pCi/L	05/21/2015	N001	2.42	U	#	7.37	3.41
Yttrium-88	pCi/L	05/21/2015	N002	-204	U	#	7.85	3.84

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: CER #1 Black Sulphur SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/21/2015	N001	-9.16	U	#	19	11.2
Americium-241	pCi/L	05/21/2015	N001	-3.99	U	#	17.6	10.4
Antimony-125	pCi/L	05/21/2015	N001	4.12	U	#	14.6	7.63
Cerium-144	pCi/L	05/21/2015	N001	-1.64	U	#	32	18.9
Cesium-134	pCi/L	05/21/2015	N001	1.56	U	#	6.32	3.19
Cesium-137	pCi/L	05/21/2015	N001	-1.27	U	#	5.01	3.19
Cobalt-60	pCi/L	05/21/2015	N001	-1.98	U	#	4.77	2.91
Europium-152	pCi/L	05/21/2015	N001	-4.01	U	#	14.6	8.86
Europium-154	pCi/L	05/21/2015	N001	-11.8	U	#	17	11.8
Europium-155	pCi/L	05/21/2015	N001	-2.17	U	#	15.4	9.1
Lead-212	pCi/L	05/21/2015	N001	4.04	U	#	8.32	5.92
Oxidation Reduction Potential	mV	05/21/2015	N001	88.3		#		
pH	s.u.	05/21/2015	N001	7.55		#		
Potassium-40	pCi/L	05/21/2015	N001	-41.8	U	#	73.8	48.3
Promethium-144	pCi/L	05/21/2015	N001	-.0472	U	#	5.04	2.75
Promethium-146	pCi/L	05/21/2015	N001	2.13	U	#	7.05	4.44
Ruthenium-106	pCi/L	05/21/2015	N001	4.01	U	#	49.5	26.4
Specific Conductance	umhos/cm	05/21/2015	N001	1610		#		



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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: CER #1 Black Sulphur SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/21/2015	N001	8.73		#		
Thorium-234	pCi/L	05/21/2015	N001	-44.6	U	#	182	108
Tritium	pCi/L	05/21/2015	N001	11.6		#	3.18	2.8
Turbidity	NTU	05/21/2015	N001	0.35		#		
Uranium-235	pCi/L	05/21/2015	N001	5.69	U	#	33.6	20.9
Uranium-238	pCi/L	05/21/2015	N001	-44.6	U	#	182	108
Yttrium-88	pCi/L	05/21/2015	N001	-4.46	U	#	6.3	4.53

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: CER #4 Black Sulphur SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/21/2015	N001	-4.67	U	#	20.2	11.6
Americium-241	pCi/L	05/21/2015	N001	4.7	U	#	22.3	13.4
Antimony-125	pCi/L	05/21/2015	N001	-2.47	U	#	11.8	6.83
Cerium-144	pCi/L	05/21/2015	N001	1.72	U	#	33.8	19.4
Cesium-134	pCi/L	05/21/2015	N001	-293	U	#	5.38	3.49
Cesium-137	pCi/L	05/21/2015	N001	2.68	U	#	4.74	3.69
Cobalt-60	pCi/L	05/21/2015	N001	0	U	#	5.37	0
Europium-152	pCi/L	05/21/2015	N001	4.68	U	#	15.2	8.24
Europium-154	pCi/L	05/21/2015	N001	-1.07	U	#	13.9	7.18
Europium-155	pCi/L	05/21/2015	N001	-5.26	U	#	15.1	9.28
Lead-212	pCi/L	05/21/2015	N001	1.83	U	#	9.85	6.39
Oxidation Reduction Potential	mV	05/21/2015	N001	75		#		
pH	s.u.	05/21/2015	N001	7.53		#		
Potassium-40	pCi/L	05/21/2015	N001	-19.2	U	#	58.6	33.3
Promethium-144	pCi/L	05/21/2015	N001	-1.72	U	#	4.66	2.98
Promethium-146	pCi/L	05/21/2015	N001	0.136	U	#	5.88	3.68
Ruthenium-106	pCi/L	05/21/2015	N001	-9.74	U	#	38.6	21.8
Specific Conductance	umhos/cm	05/21/2015	N001	1395		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: CER #4 Black Sulphur SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/21/2015	N001	8.58		#		
Thorium-234	pCi/L	05/21/2015	N001	142	U	#	255	150
Tritium	pCi/L	05/21/2015	N001	11.6		J #	4.23	3.79
Turbidity	NTU	05/21/2015	N001	0.52		#		
Uranium-235	pCi/L	05/21/2015	N001	5.48	U	#	30.8	20.3
Uranium-238	pCi/L	05/21/2015	N001	142	U	#	255	150
Yttrium-88	pCi/L	05/21/2015	N001	-1.42	U	#	6.03	3.27

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek #1 SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	-1.77	U	#	18.7	10.5
Americium-241	pCi/L	05/20/2015	N001	-586	U	#	17.1	9.73
Antimony-125	pCi/L	05/20/2015	N001	1.85	U	#	11.9	6.51
Cerium-144	pCi/L	05/20/2015	N001	4.74	U	#	32.5	21.1
Cesium-134	pCi/L	05/20/2015	N001	0.167	U	#	4.74	2.51
Cesium-137	pCi/L	05/20/2015	N001	0.955	U	#	4.98	2.61
Cobalt-60	pCi/L	05/20/2015	N001	-312	U	#	4.78	2.53
Europium-152	pCi/L	05/20/2015	N001	5.31	U	#	13.4	7.38
Europium-154	pCi/L	05/20/2015	N001	1.56	U	#	14.1	7.1
Europium-155	pCi/L	05/20/2015	N001	-1.66	U	#	14.8	8.68
Lead-212	pCi/L	05/20/2015	N001	3.33	U	#	9.36	7.11
Oxidation Reduction Potential	mV	05/20/2015	N001	10		#		
pH	s.u.	05/20/2015	N001	7.6		#		
Potassium-40	pCi/L	05/20/2015	N001	-25.1	U	#	59.1	34.8
Promethium-144	pCi/L	05/20/2015	N001	0.209	U	#	4.26	2.26
Promethium-146	pCi/L	05/20/2015	N001	-1.09	U	#	5.12	3.03
Ruthenium-106	pCi/L	05/20/2015	N001	20.5	U	#	48.5	39.8
Specific Conductance	umhos/cm	05/20/2015	N001	1695		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek #1 SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	9.32		#		
Thorium-234	pCi/L	05/20/2015	N001	-41.8	U	#	187	117
Tritium	pCi/L	05/20/2015	N001	10.5	U	#	310	177
Turbidity	NTU	05/20/2015	N001	1.02		#		
Uranium-235	pCi/L	05/20/2015	N001	11.6	U	#	30.9	25.3
Uranium-238	pCi/L	05/20/2015	N001	-41.8	U	#	187	117
Yttrium-88	pCi/L	05/20/2015	N001	-1.3	U	#	5.66	3.71

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek #3 SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	8.72	U	#	22.5	9.97
Americium-241	pCi/L	05/20/2015	N001	-13.4	U	#	46.3	27.9
Antimony-125	pCi/L	05/20/2015	N001	4.05	U	#	15.3	8.23
Cerium-144	pCi/L	05/20/2015	N001	18.4	U	#	37.9	18.3
Cesium-134	pCi/L	05/20/2015	N001	0.835	U	#	5.24	2.58
Cesium-137	pCi/L	05/20/2015	N001	0.756	U	#	5.12	2.57
Cobalt-60	pCi/L	05/20/2015	N001	1.37	U	#	6.03	2.9
Europium-152	pCi/L	05/20/2015	N001	-4.69	U	#	12.9	7.8
Europium-154	pCi/L	05/20/2015	N001	1.99	U	#	14.5	6.9
Europium-155	pCi/L	05/20/2015	N001	-4.42	U	#	18.9	11.3
Lead-212	pCi/L	05/20/2015	N001	3.14	U	#	10.4	6.39
Oxidation Reduction Potential	mV	05/20/2015	N001	-90		#		
pH	s.u.	05/20/2015	N001	7.56		#		
Potassium-40	pCi/L	05/20/2015	N001	-3.47	U	#	64.3	30.8
Promethium-144	pCi/L	05/20/2015	N001	-1.29	U	#	4.31	2.47
Promethium-146	pCi/L	05/20/2015	N001	-1.12	U	#	5.75	3.31
Ruthenium-106	pCi/L	05/20/2015	N001	-3.36	U	#	41.1	26.3
Specific Conductance	umhos/cm	05/20/2015	N001	1475		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek #3 SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	8.68		#		
Thorium-234	pCi/L	05/20/2015	N001	7.38	U	#	402	275
Tritium	pCi/L	05/20/2015	N001	-50.7	U	#	310	174
Turbidity	NTU	05/20/2015	N001	3.88		#		
Uranium-235	pCi/L	05/20/2015	N001	-18.1	U	#	33.2	25.3
Uranium-238	pCi/L	05/20/2015	N001	7.38	U	#	402	275
Yttrium-88	pCi/L	05/20/2015	N001	3.93	U	#	8.59	3.8

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 500ft Dwn SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	8.92	U	#	21.8	11.8
Americium-241	pCi/L	05/20/2015	N001	15	U	#	36.4	20
Antimony-125	pCi/L	05/20/2015	N001	-4.73	U	#	11.8	7.29
Cerium-144	pCi/L	05/20/2015	N001	-9.1	U	#	31.2	18.8
Cesium-134	pCi/L	05/20/2015	N001	0.938	U	#	4.82	2.33
Cesium-137	pCi/L	05/20/2015	N001	-812	U	#	5.23	2.86
Cobalt-60	pCi/L	05/20/2015	N001	0.207	U	#	4.79	2.28
Europium-152	pCi/L	05/20/2015	N001	4.11	U	#	14.6	7.75
Europium-154	pCi/L	05/20/2015	N001	-752	U	#	13.7	7.18
Europium-155	pCi/L	05/20/2015	N001	4.56	U	#	17.5	9.65
Lead-212	pCi/L	05/20/2015	N001	0	U	#	10.7	11.4
Oxidation Reduction Potential	mV	05/20/2015	N001	-80		#		
pH	s.u.	05/20/2015	N001	8.39		#		
Potassium-40	pCi/L	05/20/2015	N001	1.12	U	#	43.9	23.2
Promethium-144	pCi/L	05/20/2015	N001	3.09	U	#	5.45	2.87
Promethium-146	pCi/L	05/20/2015	N001	0.853	U	#	6.02	3.18
Ruthenium-106	pCi/L	05/20/2015	N001	-254	U	#	44.2	27.7
Specific Conductance	umhos/cm	05/20/2015	N001	1460		#		



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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 500ft Dwn SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	13.54		#		
Thorium-234	pCi/L	05/20/2015	N001	-101	U	#	336	193
Tritium	pCi/L	05/20/2015	N001	-69.6	U	#	310	173
Turbidity	NTU	05/20/2015	N001	1.09		#		
Uranium-235	pCi/L	05/20/2015	N001	12.9	U	#	24.8	23.5
Uranium-238	pCi/L	05/20/2015	N001	-101	U	#	336	193
Yttrium-88	pCi/L	05/20/2015	N001	0.13	U	#	7.71	3.83

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 500ft Ups SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	-3.52	U	#	20.9	11.4
Americium-241	pCi/L	05/20/2015	N001	8.09	U	#	49.1	30.2
Antimony-125	pCi/L	05/20/2015	N001	-.478	U	#	14.4	7.9
Cerium-144	pCi/L	05/20/2015	N001	-18.8	U	#	36.9	24.3
Cesium-134	pCi/L	05/20/2015	N001	-2.48	U	#	4.68	3.05
Cesium-137	pCi/L	05/20/2015	N001	0.802	U	#	4.77	2.31
Cobalt-60	pCi/L	05/20/2015	N001	-2	U	#	4.46	2.76
Europium-152	pCi/L	05/20/2015	N001	-4.04	U	#	13.6	9.24
Europium-154	pCi/L	05/20/2015	N001	4.3	U	#	17.4	8.01
Europium-155	pCi/L	05/20/2015	N001	0.926	U	#	18.8	10.6
Lead-212	pCi/L	05/20/2015	N001	0.816	U	#	10.9	9.94
Oxidation Reduction Potential	mV	05/20/2015	N001	-25		#		
pH	s.u.	05/20/2015	N001	8.42		#		
Potassium-40	pCi/L	05/20/2015	N001	48	U	#	54.5	36.2
Promethium-144	pCi/L	05/20/2015	N001	1.26	U	#	5.89	3
Promethium-146	pCi/L	05/20/2015	N001	-.524	U	#	6.46	3.59
Ruthenium-106	pCi/L	05/20/2015	N001	-16.5	U	#	45.3	26.7
Specific Conductance	umhos/cm	05/20/2015	N001	1460		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 500ft Ups SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	12.8		#		
Thorium-234	pCi/L	05/20/2015	N001	-140	U	#	395	233
Tritium	pCi/L	05/20/2015	N001	10.2		J #	4.03	3.4
Turbidity	NTU	05/20/2015	N001	1.29		#		
Uranium-235	pCi/L	05/20/2015	N001	-7.77	U	#	35.3	21.8
Uranium-238	pCi/L	05/20/2015	N001	-140	U	#	395	233
Yttrium-88	pCi/L	05/20/2015	N001	2.73	U	#	8.32	3.52

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 6800ft Up SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	19.8	U	#	27.9	15.7
Americium-241	pCi/L	05/20/2015	N001	-25.8	U	#	10.4	13.8
Antimony-125	pCi/L	05/20/2015	N001	-1.16	U	#	18.9	10.4
Cerium-144	pCi/L	05/20/2015	N001	-3.35	U	#	37.9	21.7
Cesium-134	pCi/L	05/20/2015	N001	1.11	U	#	7.28	3.59
Cesium-137	pCi/L	05/20/2015	N001	3.24	U	#	7.56	3.94
Cobalt-60	pCi/L	05/20/2015	N001	3.56	U	#	8.94	4.31
Europium-152	pCi/L	05/20/2015	N001	5.04	U	#	20.6	11.1
Europium-154	pCi/L	05/20/2015	N001	-8.13	U	#	20.8	13.7
Europium-155	pCi/L	05/20/2015	N001	-5.01	U	#	17.5	12.1
Lead-212	pCi/L	05/20/2015	N001	5.81	U	#	13.1	9.16
Oxidation Reduction Potential	mV	05/20/2015	N001	-70		#		
pH	s.u.	05/20/2015	N001	7.54		#		
Potassium-40	pCi/L	05/20/2015	N001	-10.4	U	#	88.9	46.2
Promethium-144	pCi/L	05/20/2015	N001	7.04	U	#	7.96	5.41
Promethium-146	pCi/L	05/20/2015	N001	-486	U	#	8.05	5.15
Ruthenium-106	pCi/L	05/20/2015	N001	13.9	U	#	69	36.4
Specific Conductance	umhos/cm	05/20/2015	N001	1400		#		

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**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 6800ft Up SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	9.08		#		
Thorium-234	pCi/L	05/20/2015	N001	-37.5	U	#	145	81.3
Tritium	pCi/L	05/20/2015	N001	-207	U	#	312	166
Turbidity	NTU	05/20/2015	N001	0.83		#		
Uranium-235	pCi/L	05/20/2015	N001	-6.36	U	#	42.2	25.9
Uranium-238	pCi/L	05/20/2015	N001	-37.5	U	#	145	81.3
Yttrium-88	pCi/L	05/20/2015	N001	0.492	U	#	10.6	5.07

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 8400ft Dwn SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Actinium-228	pCi/L	05/20/2015	N001	-7.85	U	#	21.4	12.5
Americium-241	pCi/L	05/20/2015	N001	0.912	U	#	17.7	11.1
Antimony-125	pCi/L	05/20/2015	N001	8.35	U	#	12.8	6.3
Cerium-144	pCi/L	05/20/2015	N001	-1.35	U	#	33.1	19.5
Cesium-134	pCi/L	05/20/2015	N001	0.975	U	#	5.37	2.69
Cesium-137	pCi/L	05/20/2015	N001	0.548	U	#	5.92	3.19
Cobalt-60	pCi/L	05/20/2015	N001	-.465	U	#	5.28	2.73
Europium-152	pCi/L	05/20/2015	N001	3.12	U	#	15.2	8.99
Europium-154	pCi/L	05/20/2015	N001	3.88	U	#	15.8	7.39
Europium-155	pCi/L	05/20/2015	N001	-3.17	U	#	15.3	9.16
Lead-212	pCi/L	05/20/2015	N001	-4.42	U	#	10.5	6.48
Oxidation Reduction Potential	mV	05/20/2015	N001	-15		#		
pH	s.u.	05/20/2015	N001	8.31		#		
Potassium-40	pCi/L	05/20/2015	N001	-18	U	#	70.7	38.5
Promethium-144	pCi/L	05/20/2015	N001	-.406	U	#	5.05	2.96
Promethium-146	pCi/L	05/20/2015	N001	1.78	U	#	7.2	3.81
Ruthenium-106	pCi/L	05/20/2015	N001	32.4	U	#	50.6	27.3
Specific Conductance	umhos/cm	05/20/2015	N001	1455		#		

**Surface Water Quality Data by Location (USEE102) FOR SITE RBL01, Rio Blanco Site**

REPORT DATE: 09/08/2015

Location: Fawn Creek 8400ft Dwn SURFACE LOCATION

Parameter	Units	Sample ID	Date	Result	Qualifiers Data	Lab QA	Detection Limit	Uncertainty
Temperature	C	05/20/2015	N001	14.73		#		
Thorium-234	pCi/L	05/20/2015	N001	30.3	U	#	170	131
Tritium	pCi/L	05/20/2015	N001	-164	U	#	309	167
Turbidity	NTU	05/20/2015	N001	1.21		#		
Uranium-235	pCi/L	05/20/2015	N001	15.1	U	#	30.4	26.8
Uranium-238	pCi/L	05/20/2015	N001	30.3	U	#	170	131
Yttrium-88	pCi/L	05/20/2015	N001	1	U	#	8.11	3.77

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

LAB QUALIFIERS:

- \* Replicate analysis not within control limits.
- > Result above upper detection limit.
- B Inorganic: Result is between the IDL and CRDL. Organic: Analyte also found in method blank.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compound (TIC).
- 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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## **Equipment Blank Data**

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**BLANKS REPORT**

LAB: GENERAL ENGINEERING (Charleston, SC)

RIN: 15057040

Report Date: 09/08/2015

Parameter	Site Code	Location ID	Sample ID	Date	Units	Result	Qualifiers Lab Data	Detection Limit	Uncertainty	Sample Type
Actinium-228	RBL01	0999	05/20/2015	N001	pCi/L	-3.33	U	22.8	13.1	E
Americium-241	RBL01	0999	05/20/2015	N001	pCi/L	-26.5	U	52.1	34.4	E
Antimony-125	RBL01	0999	05/20/2015	N001	pCi/L	-11	U	13.2	9.86	E
Cerium-144	RBL01	0999	05/20/2015	N001	pCi/L	1.88	U	39.5	22.3	E
Cesium-134	RBL01	0999	05/20/2015	N001	pCi/L	2.18	U	6.62	3.8	E
Cesium-137	RBL01	0999	05/20/2015	N001	pCi/L	-.62	U	5.55	3.1	E
Cobalt-60	RBL01	0999	05/20/2015	N001	pCi/L	2.19	U	6.44	3.33	E
Europium-152	RBL01	0999	05/20/2015	N001	pCi/L	0.441	U	16.1	8.79	E
Europium-154	RBL01	0999	05/20/2015	N001	pCi/L	2.69	U	18.4	9.21	E
Europium-155	RBL01	0999	05/20/2015	N001	pCi/L	-2.71	U	23.3	13.1	E
Lead-212	RBL01	0999	05/20/2015	N001	pCi/L	7.43	U	9.53	11.4	E
Potassium-40	RBL01	0999	05/20/2015	N001	pCi/L	-6.7	U	65.5	35.6	E
Promethium-144	RBL01	0999	05/20/2015	N001	pCi/L	-.259	U	5.77	3.19	E
Promethium-146	RBL01	0999	05/20/2015	N001	pCi/L	-1.68	U	7.3	4.96	E
Ruthenium-106	RBL01	0999	05/20/2015	N001	pCi/L	-16	U	52.6	31.6	E
Thorium-234	RBL01	0999	05/20/2015	N001	pCi/L	-144	U	450	264	E
Tritium	RBL01	0999	05/20/2015	N001	pCi/L	-127	U	305	167	E
Uranium-235	RBL01	0999	05/20/2015	N001	pCi/L	-15.9	U	38.5	27.9	E

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**BLANKS REPORT**

LAB: GENERAL ENGINEERING (Charleston, SC)

RIN: 15057040

Report Date: 09/08/2015

Parameter	Site Code	Location ID	Sample ID	Date	Units	Result	Qualifiers Lab Data	Detection Limit	Uncertainty	Sample Type
Uranium-238	RBL01	0999	05/20/2015	N001	pCi/L	-144	U	450	264	E
Yttrium-88	RBL01	0999	05/20/2015	N001	pCi/L	-.0849	U	7.04	3.96	E

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

## LAB QUALIFIERS:

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

## DATA QUALIFIERS:

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

## SAMPLE TYPES:

- E Equipment Blank.

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

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**Stoller Newport News Nuclear**

April 24, 2015

Task Assignment 104  
Control Number 15-0502

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

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

**REFERENCE:** Task Assignment 104, 3-104-1-07-618, Rio Blanco, Colorado, Site

Dear Mr. Kleinrath:

The purpose of this letter is to inform you of the upcoming sampling event at the Rio Blanco site. Enclosed are the map and tables specifying sample locations and analytes for monitoring at the site. Water quality data will be collected at this site as part of the routine environmental sampling currently scheduled to begin the week of May 25, 2015.

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

**MONITORING WELLS**

**Off-Site**

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

**On-Site**

Johnson Artesian WL Brennan Windmill

**SURFACE LOCATIONS**

**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.

A SUBSIDIARY OF HUNTINGTON INGALLS INDUSTRIES

2597 Legacy Way • Grand Junction, CO 81503-1789 • Telephone (970) 248-6000 • Fax (970) 248-6040

Art Kleinrath  
Control Number 15-0502  
Page 2

If you have any questions, please call me at (970) 248-6477 or Rick Findlay at (970) 248-6419.

Sincerely,



Richard D. Hutton  
Site Lead

RH/lcg/bkb

Enclosures (3)

cc: (electronic)

Christina Pennal, DOE  
Steve Donovan, SN3  
Lauren Goodknight, SN3  
Diana Osborne, SN3  
EDD Delivery  
re-grand.junction  
File: RBL 400.02



**Sampling Frequencies for Locations at  
Rio Blanco, Colorado**

Location ID	Quarterly	Semiannually	Annually	Biennially	Not Sampled	Notes
<b>Monitoring Wells</b>						
<b>On-Site</b>						
RB-D-01			X			
RB-D-03			X			
RB-S-03			X			
RB-W-01			X			
<b>Off-Site</b>						
Johnson Artesian WL			X			
Brennan Windmill			X			
<b>Surface Locations</b>						
<b>On-Site</b>						
Fawn Creek 500ft Dwn			X			
Fawn Creek 500ft Ups			X			
<b>Off-Site</b>						
B-1 Equity Camp			X			
CER #1 Black Sulphur			X			
CER #4 Black Sulphur			X			
Fawn Creek #1			X			
Fawn Creek #3			X			
Fawn Creek 6800ft Up			X			
Fawn Creek 8400ft Dw			X			

Sampling conducted in May

Be sure to pick different locations from last year for enriched tritium.

### Constituent Sampling Breakdown

Site	Rio Blanco		Required Detection Limit (mg/L)	Analytical Method	Line Item Code
Analyte	Groundwater	Surface Water			
<b>Approx. No. Samples/yr</b>	6	9			
<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					
Nickel					
Nickel-63					
Nitrate + Nitrite as N (NO3+NO2)-N					
Potassium					
Radium-226					
Radium-228					
Selenium					
Silica					
Sodium					
Strontium					
Sulfate					
Sulfide					
Total Dissolved Solids					
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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Stoller Newport News Nuclear

## Memorandum

DATE: June 8, 2015  
 TO: Rick Hutton  
 FROM: Jennifer Graham  
 SUBJECT: Trip Report (LTHMP Sampling)

Site: Rio Blanco, CO

**Dates of Sampling Event:** May 20 - 22, 2015

**Team Members:** Lauren Goodknight and Jeff Price

**Number of Locations Sampled:** Samples were collected from 15 of the 15 locations identified on the sampling notification letter, dated April 24, 2015, as follows:

	Locations That Were Sampled	Planned Locations
Monitoring wells	6	6
Surface water locations	9	9

All samples will be analyzed for tritium and gamma spec; a select set of samples will also be analyzed for enriched tritium (Brennan Windmill, Fawn Creek 500ft. Ups, CER #1 Black Sulphur, and CER #4 Black Sulphur).

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

### Location Specific Information:

Location IDs	Comments
RB-W-01	No cap on well. Dead mice floating in water.

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

False ID	Ticket Number	True ID	Sample Type	Associated Matrix
2489	NGQ 018	B-1 Equity Camp	Duplicate	Surface Water
2731	NGR 096	Associated with RB-W-01 and RB-D-03	Equipment Blank	Water

**Requisition Index Number (RIN) Assigned:** Samples were assigned to RIN 15057040. Field data sheets can be found in <\\crow\RAApps\SMS\15057040\FieldData>.

**Sample Shipment:** The samples were shipped overnight FedEx from Grand Junction, Colorado, to GEL Laboratories in Charleston, SC., on May 27, 2015.

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

**Water Level Measurements:** Water levels were measured in all sampled wells. The water level measurements were recorded in FDCS and uploaded to SEEPro database.

**Well Inspection Summary:** All wells sampled were in good condition.

**Sampling Method:**

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

**Field Variance:** None. Samples were collected according to the SAP.

**Equipment:** All equipment functioned properly.

**Stakeholder/Regulatory:** SN3 site lead Rick Hutton observed sampling operations on May 21, 2015.

**Institutional Controls:**

**Fences, Gates, Locks:** None.

**Signs:** None.

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

**Site Issues:**

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

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

**Maintenance Requirements:** None.

**Access Issues:** None.

**Safety Issues:** None.

**Corrective Action Required/Taken:**

- RB-W-01 requires new well cap.

cc: (electronic)  
Art Kleinrath, DOE  
Steve Donovan, SN3  
Rick Findlay, SN3  
Rex Hodges, SN3  
Rick Hutton, SN3  
EDD Delivery