

Project: 7239  
Document #: 2211159  
Date: 01/22/2016



**PDC Energy, Inc.**  
**Fourth Quarter 2012 Groundwater Monitoring Summary**

November 1, 2012

Ryan 23-25U & 25BU, 14-25U/ Scott 24-25U/ MVS #1 Tank Battery  
SESW Section 25 T5N R68W  
Weld County, API # 05-069-06179

This groundwater monitoring summary has been prepared by Tasman Geosciences, LLC for the Ryan 23-25U & 25BU, 14-25U/ Scott 24-25U/ MVS #1 tank battery. On October 1, 2012, groundwater sampling was conducted at four temporary monitoring well locations. Groundwater samples were submitted for laboratory analysis of BTEX constituents using USEPA Method 8260B. Analytical results are summarized in Table 1 below and are illustrated on Figure 2. The laboratory analytical report is included as Attachment A. Evaluation of the fourth quarter analytical results indicate that benzene concentrations are in exceedance of the COGCC regulatory standards at monitoring wells BH-03 and BH-04. Although elevated benzene and toluene persist in BH-03, concentrations significantly decreased between the third and fourth quarters. Benzene and total xylenes are in exceedance in BH-04 with little fluctuation between sampling events.

Bi-weekly enhanced fluid recovery (EFR) with air sparge (AS) was initiated on May 29, 2012. A summary of the EFR/AS operational data is provided in Table 2. Bi-weekly EFR/AS events are scheduled to be implemented through December 2012. The noted lack of decrease in dissolved phase hydrocarbon concentrations in the vicinity of BH-04 are likely due to decreasing water levels at the site which is limiting the depth at which sparge air can enter the water table. To address this issue, an additional temporary monitoring/remediation (BH-04R) well was installed on October 29, 2012 with a deeper total depth and requisite screened interval to optimize implementation air sparging of the water table in the BH-04 area.

Remedial activities appear to be contributing to reductions in petroleum hydrocarbon impacts at the site. Installation of a modified monitoring/remediation well in the vicinity of BH-04 will further mitigate dissolved phase petroleum hydrocarbon concentrations. Routine groundwater sampling will continue to be implemented to monitor the stability of the plume as well as the success of the remedial approach being implemented at the site.

First quarter 2013 groundwater sampling will be conducted during January 2013.

**TABLE 1**  
**RYAN 23-25U, 25BU, 14-25U/SCOTT 24-25U/MVS 1**  
**GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE**

Sample ID	Date Sampled	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)	Depth to Water (feet)
GW01-BH-01	4/13/2012	<b>320</b>	<b>810</b>	44	490	NM
BH01	7/17/2012	<1.0	<1.0	<1.0	<1.0	14.39
BH01	10/1/2012	<1.0	<1.0	<1.0	<1.0	14.67
GW02-BH02	4/13/2012	<b>7,100</b>	<b>14,000</b>	420	<b>4,400</b>	NM
BH02	7/17/2012	DRY	DRY	DRY	DRY	DRY
BH02	10/1/2012	DRY	DRY	DRY	DRY	DRY
GW03-BH03	4/13/2012	<b>11,000</b>	<b>13,000</b>	300	<b>3,500</b>	NM
BH03	7/17/2012	<b>1,400</b>	<b>710</b>	20	250	13.82
BH03	10/1/2012	<b>41</b>	<b>47</b>	3	32	14.20
GW04-BH04	4/13/2012	<b>3,100</b>	<b>3,900</b>	150	<b>1,700</b>	NM
BH04	7/17/2012	<b>1,500</b>	490	<1.0	<b>1,900</b>	13.21
BH04	10/1/2012	<b>2,400</b>	66	53	<b>1,800</b>	13.58
GW05-BH05	4/13/2012	<b>510</b>	<b>3,400</b>	190	<b>2,200</b>	NM
BH05	7/17/2012	<1.0	<1.0	<1.0	<1.0	13.30
BH05	10/1/2012	<1.0	<1.0	<1.0	<1.0	15.60
<b>COGCC standards for Groundwater (ug/L) <sup>(1)</sup></b>		<b>5</b>	<b>560</b>	<b>700</b>	<b>1,400</b>	

Notes:

1). Standards for Groundwater are taken from the Colorado Department of Health and Environment- Water Quality Control Commission Regulation 41, effective April 1, 2009.

**Bold** red values indicate an exceedance of the COGCC soil standards for the Site.

Sample locations are shown on Figure 2.

ug/L= Micrograms per liter.

NM- Not Measured

**TABLE 2**  
**RYAN 23-25U, 25BU, 14-25U/SCOTT 24-25U/MVS 1**  
**AIR SPARGE / EFR OPERATIONAL SUMMARY TABLE**

Detail Summary					
Date	EFR Wells	Total EFR / AS Duration (hours)	Approximate Gallons Extracted	AS Wells	Injection Pressure (psi)
5/29/2012	BH-01, BH-02, BH-03, BH-04, BH-05	6	210	BH-01, BH-02, BH-03, BH-04, BH-05	8
6/13/2012		6	210		8
7/2/2012		6	252		8
7/10/2012		6	210		8
7/25/2012		6	207		8
8/18/2012		7	124.5		7.5
8/21/2012		8	124.5		8
9/4/2012		7	0		8
10/3/2012		7	83		8
Activity Totals					
Number of Events		Total Duration (hours)	Total Gallons Extracted - 3Q12	Total Gallons Extracted	Average Flow Rate (gpm)
10		79	1,092	1,974	25

Notes:

psi = pounds per square inch

gpm = gallons per minute



Surface  
Drainage

BH03		
Compound (ug/L)	7/17/2012	10/1/2012
Benzene	1,400	41
Toluene	710	47
Ethylbenzene	20	3
Total Xylenes	250	32

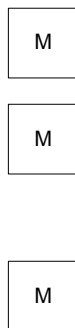
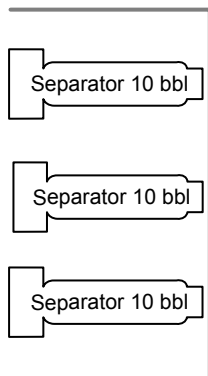
BH-03

BH04		
Compound (ug/L)	7/17/2012	10/1/2012
Benzene	1,500	2,400
Toluene	490	66
Ethylbenzene	<1.0	53
Total Xylenes	1,900	1,800

BH-04

BH05		
Compound (ug/L)	7/17/2012	10/1/2012
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

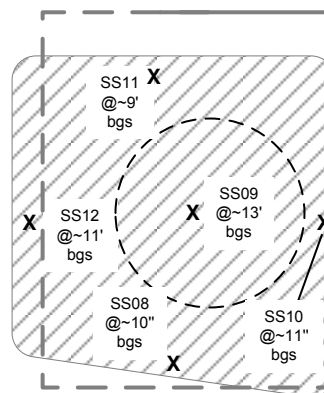
BH-05



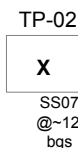
BH01		
Compound (ug/L)	7/17/2012	10/1/2012
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0



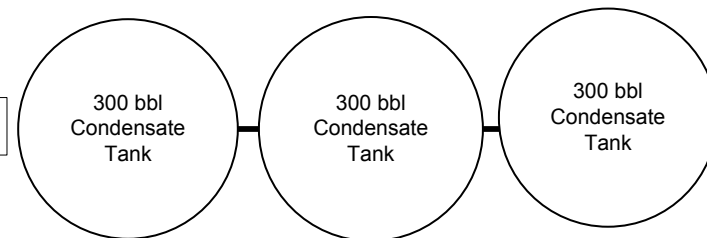
BH-01



BH-02



BH02		
Compound (ug/L)	7/17/2012	10/1/2012
Benzene	DRY	DRY
Toluene	DRY	DRY
Ethylbenzene	DRY	DRY
Total Xylenes	DRY	DRY



On 3/26, soil samples SS01 through SS05 were collected (locations not illustrated) which indicated that substantially impacted soil was still present in the excavation area. As a result, additional impacted soil was excavated on 3/27 and soil samples 08 through 12 (locations illustrated) were collected upon of completion of final excavation.

#### Total Excavation Area

Length (feet)	25
Width (feet)	18
Depth (feet)	12

DRAWN BY: CAW

DATE: 10/19/2012

#### Facility Diagram

PDC Energy – DJ Basin  
Ryan 23-25U & 25BU, 14-25U/ Scott 24-25U/ MVS #1  
SESW T5N R68W S25  
Weld County, CO



5690 Webster Street  
Arvada CO 80002

#### LEGEND

- Corrugated Steel Berm
- Approximate Soil Sample Location
- Bore Hole and Well Location. Soil and Groundwater Samples Collected
- Approximate Extent of Excavation
- Former Produced Water Tank Location

M Meter Shed

FIGURE 2

GROUNDWATER  
ANALYTICAL  
RESULTS

## **ATTACHMENT A**

# Summit Scientific

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

October 08, 2012

Brandon Bruns

PDC Energy

1775 Sherman St. STE. 3000

Denver, CO 80203

RE: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1

Enclosed are the results of analyses for samples received by Summit Scientific on 10/01/12 16:50. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Joseph J. Egry IV". The signature is stylized with a large, sweeping initial "J" and "E".

Joseph J Egry IV For Ben Shrewsbury  
President / Laboratory Manager



PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1

Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/08/12 10:03

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	R210009-01	Water	10/01/12 13:10	10/01/12 16:50
BH03	R210009-02	Water	10/01/12 13:15	10/01/12 16:50
BH04	R210009-03	Water	10/01/12 13:20	10/01/12 16:50
BH05	R210009-04	Water	10/01/12 13:25	10/01/12 16:50

Summit Scientific

*The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.*





PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/08/12 10:03

**BH01**  
**R210009-01 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **10/01/12 13:10**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	1.0	ug/l	1	2100409	10/04/12	10/05/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: **10/01/12 13:10**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		99.7 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		95.4 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		98.3 %	50.1-150		"	"	"	"	

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Brunns

**Reported:**  
10/08/12 10:03

**BH03**  
**R210009-02 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **10/01/12 13:15**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
<b>Benzene</b>	<b>41</b>	1.0		ug/l	1	2100409	10/04/12	10/05/12	EPA 8260B	
<b>Toluene</b>	<b>47</b>	1.0		"	"	"	"	"	"	
<b>Ethylbenzene</b>	<b>3.0</b>	1.0		"	"	"	"	"	"	
<b>Xylenes (total)</b>	<b>32</b>	1.0		"	"	"	"	"	"	

Date Sampled: **10/01/12 13:15**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
<i>Surrogate: 1,2-Dichloroethane-d4</i>		97.5 %		49.7-150		"	"	"	"	
<i>Surrogate: Toluene-d8</i>		99.3 %		51-150		"	"	"	"	
<i>Surrogate: 4-Bromofluorobenzene</i>		96.4 %		50.1-150		"	"	"	"	

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/08/12 10:03

**BH04**  
**R210009-03 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **10/01/12 13:20**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Benzene</b>	<b>2400</b>	20	ug/l	20	2100409	10/04/12	10/05/12	EPA 8260B	
<b>Toluene</b>	<b>66</b>	1.0	"	1	"	"	"	"	
<b>Ethylbenzene</b>	<b>53</b>	1.0	"	"	"	"	"	"	
<b>Xylenes (total)</b>	<b>1800</b>	20	"	20	"	"	"	"	

Date Sampled: **10/01/12 13:20**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<i>Surrogate: 1,2-Dichloroethane-d4</i>		90.4 %	49.7-150		"	"	"	"	
<i>Surrogate: Toluene-d8</i>		105 %	51-150		"	"	"	"	
<i>Surrogate: 4-Bromofluorobenzene</i>		95.3 %	50.1-150		"	"	"	"	

Summit Scientific

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PDC Energy  
1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/08/12 10:03

**BH05**  
**R210009-04 (Water)**

**Summit Scientific**

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **10/01/12 13:25**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	2100409	10/04/12	10/05/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: **10/01/12 13:25**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		102 %	49.7-150		"	"	"	"	
Surrogate: Toluene-d8		94.5 %	51-150		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		99.7 %	50.1-150		"	"	"	"	

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Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Brunns

**Reported:**  
10/08/12 10:03

## Volatile Organic Compounds by EPA Method 8260B - Quality Control

### Summit Scientific

Reporting				Spike	Source		%REC		RPD	
Analyte	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

#### Batch 2100409 - EPA 5030 Water MS

##### Blank (2100409-BLK1)

Prepared: 10/04/12 Analyzed: 10/05/12

Benzene	ND	1.0	ug/l							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	1.0	"							
Surrogate: 1,2-Dichloroethane-d4	12.7		"	13.2	96.1	49.7-150				
Surrogate: Toluene-d8	12.9		"	13.3	96.9	51-150				
Surrogate: 4-Bromofluorobenzene	13.6		"	13.3	102	50.1-150				

##### LCS (2100409-BS1)

Prepared: 10/04/12 Analyzed: 10/05/12

Benzene	26.6	1.0	ug/l	33.3	79.8	51-132				
Toluene	27.2	1.0	"	33.3	81.5	51-138				
Ethylbenzene	29.2	1.0	"	33.3	87.5	58-146				
m,p-Xylene	57.8	2.0	"	66.7	86.7	57-144				
o-Xylene	27.9	1.0	"	33.3	83.6	53-146				
Surrogate: 1,2-Dichloroethane-d4	13.2		"	13.2	99.7	49.7-150				
Surrogate: Toluene-d8	13.0		"	13.3	97.3	51-150				
Surrogate: 4-Bromofluorobenzene	13.3		"	13.3	99.6	50.1-150				

##### LCS Dup (2100409-BSD1)

Prepared: 10/04/12 Analyzed: 10/05/12

Benzene	25.4	1.0	ug/l	33.3	76.3	51-132	4.50	17		
Toluene	25.8	1.0	"	33.3	77.5	51-138	5.10	17		
Ethylbenzene	27.9	1.0	"	33.3	83.7	58-146	4.48	16		
m,p-Xylene	56.1	2.0	"	66.7	84.1	57-144	3.02	16		
o-Xylene	26.8	1.0	"	33.3	80.6	53-146	3.76	15		
Surrogate: 1,2-Dichloroethane-d4	12.6		"	13.2	95.2	49.7-150				
Surrogate: Toluene-d8	13.0		"	13.3	97.4	51-150				
Surrogate: 4-Bromofluorobenzene	13.2		"	13.3	98.9	50.1-150				

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Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
10/08/12 10:03

**Volatile Organic Compounds by EPA Method 8260B - Quality Control**  
**Summit Scientific**

Analyte	Reporting			Spike	Source		%REC		RPD	
	Result	Limit	Units	Level	Result	%REC	Limits	RPD	Limit	Notes

**Batch 2100409 - EPA 5030 Water MS**

Matrix Spike (2100409-MS1)				Source: R209214-01		Prepared: 10/04/12		Analyzed: 10/05/12		
Benzene	25.0	1.0	ug/l	33.3	ND	75.0	34-141			
Toluene	25.9	1.0	"	33.3	ND	77.7	27-151			
Ethylbenzene	27.6	1.0	"	33.3	ND	83.0	29-160			
m,p-Xylene	55.5	2.0	"	66.7	ND	83.2	20-166			
o-Xylene	26.6	1.0	"	33.3	ND	79.7	33-159			
Surrogate: 1,2-Dichloroethane-d4	12.5		"	13.2		94.6	49.7-150			
Surrogate: Toluene-d8	13.0		"	13.3		97.4	51-150			
Surrogate: 4-Bromofluorobenzene	13.3		"	13.3		99.9	50.1-150			
Matrix Spike Dup (2100409-MSD1)				Source: R209214-01		Prepared: 10/04/12		Analyzed: 10/05/12		
Benzene	26.1	1.0	ug/l	33.3	ND	78.3	34-141	4.27	32	
Toluene	26.9	1.0	"	33.3	ND	80.7	27-151	3.79	25	
Ethylbenzene	28.9	1.0	"	33.3	ND	86.8	29-160	4.49	50	
m,p-Xylene	57.5	2.0	"	66.7	ND	86.3	20-166	3.61	36	
o-Xylene	27.7	1.0	"	33.3	ND	83.1	33-159	4.28	26	
Surrogate: 1,2-Dichloroethane-d4	13.0		"	13.2		98.2	49.7-150			
Surrogate: Toluene-d8	13.0		"	13.3		97.2	51-150			
Surrogate: 4-Bromofluorobenzene	13.1		"	13.3		98.0	50.1-150			

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Denver CO, 80203

Project: Ryan 23-25U & 25BU,14-25U/Scott 24-25U/MVS #1

Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
10/08/12 10:03

### Notes and Definitions

DET Analyte DETECTED  
ND Analyte NOT DETECTED at or above the reporting limit  
NR Not Reported  
dry Sample results reported on a dry weight basis  
RPD Relative Percent Difference

A handwritten signature in black ink, appearing to read 'Daniel A. Bruns IV'.