

December 13, 2018
Karen Shanahan Olson
Senior Program Manager
PDC Energy, Inc.
1775 Sherman Street, Suite 3000
Denver, CO 80203

**RE: Produced Water Vessel Closure Report
Former Schaumberg 1, 12-17 Tank Battery
Facility ID #: 322862
NWNW S17 T5N R64W**

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 December 6, 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 4.5 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 geochemical 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 (912) 230-2807 if you have questions regarding this report.

Sincerely,

Tasman Geosciences, Inc.

A handwritten signature in blue ink, appearing to read "Brock Nelson".

Brock Nelson
Project 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:	December 13, 2018
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 Schaumberg 1, 12-17 Tank Battery
 NWNW, Section 17, Township 5 North, Range 64 West
 Weld County, Colorado

EXCAVATION SITE MAP

FIGURE
1

**TABLE 1
FORMER SCHAUMBERG 1, 12-17 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@4.5'	12/6/2018	4.5	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.80	0.246

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

TABLE 2
FORMER SCHAUMBERG 1, 12-17 TANK BATTERY
VOC CONCENTRATIONS SUMMARY TABLE

Sample ID	Date Sampled	Depth (feet bgs)	Sample Location ⁽¹⁾	Field Measured VOC Concentration ⁽²⁾ (ppm)
SS01@4.5'	12/6/2018	4.5	Excavation Base	0.0
SS02@3'	12/6/2018	3	North Sidewall	0.0
SS03@3'	12/6/2018	3	West Sidewall	0.0
SS04@3'	12/6/2018	3	South Sidewall	0.0
SS05@3'	12/6/2018	3	East Sidewall	0.0

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

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

December 13, 2018

Mark Longhurst

PDC Energy

1775 Sherman St. STE. 3000

Denver, CO 80203

RE: Schaumberg 1, 12-17

Enclosed are the results of analyses for samples received by Summit Scientific on 12/06/18 18:35. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink on a light blue background. The signature reads "Muri Premer" in a cursive script.

Muri Premer For Ben Shrewsbury

Laboratory Manager



PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: Schaumberg 1, 12-17 Project Number: [none] Project Manager: Mark Longhurst	Reported: 12/13/18 09:50
--------------------------------------------------------------	-------------------------------------------------------------------------------------------	------------------------------------

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@4.5'	1812069-01	Soil	12/06/18 09:53	12/06/18 18:35

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.

Summit Scientific

1812069

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

Page 1 of 1

Client: PDC
Address: _____
City/State/Zip: _____
Phone: _____ Fax: _____
Sampler Name: Jake McCarver

Project Manager: Mark Longhurst
E-Mail: Mark.Longhurst@pdce.com
Project Name: Schaumberg 1, 12-17
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)	TPH - DRO	EC/pH	HOLD					
SS01 @ 4.5'	12/6/2018	9:53	1		X			X				X	X	X						
SS02 @ 3'	12/6/2018	9:56	1		X			X												
SS03 @ 3'	12/6/2018	9:59	1		X			X												
SS04 @ 3'	12/6/2018	10:02	1		X			X												
SS05 @ 3'	12/6/2018	10:05	1		X			X												
Relinquished by: _____ Date/Time: <u>12/06/18 1835</u>				Received by: _____ Date/Time: <u>12.6.18 1835</u>				Turn Around Time (Check)				Hold SS02-SS05								
Relinquished by: _____ Date/Time: _____				Received by: _____ Date/Time: _____				Same Day <input type="checkbox"/>				72 Hours <input type="checkbox"/>								
Relinquished by: _____ Date/Time: _____				Received in Lab by: _____ Date/Time: _____				24 Hours <input type="checkbox"/>				Standard <input checked="" type="checkbox"/>								
Relinquished by: _____ Date/Time: _____				Received in Lab by: _____ Date/Time: _____				48 Hours <input type="checkbox"/>				Sample Integrity:								
Relinquished by: _____ Date/Time: _____				Received in Lab by: _____ Date/Time: _____				Temperature Upon Receipt: <u>2.0</u>				Intact: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>								

Sample Receipt Checklist

S2 Work Order 1812069

Client: PDC Client Project ID: Schaumburg 1, 12-17

Shipped Via: H.D./P.U./FedEx/UPS/USPS/Other P.U. Airbill #: _____

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

Temp (°C)	<u>2.0</u>
-----------	------------

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.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Were all samples received intact ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Was adequate sample volume provided ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
If custody seals are present, are they intact ⁽¹⁾ ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples with holding times due within 48 hours sample due within 48 hours present?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Is a chain-of-custody (COC) form present and filled out completely ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Does the COC agree with the number and type of sample bottles received ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Do the sample IDs on the bottle labels match the COC ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is the COC properly relinquished by the client w/ date and time recorded ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
For volatiles in water – is there headspace present? If yes, contact client and note in narrative.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, ect	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If samples are acid preserved for metals, is the pH ≤ 2 ⁽¹⁾ ? Record the pH in Comments.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
If dissolved metals are requested, were samples field filtered?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

Additional Comments (if any):

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

UP
Custodian Printed Name or Initials

[Signature]
Signature of Custodian

12.6.18 1840
Date/Time



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

Project: Schaumberg 1, 12-17

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/13/18 09:50

SS01@4.5'
1812069-01 (Soil)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **12/06/18 09:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	ND	0.0020	mg/kg	1	1812124	12/10/18	12/10/18	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: **12/06/18 09:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		86.8 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		101 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		101 %	21-167		"	"	"	"	

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **12/06/18 09:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1812090	12/07/18	12/08/18	EPA 8015M	

Date Sampled: **12/06/18 09:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: o-Terphenyl		113 %	30-150		"	"	"	"	

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **12/06/18 09:53**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
pH	8.80		pH Units	1	1812095	12/07/18	12/07/18	EPA 9045D	

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 1775 Sherman St. STE. 3000
 Denver CO, 80203

Project: Schaumberg 1, 12-17

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 12/13/18 09:50

SS01@4.5'
1812069-01 (Soil)

Summit Scientific

Physical Parameters by APHA/ASTM/EPA Methods

Specific Conductance by EPA Method 120.1

Date Sampled: **12/06/18 09:53**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Specific Conductance (EC)	0.246	0.0100		mmhos/cm	1	1812096	12/07/18	12/07/18	EPA 120.1	

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Denver CO, 80203

Project: Schaumburg 1, 12-17

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/13/18 09:50

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

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

Batch 1812124 - EPA 5030 Soil MS

Blank (1812124-BLK1)

Prepared & Analyzed: 12/10/18

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	0.0352		"	0.0396		89.0	23-173			
Surrogate: Toluene-d8	0.0406		"	0.0400		101	20-170			
Surrogate: 4-Bromofluorobenzene	0.0416		"	0.0400		104	21-167			

LCS (1812124-BS1)

Prepared: 12/10/18 Analyzed: 12/12/18

Benzene	0.122	0.0020	mg/kg	0.100		122	70-130			
Toluene	0.120	0.0050	"	0.100		120	70-130			
Ethylbenzene	0.124	0.0050	"	0.100		124	70-130			
m,p-Xylene	0.242	0.010	"	0.200		121	70-130			
o-Xylene	0.121	0.0050	"	0.100		121	70-130			
Surrogate: 1,2-Dichloroethane-d4	0.0344		"	0.0396		86.8	23-173			
Surrogate: Toluene-d8	0.0416		"	0.0400		104	20-170			
Surrogate: 4-Bromofluorobenzene	0.0406		"	0.0400		101	21-167			

Matrix Spike (1812124-MS1)

Source: 1812069-01

Prepared: 12/10/18 Analyzed: 12/12/18

Benzene	0.113	0.0020	mg/kg	0.100	ND	113	70-130			
Toluene	0.111	0.0050	"	0.100	ND	111	70-130			
Ethylbenzene	0.115	0.0050	"	0.100	ND	115	70-130			
m,p-Xylene	0.226	0.010	"	0.200	ND	113	70-130			
o-Xylene	0.114	0.0050	"	0.100	ND	114	70-130			
Surrogate: 1,2-Dichloroethane-d4	0.0336		"	0.0396		84.9	23-173			
Surrogate: Toluene-d8	0.0413		"	0.0400		103	20-170			
Surrogate: 4-Bromofluorobenzene	0.0405		"	0.0400		101	21-167			

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

Project: Schaumberg 1, 12-17

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 12/13/18 09:50

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

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

Batch 1812124 - EPA 5030 Soil MS

Matrix Spike Dup (1812124-MSD1)	Source: 1812069-01			Prepared: 12/10/18 Analyzed: 12/12/18						
Benzene	0.113	0.0020	mg/kg	0.100	ND	113	70-130	0.451	30	
Toluene	0.113	0.0050	"	0.100	ND	113	70-130	2.04	30	
Ethylbenzene	0.115	0.0050	"	0.100	ND	115	70-130	0.365	30	
m,p-Xylene	0.225	0.010	"	0.200	ND	113	70-130	0.531	30	
o-Xylene	0.114	0.0050	"	0.100	ND	114	70-130	0.316	30	
Surrogate: 1,2-Dichloroethane-d4	0.0334		"	0.0396		84.5	23-173			
Surrogate: Toluene-d8	0.0415		"	0.0400		104	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: Schaumberg 1, 12-17

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 12/13/18 09:50

Extractable Petroleum Hydrocarbons by 8015 - Quality Control
Summit Scientific

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

Batch 1812090 - EPA 3550A

Blank (1812090-BLK1)

Prepared: 12/07/18 Analyzed: 12/08/18

C10-C28 (DRO) ND 50 mg/kg

LCS (1812090-BS1)

Prepared: 12/07/18 Analyzed: 12/08/18

C10-C28 (DRO) 602 50 mg/kg 500 120 70-130

Matrix Spike (1812090-MS1)

Source: 1812069-01

Prepared: 12/07/18 Analyzed: 12/08/18

C10-C28 (DRO) 592 50 mg/kg 500 20.8 114 70-130

Matrix Spike Dup (1812090-MSD1)

Source: 1812069-01

Prepared: 12/07/18 Analyzed: 12/08/18

C10-C28 (DRO) 571 50 mg/kg 500 20.8 110 70-130 3.67 20

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PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: Schaumburg 1, 12-17 Project Number: [none] Project Manager: Mark Longhurst	Reported: 12/13/18 09:50
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Physical Parameters by APHA/ASTM/EPA Methods - Quality Control
Summit Scientific

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

Batch 1812095 - General Preparation

LCS (1812095-BS1)		Prepared & Analyzed: 12/07/18								
pH	9.3		pH Units	9.18		101	95-105			
Duplicate (1812095-DUP1)		Source: 1812069-01		Prepared & Analyzed: 12/07/18						
pH	8.8		pH Units	8.8				0.00	20	

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

Project: Schaumberg 1, 12-17

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 12/13/18 09:50

Specific Conductance by EPA Method 120.1 - Quality Control
Summit Scientific

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

Batch 1812096 - General Preparation

Blank (1812096-BLK1)

Prepared & Analyzed: 12/07/18

Specific Conductance (EC) ND 0.0100 mmhos/cm

LCS (1812096-BS1)

Prepared & Analyzed: 12/07/18

Specific Conductance (EC) 0.754 0.0100 mmhos/cm 0.750 101 90-110

Duplicate (1812096-DUP1)

Source: 1812069-01

Prepared & Analyzed: 12/07/18

Specific Conductance (EC) 0.246 0.0100 mmhos/cm 0.246 0.122 20

Summit Scientific

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

Project: Schaumberg 1, 12-17

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
12/13/18 09:50

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