Monitoring Results for Natural Gas Wells Near Project Rulison, 1st Quarter, Fiscal Year 2015

U.S. Department of Energy Office of Legacy Management
Grand Junction, Colorado

Date Sampled: January 7, 2015

Background

Project Rulison was the second Plowshare Program test to stimulate natural gas recovery from deep, low-permeability formations. On September 10, 1969, a 40-kiloton-yield nuclear device was detonated 8,426 feet (1.6 miles) below ground surface in the Williams Fork Formation at what is now the Rulison, Colorado, Site. Following the detonation, a series of production tests were conducted. Afterward, the site was shut down and then remediated, and the emplacement well (R-E) and the reentry well (R-Ex) were plugged.

Purpose

As part of the U.S. Department of Energy (DOE) Office of Legacy Management (LM) mission to protect human health and the environment, LM is monitoring natural gas wells that are near the Rulison site for radionuclides associated with the detonation. The very low permeability of the Williams Fork Formation limits contaminant migration, and institutional controls restrict subsurface access in the detonation zone. When companies apply for a permit to drill wells within 3 miles of the site, the Colorado Oil and Gas Conservation Commission notifies DOE, and the State of Colorado and DOE have an opportunity to review and comment on drilling permits and gas well development practices to help protect human health and the environment from the Rulison-related contaminants. The DOE Rulison Monitoring Plan (LMS/RUL/S06178) provides guidance for sample collection frequency based on distance from the Rulison detonation point, the types of analyses, and the reporting thresholds.

Summary of Results

Due to operational issues at several well heads and bad weather causing safety concerns, the sampling planned for mid-October of 2014 was delayed several times. The natural gas and production water sampling occurred on January 7, 2015. Analytical results of production water samples and natural gas samples collected in January 2015 were all below the screening levels specified in the Rulison Monitoring Plan.

The January sampling effort consisted of sampling a total of 13 natural gas wells. Seven wells (Battlement Mesa [BM] 26-34B, 26-22C, 26-22D, 35-32A, 36-13B, 36-13, and a duplicate from 36-13) produced enough production water volume to conduct all scheduled analyses. At all wells, natural gas was collected and analyzed for tritium and carbon-14. Due to operational issues, a bailer was brought to the 26N to collect downhole production water samples. In well BM 26-33C the production water return lines had an obstruction that limited the potential to bail
production water for sampling. The natural gas temperatures and pressures were lower than normal during this sampling event (Table 2). The well operator was unaware of any operational processes that would cause the lower temperature and pressure to occur.

Table 1 lists the 13 wells, and Table 2 lists the sequential sample collection information.

### Table 1. Sample Collection Locations

<table>
<thead>
<tr>
<th>Pad</th>
<th>Collection Location</th>
<th>Well Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>26N</td>
<td>Wellhead separator</td>
<td>BM 26-33B–D, BM 26-34A–D</td>
</tr>
<tr>
<td>26K</td>
<td>Wellhead separator</td>
<td>BM 26-22B–D</td>
</tr>
<tr>
<td>35C</td>
<td>Wellhead separator</td>
<td>BM 35-32A</td>
</tr>
<tr>
<td>36L</td>
<td>Wellhead separator</td>
<td>BM36-13B</td>
</tr>
<tr>
<td>36B</td>
<td>Wellhead separator</td>
<td>BM36-13</td>
</tr>
</tbody>
</table>

### Table 2. Samples Collected

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Pad</th>
<th>Well Name</th>
<th>Location</th>
<th>Sample Phase</th>
<th>Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26N</td>
<td>BM 26-33B</td>
<td>15743</td>
<td>WL NGSA Yes No 84 264</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>26N</td>
<td>BM 26-33C</td>
<td>15742</td>
<td>WL NGSA Yes No 85 260</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>26N</td>
<td>BM 26-33D</td>
<td>15739</td>
<td>WL NGSA Yes No 84.9 261</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>26N</td>
<td>BM 26-34A</td>
<td>15744</td>
<td>WL NGSA Yes No 83.9 263</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>26N</td>
<td>BM 26-34B</td>
<td>15745</td>
<td>WL NGSA Yes Yes 80.1 258</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>26N</td>
<td>BM 26-34C</td>
<td>15741</td>
<td>WL NGSA Yes No 88.8 256</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>26N</td>
<td>BM 26-34D</td>
<td>15748</td>
<td>WL NGSA Yes Yes 81 259</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>26K</td>
<td>BM 26-22B</td>
<td>16086</td>
<td>WL NGSA Yes No 91.8 239</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>26K</td>
<td>BM 26-22C</td>
<td>16087</td>
<td>WL NGSA Yes Yes 89.1 234</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>26K</td>
<td>BM 26-22D</td>
<td>16074</td>
<td>WL NGSA Yes Yes 83.1 240</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>35C</td>
<td>BM 35-32A</td>
<td>10919</td>
<td>WL NGSA Yes Yes 65.3 270</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>36L</td>
<td>BM 36-13B</td>
<td>15469</td>
<td>WL NGSV Yes Yes 67.7 223</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>36B</td>
<td>BM 36-13</td>
<td>10840</td>
<td>WL NGSV Yes Yes 76.7 287</td>
<td></td>
</tr>
<tr>
<td>Duplicate</td>
<td>36B</td>
<td>BM 36-13</td>
<td>10840</td>
<td>WL NGSV No Yes 76.7 279</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:**
- API: American Petroleum Institute
- NGSA: natural gas well—angle
- NGSV: natural gas well—vertical
- P (psi): pressure in pounds per square inch
- T (°F): temperature in degrees Fahrenheit
- WL: well
Sample Locations

The bottom-hole locations of the 13 gas wells planned for sample collection are between 0.75 mile and 1.07 miles from the Project Rulison detonation point. All gas wells sampled are producing gas from the Williams Fork Formation at a depth near that of the Rulison detonation point.

Sample Collection

A produced-water sample is collected at the wellhead from a tap on the common line connecting two gas-liquid separators and the accumulation tank. The produced water collected from one well separator is isolated from the other well separator by valves. Lines from each of the two separators are purged of produced water and condensate prior to sample collection. Each sample is collected in a new, 1-gallon plastic container. Due to operational issues on the 26N (wells BM 26-33C and 34D), an operator-provided bailer was used to collect production water from the downhole water return line. An obstruction in the production water return line at well BM 26-33C prohibited lowering of the bailer to the water level and the collection of a production water sample.

Gas samples are collected from a tap on the gas line at the separator output. The line between the tap and the sample bottle is purged before sample collection. Each gas sample is collected in an evacuated 18-liter bottle furnished by the laboratory.

Monitoring Protocol

The Rulison Monitoring Plan provides guidance regarding the type and frequency of sample collection as a function of distance and heading from the Rulison detonation point; it also specifies the types of analyses. A copy of the monitoring plan is available at http://www.lm.doe.gov/Rulison/Documents.aspx. Table 3a lists gas-phase screening concentrations for tritium and carbon-14, and Table 3b lists liquid-phase screening concentrations for tritium, gross alpha, gross beta, and the suite of radionuclides identified by high-resolution gamma spectrometry.

Table 3a. Gas-Phase Concentrations for Tritium Sample Results

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Reporting Units</th>
<th>Screening Concentration</th>
<th>Action Concentration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tritium</td>
<td>TU</td>
<td>19,293</td>
<td>TBD</td>
<td>5.183 × 10^{-6} pCi/cc T U^{-1}</td>
</tr>
<tr>
<td>^14 Carbon</td>
<td>pMC</td>
<td>2 pMC</td>
<td>5 pMC</td>
<td>6.54 × 10^{-5} pCi/cc and 16.4 × 10^{-5} pCi/cc, respectively</td>
</tr>
</tbody>
</table>

Abbreviations:
- pCi/cc: picocuries per cubic centimeter
- pCi/cc T U^{-1}: picocuries per cubic centimeter of methane gas per tritium unit
- pMC: percent modern carbon
- TBD: to be determined
- TU: tritium unit
### Table 3b. Liquid-Phase Screening Concentrations for Tritium and Other Radionuclides

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Reporting Units</th>
<th>Screening Concentration</th>
<th>Action Concentration</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>800</td>
<td>TBD</td>
<td>20,000 pCi/L = EPA drinking water standard</td>
</tr>
<tr>
<td>Gross alpha</td>
<td>pCi/L</td>
<td>3× background</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>Gross beta</td>
<td>pCi/L</td>
<td>3× background</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>High-resolution gamma</td>
<td>pCi/L</td>
<td>20</td>
<td>TBD</td>
<td>Based on cesium-137</td>
</tr>
<tr>
<td>spectrometry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lab Method**
- Tritium
- Gross alpha: 3× background
- Gross beta: 3× background

**Notes:**
See the *Rulison Monitoring Plan*, Table 2, for response scenarios to use when the screening concentrations, action concentrations, or both, are exceeded.

The derived air effluent concentration for a 50 millirem per year dose from tritium exposure is 0.10 pCi (tritium)/cc (methane).

**Abbreviations:**
- EPA: U.S. Environmental Protection Agency
- pCi/L: picocuries per liter
- TBD: to be determined

**Results**

Seven of the total 13 sampling locations plus a duplicate at BM 36-13 produced enough production water to analyze for some or all of the Rulison-related contaminants.

Production water analytical results are tabulated by well in Appendix A.

**Laboratory Qualifiers**

A “detect” is a result greater than the laboratory’s reporting threshold or minimum detectable concentration (MDC).

A “nondetect” is a result that is less than the laboratory’s MDC for that sample. The laboratory assigns the qualifier “U” to a nondetect result.

**Data Validation Qualifiers**

A detect result less than 3 times the sample MDC is assigned the data validation qualifier “J” (estimated quantity).

A laboratory detect result less than 3 times the 1-sigma total propagated uncertainty is considered a nondetect. Data validation assigns the qualifier “U” to this result.
Results Summaries

Table 4a is a summary of analytical results for liquid-phase tritium, Table 4b is a summary of results for liquid-phase gross alpha and gross beta, and Table 4c shows results for potassium-40 analyses. Sample volumes not adequate for laboratory analysis are counted as not applicable (NA).

**Table 4a. Summary of Tritium Samples Based on Laboratory-Assigned Qualifiers**

<table>
<thead>
<tr>
<th>Collection Location</th>
<th>Total Samples (gas/liquid) Collected</th>
<th>Tritium Results (gas phase)</th>
<th>Tritium Results (liquid phase)</th>
<th>Carbon-14 (gas phase)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Detect</td>
<td>Nondetect</td>
<td>NA</td>
</tr>
<tr>
<td>Natural gas wells</td>
<td>13/8</td>
<td>0</td>
<td>13</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes:
Natural gas samples were successfully collected from all 13 wells associated with the sampling plan. Well BM 36-13 was selected as a duplicate sampling location where duplicate production water was collected but no natural gas sample was collected.
At wells BM 26-33B, 26-33C, 26-33D, 26-34A, 26-34C, and 26-22B, no production water was produced during sampling operations. Historically, BM 26-33D and BM 26-22B have typically produced no or very small amounts of production water. At BM 26-33C and BM 26-34D the operator utilized a bailer to collect production water from the wells’ water return lines. An obstruction in the water return line was encountered in well BM 26-33C so no production water was collected using the bailer.

**Table 4b. Summary of Gross Alpha and Gross Beta Liquid-Phase Samples Based on Laboratory-Assigned Qualifiers**

<table>
<thead>
<tr>
<th>Collection Location</th>
<th>Total Liquid Samples Collected</th>
<th>Gross Alpha Results</th>
<th>Gross Beta Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Detect</td>
<td>Nondetect</td>
</tr>
<tr>
<td>Natural gas wells</td>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Notes:
Data validation assigned a J qualifier to three gross-alpha detect results.
Data validation assigned a J qualifier to two gross-beta detect results.
No production water was collected from wells BM 26-33B, 26-33C, 26-33D, 26-34A, 26-34C, and 26-22B.

**Table 4c. Summary of Potassium-40 Liquid-Phase Samples Based on Laboratory-Assigned Qualifiers**

<table>
<thead>
<tr>
<th>Collection Location</th>
<th>Total Liquid Samples Collected</th>
<th>Potassium-40 Results</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Detect</td>
</tr>
<tr>
<td>Natural gas wells</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

Notes:
Data validation assigned a J qualifier to both potassium-40 detect results.
No production water was collected from wells BM 26-33B, 26-33C, 26-33D, 26-34A, 26-34C, and 26-22B.
Data Review and Validation Report
Data Validation Package

January 2015
Produced Water Sampling at the Rulison, Colorado, Site

May 2015
Available for sale to the public from:

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Road
Alexandria, VA 22312
Telephone: 800.553.6847
Fax: 703.605.6900
E-mail: orders@ntis.gov

Available electronically at http://www.osti.gov/scitech/

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Phone: 865.576.8401
Fax: 865.576.5728
Email: reports@adonis.osti.gov

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.
Contents

Sampling Event Summary ...............................................................................................................1
Rulison, Colorado, Site Sample Location Map ...............................................................................2
Data Assessment Summary ..........................................................................................................3
  Water Sampling Field Activities Verification Checklist .............................................................5
  Laboratory Performance Assessment .......................................................................................7
  Sampling Quality Control Assessment .....................................................................................18
  Certification ..........................................................................................................................20

Attachment 1—Data Presentation

Produced Water Data
Natural Gas Data

Attachment 2—Trip Report
This page intentionally left blank
Sampling Event Summary

Site: Rulison, Colorado, Site

Sampling Period: January 7, 2015

The U.S. Department of Energy Office of Legacy Management conducted sampling at the Rulison, Colorado, Site on January 7, 2015, in accordance with the 2010 Rulison Monitoring Plan. The Monitoring Plan provides guidance regarding the type and frequency of sample collection as a function of distance and heading from the Rulison detonation point; it also specifies the types of analyses. Natural gas and produced water samples are analyzed for radionuclides to determine if contamination is migrating from the Rulison detonation zone to producing gas wells. Samples were submitted for analysis as follows:

- Natural gas samples were submitted under requisition 14126698 to Isotech Laboratories in Champaign, Illinois, for the determination of carbon-14 and tritium.
- Produced water samples were submitted under requisition 14126699 to ALS Laboratory Group in Fort Collins, Colorado, for the determination of chloride, gross alpha/beta, gamma-emitting nuclides, and tritium.

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 of produced water was collected at location 05-045-10840.

Sample radionuclide results are compared to the screening levels listed in the Monitoring Plan to determine if any further action is merited. None of the results for the 13 wells sampled during this event exceeded the screening levels specified in the Monitoring Plan. The natural gas and produced water sample results are presented in Attachment 1.

Rick Hutton, Site Lead
Stoller Newport News Nuclear, Inc.,
a wholly owned subsidiary of
Huntington Ingalls Industries, Inc.

Date 5-29-15
Data Assessment Summary
This page intentionally left blank
Water Sampling Field Activities Verification Checklist

<table>
<thead>
<tr>
<th>Project</th>
<th>Rulison, Colorado</th>
<th>Date(s) of Water Sampling</th>
<th>January 7, 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date(s) of Verification</td>
<td>April 2, 2015</td>
<td>Name of Verifier</td>
<td>Stephen Donivan</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. Is the SAP the primary document directing field procedures?</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>List any Program Directives or other documents, SOPs, instructions.</td>
<td>Program Directive RUL-2015-01.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Were the sampling locations specified in the planning documents sampled?</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited volume of produced water was available from eight of the wells.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Were calibrations conducted as specified in the above-named documents?</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field measurements were not required.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Was an operational check of the field equipment conducted daily?</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did the operational checks meet criteria?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Were the number and types (alkalinity, temperature, specific conductance, pH, turbidity, DO, ORP) of field measurements taken as specified?</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>This sampling event did not include ground water.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Were wells categorized correctly?</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>This sampling event did not include ground water.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Were the following conditions met when purging a Category I well:</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was one pump/tubing volume purged prior to sampling?</td>
<td>This sampling event did not include ground water.</td>
</tr>
<tr>
<td>Did the water level stabilize prior to sampling?</td>
<td></td>
</tr>
<tr>
<td>Did pH, specific conductance, and turbidity measurements meet criteria prior to sampling?</td>
<td></td>
</tr>
<tr>
<td>Was the flow rate less than 500 mL/min?</td>
<td></td>
</tr>
</tbody>
</table>


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

<table>
<thead>
<tr>
<th></th>
<th>Response (Yes, No, NA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Was the flow rate less than 500 mL/min? NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>This sampling event did not include groundwater.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Was one pump/tubing volume removed prior to sampling?</td>
</tr>
<tr>
<td>9.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A duplicate sample was collected at location 05-045-10840.</td>
</tr>
<tr>
<td>10.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>An equipment blank was not required.</td>
</tr>
<tr>
<td>11.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>A equipment blank was not required.</td>
</tr>
<tr>
<td>12.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sample cooling was not required.</td>
</tr>
<tr>
<td>19.</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>
Laboratory Performance Assessment

General Information

Requisition No. (RIN): 14126699
Sample Event: January 7, 2015
Site(s): Rulison, Colorado, Site
Laboratory: ALS Laboratory Group, Fort Collins, Colorado
Work Order No.: 1501106
Analysis: Radiochemistry and Wet Chemistry
Validator: Stephen Donivan
Review Date: April 2, 2015

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

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Line Item Code</th>
<th>Prep Method</th>
<th>Analytical Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride</td>
<td>WCH-B-011</td>
<td>EPA 300.0</td>
<td>EPA 300.0</td>
</tr>
<tr>
<td>Gamma Spectrometry</td>
<td>GAM-A-001</td>
<td>PA SOP713R11</td>
<td>PA SOP713R11</td>
</tr>
<tr>
<td>Gross Alpha/Beta</td>
<td>GPC-A-001</td>
<td>PA SOP702R19</td>
<td>PA SOP724R10</td>
</tr>
<tr>
<td>Tritium</td>
<td>LCS-A-001</td>
<td>PA SOP700R10</td>
<td>PA SOP704R9</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Location</th>
<th>Analyte</th>
<th>Flag</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1501106-2</td>
<td>BM 26-22C</td>
<td>Gross Alpha</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-3</td>
<td>BM 26-22D</td>
<td>Actinium-228</td>
<td>U</td>
<td>Nuclide identification criteria</td>
</tr>
<tr>
<td>1501106-3</td>
<td>BM 26-22D</td>
<td>Gross Alpha</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-3</td>
<td>BM 26-22D</td>
<td>Potassium-40</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-4</td>
<td>BM 26-34B</td>
<td>Gross Beta</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-5</td>
<td>BM 26-34D</td>
<td>Gross Beta</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-6</td>
<td>BM 35-32A</td>
<td>Actinium-228</td>
<td>U</td>
<td>Nuclide identification criteria</td>
</tr>
<tr>
<td>1501106-7</td>
<td>BM 36-13</td>
<td>Potassium-40</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
<tr>
<td>1501106-8</td>
<td>BM 36-13B</td>
<td>Gross Alpha</td>
<td>J</td>
<td>Less than the determination limit</td>
</tr>
</tbody>
</table>
Sample Shipping/Receiving

ALS Laboratory Group in Fort Collins, Colorado, received eight water samples on January 9, 2015, accompanied by a Chain of Custody form. The Chain of Custody form 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. Copies of the shipping labels were included in the receiving documentation. The Chain of Custody form was complete with no errors or omissions.

Preservation and Holding Times

The sample shipment was received intact at ambient temperature which complies with requirements. All samples were received in the correct container types and had been preserved correctly for the requested analyses. Sample analysis was completed within the applicable holding times.

Detection and Quantitation Limits

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

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

The reported MDLs for the wet chemical analyte and MDCs for radiochemical analytes met the detection limits requirements with the following exceptions. The required detection limits were not met for gross alpha and gross beta samples because of the elevated levels of dissolved solids in the samples.

Laboratory Instrument Calibration

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

Method EPA 300.0, Chloride
Calibration for chloride was performed using five calibration standards on January 2, 2015. The calibration curve correlation coefficient values were greater than 0.995 and the absolute values of the intercepts were less than 3 times the MDL. Initial and continuing calibration verification checks were made at the required frequency with all calibration checks meeting the laboratory’s acceptance criteria.

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

Method and Calibration Blanks
Method blanks are analyzed to assess any contamination that may have occurred during sample preparation. Calibration blanks are analyzed to assess instrument contamination prior to and during sample analysis. All radiochemical method blank results were below the Decision Level Concentration.

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.

Laboratory Replicate Analysis
Laboratory replicate sample results demonstrate acceptable laboratory precision. The relative percent difference value for the chloride matrix spike replicate met the acceptance criteria. The radiochemical relative error ratio (calculated using the one-sigma total propagated uncertainty) for the sample replicates was less than three for all duplicates.

Matrix Spike Analysis
Matrix spike and matrix spike duplicate (MS/MSD) samples are used to measure method performance in the sample matrix. The MS/MSD data are not evaluated when the concentration of the unspiked sample is greater than 4 times the spike concentration. The spike recoveries met the recovery and precision criteria for all analytes evaluated.
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 February 2, 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: 14126699  Lab Code: PAR  Validator: Stephen Donivan  Validation Date: 04/02/2015
Project: Rulison Site  Analysis Type: ☑ Metals  ☑ General Chem  ☑ Rad  ☑ Organics
# of Samples: 8  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 16 detection limit failures.

There was 1 duplicate evaluated.
# SAMPLE MANAGEMENT SYSTEM

Non-Compliance Report: Detection Limits

<table>
<thead>
<tr>
<th>Ticket</th>
<th>Location</th>
<th>Lab Sample ID</th>
<th>Method Code</th>
<th>Lab Method</th>
<th>Analyte Name</th>
<th>Result</th>
<th>Qualifier</th>
<th>Reported Detection Limit</th>
<th>Required Detection Limit</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNJ 712</td>
<td>2687</td>
<td>150106-1</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>150</td>
<td>A</td>
<td>64</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 712</td>
<td>2687</td>
<td>150106-1</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>11.7</td>
<td>J</td>
<td>64</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 765</td>
<td>BM 26-22C</td>
<td>150106-2</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>967</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 765</td>
<td>BM 26-22C</td>
<td>150106-2</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>45.6</td>
<td>A</td>
<td>42</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 768</td>
<td>BM 26-22D</td>
<td>150106-3</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>211</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 768</td>
<td>BM 26-22D</td>
<td>150106-3</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>55</td>
<td>A</td>
<td>47</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 769</td>
<td>BM 26-34B</td>
<td>150106-4</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>68.1</td>
<td>A</td>
<td>75</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 769</td>
<td>BM 26-34B</td>
<td>150106-4</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>8.25</td>
<td>A</td>
<td>20</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 794</td>
<td>BM 26-34D</td>
<td>150106-5</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>120</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 794</td>
<td>BM 26-34D</td>
<td>150106-5</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>32.5</td>
<td>A</td>
<td>45</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 797</td>
<td>BM 55-35A</td>
<td>150106-6</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>143</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 797</td>
<td>BM 55-35A</td>
<td>150106-6</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>16.7</td>
<td>A</td>
<td>41</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 798</td>
<td>BM 56-13</td>
<td>150106-7</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>24.1</td>
<td>A</td>
<td>30</td>
<td>2</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 798</td>
<td>BM 56-13</td>
<td>150106-7</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>18.1</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 799</td>
<td>BM 56-13B</td>
<td>150106-8</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS BETA</td>
<td>17.9</td>
<td>A</td>
<td>45</td>
<td>4</td>
<td>CIL</td>
</tr>
<tr>
<td>MNJ 799</td>
<td>BM 56-13B</td>
<td>150106-8</td>
<td>GPCA-001</td>
<td>24R11</td>
<td>GROSS ALPHA</td>
<td>57.6</td>
<td>A</td>
<td>45</td>
<td>2</td>
<td>CIL</td>
</tr>
</tbody>
</table>
### SAMPLE MANAGEMENT SYSTEM

Radiochemistry Data Validation Worksheet

<table>
<thead>
<tr>
<th>Sample</th>
<th>Analyte</th>
<th>Date Analyzed</th>
<th>Result</th>
<th>Flag</th>
<th>Tracer %R</th>
<th>LCS %R</th>
<th>MS %R</th>
<th>Duplicate RER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM 35-32A</td>
<td>Actinium-228</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Americium-241</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank Spike</td>
<td>Americium-241</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Antimony-125</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Cerium-144</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Cesium-134</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Cesium-137</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank Spike</td>
<td>Cesium-137</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Cobalt-60</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank Spike</td>
<td>Cobalt-60</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Europium-152</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Europium-154</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Europium-155</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank Spike</td>
<td>GROSS ALPHA</td>
<td>01/14/2015</td>
<td></td>
<td></td>
<td>103.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 36-13B</td>
<td>GROSS ALPHA</td>
<td>01/14/2015</td>
<td></td>
<td>-0.06</td>
<td>63.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank</td>
<td>GROSS ALPHA</td>
<td>01/14/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>GROSS ALPHA</td>
<td>01/16/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank Spike</td>
<td>GROSS BETA</td>
<td>01/14/2015</td>
<td></td>
<td></td>
<td>104.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 36-13B</td>
<td>GROSS BETA</td>
<td>01/14/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blank</td>
<td>GROSS BETA</td>
<td>01/14/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>U</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>GROSS BETA</td>
<td>01/16/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM 36-13</td>
<td>H-3</td>
<td>01/28/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.85</td>
</tr>
<tr>
<td>2557</td>
<td>H-3</td>
<td>01/28/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Blank Spike</td>
<td>H-3</td>
<td>01/30/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100.0</td>
</tr>
<tr>
<td>Blank</td>
<td>H-3</td>
<td>01/30/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>99.30</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Lead-212</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.16</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Potassium-40</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.32</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Promethium-144</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Promethium-146</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Ruthenium-106</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.64</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Thorium-234</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.19</td>
</tr>
<tr>
<td>BM 35-32A</td>
<td>Uranium-235</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.18</td>
</tr>
</tbody>
</table>
### SAMPLE MANAGEMENT SYSTEM
Radiochemistry Data Validation Worksheet

<table>
<thead>
<tr>
<th>Sample</th>
<th>Analyte</th>
<th>Date Analyzed</th>
<th>Result</th>
<th>Flag</th>
<th>Tracer %R</th>
<th>LCS %R</th>
<th>MS %R</th>
<th>Duplicate RER</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM 35-32A</td>
<td>Yttrium-88</td>
<td>01/29/2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.65</td>
</tr>
</tbody>
</table>
## SAMPLE MANAGEMENT SYSTEM

### Wet Chemistry Data Validation Worksheet

**RIN**: 14126699  
**Lab Code**: PAR  
**Date Due**: 02/06/2015  
**Matrix**: Water  
**Site Code**: RUL01  
**Date Completed**: 02/03/2015

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Date Analyzed</th>
<th>CALIBRATION</th>
<th>Method</th>
<th>LCS %R</th>
<th>MS %R</th>
<th>MSD %R</th>
<th>DPD</th>
<th>RPD</th>
<th>Serial Dil. %R</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHLORIDE</td>
<td>01/13/2015</td>
<td></td>
<td></td>
<td>0.000</td>
<td>1.000</td>
<td>OK</td>
<td>OK</td>
<td>106.00</td>
<td>110.00</td>
</tr>
</tbody>
</table>
General Information

Requisition (RIN): 14126698
Sample Event: January 1, 2015
Site(s): Rulison, Colorado
Laboratory: Isotech Laboratories
Work Order No.: 27809
Analysis: Radiochemistry
Validator: Stephen Donivan
Review Date: April 2, 2015

This validation was performed according to the *Environmental Procedures Catalog*, (LMS/POL/S04325, continually updated) “Standard Practice for Validation of Environmental Data.” The procedure was applied at Level 1, Data Deliverables Examination. The data were examined to assess the completeness of the deliverables, identify any reporting errors, and assess the usability of the data based on the results of the field duplicate and the laboratory’s evaluation of their data, as described in the narrative provided. The data are acceptable as received. The samples were prepared and analyzed using accepted procedures based on methods specified by line item code, which are listed in Table 1.

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Line Item Code</th>
<th>Prep Method</th>
<th>Analytical Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas Analysis</td>
<td>LMG-01</td>
<td>NA</td>
<td>Gas Chromatography</td>
</tr>
<tr>
<td>Carbon-14 and Tritium</td>
<td>LMG-03</td>
<td>Combustion</td>
<td>Liquid Scintillation Counting</td>
</tr>
</tbody>
</table>

Data Qualifier Summary

None of the analytical results required qualification.

Sample Shipping/Receiving

Isotech Laboratories received 13 natural gas samples on January 12, 2015, accompanied by a Chain of Custody (COC) form. The COC form 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 COC form was complete with no errors or omissions.

Summary

Thirteen natural gas samples were received at Isotech Laboratories and analyzed by gas chromatography to determine the natural gas composition. The samples were then combusted with the resulting water collected for analysis. Carbon-14 and tritium were measured in the water collected by liquid scintillation counting. There were no analytical difficulties noted by the laboratory.
Completeness

The results of the gas chromatography analysis were reported in volume percent showing the average sample composition of 90% methane.

The carbon-14 results were reported in percent modern carbon (pMC). The tritium results were reported in tritium units. Carbon-14 and tritium were not detected in any of the samples.
Sampling Quality Control Assessment

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

Sampling Protocol

The produced water samples were collected from a tap on a common line connecting the output of two separators (each servicing a well) and the nearby accumulation tanks. The collected water sample from one separator was isolated from the other separator by valves. Lines from each of the two separators were purged before sample collection.

Natural gas samples were collected as specified in Program Directive RUL-2013-01 in an evacuated 17.8-liter gas cylinder provided by Isotech Laboratories, Inc. Each sampling container was filled to approximately 25 pounds per square inch with natural gas from each well.

Equipment Blank Assessment

An equipment blank was not required.

Field Duplicate Assessment

Field duplicate samples are collected and analyzed as an indication of overall precision of the measurement process. The precision observed includes both field and laboratory precision and has more variability than laboratory duplicates, which measure only laboratory performance. A duplicate sample was collected from location BM 36-13. For non-radiochemical measurements, the relative percent difference for duplicate results that are greater than 5 times the PQL should be less than 20 percent. For results less than 5 times the PQL, the range should be no greater than the PQL. For radiochemical measurements, the relative error ratio (the ratio of the absolute difference between the sample and duplicate results and the sum of the 1-sigma uncertainties) is used to evaluate duplicate results and should be less than 3. All duplicate results met these criteria demonstrating acceptable precision.
SAMPLE MANAGEMENT SYSTEM

Validation Report: Field Duplicates

RIN: 14126699 Lab Code: PAR Project: Rulison Site Validation Date: 04/02/2015

<table>
<thead>
<tr>
<th>Duplicate: 2657</th>
<th>Sample: BM 36-13</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analyst</strong></td>
<td><strong>Result</strong></td>
</tr>
<tr>
<td>Actinium-228</td>
<td>12.7</td>
</tr>
<tr>
<td>Americium-241</td>
<td>-6.23</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>4.17</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>6.8</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>1.04</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>-1.47</td>
</tr>
<tr>
<td>CHLORIDE</td>
<td>9800</td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>1.72</td>
</tr>
<tr>
<td>Europium-152</td>
<td>-4.24</td>
</tr>
<tr>
<td>Europium-154</td>
<td>-8.58</td>
</tr>
<tr>
<td>Europium-155</td>
<td>-0.599</td>
</tr>
<tr>
<td>GROSS ALPHA</td>
<td>24.1</td>
</tr>
<tr>
<td>GROSS BETA</td>
<td>181</td>
</tr>
<tr>
<td>H-3</td>
<td>-65.8</td>
</tr>
<tr>
<td>Lead-212</td>
<td>0.116</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>150</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>2.89</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>-0.0925</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>-9.12</td>
</tr>
<tr>
<td>Thorium-234</td>
<td>21.3</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>-5.71</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>2.26</td>
</tr>
</tbody>
</table>
Certification

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

Laboratory Coordinator:  
Stephen Donivan  
5-29-2015

Date

Data Validation Lead:  
Stephen Donivan  
5-22-2015

Date
Attachment 1
Data Presentation
Produced Water Data
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>Sample ID</th>
<th>Depth Range (Ft BLS)</th>
<th>Result</th>
<th>Qualifiers</th>
<th>QA</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>12.7</td>
<td>U</td>
<td>#</td>
<td>28</td>
<td>13.5</td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>12.7</td>
<td>U</td>
<td>#</td>
<td>34</td>
<td>20.8</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-6.23</td>
<td>U</td>
<td>#</td>
<td>26</td>
<td>15.1</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-15.4</td>
<td>U</td>
<td>#</td>
<td>92</td>
<td>55.4</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.17</td>
<td>U</td>
<td>#</td>
<td>11</td>
<td>5.79</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>4.04</td>
<td>U</td>
<td>#</td>
<td>12</td>
<td>6.71</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>6.8</td>
<td>U</td>
<td>#</td>
<td>21</td>
<td>12.5</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-12.2</td>
<td>U</td>
<td>#</td>
<td>35</td>
<td>20.8</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.04</td>
<td>U</td>
<td>#</td>
<td>7.1</td>
<td>4.29</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-245</td>
<td>U</td>
<td>#</td>
<td>4.8</td>
<td>2.84</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-1.47</td>
<td>U</td>
<td>#</td>
<td>4.4</td>
<td>2.57</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-.593</td>
<td>U</td>
<td>#</td>
<td>4.7</td>
<td>2.76</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>9600</td>
<td>#</td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>10000</td>
<td>#</td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.72</td>
<td>U</td>
<td>#</td>
<td>5.4</td>
<td>3.25</td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>0.271</td>
<td>U</td>
<td>#</td>
<td>4.8</td>
<td>2.77</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-4.24</td>
<td>U</td>
<td>#</td>
<td>29</td>
<td>16.8</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>9.41</td>
<td>U</td>
<td>#</td>
<td>23</td>
<td>13.9</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
<td>-------------</td>
<td>------</td>
<td>----------------------</td>
<td>---------</td>
<td>------------</td>
<td>-----------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>-8.58</td>
<td>U</td>
<td>#</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>-5.55</td>
<td>U</td>
<td>#</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>-559</td>
<td>U</td>
<td>#</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>-2.85</td>
<td>U</td>
<td>#</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>24.1</td>
<td>U</td>
<td>#</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>11.7</td>
<td>U</td>
<td>#</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>181</td>
<td>#</td>
<td></td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>180</td>
<td>#</td>
<td></td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>0.118</td>
<td>U</td>
<td>#</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>0.492</td>
<td>U</td>
<td>#</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>150</td>
<td>J</td>
<td>#</td>
<td>140</td>
<td></td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>103</td>
<td>U</td>
<td>#</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>2.89</td>
<td>U</td>
<td>#</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>-2.1</td>
<td>U</td>
<td>#</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>-0.925</td>
<td>U</td>
<td>#</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>-1.36</td>
<td>U</td>
<td>#</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>-9.12</td>
<td>U</td>
<td>#</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0</td>
<td>-19.3</td>
<td>U</td>
<td>#</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>
**General Water Quality Data by Location (USEE105) FOR SITE RUL01, Rulison Site**  
REPORT DATE: 04/17/2015  
Location: 05-045-10840 WELL BM 36-13

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Depth Range (Ft BLS)</th>
<th>Result</th>
<th>Qualifiers</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>21.3</td>
<td>U</td>
<td>#</td>
<td>120</td>
</tr>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>34.9</td>
<td>U</td>
<td>#</td>
<td>150</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-65.8</td>
<td>U</td>
<td>#</td>
<td>350</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-133</td>
<td>U</td>
<td>#</td>
<td>320</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-5.71</td>
<td>U</td>
<td>#</td>
<td>35</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>15.7</td>
<td>U</td>
<td>#</td>
<td>25</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>2.26</td>
<td>U</td>
<td>#</td>
<td>4.6</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>0 - 0</td>
<td>-2.96</td>
<td>U</td>
<td>#</td>
<td>13</td>
</tr>
</tbody>
</table>
### General Water Quality Data by Location (USEE105) FOR SITE RUL01, Rulison Site

**REPORT DATE: 04/17/2015**  
**Location: 05-045-10919 WELL BM 35-32A**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>Depth Range (Ft BLS)</th>
<th>Result</th>
<th>Qualifiers</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>18</td>
<td>U</td>
<td>#</td>
<td>17</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-15</td>
<td>U</td>
<td>#</td>
<td>25</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.143</td>
<td>U</td>
<td>#</td>
<td>9.7</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>7.6</td>
<td>U</td>
<td>#</td>
<td>20</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-4.46</td>
<td>U</td>
<td>#</td>
<td>4.6</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.151</td>
<td>U</td>
<td>#</td>
<td>4.1</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>8800</td>
<td>U</td>
<td>#</td>
<td>200</td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.46</td>
<td>U</td>
<td>#</td>
<td>5</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>0.744</td>
<td>U</td>
<td>#</td>
<td>25</td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>17.1</td>
<td>U</td>
<td>#</td>
<td>23</td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-2.98</td>
<td>U</td>
<td>#</td>
<td>10</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>18.7</td>
<td>U</td>
<td>#</td>
<td>41</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>143</td>
<td>U</td>
<td>#</td>
<td>45</td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>1.28</td>
<td>U</td>
<td>#</td>
<td>12</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>114</td>
<td>U</td>
<td>#</td>
<td>120</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>1.16</td>
<td>U</td>
<td>#</td>
<td>3.6</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.53</td>
<td>U</td>
<td>#</td>
<td>4.7</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>6.06</td>
<td>U</td>
<td>#</td>
<td>54</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>QA</td>
</tr>
<tr>
<td>------------------</td>
<td>-------</td>
<td>---------------</td>
<td>--------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>----</td>
</tr>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0 - 30.9</td>
<td>-30.9</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0 - 184</td>
<td>-184</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>8.43</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.16</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Lab</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
<td>-------------</td>
<td>------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>-----</td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>19.2</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.51</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.56</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.83</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.55</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.08</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>9500</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.02</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.1</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-5.99</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>0.515</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>57.6</td>
<td>J</td>
<td>#</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>170</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.03</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>77.6</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>0.497</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.02</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-11</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>QA</td>
</tr>
<tr>
<td>----------------</td>
<td>--------</td>
<td>-------------</td>
<td>------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>----</td>
</tr>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>1.32</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>-64.5</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>8.32</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0</td>
<td>1.64</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>Sample ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Data</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>-------------</td>
<td>-----------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>------</td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>14.5</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>17</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-1.14</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-4.48</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.18</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-0.77</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>6500</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-1.6</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-7.22</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>8.41</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>0.389</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-8.25</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>46.1</td>
<td>J</td>
<td>#</td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>6.63</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>36.3</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>2.21</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>4.04</td>
<td>U</td>
<td>#</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-0.748</td>
<td>U</td>
<td>#</td>
</tr>
</tbody>
</table>
### General Water Quality Data by Location (USEE105) FOR SITE RUL01, Rulison Site
#### REPORT DATE: 04/17/2015
#### Location: 05-045-15745 WELL BM 26-34B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Depth Range (Ft BLS)</th>
<th>Result</th>
<th>Qualifiers</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-62.1</td>
<td>U</td>
<td>#</td>
<td>170</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-112</td>
<td>U</td>
<td>#</td>
<td>350</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>20.7</td>
<td>U</td>
<td>#</td>
<td>23</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>3.01</td>
<td>U</td>
<td>#</td>
<td>6.9</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>QA</td>
<td>Detection Limit</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------</td>
<td>-------------</td>
<td>-----</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>----</td>
<td>-----------------</td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>12.9</td>
<td>U</td>
<td>#</td>
<td>18</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-12</td>
<td>U</td>
<td>#</td>
<td>140</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.86</td>
<td>U</td>
<td>#</td>
<td>10</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-5.47</td>
<td>U</td>
<td>#</td>
<td>24</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-1.42</td>
<td>U</td>
<td>#</td>
<td>4.1</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-7.22</td>
<td>U</td>
<td>#</td>
<td>3.8</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>13000</td>
<td>#</td>
<td></td>
<td>200</td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-255</td>
<td>U</td>
<td>#</td>
<td>3.8</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>3.29</td>
<td>U</td>
<td>#</td>
<td>19</td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-5.03</td>
<td>U</td>
<td>#</td>
<td>22</td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>9.98</td>
<td>U</td>
<td>#</td>
<td>16</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>33.5</td>
<td>U</td>
<td>#</td>
<td>48</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>120</td>
<td>J</td>
<td>#</td>
<td>45</td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.01</td>
<td>U</td>
<td>#</td>
<td>11</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>75</td>
<td>U</td>
<td>#</td>
<td>130</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.22</td>
<td>U</td>
<td>#</td>
<td>3.9</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.13</td>
<td>U</td>
<td>#</td>
<td>4.5</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-8.54</td>
<td>U</td>
<td>#</td>
<td>36</td>
</tr>
</tbody>
</table>
## General Water Quality Data by Location (USEE105) FOR SITE RUL01, Rulison Site

**REPORT DATE:** 04/17/2015  
**Location:** 05-045-15748 WELL BM 26-34D

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Depth Range (Ft BLS)</th>
<th>Result</th>
<th>Qualifiers</th>
<th>QA</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>14</td>
<td>U</td>
<td>#</td>
<td>210</td>
<td>128</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-161</td>
<td>U</td>
<td>#</td>
<td>340</td>
<td>200</td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>3.39</td>
<td>U</td>
<td>#</td>
<td>40</td>
<td>24.4</td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-.103</td>
<td>U</td>
<td>#</td>
<td>8.6</td>
<td>5.11</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers Data</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>-------------</td>
<td>----------------------</td>
<td>--------</td>
<td>-----------------</td>
<td>----------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>45.7</td>
<td>U</td>
<td>#</td>
<td>30</td>
<td>18.9</td>
<td></td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-5.5</td>
<td>U</td>
<td>#</td>
<td>37</td>
<td>22.1</td>
<td></td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>3.49</td>
<td>U</td>
<td>#</td>
<td>11</td>
<td>6.09</td>
<td></td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>5.11</td>
<td>U</td>
<td>#</td>
<td>22</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-2.61</td>
<td>U</td>
<td>#</td>
<td>4.5</td>
<td>2.61</td>
<td></td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-0.99</td>
<td>U</td>
<td>#</td>
<td>4.7</td>
<td>2.72</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>13000</td>
<td>#</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.2</td>
<td>U</td>
<td>#</td>
<td>5.6</td>
<td>3.17</td>
<td></td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-8.73</td>
<td>U</td>
<td>#</td>
<td>26</td>
<td>14.8</td>
<td></td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-8.86</td>
<td>U</td>
<td>#</td>
<td>26</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>1.79</td>
<td>U</td>
<td>#</td>
<td>13</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>58</td>
<td>J</td>
<td>#</td>
<td>47</td>
<td>31.8</td>
<td></td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>211</td>
<td>#</td>
<td>45</td>
<td>45.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-3.43</td>
<td>U</td>
<td>#</td>
<td>14</td>
<td>8.37</td>
<td></td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>158</td>
<td>J</td>
<td>#</td>
<td>120</td>
<td>78.9</td>
<td></td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>2.57</td>
<td>U</td>
<td>#</td>
<td>4.7</td>
<td>2.88</td>
<td></td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-1.86</td>
<td>U</td>
<td>#</td>
<td>5.7</td>
<td>3.32</td>
<td></td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-6.59</td>
<td>U</td>
<td>#</td>
<td>45</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>-----------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>6.32</td>
<td>U</td>
<td>#</td>
<td>140</td>
<td>87.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>58</td>
<td>U</td>
<td>#</td>
<td>330</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>0.58</td>
<td>U</td>
<td>#</td>
<td>44</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>2.14</td>
<td>U</td>
<td>#</td>
<td>5.2</td>
<td>3.15</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>Sample ID</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>-----------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Actinium-228</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>14.2</td>
<td>U</td>
<td>#</td>
<td>32</td>
<td>19.2</td>
</tr>
<tr>
<td>Americium-241</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>28.8</td>
<td>U</td>
<td>#</td>
<td>110</td>
<td>63.9</td>
</tr>
<tr>
<td>Antimony-125</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.9</td>
<td>U</td>
<td>#</td>
<td>10</td>
<td>5.85</td>
</tr>
<tr>
<td>Cerium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>12.3</td>
<td>U</td>
<td>#</td>
<td>26</td>
<td>15.6</td>
</tr>
<tr>
<td>Cesium-134</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-2.98</td>
<td>U</td>
<td>#</td>
<td>4.6</td>
<td>2.65</td>
</tr>
<tr>
<td>Cesium-137</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-0.65</td>
<td>U</td>
<td>#</td>
<td>4.5</td>
<td>2.63</td>
</tr>
<tr>
<td>Chloride</td>
<td>mg/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>9900</td>
<td></td>
<td>#</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Cobalt-60</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>0.484</td>
<td>U</td>
<td>#</td>
<td>4.4</td>
<td>2.58</td>
</tr>
<tr>
<td>Europium-152</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>6.26</td>
<td>U</td>
<td>#</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>Europium-154</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>-9.06</td>
<td>U</td>
<td>#</td>
<td>24</td>
<td>13.6</td>
</tr>
<tr>
<td>Europium-155</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>2.25</td>
<td>U</td>
<td>#</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>45.6</td>
<td>J</td>
<td>#</td>
<td>42</td>
<td>27.6</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>167</td>
<td></td>
<td>#</td>
<td>43</td>
<td>38.9</td>
</tr>
<tr>
<td>Lead-212</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.87</td>
<td>U</td>
<td>#</td>
<td>16</td>
<td>9.49</td>
</tr>
<tr>
<td>Potassium-40</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>115</td>
<td>U</td>
<td>#</td>
<td>130</td>
<td>78.4</td>
</tr>
<tr>
<td>Promethium-144</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>1.04</td>
<td>U</td>
<td>#</td>
<td>4.6</td>
<td>2.74</td>
</tr>
<tr>
<td>Promethium-146</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>0.184</td>
<td>U</td>
<td>#</td>
<td>4.8</td>
<td>2.86</td>
</tr>
<tr>
<td>Ruthenium-106</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>0 - 0</td>
<td>7</td>
<td>U</td>
<td>#</td>
<td>41</td>
<td>24.3</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>Depth Range (Ft BLS)</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------------</td>
<td>----------------------</td>
<td>--------</td>
<td>------------</td>
<td>-----------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thorium-234</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>4.16</td>
<td>U</td>
<td>#</td>
<td>230</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>61.1</td>
<td>U</td>
<td>#</td>
<td>330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uranium-235</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>7.11</td>
<td>U</td>
<td>#</td>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yttrium-88</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>0 - 0</td>
<td>-3.16</td>
<td>U</td>
<td>#</td>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

QA QUALIFIER:
# Validated according to quality assurance guidelines.
This page intentionally left blank
Natural Gas Data
This page intentionally left blank
### Gas Matrix Chemistry Data by Location (USEE510) FOR SITE RUL01, Rulison Site

**REPORT DATE: 06/01/2015**  
**Location:** 05-045-10840 WELL, Natural Gas Well - Angle, BM 36-13

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Ticket Number</th>
<th>Elev. Range (Ft)</th>
<th>Matrix Subtype</th>
<th>Result</th>
<th>Qualifiers</th>
<th>Lab</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N003</td>
<td>MNU 699</td>
<td>8683 - 8683</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N003</td>
<td>MNU 699</td>
<td>8683 - 8683</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers Data</td>
<td>QA</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>--------------</td>
<td>------</td>
<td>---------------</td>
<td>------------------</td>
<td>--------------------</td>
<td>--------</td>
<td>----------------</td>
<td>----</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 698</td>
<td>9236 - 9236</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 698</td>
<td>9236 - 9236</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers Data</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>-------------</td>
<td>-----</td>
<td>---------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>--------</td>
<td>----------------</td>
<td>-----------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 700</td>
<td>8901 - 8901</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td></td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 700</td>
<td>8901 - 8901</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td></td>
<td>0.0514</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (FT)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Lab</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>------</td>
<td>---------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------</td>
<td>-----</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 690</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td></td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 690</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td></td>
<td></td>
<td>0.0514</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Lab</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
</tr>
<tr>
<td>--------------</td>
<td>-------</td>
<td>-------------</td>
<td>----</td>
<td>---------------</td>
<td>------------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------</td>
<td>-----</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 693</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 693</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>#</td>
<td>0.0514</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers Data</td>
<td>QA</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-------------</td>
<td>-----</td>
<td>---------------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>--------</td>
<td>-----------------</td>
<td>----</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 689</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 689</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
<td></td>
</tr>
</tbody>
</table>
### Gas Matrix Chemistry Data by Location (USEE510) FOR SITE RUL01, Rulison Site

**REPORT DATE:** 06/01/2015  
**Location:** 05-045-15743 WELL, Natural Gas Well - Angle, BM 26-33B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Ticket Number</th>
<th>Elev. Range (Ft)</th>
<th>Matrix Subtype</th>
<th>Result</th>
<th>Qualifiers</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 688</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 688</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (FT)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers Data</td>
<td>QA</td>
<td>Detection Limit</td>
</tr>
<tr>
<td>---------------</td>
<td>-------</td>
<td>-------------</td>
<td>-----</td>
<td>---------------</td>
<td>------------------</td>
<td>------------------</td>
<td>--------</td>
<td>----------------</td>
<td>----</td>
<td>----------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 691</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 691</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
</tr>
</tbody>
</table>
## Gas Matrix Chemistry Data by Location (USEE510) FOR SITE RUL01, Rulison Site

**Report Date:** 06/01/2015  
**Location:** 05-045-15745 WELL, Natural Gas Well - Angle, BM 26-34B

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Ticket Number</th>
<th>Elev. Range (FT)</th>
<th>Matrix Subtype</th>
<th>Result</th>
<th>Qualifiers Lab Data QA</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 692</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 692</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Data</td>
<td>QA</td>
</tr>
<tr>
<td>-----------</td>
<td>-------</td>
<td>-------------</td>
<td>------</td>
<td>---------------</td>
<td>------------------</td>
<td>-----------------</td>
<td>--------</td>
<td>------------</td>
<td>------</td>
<td>----</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 694</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 694</td>
<td>8963.5 - 8963.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (FT)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers</td>
<td>Detection Limit</td>
<td>Uncertainty</td>
</tr>
<tr>
<td>------------</td>
<td>----------</td>
<td>-------------</td>
<td>-------</td>
<td>---------------</td>
<td>------------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 697</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 697</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
</tr>
<tr>
<td>Parameter</td>
<td>Units</td>
<td>Sample Date</td>
<td>ID</td>
<td>Ticket Number</td>
<td>Elev. Range (Ft)</td>
<td>Matrix Subtype</td>
<td>Result</td>
<td>Qualifiers</td>
<td>QA</td>
<td>Detection Limit</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>-------------</td>
<td>------</td>
<td>---------------</td>
<td>-----------------</td>
<td>----------------</td>
<td>--------</td>
<td>------------</td>
<td>----</td>
<td>----------------</td>
</tr>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 695</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td>#</td>
<td>0.2</td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N001</td>
<td>MNU 695</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td>0.0514</td>
</tr>
</tbody>
</table>
Gas Matrix Chemistry Data by Location (USEE510) FOR SITE RUL01, Rulison Site
REPORT DATE: 06/01/2015
Location: 05-045-16087 WELL, Natural Gas Well - Angle, BM 26-22C

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Sample Date</th>
<th>ID</th>
<th>Ticket Number</th>
<th>Elev. Range (Ft)</th>
<th>Matrix Subtype</th>
<th>Result</th>
<th>Lab</th>
<th>Data</th>
<th>QA</th>
<th>Detection Limit</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-14</td>
<td>pMC</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 696</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.2</td>
<td>U</td>
<td></td>
<td>#</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Tritium</td>
<td>pCi/L</td>
<td>01/07/2015</td>
<td>N002</td>
<td>MNU 696</td>
<td>8983.5 - 8983.5</td>
<td>NATURAL GAS</td>
<td>0.0514</td>
<td>U</td>
<td>#</td>
<td></td>
<td>0.0514</td>
<td></td>
</tr>
</tbody>
</table>

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.
H Estimated value.
L Less than 3 bore volumes purged prior to sampling.
Q Qualitative result due to sampling technique.
R Unusable result.
U Parameter analyzed for but was not detected.
X Location is undefined.

QA QUALIFIER:
# Validated according to quality assurance guidelines.
Attachment 2
Trip Report
Trip Report
Natural Gas Wells near Project Rulison
First Quarter 2015

U.S. Department of Energy Office of Legacy Management
Grand Junction, Colorado

Date Sampled
January 7, 2015

Background

Project Rulison was the second Plowshare Program test to investigate using a nuclear detonation to stimulate natural gas recovery from deep, low-permeability formations. On September 10, 1969, a 40-kiloton-yield nuclear device was detonated 8,426 feet (1.6 miles) below ground surface in the Williams Fork Formation, at what is now the Rulison, Colorado, Site. A series of production tests followed the detonation, and the site was subsequently shut down, the emplacement well (R-E) and reentry well (R-Ex) were plugged, and the surface soils were remediated.

Purpose

As part of the U.S. Department of Energy (DOE) Office of Legacy Management (LM) mission to protect human health and the environment, LM is monitoring natural gas wells near the Rulison site for radionuclides associated with the detonation. The very low permeability of the Williams Fork Formation limits contaminant migration in the subsurface and institutional controls limit subsurface access near the detonation zone. The Colorado Oil and Gas Conservation Commission notifies DOE of any drilling permit activity within 3 miles of the site. The State and DOE review drilling permits and gas well development practices within this boundary to ensure that drilling activities maintain a safe distance from the detonation zone. The DOE Rulison Monitoring Plan (LMS/RUL/S06178) provides guidance for sample collection frequency based on distance from the Rulison detonation point, the types of analyses, and the reporting thresholds. The purpose of this trip was to collect natural gas and production water from producing natural gas wells in the Battlement Mesa (BM) field. The sampled wells collect natural gas from the formation horizon where the Project Rulison detonation occurred. The well locations are within 1.5 miles of the detonation location (surface ground zero on Figure 1).

Summary of Results

During the first quarter of 2015, several attempts were made to collect production water and natural gas samples. Due to operational issues at the well heads and bad weather conditions causing safety concerns, the sampling planned for October through December 2014 timeframe was delayed and occurred on January 7, 2015. Operational issues continued during this sampling January 7th sampling event with most of the wells on Pad 26N, not producing production water for unknown reasons. All planned natural gas samples were collected. The operator that owns the wells brought a bailer to collect water samples but obstructions in the water return lines limited
the potential to bail production water for sampling. The following wells were sampled: seven producing gas wells on Pad 26N, three gas wells on Pad 26K, one well on Pad 35C, one well on Pad 36L, and one well on Pad 36B.

For the 10 wells sampled on Pads 26N and 26K, the bottom-hole locations are between 0.76 mile and 1.1 miles from the Project Rulison vertical emplacement well 25-95 (R-E). Wells on Pads 35C and 36L are approximately 0.95 mile from the detonation point. The well on Pad 36B is approximately 0.55 mile southeast of well 25-95 (R-E). Surface projections of the bottom-hole well locations and Project Rulison surface ground zero, at well 25-95 (R-E) (i.e., the detonation point), are shown in Figure 1.

Notes:
All wells sampled have been previously sampled by DOE.
The first two numerals in the well name designate the section number of the bottom-well location in the BM field.
The Project Rulison emplacement well, 25-95 (R-E) (i.e., ground zero), is located in Lot 11, Section 25.

Figure 1. Wells Sampled and Well 25-95 (R-E)

Table 1 lists the wells by sample-collection sequence. Before sample collection occurs at each well, each well’s pressure and temperature (see Table 2) were read and recorded from surface transducers in the wells. Latitude and longitude values (not shown in Table 2) were compiled from survey plats included with the applications for permits to drill and from Colorado Oil and Gas Conservation Commission scout cards.
All planned wellheads were available for sampling, and wellhead pressures and temperatures were lower than normal. A total of seven 1-gallon production-water samples were collected for total analysis. At six locations—26-33B, 26-33C, 26-33D, 26-34A, 26-34C, and 26-22B—no production water was collected. A duplicate sample was collected from BM 36-13 and is noted in Table 2. All other well functions were performing normally, so no impact to the analytical data is expected.

Table 2. Samples Collected

<table>
<thead>
<tr>
<th>Sample Collection Sequence</th>
<th>Pad</th>
<th>Well Name</th>
<th>Location</th>
<th>API #</th>
<th>Type</th>
<th>Subtype</th>
<th>Gas</th>
<th>Liquid</th>
<th>T (°F)</th>
<th>P (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26N</td>
<td>BM 26-33B</td>
<td>WL</td>
<td>15739</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>84</td>
<td>264</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>26N</td>
<td>BM 26-33C</td>
<td>WL</td>
<td>15742</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>85</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>26N</td>
<td>BM 26-33D</td>
<td>WL</td>
<td>15743</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>84.9</td>
<td>261</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>26N</td>
<td>BM 26-34A</td>
<td>WL</td>
<td>15744</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>83.9</td>
<td>263</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>26N</td>
<td>BM 26-34B</td>
<td>WL</td>
<td>15745</td>
<td>NGSA</td>
<td>Yes</td>
<td>Yes</td>
<td>80.1</td>
<td>258</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>26N</td>
<td>BM 26-34C</td>
<td>WL</td>
<td>15741</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>88.8</td>
<td>256</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>26N</td>
<td>BM 26-34D</td>
<td>WL</td>
<td>15748</td>
<td>NGSA</td>
<td>Yes</td>
<td>Yes</td>
<td>81</td>
<td>259</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>26K</td>
<td>BM 26-22B</td>
<td>WL</td>
<td>16086</td>
<td>NGSA</td>
<td>Yes</td>
<td>No</td>
<td>91.5</td>
<td>239</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>26K</td>
<td>BM 26-22C</td>
<td>WL</td>
<td>16087</td>
<td>NGSA</td>
<td>Yes</td>
<td>Yes</td>
<td>89.1</td>
<td>234</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>26K</td>
<td>BM 26-22D</td>
<td>WL</td>
<td>16074</td>
<td>NGSA</td>
<td>Yes</td>
<td>Yes</td>
<td>83.1</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>35C</td>
<td>BM 35-32A</td>
<td>WL</td>
<td>10919</td>
<td>NGSV</td>
<td>Yes</td>
<td>Yes</td>
<td>65.3</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>36L</td>
<td>BM 36-13B</td>
<td>WL</td>
<td>15469</td>
<td>NGSV</td>
<td>Yes</td>
<td>Yes</td>
<td>67.7</td>
<td>223</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>36B</td>
<td>BM 36-13</td>
<td>WL</td>
<td>10840</td>
<td>NGSV</td>
<td>Yes</td>
<td>Yes</td>
<td>76.7</td>
<td>279</td>
<td></td>
</tr>
<tr>
<td>Duplicate</td>
<td>36B</td>
<td>BM 36-13</td>
<td>WL</td>
<td>10840</td>
<td>NGSV</td>
<td>No</td>
<td>Yes</td>
<td>76.7</td>
<td>279</td>
<td></td>
</tr>
</tbody>
</table>

a BM 26-34D included approximately 400ML of production water.

Abbreviations:
API American Petroleum Institute
NGSA natural gas well–angle
NGSV natural gas well–vertical
P (psi) pressure in pounds per square inch
T (°F) temperature in degrees Fahrenheit
WL well

The produced-water samples were collected from a tap on a common line connecting the output of two separators (each servicing a well) and the nearby accumulation tanks. With the wells on Pad 26N continuing to have operational issues, a well head service company installed a bailer to try to collect production water. The collected water sample from one separator was isolated from the other separator by valves. Lines from each of the two separators were purged before sample collection.

Water condensation is variable and often not desired for the planned analytes. Collected sample volumes (Table 3) varied due to the water vapor concentration in the gas, temperature, age of the well, the cycle times of the well plunger, and transfer to the accumulation tank. Analysis priorities are tritium, gross alpha/beta, technetium-99, and high-resolution gamma spectrometry.
If condensate was collected with a sample, which happens for most samples, the condensate naturally separated from water after a short time in the sample bottle. The condensate was decanted in the field and returned to the operator. Table 3 lists the estimated sample volumes (including the condensate).

Table 3. Collected Water Sample Volumes (Before Decanting)

<table>
<thead>
<tr>
<th>Sample Ticket</th>
<th>Well Name</th>
<th>Planned Analytes</th>
<th>Sample Volume (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BM 26-33B</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>2</td>
<td>BM 26-33C</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>3</td>
<td>BM 26-33D</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>4</td>
<td>BM 26-34A</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>5</td>
<td>BM 26-34B</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
<tr>
<td>6</td>
<td>BM 26-34C</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>7</td>
<td>BM 26-34D</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L 400ML</td>
</tr>
<tr>
<td>8</td>
<td>BM 26-22B</td>
<td>NA</td>
<td>No Sample</td>
</tr>
<tr>
<td>9</td>
<td>BM 26-22C</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
<tr>
<td>10</td>
<td>BM 26-22D</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 1.75 L</td>
</tr>
<tr>
<td>11</td>
<td>BM 35-32A</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
<tr>
<td>12</td>
<td>BM 36-13B</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
<tr>
<td>13</td>
<td>BM 36-13</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
<tr>
<td>Duplicate</td>
<td>BM 36-13</td>
<td>$^3$H, Gross $\alpha/\beta$, Gamma spec, $\text{Cl}^-$, $^{99}$Tc</td>
<td>≈ 2.5 L</td>
</tr>
</tbody>
</table>

Notes:
Water sample information is listed in the order of collection.
Wells BM 26-33B, BM 26-33C, BM 26-33D, BM 26-34A, BM 26-34C, and BM 26-22B did not produce water for laboratory analyses.

Abbreviations:
- $\text{Cl}^-$: chloride
- Gamma spec: high-resolution gamma spectrometry analysis
- Gross $\alpha/\beta$: gross alpha and beta analyses
- $^3$H: tritium
- L: liter
- NA: not applicable
- $^{99}$Tc: technetium-99

Equipment

Each produced-water sample was collected in a new, 1-gallon plastic bottle. After decanting, each water sample was poured into white, high-density polyethylene bottles of appropriate volumes for analysis.
Isotech Analysis Report
This page intentionally left blank
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>mol. %</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.10</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>2.47</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Methane</td>
<td>91.40</td>
<td>100.0</td>
<td>-32.62</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.11</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Propane</td>
<td>0.989</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.220</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>N-butane</td>
<td>0.206</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.108</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0728</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.324</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1062
Specific gravity, calculated: 0.625

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical Composition</th>
<th>(\delta^{13}C)</th>
<th>(\delta^D)</th>
<th>(^{14}C) conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>3.29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>90.17</td>
<td>-32.77</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.245</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.236</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.0989</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0704</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.203</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1055
Specific gravity, calculated: 0.634

\(nd = \) not detected. \(na = \) not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
Lab #: 482744  Job #: 27809  IS-61901  Co. Job#: 
Sample Name: Ticket #MNU 697
Company: S.M. Stoller
API/Well: 
Container: Isotech LP Tank
Field/Site Name: Rulison Site
Location: BM 26-22D
Formation/Depth: 
Sampling Point: 
Date Sampled: 1/07/2015
Date Received: 1/12/2015
Date Reported: 2/12/2015

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.076</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>3.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>89.25</td>
<td>-34.68</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.301</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.290</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.0972</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0621</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.289</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1065
Specific gravity, calculated: 0.644

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
### Analysis Report

**Sample Information**
- **Lab #**: 482745
- **Job #**: 27809
- **IS-61901**
- **Co. Job#**: IS-61901
- **Co. Lab#**: IS-61901
- **Ticket #MNU 688**
- **Company**: S.M. Stoller
- **API/Well**: Isotech LP Tank
- **Field/Site Name**: Rulison Site
- **Location**: BM 26-33B
- **Sampling Point**: IS-61901 Co. Job#
- **Container**: Isotech LP Tank
- **Date Sampled**: 1/07/2015
- **Date Received**: 1/12/2015
- **Date Reported**: 2/12/2015
- **Date Reported**: IS-61901 Co. Lab#
- **Company**: S.M. Stoller
- **Ticket #MNU 688**
- **Cylinder**: 6067

### Chemical Compositions

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>0.082</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>1.81</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>90.74</td>
<td>-34.96</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.278</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.287</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.113</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0829</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.249</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated**: 1075

**Specific gravity, calculated**: 0.627

*nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.*
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mol. %</td>
<td>‰</td>
<td>‰</td>
<td>pMC</td>
<td>TU</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.068</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>2.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>89.94</td>
<td>-34.05</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.80</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.294</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.280</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.116</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0833</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.241</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1069
Specific gravity, calculated: 0.636

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
### Component Analysis

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical mol. %</th>
<th>$\delta^{13}C$</th>
<th>$\delta^D$</th>
<th>$^{14}C$ conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td>1</td>
<td>-</td>
<td>&lt; 10.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td>4.03</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td>0.296</td>
<td>0.253</td>
<td>0.109</td>
<td>0.0774</td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td>1.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td>5.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.076</td>
<td>-33.26</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>88.59</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>5.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>1.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>2.53</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>0.296</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>1.09</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.0774</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.277</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1059
Specific gravity, calculated: 0.648

**Notes:**
- **nd** = not detected.
- **na** = not analyzed.
- Isotopic composition of hydrogen is relative to VSMOW.
- Isotopic composition of carbon is relative to VPDB.
- Calculations for BTU and specific gravity per ASTM D3588.
- Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
Isotech LP Tank
Rulison Site
BM 26-34A

Date Sampled: 1/07/2015
Date Received: 1/12/2015
Date Reported: 2/12/2015

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical mol. %</th>
<th>δ(^{13})C ‰</th>
<th>δD ‰</th>
<th>(^{14})C conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.069</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>2.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>89.94</td>
<td>-37.02</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>5.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.313</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.319</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.134</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.107</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.281</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1085
Specific gravity, calculated: 0.636

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>mol. %</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.059</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>4.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>87.81</td>
<td>-33.65</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>5.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.287</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.196</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.106</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0830</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.259</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1047
Specific gravity, calculated: 0.654

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
### Analysis Report

**Lab #:** 482750  
**Job #:** 27809  
**IS-61901**  
**Co. Job#:**  
**Co. Lab#:**  
**Ticket #MNU 693**  
**Company:** S.M. Stoller  
**Cylinder:** 6078

**Container:** Isotech LP Tank  
**Field/Site Name:** Rulison Site  
**Location:** BM 26-34C  
**Date Sampled:** 1/07/2015  
**Date Received:** 1/12/2015  
**Date Reported:** 2/12/2015

### Component

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>mol. %</th>
<th>δ¹³C</th>
<th>δD</th>
<th>¹⁴C conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td></td>
<td>0.068</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td></td>
<td>3.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td></td>
<td>90.00</td>
<td>-34.01</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td></td>
<td>4.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td></td>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td></td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td></td>
<td>0.268</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td></td>
<td>0.262</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td></td>
<td>0.110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td></td>
<td>0.0806</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td></td>
<td>0.259</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated:** 1065  
**Specific gravity, calculated:** 0.636

*nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.*
Lab #: 482751    Job #: 27809    IS-61901    Co. Job#: 
Sample Name: Ticket #MNU 694    Co. Lab#: 
Company: S.M. Stoller    Cylinder: 6103
API/Well: 
Container: Isotech LP Tank 
Field/Site Name: Rulison Site
Location: BM 26-34D
Formation/Depth: 
Sampling Point: 
Date Sampled: 1/07/2015    Date Received: 1/12/2015    Date Reported: 2/12/2015

<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>13C</th>
<th>14C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mol. %</td>
<td>‰</td>
<td>pMC</td>
<td>TU</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.072</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>3.28</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>89.59</td>
<td>-34.70</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
</tr>
<tr>
<td>Ethane</td>
<td>4.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.274</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.246</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.0946</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0677</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.239</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1063
Specific gravity, calculated: 0.638

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical mol. %</th>
<th>δ¹³C %</th>
<th>δD %</th>
<th>δ¹⁴C conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.065</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>3.79</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>89.53</td>
<td>-32.49</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.226</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.208</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.0808</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0561</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.193</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1050
Specific gravity, calculated: 0.638

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %. 
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical</th>
<th>δ(^{13})C</th>
<th>δD</th>
<th>(^{14})C conc.</th>
<th>Tritium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>1.24</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Methane</td>
<td>91.77</td>
<td>-35.11</td>
<td>&lt;  0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>4.72</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Propane</td>
<td>1.28</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.249</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N-butane</td>
<td>0.256</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Iso-pentane</td>
<td>0.0981</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0715</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.176</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73psia, calculated: 1079
Specific gravity, calculated: 0.617

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
<table>
<thead>
<tr>
<th>Component</th>
<th>Chemical mol. %</th>
<th>$\delta^{13}$C</th>
<th>$\delta^D$</th>
<th>$^{14}$C conc. pMC</th>
<th>Tritium TU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helium</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argon</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen</td>
<td>0.064</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>3.86</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methane</td>
<td>87.99</td>
<td>-33.40</td>
<td>&lt; 0.2</td>
<td>&lt; 10.0</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>5.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>1.33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Propylene</td>
<td>nd</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iso-butane</td>
<td>0.283</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-butane</td>
<td>0.242</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iso-pentane</td>
<td>0.101</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-pentane</td>
<td>0.0712</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hexanes +</td>
<td>0.289</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total BTU/cu.ft. dry @ 60deg F & 14.73 psia, calculated: 1067
Specific gravity, calculated: 0.650

nd = not detected. na = not analyzed. Isotopic composition of hydrogen is relative to VSMOW. Isotopic composition of carbon is relative to VPDB. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100%. Mol. % is approximately equal to vol. %.
This page intentionally left blank