

January 27, 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
Lorenz 44-28 Tank Battery
Facility ID: 327289
SESE S28 T4N R66W
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 January 5, 2016, 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 0.5 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, TPH - diesel range organics (DRO) by EPA Method 8015, pH, and electrical conductivity (EC).

Analytical results indicated organic compound concentrations and physical parameters in soil sample SS01 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 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,

A handwritten signature in blue ink that reads "Christine Wasko".

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: EMB


DATE: 1/22/2016

Facility Diagram
 PDC Energy – DJ Basin
 Lorenz 44-28 Tank Battery
 SESE S28 T4N R66W
 Weld County, CO

 **TASMAN** 6899 Pecos St., Unit C
 GEOSCIENCES Denver, CO 80221

LEGEND

 Excavation Extent

 Soil Sample Location

All locations are approximate unless otherwise noted

FIGURE 1
 SOIL SAMPLE LOCATION MAP

TABLE 1
LORENZ 44-28 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 @ 0.5'	1/5/2016	0.5	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.21	0.392

Notes:

1. Standards for soil are taken from 2 CCR 404-1, Table 910-1, effective January 30, 2015.

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.

ATTACHMENT A

Summit Scientific

741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

January 12, 2016

Mark Longhurst
PDC Energy
1775 Sherman St. STE. 3000
Denver, CO 80203
RE: Lorenz 44-28

Enclosed are the results of analyses for samples received by Summit Scientific on 01/05/16 17:10. 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: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@0.5'	1601016-01	Soil	01/05/16 13:00	01/05/16 17:10

Summit Scientific

1601016

741 Corporate Circle Suite I • Golden, Colorado 80401
303-277-9310 • 303-277-9531 Fax

Page 1 of 1

Client: PDC
Address: _____
City/State/Zip: _____
Phone: 970 470 9047 Fax: _____
Sampler Name: Rob Irvin

Project Manager: Mark Longhurst
E-Mail: mark.longhurst@pdc.com
Project Name: Lorenz 44-28
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)	BTEX	DR	pH	EC		SAR (Hold)	
PW-SS01@0.5'	1/5/2016	1300	1			X			X			X	X	X	X	X		SAR on hold
Relinquished by: <u>[Signature]</u>	Date/Time: <u>1/5/2016</u>	Received by: <u>[Signature]</u>	Date/Time: <u>1/5/16 1710</u>	Turn Around Time (Check)				Notes:										
Relinquished by: <u>[Signature]</u>	Date/Time: <u>1/5/16 1745</u>	Received by:	Date/Time:	Same Day	24 Hours	48 Hours	72 Hours	Standard	On file									
Relinquished by:	Date/Time:	Received in Lab by:	Date/Time:	Sample Integrity:				Temperature Upon Receipt: <u>5.5°C</u>										
				Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No														

www.s2scientific.com



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

Project: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

SS01@0.5'
1601016-01 (Soil)

Summit Scientific

Extractable Petroleum Hydrocarbons by 8015

Date Sampled: **01/05/16 13:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1601032	01/06/16	01/06/16	8015M	

Date Sampled: **01/05/16 13:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: <i>o</i> -Terphenyl		85.4 %	30-150		"	"	"	"	

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **01/05/16 13:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1601031	01/06/16	01/09/16	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: **01/05/16 13:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		115 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		101 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		99.4 %	21-167		"	"	"	"	

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **01/05/16 13:00**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	0.392	0.0100	mmhos/cm	1	1601018	01/07/16	01/07/16	SM 2510B	

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: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

SS01@0.5'
1601016-01 (Soil)

Summit Scientific

Physical Parameters by APHA/ASTM/EPA Methods

Date Sampled: **01/05/16 13:00**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
pH	8.21	0.100	pH Units	1	1601017	01/07/16	01/07/16	EPA 9045	

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

Project: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

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 1601032 - EPA 3550A

Blank (1601032-BLK1)				Prepared & Analyzed: 01/06/16							
C10-C28 (DRO)	ND	50	mg/kg								
<i>Surrogate: o-Terphenyl</i>	10.8		"	12.5		86.4	30-150				
LCS (1601032-BS1)				Prepared & Analyzed: 01/06/16							
C10-C28 (DRO)	513	50	mg/kg	499		103	73-134				
<i>Surrogate: o-Terphenyl</i>	11.2		"	12.5		89.7	30-150				
Matrix Spike (1601032-MS1)				Source: 1601016-01		Prepared & Analyzed: 01/06/16					
C10-C28 (DRO)	506	50	mg/kg	488	16.4	100	50-148				
<i>Surrogate: o-Terphenyl</i>	10.9		"	12.2		89.2	30-150				
Matrix Spike Dup (1601032-MSD1)				Source: 1601016-01		Prepared & Analyzed: 01/06/16					
C10-C28 (DRO)	515	50	mg/kg	483	16.4	103	50-148	1.84		13	
<i>Surrogate: o-Terphenyl</i>	11.0		"	12.1		90.8	30-150				

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

Project: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

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 1601031 - EPA 5030 Soil MS

Blank (1601031-BLK1)

Prepared: 01/06/16 Analyzed: 01/07/16

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>0.0427</i>		<i>"</i>	<i>0.0400</i>		<i>107</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0410</i>		<i>"</i>	<i>0.0400</i>		<i>102</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0408</i>		<i>"</i>	<i>0.0400</i>		<i>102</i>	<i>21-167</i>			

LCS (1601031-BS1)

Prepared: 01/06/16 Analyzed: 01/07/16

Naphthalene	0.169	0.010	mg/kg	0.150		113	66-138			
Benzene	0.140	0.0020	"	0.150		93.2	58-130			
Toluene	0.136	0.0050	"	0.150		90.8	61-134			
Ethylbenzene	0.137	0.0050	"	0.150		91.0	74-139			
m,p-Xylene	0.273	0.010	"	0.300		90.9	73-137			
o-Xylene	0.136	0.0050	"	0.150		90.4	73-141			
Xylenes (total)	0.408	0.010	"				0-200			
Gasoline Range Hydrocarbons	13.7	0.50	"				30-150			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0407</i>		<i>"</i>	<i>0.0400</i>		<i>102</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>0.0393</i>		<i>"</i>	<i>0.0400</i>		<i>98.2</i>	<i>21-167</i>			

Matrix Spike (1601031-MS1)

Source: 1601017-02

Prepared: 01/06/16 Analyzed: 01/07/16

Naphthalene	0.106	0.010	mg/kg	0.150	ND	70.3	10-158			
Benzene	0.131	0.0020	"	0.150	ND	87.7	30-131			
Toluene	0.121	0.0050	"	0.150	ND	80.4	30-134			
Ethylbenzene	0.118	0.0050	"	0.150	ND	78.8	22-153			
m,p-Xylene	0.227	0.010	"	0.300	ND	75.7	10-159			
o-Xylene	0.107	0.0050	"	0.150	ND	71.1	31-151			
Xylenes (total)	0.334	0.010	"		0.00		30-160			
Gasoline Range Hydrocarbons	10.7	0.50	"		ND		30-160			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0412</i>		<i>"</i>	<i>0.0400</i>		<i>103</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0406</i>		<i>"</i>	<i>0.0400</i>		<i>101</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0376</i>		<i>"</i>	<i>0.0400</i>		<i>94.0</i>	<i>21-167</i>			

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

Project: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

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 1601031 - EPA 5030 Soil MS

Matrix Spike Dup (1601031-MSD1)	Source: 1601017-02			Prepared: 01/06/16		Analyzed: 01/07/16			
Naphthalene	0.0898	0.010	mg/kg	0.150	ND	59.9	10-158	16.1	42
Benzene	0.121	0.0020	"	0.150	ND	80.6	30-131	8.42	34
Toluene	0.110	0.0050	"	0.150	ND	73.5	30-134	9.07	30
Ethylbenzene	0.113	0.0050	"	0.150	ND	75.6	22-153	4.22	24
m,p-Xylene	0.221	0.010	"	0.300	ND	73.6	10-159	2.83	68
o-Xylene	0.104	0.0050	"	0.150	ND	69.6	31-151	2.25	38
Xylenes (total)	0.325	0.010	"		0.00		30-160	2.64	30
Gasoline Range Hydrocarbons	9.89	0.50	"		ND		30-160	8.10	30
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0421</i>		<i>"</i>	<i>0.0400</i>		<i>105</i>	<i>23-173</i>		
<i>Surrogate: Toluene-d8</i>	<i>0.0398</i>		<i>"</i>	<i>0.0400</i>		<i>99.4</i>	<i>20-170</i>		
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0376</i>		<i>"</i>	<i>0.0400</i>		<i>93.9</i>	<i>21-167</i>		

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

Project: Lorenz 44-28

Project Number: [none]
 Project Manager: Mark Longhurst

Reported:
 01/12/16 10:07

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

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

Batch 1601017 - General Preparation

LCS (1601017-BS1)					Prepared & Analyzed: 01/05/16						
pH	8.06	0.100	pH Units	8.00		101	95-105				
Duplicate (1601017-DUP1)					Source: 1601012-02 Prepared & Analyzed: 01/05/16						
pH	8.15	0.100	pH Units	8.15				0.00	20		

Batch 1601018 - General Preparation

Blank (1601018-BLK1)					Prepared & Analyzed: 01/05/16						
Specific Conductance (EC)	ND	0.0100	mmhos/cm								
LCS (1601018-BS1)					Prepared & Analyzed: 01/05/16						
Specific Conductance (EC)	0.489	0.0100	mmhos/cm	0.500		97.9	90-110				
Duplicate (1601018-DUP1)					Source: 1601012-02 Prepared & Analyzed: 01/05/16						
Specific Conductance (EC)	0.270	0.0100	mmhos/cm	0.263				2.44	20		

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

Project: Lorenz 44-28

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
01/12/16 10:07

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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