

**Monitoring Results
Natural Gas Wells
near the Project Rio Blanco Horizon**

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

Date Sampled: 13 September 2010

Purpose:

The purpose of this sample collection is to monitor natural gas wells for radionuclides from Project Rio Blanco. The bottom-hole locations (BHLs) of the 3 gas wells sampled are within 1.4 miles of the Project Rio Blanco detonation horizon. All wells sampled have produced or are producing gas from the Mesaverde Group.

Background:

Project Rio Blanco is the Plowshare Program code name for the near-simultaneous detonation of a three 33-kiloton-yield nuclear devices in one emplacement well (RB-E-01) on 17 May 1973. The devices were detonated at 5,839-feet, 6,230-feet, and 6,689-feet below the ground surface. The shallowest device (at 5,839 feet) was detonated in the lower part of the Fort Union Formation, the middle and deepest devices were detonated in the Mesaverde Group. The purpose of the test was to stimulate recovery of natural gas in low permeability gas sands.

Samples Collected:

- 3 gas samples from 3 wells
- 1 produced water sample from 1 well

Findings:

- No analytical result exceeded its respective screening level.

Table 1. Sample Collection Locations

Pad	Collection Point	Common name
unknown	well head separator	Federal RG 24-13-398
unknown	well head	Government Federal MHF-3
unknown	well head	Government Federal 398-10-1

Each natural gas sample was collected in an evacuated 18-liter propane tank. After collection, the sample-tank pressure was typically 20 to 25 pounds per square inch. The natural gas sample from well Federal RG 24-13-398 was collected after the gas-liquid separator. The other gas wells were shut in: samples were collected at the well head.

The produced water sample from well Federal RG 24-13-398 was collected in a clean 5-gallon bucket from a tap between the separator and the accumulator tank. Water was transferred from the bucket to one-liter polyethylene bottles for shipment to the laboratory for analyses.

Table 2. Sample Collection Information

Seq.	Name	API # 05-103-	Location subtype	Sample Phase		Well Data		Comments
				Gas	Liquid	T(°F)	P(psi)	
1	Federal RG 24-13-398	10702	NG-Vert	X	X	69	230	
2	Government Federal MHF-3	07613	NG-Vert	X	NA	NA	1020	Shut in, well is not producing.
3	Government Federal 398-10-1	08914	NG-Vert	X	NA	NA	NA	Shut in, well is not producing.

T: Temperature P: Pressure NG-Vert: Vertical well NA: Missing or not applicable

The perforation intervals for the 3 wells sampled are at various locations in the Mesaverde Group, hundreds of feet below the lowest of the three Project Rio Blanco horizons. The upper perforation interval for well MHF-3 is in the lower part of the Fort Union Formation, which is within the shallowest Project Rio Blanco detonation horizon.

Monitoring Protocol:

The *Rio Blanco Monitoring Plan* is in preparation. Except for location differences, the Rio Blanco monitoring plan will be similar to the Rulison Monitoring Plan (July 2010, LMS/RUL/S06178). A copy of the Rulison Monitoring Plan is available at <http://www.lm.doe.gov/Rulison/Documents.aspx>

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

Analyte	Reporting Units	Screening conc.	Action Conc.	Comment
Tritium	TU	19,293	TBD	5.183×10^{-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 3b. 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
Lab Method				
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 3 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 unique liquid sample was collected from 1 producing gas well
- 3 unique gas samples were collected from 3 gas wells.

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

A “detect” result less than 3 times the MDC for a sample is assigned the data qualifier, “J,” during data validation.

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

“NA” denotes missing results.

Table 4a. 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
Well head or at separator	3/1	0	3	–	0	1	–

Table 4b. 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
Separator	1	0	1	–	1	0	–

Backgrounds for gross alpha and gross beta counting results have not been established.

Table 4c. Summary of Potassium-40 Results for Liquid-Phase Samples

Collection Point	Total Sampled	Potassium-40		
		Detect	Nondetect	NA
Natural gas wells	1	1	0	–

Table 5. Bottom Hole Locations (BHLs) of Wells Sampled and Ground Zero (GZ)

Pad	Well Name	Total Depth (ft)	Location				Rio Blanco GZ to BHL		Comment
			Q-Q	S	Lat (NAD 83)	Long (NAD 83)	Distance (miles)	Heading (degrees)	
GZ	RB-E-01	7,001	NWNW	14	39.793133	-108.367257	0		Ground zero (GZ), vertical well
unk	Government Federal 398-10-1	9,642	SESE	10	39.799640	-108.376190	0.65	W45.2°N	Vertical well
unk	Government Federal MHF-3	8,162	SWNE	11	39.803482	-108.358667	0.85	N34.5E	Vertical well
unk	Federal RG 24-13-398	11,170	SESW	13	39.783875	-108.343547	1.41	E28.7°W	Vertical well

Q-Q: quarter-quarter section
unk: unknown

S: Section

Lat: latitude

Long: longitude

NAD 83: North American Datum of 1983

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Gas Phase Sample Results

RESULTS REPORT
RIN: 10093338
Site: Rio Blanco Site
Location: MHF-3
Ticket Number: IKZ 709
Report Date: 10/24/2010

Parameter	Units	Sample		Result	Qualifiers	
		Date	ID		Lab	Data
Helium	percent	09/13/2010	N001	0.0088		#
Hydrogen	percent	09/13/2010	N001	0.0052		#
Argon	percent	09/13/2010	N001	nd ¹		#
Oxygen	percent	09/13/2010	N001	0.033		#
Nitrogen	percent	09/13/2010	N001	0.30		#
Carbon Dioxide	percent	09/13/2010	N001	0.71		#
Methane	percent	09/13/2010	N001	94.33		#
Ethane	percent	09/13/2010	N001	3.36		#
Propane	percent	09/13/2010	N001	0.677		#
Isobutane	percent	09/13/2010	N001	0.162		#
Butane	percent	09/13/2010	N001	0.152		#
Isopentane	percent	09/13/2010	N001	0.0687		#
Pentane	percent	09/13/2010	N001	0.0514		#
Hexanes	percent	09/13/2010	N001	0.145		#
Carbon-14	Percent modern carbon	09/13/2010	N001	0.7	U	#
Tritium	pCi/L methane	09/13/2010	N001	0.0514	U	#

¹ Not detected.

RESULTS REPORT
RIN: 10093338
Site: Rio Blanco Site
Location: 389-10-1
Ticket Number: IKZ 710
Report Date: 10/24/2010

Parameter	Units	Sample		Result	Qualifiers	
		Date	ID		Lab	Data QA
Helium	percent	09/13/2010	N001	0.0214		#
Hydrogen	percent	09/13/2010	N001	0.0227		#
Argon	percent	09/13/2010	N001	0.0071		#
Oxygen	percent	09/13/2010	N001	0.042		#
Nitrogen	percent	09/13/2010	N001	1.04		#
Carbon Dioxide	percent	09/13/2010	N001	0.022		#
Methane	percent	09/13/2010	N001	95.91		#
Ethane	percent	09/13/2010	N001	1.21		#
Propane	percent	09/13/2010	N001	0.989		#
Isobutane	percent	09/13/2010	N001	0.164		#
Butane	percent	09/13/2010	N001	0.309		#
Isopentane	percent	09/13/2010	N001	0.110		#
Pentane	percent	09/13/2010	N001	0.0710		#
Hexanes	percent	09/13/2010	N001	0.085		#
Carbon-14	Percent modern carbon	09/13/2010	N001	0.7	U	#
Tritium	pCi/L methane	09/13/2010	N001	0.0514	U	#

RESULTS REPORT
RIN: 10093338
Site: Rio Blanco Site
Location: 24-13-398
Ticket Number: IKZ 711
Report Date: 10/24/2010

Parameter	Units	Sample		Result	Qualifiers	
		Date	ID		Lab	Data
Helium	percent	09/13/2010	N001	0.0023		#
Hydrogen	percent	09/13/2010	N001	0.0044		#
Argon	percent	09/13/2010	N001	nd ¹		#
Oxygen	percent	09/13/2010	N001	0.008		#
Nitrogen	percent	09/13/2010	N001	0.11		#
Carbon Dioxide	percent	09/13/2010	N001	6.75		#
Methane	percent	09/13/2010	N001	87.73		#
Ethane	percent	09/13/2010	N001	4.03		#
Propane	percent	09/13/2010	N001	0.734		#
Isobutane	percent	09/13/2010	N001	0.182		#
Butane	percent	09/13/2010	N001	0.145		#
Isopentane	percent	09/13/2010	N001	0.0714		#
Pentane	percent	09/13/2010	N001	0.0457		#
Hexanes	percent	09/13/2010	N001	0.192		#
Carbon-14	Percent modern carbon	09/13/2010	N001	0.6	U	#
Tritium	pCi/L methane	09/13/2010	N001	0.0514	U	#

¹nd - not detected.

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.

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Liquid Phase Sample Results

RESULTS REPORT
RIN: 10093339
Site: Rio Blanco Site
Site Code: RBL01 Location: 24-13-398
Ticket Number: IKZ 722
Report Date: 10/24/2010

Parameter	Units	Sample		Result	TPU ¹	Qualifiers	
		Date	ID			Lab	Data
Actinium-228	pCi/L	09/13/2010	N001	12.6	13.0	U	#
Americium-241	pCi/L	09/13/2010	N001	-24.4	15.7	U	#
Antimony-125	pCi/L	09/13/2010	N001	-0.10	6.90	U	#
Cerium-144	pCi/L	09/13/2010	N001	0.328	18.9	U	#
Cesium-134	pCi/L	09/13/2010	N001	1.37	3.93	U	#
Cesium-137	pCi/L	09/13/2010	N001	-2.2	2.71	U	#
Cobalt-60	pCi/L	09/13/2010	N001	0.955	3.20	U	#
Europium-152	pCi/L	09/13/2010	N001	-3.51	8.68	U	#
Europium-154	pCi/L	09/13/2010	N001	1.17	9.05	U	#
Europium-155	pCi/L	09/13/2010	N001	-3.73	9.83	U	#
Lead-212	pCi/L	09/13/2010	N001	3.83	5.85	U	#
Potassium-40	pCi/L	09/13/2010	N001	143	51.6		#
Promethium-144	pCi/L	09/13/2010	N001	-1.57	2.93	U	#
Promethium-146	pCi/L	09/13/2010	N001	-0.676	3.47	U	#
Ruthenium-106	pCi/L	09/13/2010	N001	-32.4	24.1	U	#
Thorium-234	pCi/L	09/13/2010	N001	-20.8	155	U	#
Uranium-235	pCi/L	09/13/2010	N001	-8.17	19.2	U	#
Uranium-238	pCi/L	09/13/2010	N001	-20.8	155	U	#
Yttrium-88	pCi/L	09/13/2010	N001	1.61	3.94	U	#
GROSS ALPHA	pCi/L	09/13/2010	N001	18.6	16.7	U	#
GROSS BETA	pCi/L	09/13/2010	N001	34.5	19.8		J #
Tritium	pCi/L	09/13/2010	N001	44.4	107	U	#

¹TPU – Total Propagated Uncertainty 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.

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