

**Project Rio Blanco  
Monitoring Results  
For Separated Water at a  
Natural Gas Plant, Parachute, Colorado**

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

Date Sampled: 1 December 2010

Purpose:

Test the separated water sample-collection procedure at the Parachute Creek Gas Plant.

Background:

Natural gas from wells in local gas fields is sent by pipelines to the processing plant in Parachute, Colorado. Some of the gas comes from wells near the sites of Project Rulison and Project Rio Blanco—Plowshare Program sites—where deeply buried nuclear devices were detonated (10 September 1969 and 17 May 1973, respectively) to stimulate the recovery of natural gas. Sampling the water removed from the gas and performing laboratory analyses on it for residual radionuclides—especially tritium—monitors the subsurface regions drained by the gas wells.

Samples Collected:

- 1 separated water sample from a glycol regeneration unit

Findings:

- No analytical result exceeded its respective screening level.

Sample Collection Location:

The sample was collected from a spigot on regeneration unit PC2. The regeneration unit removes water collected by the triethylene glycol/ethylene glycol in the counter-current contactor unit.

Sample Name: PC2\_TEG\_EG

Sample Ticket Number: IMR 240

Requisition Identification Number (RIN): 10113481 (GEL Laboratories, Charleston, SC 29407)

Monitoring Protocol:

*Rulison Monitoring Plan* (July 2010, LMS/RUL/S06178)

A copy is available at <http://www.lm.doe.gov/Rulison/Documents.aspx>

*Table 1a. Gas-Phase Screening and Action Concentrations for Tritium Sample Results*

| Analyte | Reporting Units | Screening conc. | Action Conc. | Comment                          |
|---------|-----------------|-----------------|--------------|----------------------------------|
| Tritium | TU              | 19,293          | TBD          | $5.183 \times 10^{-6}$ pCi/cc/TU |

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

*Table 1b. Liquid-Phase Screening and Action Concentrations for Tritium and Various Analytical Method Results*

| Analyte                            | Reporting Units | Screening conc. | Action Conc. | Comment                                    |
|------------------------------------|-----------------|-----------------|--------------|--|
| Tritium                            | pCi/L           | 800             | TBD          | 20,000 pCi/L = EPA drinking water standard |
| <b>Lab Method</b>                  |                 |                 |              |  |
| Gross alpha                        | pCi/L           | 3x background   | TBD          |  |
| Gross beta                         | pCi/L           | 3x background   | TBD          |  |
| High-resolution gamma spectroscopy | pCi/L           | 20              | TBD          | Based on cesium-137                        |

Table 1 Notes: See the Rulison Monitoring Plan, Table 2, for response scenarios when the screening and/or action concentrations are exceeded.

TU: tritium unit

pCi/cc/TU: picocurie per cubic centimeter per tritium unit

pCi/L: picocuries per liter

TBD: to be determined

Results Summary:

- 1 liquid sample was collected at a regeneration unit

Laboratory Qualifiers:

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

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

Data Validation Qualifiers:

A “detect” result less than 3 times the sample MDC is assigned the data qualifier “J.”

A laboratory result less than three times the one-sigma total propagated uncertainty is considered a “nondetect” and assigned the data qualifier “U.” Three times the one-sigma propagated uncertainty is called the Decision Level Concentration.

“NA” denotes missing results.

*Table 2a. Summary of Tritium Results for Gas- and Liquid-Phase Samples*

| Collection Point  | Total Sampled (gas/liquid) | Tritium (gas phase) |           |    | Tritium (liquid phase) |           |    |
|-------------------|----------------------------|---------------------|-----------|----|------------------------|-----------|----|
|                   |                            | Detect              | Nondetect | NA | Detect                 | Nondetect | NA |
| Regeneration unit | 0/1                        | –                   | –         | –  | –                      | 1         | –  |

Table 2b. Summary of Gross Count Results for Liquid Phase-Samples

| Collection Point  | Total Sampled | Gross Alpha Counting |           |    | Gross Beta Counting |           |    |
|-------------------|---------------|----------------------|-----------|----|---------------------|-----------|----|
|                   |               | Detect               | Nondetect | NA | Detect              | Nondetect | NA |
| Regeneration unit | 1             | –                    | 1         | –  | –                   | 1         | –  |

Table 2c. Summary of Potassium-40 Results for Liquid-Phase Samples

| Collection Point  | Total Sampled | Potassium-40 |           |    |
|-------------------|---------------|--------------|-----------|----|
|                   |               | Detect       | Nondetect | NA |
| Regeneration unit | 1             | –            | 1         | –  |

## **Liquid Phase Sample Results**

**RESULTS REPORT**  
**RIN: 10113481**  
**Site: Rio Blanco Site**  
**Site Code: RUL01 Location: PC2\_TEG\_EG**  
**Ticket Number: IMR 240**  
**Report Date: 1/19/2011**

| Parameter      | Units | Sample Date | ID   | Result | TPU <sup>1</sup> | Lab | Qualifiers Data | QA |
|----------------|-------|-------------|------|--------|------------------|-----|-----------------|----|
| Actinium-228   | pCi/L | 12/01/2010  | N001 | -3.49  | 14.7             | U   |                 | #  |
| Americium-241  | pCi/L | 12/01/2010  | N001 | -18.7  | 27.4             | U   |                 | #  |
| Antimony-125   | pCi/L | 12/01/2010  | N001 | 3.95   | 8.00             | U   |                 | #  |
| Cerium-144     | pCi/L | 12/01/2010  | N001 | -18.6  | 21.3             | U   |                 | #  |
| Cesium-134     | pCi/L | 12/01/2010  | N001 | -1.52  | 3.41             | U   |                 | #  |
| Cesium-137     | pCi/L | 12/01/2010  | N001 | -1.96  | 2.63             | U   |                 | #  |
| Cobalt-60      | pCi/L | 12/01/2010  | N001 | 1.51   | 3.05             | U   |                 | #  |
| Europium-152   | pCi/L | 12/01/2010  | N001 | -1.05  | 8.80             | U   |                 | #  |
| Europium-154   | pCi/L | 12/01/2010  | N001 | -3.99  | 9.36             | U   |                 | #  |
| Europium-155   | pCi/L | 12/01/2010  | N001 | 4.47   | 11.6             | U   |                 | #  |
| Lead-212       | pCi/L | 12/01/2010  | N001 | 1.79   | 7.53             | U   |                 | #  |
| Potassium-40   | pCi/L | 12/01/2010  | N001 | 52.5   | 45.4             | U   |                 | #  |
| Promethium-144 | pCi/L | 12/01/2010  | N001 | 0.978  | 2.88             | U   |                 | #  |
| Promethium-146 | pCi/L | 12/01/2010  | N001 | -0.835 | 3.88             | U   |                 | #  |
| Ruthenium-106  | pCi/L | 12/01/2010  | N001 | 7.34   | 25.7             | U   |                 | #  |
| Thorium-234    | pCi/L | 12/01/2010  | N001 | -40.4  | 227              | U   |                 | #  |
| Uranium-235    | pCi/L | 12/01/2010  | N001 | -10.2  | 24.1             | U   |                 | #  |
| Uranium-238    | pCi/L | 12/01/2010  | N001 | -40.4  | 227              | U   |                 | #  |

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| Parameter   | Units | Sample Date | ID   | Result | TPU <sup>1</sup> | Lab | Qualifiers Data | QA |
|-------------|-------|-------------|------|--------|------------------|-----|-----------------|----|
| Yttrium-88  | pCi/L | 12/01/2010  | N001 | 0.469  | 3.99             | U   |                 | #  |
| GROSS ALPHA | pCi/L | 12/01/2010  | N001 | 0.405  | 0.655            | U   |                 | #  |
| GROSS BETA  | pCi/L | 12/01/2010  | N001 | 0.494  | 1.52             | U   |                 | #  |
| Tritium     | pCi/L | 12/01/2010  | N001 | 18.8   | 192              | U   |                 | #  |
| Chloride    | mg/L  | 12/01/2010  | N001 | 1.22   |                  |     |                 | #  |

<sup>1</sup>TPU – Total Propagated Uncertainty including both random and systematic errors reported at 2-sigma.

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

**LAB QUALIFIERS:**

U Analytical result below detection limit.

**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 at Level 1 according to quality assurance guidelines.