

March 21, 2017

Karen Olson
Senior EHS Manager
PDC Energy, Inc.
1775 Sherman Street, Suite 3000
Denver, CO 80203

**RE: Produced Water Vessel Closure Report
FHA 10-1 & 15-1 Tank Battery
Facility ID #: 323104
NWSE S1 T4N R64W
Blanket Remediation #: 9440**

Dear Mrs. Olson,

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 March 3, 2017, confirmation sampling activities were conducted following the removal of the partially buried produced water vessel. Soil encountered in the excavation was field screened for volatile organic compound (VOC) concentrations in soil using a photoionization detector (PID). One soil sample (SS01) was collected below the former vessel location at approximately 5 feet below ground surface (bgs). The sample was submitted to Summit Scientific Laboratories in Golden, Colorado for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX), naphthalene, and total petroleum hydrocarbons (TPH) – gasoline range organics (GRO) by United States Environmental Protection Agency (USEPA) Method 8260B, TPH – diesel range organics (DRO) by USEPA Method 8015, pH, and electrical conductivity (EC).

Analytical results indicated that organic compound concentrations and physical parameters were in compliance with COGCC Table 910-1 soil standards.

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 included as Attachment A.

Conclusions

Based on the soil analytical data described herein, petroleum hydrocarbon impacts in exceedance of regulatory standards 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 questions regarding this report.

Sincerely,

Tasman Geosciences, Inc.



Christine Hamlin
Program Manager

Enclosures:

Figure 1 – Excavation Site Map

Table 1 – Soil Analytical Results Summary Table

Attachment A – Laboratory Analytical Report



DATE:	March 21, 2017
DESIGNED BY:	C. Hamlin
DRAWN BY:	T. Blessing



TASMAN
GEOSCIENCES

Tasman Geosciences, Inc.
6899 Pecos Street – Unit C
Denver, CO 80221

PDC Energy, Inc. – DJ Basin
FHA 10-1 & 15-1 Tank Battery
NWSE, Section 1, Township 4 North, Range 64 West
Weld County, Colorado

EXCAVATION SITE MAP

FIGURE
1

TABLE 1
FHA 10-1 & 15-1 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 ⁽²⁾ (mg/kg)	pH (units)	EC (mmhos/cm)
COGCC standards for soil (mg/kg) ⁽¹⁾			0.17	85	100	175	23	500	6-9	<4
SS01 @ 5'	3/3/2017	5	<.0020	<0.0050	<0.0050	<0.010	<0.010	<50	7.88	0.604

Notes:

- Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective January 30, 2015.
 - 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
EC = Electrical conductivity
mmhos/cm = millimhos per centimeter
BOLD = Analytical result is in exceedance of COGCC soil standards.

ATTACHMENT A

Summit Scientific

741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

March 10, 2017

Mark Longhurst
PDC Energy
1775 Sherman St. STE. 3000
Denver, CO 80203
RE: FHA 10-1, 15-1

Enclosed are the results of analyses for samples received by Summit Scientific on 03/03/17 16:30. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'P. Shrewsbury', with a stylized, cursive script.

Paul Shrewsbury
President



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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@5'	1703029-01	Soil	03/03/17 12:30	03/03/17 16:30

Summit Scientific

A handwritten signature in black ink, appearing to be 'MSM'.

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: FHA 10-1, 15-1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

Sample Receipt Checklist

S2 Work Order: 1703009

Client: PDC Energy Client Project ID: FHA 10,15-1

Shipped Via: PIV Airbill #: _____
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Matrix (check all that apply): ☐ Air ☒ Soil/Solid ☐ Water ☐ Other: _____
(Describe)

Cooler ID					
Temp (°C)	<u>3.7</u>				

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature just above 0°C to ≤ 6°C ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
NOTE: If samples are delivered the same day of sampling, this requirement is waived provided that there is evidence that cooling has begun.				
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
If custody seals are present, are they intact ⁽¹⁾ ?			<input checked="" type="checkbox"/>	
Are short holding time analytes or samples with HTs due within 48 hours present?			<input checked="" type="checkbox"/>	
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
Is the COC properly relinquished by the client w/ date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>			
For volatiles in water – is there headspace present? If yes, contact client and note in narrative.			<input checked="" type="checkbox"/>	
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ?			<input checked="" type="checkbox"/>	
Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect			<input checked="" type="checkbox"/>	
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ?			<input checked="" type="checkbox"/>	
Record the pH in Comments.			<input checked="" type="checkbox"/>	
If dissolved metals are requested, were samples field filtered?			<input checked="" type="checkbox"/>	
Additional Comments (if any):				

⁽¹⁾ If NO, then contact the client before proceeding with analysis and note in case narrative.

Nakitz
Custodian Printed Name

[Signature]
Signature or Initials of Custodian

3/3/17 1650
Date/Time



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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

SS01@5'
1703029-01 (Soil)

Summit Scientific

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **03/03/17 12:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1703051	03/06/17	03/07/17	8015M	

Date Sampled: **03/03/17 12:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		117 %	30-150		"	"	"	"	

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **03/03/17 12:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1703042	03/06/17	03/07/17	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: **03/03/17 12:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		108 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		105 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		100 %	21-167		"	"	"	"	

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **03/03/17 12:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
pH	7.88	0.100	pH Units	1	1703063	03/07/17	03/07/17	EPA 9045	

Summit Scientific

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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

SS01@5'
1703029-01 (Soil)

Summit Scientific

Physical Parameters by APHA/ASTM/EPA Methods

Specific Conductance (EC)	0.604	0.0100 mmhos/cm	1	1703062	03/07/17	03/07/17	SM 2510B
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PDC Energy
1775 Sherman St. STE. 3000
Denver CO, 80203

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

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 1703051 - EPA 3550A

Blank (1703051-BLK1)

Prepared: 03/06/17 Analyzed: 03/07/17

C10-C28 (DRO) ND 50 mg/kg

Surrogate: o-Terphenyl 13.9 " 12.5 111 30-150

LCS (1703051-BS1)

Prepared: 03/06/17 Analyzed: 03/07/17

C10-C28 (DRO) 522 50 mg/kg 499 105 73-134

Surrogate: o-Terphenyl 17.3 " 12.5 138 30-150

Matrix Spike (1703051-MS1)

Source: 1703021-01

Prepared: 03/06/17 Analyzed: 03/07/17

C10-C28 (DRO) 845 50 mg/kg 499 290 111 50-148

Surrogate: o-Terphenyl 20.9 " 12.5 167 30-150 S-02

Matrix Spike Dup (1703051-MSD1)

Source: 1703021-01

Prepared: 03/06/17 Analyzed: 03/07/17

C10-C28 (DRO) 808 50 mg/kg 499 290 104 50-148 4.51 20

Surrogate: o-Terphenyl 20.0 " 12.5 160 30-150 S-02

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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

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

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

Batch 1703042 - EPA 5030 Soil MS

Blank (1703042-BLK1)

Prepared & Analyzed: 03/06/17

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	"							
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0395</i>		<i>"</i>	<i>0.0400</i>		<i>98.8</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0416</i>		<i>"</i>	<i>0.0400</i>		<i>104</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0378</i>		<i>"</i>	<i>0.0400</i>		<i>94.6</i>	<i>21-167</i>			

LCS (1703042-BS1)

Prepared & Analyzed: 03/06/17

Naphthalene	ND	0.010	mg/kg				66-138			
Benzene	0.100	0.0020	"	0.100		100	58-130			
Toluene	0.103	0.0050	"	0.100		103	61-134			
Ethylbenzene	0.0958	0.0050	"	0.0992		96.6	74-139			
m,p-Xylene	0.189	0.010	"	0.200		94.9	73-137			
o-Xylene	0.0996	0.0050	"	0.0980		102	73-141			
Xylenes (total)	0.289	0.010	"				0-200			
Gasoline Range Hydrocarbons	0.756	0.50	"				30-150			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0405</i>		<i>"</i>	<i>0.0400</i>		<i>101</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0421</i>		<i>"</i>	<i>0.0400</i>		<i>105</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0410</i>		<i>"</i>	<i>0.0400</i>		<i>102</i>	<i>21-167</i>			

Matrix Spike (1703042-MS1)

Source: 1703018-01

Prepared & Analyzed: 03/06/17

Naphthalene	0.00687	0.010	mg/kg		0.0383		10-158			
Benzene	0.0696	0.0020	"	0.100	ND	69.6	30-131			
Toluene	0.0590	0.0050	"	0.100	ND	59.0	30-134			
Ethylbenzene	0.0452	0.0050	"	0.0992	0.0341	11.1	22-153			QM-07
m,p-Xylene	0.0882	0.010	"	0.200	0.0653	11.5	10-159			
o-Xylene	0.0461	0.0050	"	0.0980	0.0647	NR	31-151			QM-07
Xylenes (total)	0.134	0.010	"		0.130		30-160			
Gasoline Range Hydrocarbons	0.408	0.50	"		7.76		30-160			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0443</i>		<i>"</i>	<i>0.0400</i>		<i>111</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0396</i>		<i>"</i>	<i>0.0400</i>		<i>99.1</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0403</i>		<i>"</i>	<i>0.0400</i>		<i>101</i>	<i>21-167</i>			

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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

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 1703042 - EPA 5030 Soil MS

Matrix Spike Dup (1703042-MSD1)		Source: 1703018-01			Prepared & Analyzed: 03/06/17					
Naphthalene	0.00702	0.010	mg/kg		0.0383		10-158	2.16	42	
Benzene	0.0650	0.0020	"	0.100	ND	65.0	30-131	6.73	34	
Toluene	0.0552	0.0050	"	0.100	ND	55.2	30-134	6.57	30	
Ethylbenzene	0.0387	0.0050	"	0.0992	0.0341	4.60	22-153	15.5	24	QM-07
m,p-Xylene	0.0776	0.010	"	0.200	0.0653	6.18	10-159	12.8	68	QM-07
o-Xylene	0.0412	0.0050	"	0.0980	0.0647	NR	31-151	11.1	38	QM-07
Xylenes (total)	0.119	0.010	"		0.130		30-160	12.2	30	
Gasoline Range Hydrocarbons	0.339	0.50	"		7.76		30-160	18.5	30	
Surrogate: 1,2-Dichloroethane-d4	0.0444		"	0.0400		111	23-173			
Surrogate: Toluene-d8	0.0401		"	0.0400		100	20-170			
Surrogate: 4-Bromofluorobenzene	0.0398		"	0.0400		99.6	21-167			

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

Project: FHA 10-1, 15-1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

Physical Parameters by APHA/ASTM/EPA Methods - Quality Control
Summit Scientific

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

Batch 1703062 - General Preparation

Blank (1703062-BLK1)

Prepared & Analyzed: 03/07/17

Specific Conductance (EC) ND 0.0100 mmhos/cm

LCS (1703062-BS1)

Prepared & Analyzed: 03/07/17

Specific Conductance (EC) 0.500 0.0100 mmhos/cm 0.500 100 90-110

Duplicate (1703062-DUP1)

Source: 1703039-01

Prepared & Analyzed: 03/07/17

Specific Conductance (EC) 1.22 0.0100 mmhos/cm 1.16 4.28 20

Batch 1703063 - General Preparation

LCS (1703063-BS1)

Prepared & Analyzed: 03/07/17

pH 6.00 0.100 pH Units 6.00 100 95-105

Duplicate (1703063-DUP1)

Source: 1703039-01

Prepared & Analyzed: 03/07/17

pH 7.84 0.100 pH Units 7.76 1.03 20

Summit Scientific

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

Project: FHA 10-1, 15-1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/10/17 12:52

Notes and Definitions

S-02	The surrogate recovery for this sample cannot be accurately quantified due to interference from coeluting organic compounds present in the sample extract.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS/LCSD recovery.
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