

January 4, 2016

Mr. Randall Ferguson  
EHS Senior Compliance Specialist  
PDC Energy, Inc.  
1775 Sherman Street, Suite 3000  
Denver, CO 80203

Re: **Produced Water Vessel Closure Report**  
**Esther 1-23 Tank Battery**  
**Facility ID: 323180**  
**NESE S23 T5N R65W**  
**Blanket Remediation #: 9440**

Dear Mr. Ferguson,

On behalf of PDC Energy, Inc. (PDC), Tasman Geosciences, Inc. (Tasman) has prepared this Produced Water Vessel Closure Report (Report) to document environmental sampling activities performed at the above-referenced site. This Report is being submitted under the Form 27 Management Plan for Closure of Produced Water Vessels, which has been assigned Blanket Remediation #9440 by the Colorado Oil and Gas Conservation Commission (COGCC).

A summary of excavation and environmental sampling activities is provided below.

#### **Site Assessment Activities**

On February 20, 2014, confirmation sampling activities were completed following the removal of the partially buried produced water vessel. Soil encountered in the excavation area was field screened for volatile organic compound (VOC) concentrations using a photoionization detector (PID). One soil sample (SS01) was collected below the former vessel location at approximately 3 feet below ground surface (bgs). The sample was submitted to Summit Scientific Laboratories in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, total xylenes (BTEX), naphthalene, and total petroleum hydrocarbons (TPH) - gasoline range organics (GRO) by Environmental Protection Agency (EPA) Method 8260B, and TPH - diesel range organics (DRO) by EPA Method 8015.

Analytical results indicated constituent concentrations were below COGCC Table 910-1 standards in soil sample SS01.

The excavation extent and soil sample location are illustrated on Figure 1. Soil analytical data is summarized in Table 1 and the laboratory analytical report is provided in Attachment A.

#### **Conclusions**

Based on the soil analytical data described herein, petroleum hydrocarbon impacts were not encountered during the removal of the produced water vessel. Consequently, no further site investigation is recommended at this time. The facility was decommissioned following site assessment activities.

Please contact me at (720) 409-8791 if you have any questions regarding this report.

Sincerely,






Christine Wasko  
Project Manager  
Tasman Geosciences, Inc.

**Enclosures:**

Figure 1 – Soil Sample Location Map  
Table 1 – Soil Analytical Results Summary Table  
Attachment A – Laboratory Analytical Report



DRAWN BY: MAP	<b>Facility Diagram</b> PDC Energy – DJ Basin Esther 1-23 Tank Battery NESE S23 T5N R65W Weld County, CO	 <b>TASMAN</b> GEOSCIENCES 6899 Pecos St., Unit C Denver, CO 80221	<b>LEGEND</b>  Excavation Extent  Soil Sample Location <p>All locations are approximate unless otherwise noted</p>	<b>FIGURE 1</b>  <b>SOIL SAMPLE LOCATION MAP</b>
DATE: 12/21/2015				

**TABLE 1**  
**ESTHER 1-23 TANK BATTERY**  
**SOIL ANALYTICAL RESULTS SUMMARY TABLE**

Sample ID	Date Sampled	Depth (feet bgs)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Total Xylenes (mg/kg)	Naphthalene (mg/kg)	TPH <sup>(2)</sup> (mg/kg)
COGCC standards for soil (mg/kg) <sup>(1)</sup>			0.17	85	100	175	23	500
SS01 @ 3'	2/20/2014	3	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50

**Notes:**

1. Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective February 1, 2014.

2. TPH - Total volatile and extractable petroleum hydrocarbons. Value calculated by adding GRO and DRO concentrations.

COGCC = Colorado Oil and Gas Conservation Commission

(<) = Analytical result is less than the indicated laboratory reporting limit.

GRO = Total volatile petroleum hydrocarbons - gasoline range organics

DRO = Total extractable petroleum hydrocarbons - diesel range organics

mg/kg = Milligrams per kilogram

bgs = Below ground surface

**BOLD** = Analytical result is in exceedance of COGCC soil standards.

## **ATTACHMENT A**

# Summit Scientific

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

February 24, 2014

Brandon Bruns  
PDC Energy  
1775 Sherman St. STE. 3000  
Denver, CO 80203  
RE: Esther 1-23

Enclosed are the results of analyses for samples received by Summit Scientific on 02/20/14 16:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to be 'BS' or 'Shrewsbury', with a long, sweeping horizontal line extending to the right.

Ben Shrewsbury  
President / Laboratory Manager





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

Project: Esther 1-23  
Project Number: [none]  
Project Manager: Brandon Bruns

Reported:  
02/24/14 17:26

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@3'	1402100-01	Soil	02/20/14 12:15	02/20/14 16:00

1402100

Summit Scientific

741 Corporate Circle Suite 1 • Golden, Colorado 80401  
303-277-9310 • 303-374-9333 Fax

Client: PDC/Esther  
Address:  
City/State/Zip:  
Phone:  
Sample Name: Eric Siegel

Project Manager: Brandon Bruns  
E-Mail:  
Project Name: Esther 1-23  
Project Number:

Page 1 of 1

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative	Matrix	Analyze For:	Special Instructions
SS01@3'	2/20/14	12:15	1		Soil		
					Groundwater		
					Other (Specify)		
					None		
					HNO <sub>3</sub>		
					HCl		
					Air - Canister Serial #		
					Other (Specify)		
					8015 DRO		
					6260 GSTRX		
					Naphthalene		

Relinquished by:	Date/Time:	Received by:	Date/Time:	Relinquished by:	Date/Time:	Received by:	Date/Time:	Relinquished by:	Date/Time:
Eric A. Siegel	2/20/14	[Signature]	2/20/14 16:00						

Notes:

Turn Around Time (Check): ☒ 72 Hours ☐ Standard

Sample Integrity: ☒ Yes ☐ No

Temperature Upon Receipt: ☒ ☐

Infect: ☒ ☐

www.summitscientific.com

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: Esther 1-23  
Project Number: [none]  
Project Manager: Brandon Brunns

Reported:  
02/24/14 17:26

SS01@3'  
1402100-01 (Soil)

Summit Scientific

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: 02/20/14 12:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1402156	02/21/14	02/22/14	8015M	

Date Sampled: 02/20/14 12:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		111 %	30-150		"	"	"	"	

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 02/20/14 12:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1402155	02/21/14	02/21/14	EPA 8260B	
Benzene	ND	0.0020	"	"	"	"	"	"	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: 02/20/14 12:15

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		105 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		102 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		96.1 %	21-167		"	"	"	"	

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1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Esther 1-23  
Project Number: [none]  
Project Manager: Brandon Brunns

**Reported:**  
02/24/14 17:26

**Extractable Petroleum Hydrocarbons by 8015 - Quality Control**  
**Summit Scientific**

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

**Batch 1402156 - EPA 3550A**

**Blank (1402156-BLK1)**

Prepared & Analyzed: 02/21/14

C10-C28 (DRO) ND 50 mg/kg

**LCS (1402156-BS1)**

Prepared & Analyzed: 02/21/14

C10-C28 (DRO) 410 50 mg/kg 501 81.8 73-134

**Matrix Spike (1402156-MS1)**

**Source: 1402111-01**

Prepared & Analyzed: 02/21/14

C10-C28 (DRO) 428 50 mg/kg 501 ND 85.4 50-148

**Matrix Spike Dup (1402156-MSD1)**

**Source: 1402111-01**

Prepared & Analyzed: 02/21/14

C10-C28 (DRO) 448 50 mg/kg 501 ND 89.5 50-148 4.65 13

Summit Scientific

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Project: Esther 1-23  
Project Number: [none]  
Project Manager: Brandon Brunns

**Reported:**  
02/24/14 17:26

**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 1402155 - EPA 5030 Soil MS**

**Blank (1402155-BLK1)**

Prepared: 02/21/14 Analyzed: 02/22/14

Naphthalene	ND	0.010	mg/kg							
Benzene	ND	0.0020	"							
Toluene	ND	0.0050	"							
Ethylbenzene	ND	0.0050	"							
Xylenes (total)	ND	0.010	"							
Gasoline Range Hydrocarbons	ND	0.50	"							
Surrogate: 1,2-Dichloroethane-d4	0.0413		"	0.0397	104	23-173				
Surrogate: Toluene-d8	0.0381		"	0.0400	95.2	20-170				
Surrogate: 4-Bromofluorobenzene	0.0427		"	0.0400	107	21-167				

**LCS (1402155-BS1)**

Prepared: 02/21/14 Analyzed: 02/22/14

Naphthalene	ND	0.010	mg/kg				66-138			
Benzene	0.102	0.0020	"	0.0997	102	58-130				
Toluene	0.103	0.0050	"	0.100	103	61-134				
Ethylbenzene	0.125	0.0050	"	0.0992	126	74-139				
m,p-Xylene	0.249	0.010	"	0.200	125	73-137				
o-Xylene	0.128	0.0050	"	0.0988	130	73-141				
Surrogate: 1,2-Dichloroethane-d4	0.0447		"	0.0397	113	23-173				
Surrogate: Toluene-d8	0.0375		"	0.0400	93.8	20-170				
Surrogate: 4-Bromofluorobenzene	0.0436		"	0.0400	109	21-167				

**Matrix Spike (1402155-MS1)**

**Source: 1402111-01**

Prepared: 02/21/14 Analyzed: 02/22/14

Naphthalene	ND	0.010	mg/kg		0.0194		10-158			
Benzene	0.110	0.0020	"	0.0997	ND	110	30-131			
Toluene	0.107	0.0050	"	0.100	ND	107	30-134			
Ethylbenzene	0.123	0.0050	"	0.0992	0.00405	120	22-153			
m,p-Xylene	0.245	0.010	"	0.200	0.0219	111	10-159			
o-Xylene	0.126	0.0050	"	0.0988	0.00975	118	31-151			
Surrogate: 1,2-Dichloroethane-d4	0.0448		"	0.0397		113	23-173			
Surrogate: Toluene-d8	0.0376		"	0.0400		94.0	20-170			
Surrogate: 4-Bromofluorobenzene	0.0414		"	0.0400		104	21-167			

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Project: Esther 1-23  
Project Number: [none]  
Project Manager: Brandon Bruns

**Reported:**  
02/24/14 17:26

**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 1402155 - EPA 5030 Soil MS**

Matrix Spike Dup (1402155-MSD1)		Source: 1402111-01			Prepared: 02/21/14		Analyzed: 02/22/14			
Naphthalene	ND	0.010	mg/kg		0.0194		10-158			42
Benzene	0.106	0.0020	"	0.0997	ND	106	30-131	3.86		34
Toluene	0.113	0.0050	"	0.100	ND	113	30-134	6.00		30
Ethylbenzene	0.121	0.0050	"	0.0992	0.00405	118	22-153	1.18		24
m,p-Xylene	0.241	0.010	"	0.200	0.0219	109	10-159	1.61		68
o-Xylene	0.126	0.0050	"	0.0988	0.00975	118	31-151	0.0475		38
Surrogate: 1,2-Dichloroethane-d4		0.0440	"	0.0397		111	23-173			
Surrogate: Toluene-d8		0.0413	"	0.0400		103	20-170			
Surrogate: 4-Bromofluorobenzene		0.0407	"	0.0400		102	21-167			

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Project Number: [none]  
Project Manager: Brandon Bruns

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02/24/14 17:26

### 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

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