

April 5, 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**  
**Elder 14-21 Tank Battery**  
**Facility ID: 328362**  
**SESW S21 T5N R64W**  
**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 March 24, 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 4 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,



Christine Wasko  
Project Manager  
Tasman Geosciences, Inc.

**Enclosures:**

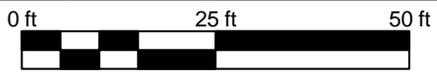
Figure 1 – Soil Sample Location Map  
Table 1 – Soil Analytical Results Summary Table  
Attachment A – Laboratory Analytical Report



Surface  
Drainage

SS01 @ 4' +

**Note:** Surface drainage direction is estimated based on site topography and is not related to regional topography.



Google earth: Google earth 2014

DRAWN BY: EMB

DATE: 4/4/2016

**Facility Diagram**  
PDC Energy – DJ Basin  
Elder 14-21 Tank Battery  
SESW S21 T5N R64W  
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**  
**ELDER 14-21 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)	pH (units)	EC (mmhos/cm)
<b>COGCC standards for soil (mg/kg) <sup>(1)</sup></b>			<b>0.17</b>	<b>85</b>	<b>100</b>	<b>175</b>	<b>23</b>	<b>500</b>	<b>6-9</b>	<b>&lt;4</b>
SS01 @ 4'	3/24/2016	4	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.22	0.155

**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

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741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

March 30, 2016

Mark Longhurst  
PDC Energy  
1775 Sherman St. STE. 3000  
Denver, CO 80203  
RE: Elder 14-21

Enclosed are the results of analyses for samples received by Summit Scientific on 03/24/16 12:55. 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', written in a cursive style.

Paul Shrewsbury  
President



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

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
03/30/16 09:26

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@4'	1603168-01	Soil	03/24/16 10:35	03/24/16 12:55

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: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
03/30/16 09:26

Sample Receipt Checklist

S2 Work Order: 1603168

Client: PDC Gasman Client Project ID: Elder 14-21

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

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

Cooler ID				
Temp (°C)	1.3			

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

Muri Premer  
Custodian Printed Name

MA 3-24-16  
Signature or Initials of Custodian

13:00  
Date/Time



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

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
03/30/16 09:26

**SS01@4'**  
**1603168-01 (Soil)**

**Summit Scientific**

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **03/24/16 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1603264	03/25/16	03/25/16	8015M	

Date Sampled: **03/24/16 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: <i>o</i> -Terphenyl		120 %	30-150		"	"	"	"	

**Volatile Organic Compounds by EPA Method 8260B**

Date Sampled: **03/24/16 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1603265	03/25/16	03/25/16	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: **03/24/16 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		107 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		106 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		108 %	21-167		"	"	"	"	

**Physical Parameters by APHA/ASTM/EPA Methods**

Date Sampled: **03/24/16 10:35**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Specific Conductance (EC)	<b>0.155</b>	0.0100	mmhos/cm	1	1603279	03/28/16	03/28/16	SM 2510B	

Summit Scientific

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

Project: Elder 14-21

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 03/30/16 09:26

**SS01@4'**  
**1603168-01 (Soil)**

**Summit Scientific**

**Physical Parameters by APHA/ASTM/EPA Methods**

Date Sampled: **03/24/16 10:35**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
<b>pH</b>	<b>8.22</b>	0.100	pH Units	1	1603278	03/28/16	03/28/16	EPA 9045	

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Denver CO, 80203

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
03/30/16 09:26

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

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

**Batch 1603264 - EPA 3550A**

**Blank (1603264-BLK1)**

Prepared & Analyzed: 03/25/16

C10-C28 (DRO)	ND	50	mg/kg							
<i>Surrogate: o-Terphenyl</i>	13.9		"	12.5		111	30-150			

**LCS (1603264-BS1)**

Prepared & Analyzed: 03/25/16

C10-C28 (DRO)	569	50	mg/kg	499		114	73-134			
<i>Surrogate: o-Terphenyl</i>	13.9		"	12.5		111	30-150			

**Matrix Spike (1603264-MS1)**

Source: 1603168-01

Prepared & Analyzed: 03/25/16

C10-C28 (DRO)	489	50	mg/kg	499	31.4	91.7	50-148			
<i>Surrogate: o-Terphenyl</i>	13.8		"	12.5		111	30-150			

**Matrix Spike Dup (1603264-MSD1)**

Source: 1603168-01

Prepared & Analyzed: 03/25/16

C10-C28 (DRO)	514	50	mg/kg	499	31.4	96.7	50-148	4.91	13	
<i>Surrogate: o-Terphenyl</i>	14.7		"	12.5		117	30-150			

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Denver CO, 80203

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
03/30/16 09:26

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

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

**Batch 1603265 - EPA 5030 Soil MS**

**Blank (1603265-BLK1)**

Prepared & Analyzed: 03/25/16

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>0.0422</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>		<i>23-173</i>		
<i>Surrogate: Toluene-d8</i>	<i>0.0424</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>		<i>20-170</i>		
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0430</i>		<i>"</i>	<i>0.0400</i>		<i>108</i>		<i>21-167</i>		

**LCS (1603265-BS1)**

Prepared & Analyzed: 03/25/16

Naphthalene	ND	0.010	mg/kg					66-138		
Benzene	0.0962	0.0020	"	0.100		96.2		58-130		
Toluene	0.0974	0.0050	"	0.100		97.4		61-134		
Ethylbenzene	0.104	0.0050	"	0.0992		105		74-139		
m,p-Xylene	0.218	0.010	"	0.200		109		73-137		
o-Xylene	0.101	0.0050	"	0.0980		103		73-141		
Xylenes (total)	0.319	0.010	"					0-200		
Gasoline Range Hydrocarbons	2.48	0.50	"					30-150		
<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>0.0429</i>		<i>"</i>	<i>0.0400</i>		<i>107</i>		<i>20-170</i>		
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0423</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>		<i>21-167</i>		

**Matrix Spike (1603265-MS1)**

Source: 1603168-01

Prepared & Analyzed: 03/25/16

Naphthalene	ND	0.010	mg/kg		ND			10-158		
Benzene	0.0958	0.0020	"	0.100	ND	95.8		30-131		
Toluene	0.0977	0.0050	"	0.100	ND	97.7		30-134		
Ethylbenzene	0.107	0.0050	"	0.0992	ND	107		22-153		
m,p-Xylene	0.226	0.010	"	0.200	ND	113		10-159		
o-Xylene	0.104	0.0050	"	0.0980	ND	106		31-151		
Xylenes (total)	0.331	0.010	"		ND			30-160		
Gasoline Range Hydrocarbons	2.62	0.50	"		ND			30-160		
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0415</i>		<i>"</i>	<i>0.0400</i>		<i>104</i>		<i>23-173</i>		
<i>Surrogate: Toluene-d8</i>	<i>0.0426</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>		<i>20-170</i>		
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0422</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>		<i>21-167</i>		

Summit Scientific

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

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
03/30/16 09:26

**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 1603265 - EPA 5030 Soil MS**

<b>Matrix Spike Dup (1603265-MSD1)</b>	<b>Source: 1603168-01</b>			<b>Prepared &amp; Analyzed: 03/25/16</b>						
Naphthalene	ND	0.010	mg/kg	ND	ND	107	23-173		42	
Benzene	0.0974	0.0020	"	0.100	ND	97.4	30-131	1.65	34	
Toluene	0.0971	0.0050	"	0.100	ND	97.1	30-134	0.616	30	
Ethylbenzene	0.105	0.0050	"	0.0992	ND	106	22-153	1.30	24	
m,p-Xylene	0.220	0.010	"	0.200	ND	110	10-159	2.73	68	
o-Xylene	0.103	0.0050	"	0.0980	ND	105	31-151	1.39	38	
Xylenes (total)	0.323	0.010	"		ND		30-160	2.30	30	
Gasoline Range Hydrocarbons	2.62	0.50	"		ND		30-160	0.360	30	
<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>0.0427</i>		<i>"</i>	<i>0.0400</i>		<i>107</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0425</i>		<i>"</i>	<i>0.0400</i>		<i>106</i>	<i>21-167</i>			

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Project: Elder 14-21

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 03/30/16 09:26

**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 1603278 - General Preparation**

<b>LCS (1603278-BS1)</b>					Prepared & Analyzed: 03/28/16					
pH	8.01	0.100	pH Units	8.00	100	95-105				
<b>Duplicate (1603278-DUP1)</b>					Source: 1603123-03 Prepared & Analyzed: 03/28/16					
pH	9.03	0.100	pH Units	9.02	0.111	20				

**Batch 1603279 - General Preparation**

<b>Blank (1603279-BLK1)</b>					Prepared & Analyzed: 03/28/16					
Specific Conductance (EC)	ND	0.0100	mmhos/cm							
<b>LCS (1603279-BS1)</b>					Prepared & Analyzed: 03/28/16					
Specific Conductance (EC)	0.489	0.0100	mmhos/cm	0.500	97.8	90-110				
<b>Duplicate (1603279-DUP1)</b>					Source: 1603123-03 Prepared & Analyzed: 03/28/16					
Specific Conductance (EC)	2.71	0.0100	mmhos/cm	2.18	21.6	20	QR-03			

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

Project: Elder 14-21

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
03/30/16 09:26

### Notes and Definitions

- QR-03 The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.
- 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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Summit Scientific

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