

July 24, 2018
Karen Shanahan Olson
Senior EHS Manager
PDC Energy, Inc.
1775 Sherman Street, Suite 3000
Denver, CO 80203

**RE: Produced Water Vessel Closure Report
Former Moser 25, 32-42 Tank Battery
Facility ID #: 330925
SENE S25 T3N R65W**

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 in accordance with Colorado Oil and Gas Conservation Commission (COGCC) Rule 905 – Closure of Buried or Partially Buried Produced Water Vessels.

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

Site Assessment Activities

On July 17, 2018, 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) [Table 2]. One soil sample (SS01) was collected below the former vessel location at approximately 4 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.

A handwritten signature in black ink that reads "Christine Hamlin".

Christine Hamlin
Program Manager

Enclosures:

Figure 1 – Excavation Site Map

Table 1 – Soil Analytical Results Summary Table

Table 2 – VOC Concentrations Summary Table

Attachment A – Laboratory Analytical Report



Legend

- — Excavation Extent
- ⊕ Soil Sample Location

Notes

All locations are approximate unless otherwise noted.

Surface drainage direction is estimated based on topography and is not related to regional topography.

0 ft. 15 ft. 30 ft.

Image Source: Google Earth; 2017 Google
Projection: WGS 84 UTM Zone 13 North



DATE:	July 24, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	T. Blessing



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

PDC Energy, Inc. – DJ Basin
Former Moser 25, 32-42 Tank Battery
SENE, Section 25, Township 3 North, Range 65 West
Weld County, Colorado

EXCAVATION SITE MAP

FIGURE
1

TABLE 1
FORMER MOSER 25, 32-42 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 @ 4'	7/17/2018	4	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.04	0.556

Notes:

1. Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective May 1, 2018.

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

EC = Electrical conductivity

mmhos/cm = millimhos per centimeter

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

TABLE 2
FORMER MOSER 25-32, 42 TANK BATTERY
VOC CONCENTRATIONS SUMMARY TABLE

Sample ID	Date Sampled	Depth (feet bgs)	Sample Location ⁽¹⁾	Field Measured VOC Concentration ⁽²⁾ (ppm)
SS01 @ 4'	7/17/2018	4	Base	66.5
SS02 @ 3'	7/17/2018	3	North Sidewall	44.1
SS03 @ 3'	7/17/2018	3	East Sidewall	57.3
SS04 @ 3'	7/17/2018	3	South Sidewall	46.6
SS05 @ 3'	7/17/2018	3	West Sidewall	30.9

Notes:

1. Refers to the sample location within the excavation area below the former produced water vessel.

2. Volatile organic compound (VOC) concentrations are measured in the field using a photoionization detector (PID).

bgs = Below ground surface

ppm = Parts per million

= Sample submitted for laboratory analysis.

ATTACHMENT A

Summit Scientific

741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

July 18, 2018

Mark Longhurst
PDC Energy
1775 Sherman St. STE. 3000
Denver, CO 80203
RE: Moser 25-32,42

Enclosed are the results of analyses for samples received by Summit Scientific on 07/17/18 18:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Paul Shrewsbury
President



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

Project: Moser 25-32,42

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/18/18 05:53

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@4'	1807191-01	Soil	07/17/18 10:49	07/17/18 18:00

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.

1807191

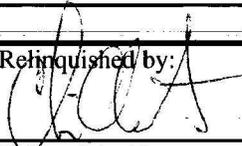
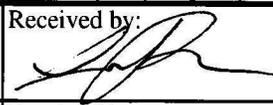
Summit Scientific

741 Corporate Circle Suite I ♦ Golden, Colorado 80401
 303-277-9310 ♦ 303-374-5933 Fax

Client: PDC Energy
 Address: _____
 City/State/Zip: _____
 Phone: _____ Fax: _____
 Sampler Name: Chris Armbruster

Project Manager: Mark Longhurst
 E-Mail: Mark.Longhurst@pdce.com
 Project Name: Moser 25-32, 42
 Project Number: _____

Sample Description	Date Sampled	Time Sampled	Number of Containers	Preservative				Matrix				Analyze For:						Special Instructions	
				HCl	HNO ₃	None	Other (Specify)	Groundwater	Soil	Air - Canister Serial #	Other (Specify)	GBTEXN (8260)	DRO (TPH)	EC	PH	Hold For Analysis			
SS01@4'	7/17/2018	10:49	1			X		X					X	X	X	X			
SS02@3'	7/17/2018	10:51	1			X		X									X		
SS03@3'	7/17/2018	10:54	1			X		X									X		
SS04@3'	7/17/2018	10:57	1			X		X									X		
SS05@3'	7/17/2018	11:00	1			X		X									X		

Relinquished by: 	Date/Time: <u>7/17/18 1800</u>	Received by: 	Date/Time: <u>7.17.18 1800</u>	Turn Around Time (Check) Same Day <input checked="" type="checkbox"/> 72 Hours <input type="checkbox"/> 24 Hours <input type="checkbox"/> Standard <input type="checkbox"/> 48 Hours <input type="checkbox"/> Sample Integrity: Temperature Upon Receipt: <u>8.5</u> Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Notes: <u>on ice</u>
Relinquished by:	Date/Time:	Received by:	Date/Time:		
Relinquished by:	Date/Time:	Received in Lab by:	Date/Time:		

1807191

Sample Receipt Checklist

S2 Work Order: _____

Client: PDC Client Project ID: Moser 25-32, 42

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

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

Temp (°C)	8.5
-----------	-----

Thermometer ID: 61857155-K

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C ⁽¹⁾ ? NOTE: If samples are delivered the same day of sampling, this requirement is met provided that there is evidence that cooling has begun.	/			
Were all samples received intact ⁽¹⁾ ?	/			
Was adequate sample volume provided ⁽¹⁾ ?	/			
If custody seals are present, are they intact ⁽¹⁾ ?			/	
Are samples with holding times due within 48 hours sample due within 48 hours present?			/	
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	/			
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	/			
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	/			
Is the COC properly relinquished by the client w/ date and time recorded ⁽¹⁾ ?	/			
For volatiles in water – is there headspace present? If yes, contact client and note in narrative.			/	
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect			/	
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ? Record the pH in Comments.			/	
If dissolved metals are requested, were samples field filtered?			/	

Additional Comments (if any):

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

[Signature]
 Custodian Printed Name or Initials

[Signature]
 Signature or Initials of Custodian

7-17-18 1800
 Date/Time



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

Project: Moser 25-32,42

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/18/18 05:53

SS01@4'
1807191-01 (Soil)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1807177	07/17/18	07/18/18	EPA 8260B	
Toluene	ND	0.0050	"	"	"	"	"	"	
Ethylbenzene	ND	0.0050	"	"	"	"	"	"	
Xylenes (total)	ND	0.010	"	"	"	"	"	"	
Naphthalene	ND	0.010	"	"	"	"	"	"	
Gasoline Range Hydrocarbons	ND	0.50	"	"	"	"	"	"	

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		115 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		104 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		105 %	21-167		"	"	"	"	

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1807176	"	07/18/18	EPA 8015M	

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		101 %	30-150		"	"	"	"	

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
pH	8.04		pH Units	1	1807182	07/17/18	07/17/18	EPA 9045D	

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

Project: Moser 25-32,42

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/18/18 05:53

SS01@4'
1807191-01 (Soil)

Summit Scientific

Physical Parameters by APHA/ASTM/EPA Methods

Specific Conductance by EPA Method 120.1

Date Sampled: **07/17/18 10:49**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	0.556	0.0100	mmhos/cm	1	1807183	07/17/18	07/17/18	EPA 120.1	

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

Project: Moser 25-32,42

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/18/18 05:53

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

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

Batch 1807177 - EPA 5030 Soil MS

Blank (1807177-BLK1)

Prepared & Analyzed: 07/17/18

Benzene	ND	0.0020	mg/kg								
Toluene	ND	0.0050	"								
Ethylbenzene	ND	0.0050	"								
Xylenes (total)	ND	0.010	"								
Naphthalene	ND	0.010	"								
Gasoline Range Hydrocarbons	ND	0.50	"								
Surrogate: 1,2-Dichloroethane-d4	0.0392		"	0.0396		98.9	23-173				
Surrogate: Toluene-d8	0.0384		"	0.0400		96.1	20-170				
Surrogate: 4-Bromofluorobenzene	0.0404		"	0.0400		101	21-167				

LCS (1807177-BS1)

Prepared & Analyzed: 07/17/18

Benzene	0.0798	0.0020	mg/kg	0.100		79.8	70-130				
Toluene	0.0888	0.0050	"	0.100		88.8	70-130				
Ethylbenzene	0.0806	0.0050	"	0.100		80.6	70-130				
m,p-Xylene	0.154	0.010	"	0.200		77.2	70-130				
o-Xylene	0.0717	0.0050	"	0.100		71.7	70-130				
Surrogate: 1,2-Dichloroethane-d4	0.0362		"	0.0396		91.3	23-173				
Surrogate: Toluene-d8	0.0465		"	0.0400		116	20-170				
Surrogate: 4-Bromofluorobenzene	0.0379		"	0.0400		94.8	21-167				

Matrix Spike (1807177-MS1)

Source: 1807174-01

Prepared & Analyzed: 07/17/18

Benzene	0.0849	0.0020	mg/kg	0.100	ND	84.9	70-130				
Toluene	0.0928	0.0050	"	0.100	ND	92.8	70-130				
Ethylbenzene	0.0926	0.0050	"	0.100	ND	92.6	70-130				
m,p-Xylene	0.178	0.010	"	0.200	ND	88.8	70-130				
o-Xylene	0.0828	0.0050	"	0.100	ND	82.8	70-130				
Surrogate: 1,2-Dichloroethane-d4	0.0395		"	0.0396		99.8	23-173				
Surrogate: Toluene-d8	0.0433		"	0.0400		108	20-170				
Surrogate: 4-Bromofluorobenzene	0.0384		"	0.0400		95.9	21-167				

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

Project: Moser 25-32,42

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/18/18 05:53

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

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

Batch 1807177 - EPA 5030 Soil MS

Matrix Spike Dup (1807177-MSD1)	Source: 1807174-01			Prepared & Analyzed: 07/17/18					
Benzene	0.0942	0.0020	mg/kg	0.100	ND	94.2	70-130	10.4	30
Toluene	0.105	0.0050	"	0.100	ND	105	70-130	12.1	30
Ethylbenzene	0.111	0.0050	"	0.100	ND	111	70-130	17.8	30
m,p-Xylene	0.211	0.010	"	0.200	ND	106	70-130	17.4	30
o-Xylene	0.0996	0.0050	"	0.100	ND	99.6	70-130	18.4	30
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0407</i>		<i>"</i>	<i>0.0396</i>		<i>103</i>	<i>23-173</i>		
<i>Surrogate: Toluene-d8</i>	<i>0.0401</i>		<i>"</i>	<i>0.0400</i>		<i>100</i>	<i>20-170</i>		
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0388</i>		<i>"</i>	<i>0.0400</i>		<i>97.1</i>	<i>21-167</i>		

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

Project: Moser 25-32,42

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/18/18 05:53

Extractable Petroleum Hydrocarbons by 8015 - Quality Control
Summit Scientific

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

Batch 1807176 - EPA 3550A

Blank (1807176-BLK1)				Prepared: 07/17/18 Analyzed: 07/18/18						
C10-C28 (DRO)	ND	50	mg/kg							
LCS (1807176-BS1)				Prepared: 07/17/18 Analyzed: 07/18/18						
C10-C28 (DRO)	475	50	mg/kg			70-130				
Matrix Spike (1807176-MS1)				Source: 1807174-01 Prepared: 07/17/18 Analyzed: 07/18/18						
C10-C28 (DRO)	474	50	mg/kg		29.2	70-130				
Matrix Spike Dup (1807176-MSD1)				Source: 1807174-01 Prepared: 07/17/18 Analyzed: 07/18/18						
C10-C28 (DRO)	491	50	mg/kg		29.2	70-130	3.51	20		

Summit Scientific

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

Project: Moser 25-32,42

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/18/18 05:53

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

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

Batch 1807182 - General Preparation

LCS (1807182-BS1)				Prepared & Analyzed: 07/17/18						
pH	9.1		pH Units	9.18		99.3	95-105			
Duplicate (1807182-DUP1)				Source: 1807191-01		Prepared & Analyzed: 07/17/18				
pH	8.1		pH Units		8.0			0.743	20	

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: Moser 25-32,42

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 07/18/18 05:53

Specific Conductance by EPA Method 120.1 - Quality Control
Summit Scientific

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

Batch 1807183 - General Preparation

LCS (1807183-BS1)

Prepared & Analyzed: 07/17/18

Specific Conductance (EC)	0.748	0.0100	mmhos/cm	0.750	99.7	90-110
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Duplicate (1807183-DUP1)

Source: 1807191-01

Prepared & Analyzed: 07/17/18

Specific Conductance (EC)	0.572	0.0100	mmhos/cm	0.556	3.01	20
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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: Moser 25-32,42

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
07/18/18 05:53

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