

May 23, 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**  
**Moore 31-24C Tank Battery**  
**Facility ID: 323254**  
**NWNE S24 T2N R68W**  
**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 May 13, 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 6 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:**

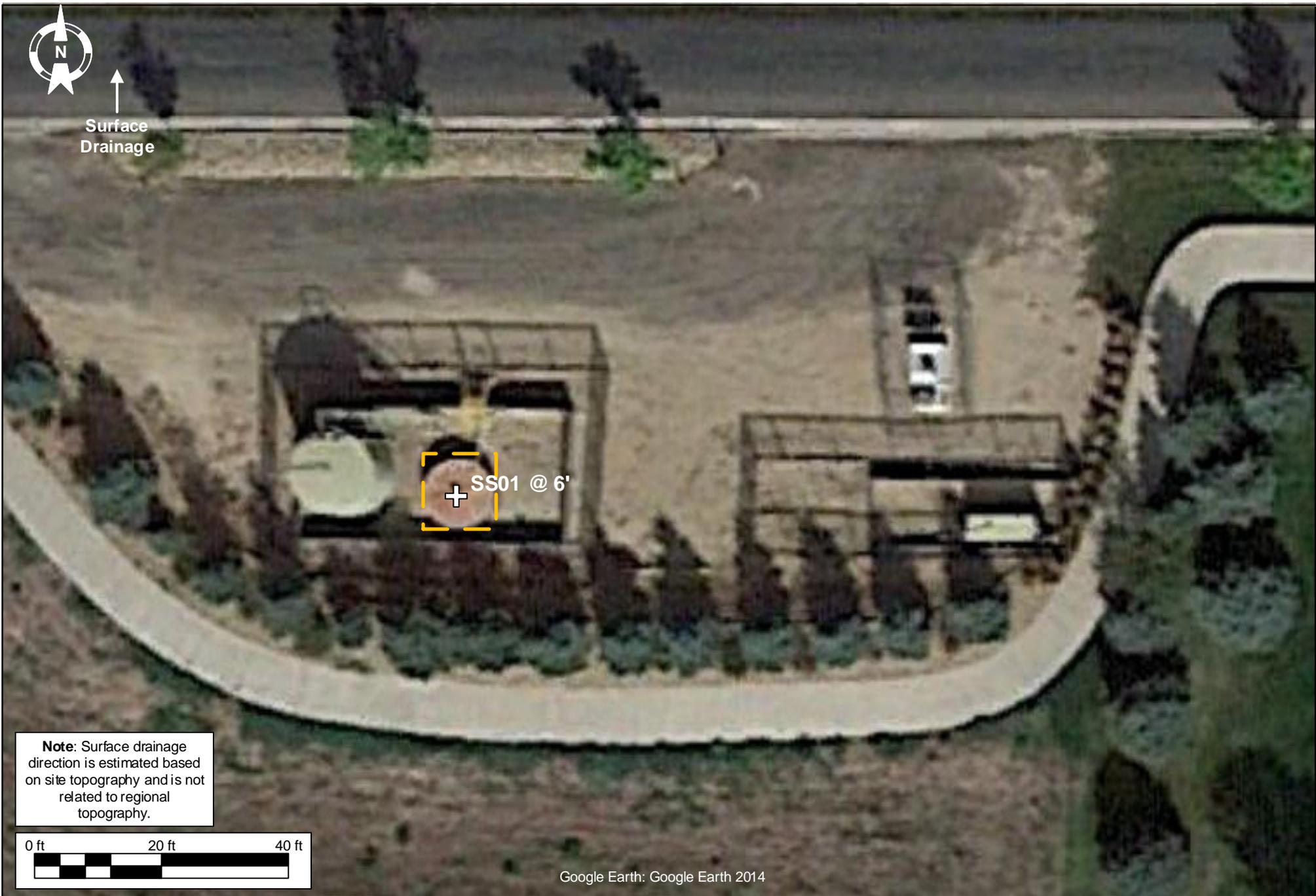
Figure 1 – Soil Sample Location Map

Table 1 – Soil Analytical Results Summary Table

Attachment A – Laboratory Analytical Report

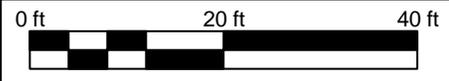


Surface  
Drainage



SS01 @ 6'

**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:	5/23/2016

**Facility Diagram**  
PDC Energy – DJ Basin  
Moore 31-24C Tank Battery  
NWNE S24 T2N R68W  
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**  
**MOORE 31-24C 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 @ 6'	5/13/2016	6	<0.0020	<0.0050	<0.0050	<0.010	<0.010	<50	8.04	1.06

**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

May 25, 2016

Mark Longhurst  
PDC Energy  
1775 Sherman St. STE. 3000  
Denver, CO 80203  
RE: Moore 31-24C

Enclosed are the results of analyses for samples received by Summit Scientific on 05/13/16 17:15. 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: Moore 31-24C

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
05/25/16 07:52

### ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
SS01@6'	1605133-01	Soil	05/13/16 14:30	05/13/16 17:15

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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: Moore 31-24C

Project Number: [none]  
 Project Manager: Mark Longhurst

Reported:  
 05/25/16 07:52

Sample Receipt Checklist

S2 Work Order: 1605133

Client: PDC

Client Project ID: Moore 31-24C

Shipped Via: pick-up  
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Airbill #: \_\_\_\_\_

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

Cooler ID				
Temp (°C)		<u>4.7°C</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 <sup>(1)</sup> ?			<input checked="" type="checkbox"/>	
<small>NOTE: If samples are delivered the same day of sampling, this requirement is waived provided that there is evidence that cooling has begun.</small>				
Were all samples received intact <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Was adequate sample volume provided <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
If custody seals are present, are they intact <sup>(1)</sup> ?			<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 <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Does the COC agree with the number and type of sample bottles received <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Do the sample IDs on the bottle labels match the COC <sup>(1)</sup> ?	<input checked="" type="checkbox"/>			
Is the COC properly relinquished by the client w/ date and time recorded <sup>(1)</sup> ?	<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) <sup>(1)</sup> ?			<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 <sup>(1)</sup> ?			<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):				

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

Nakita  
 Custodian Printed Name

MS  
 Signature of Initials of Custodian

5/13/16 1800  
 Date/Time



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

Project: Moore 31-24C

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
05/25/16 07:52

**SS01@6'**  
**1605133-01 (Soil)**

**Summit Scientific**

**Extractable Petroleum Hydrocarbons by 8015**

Date Sampled: **05/13/16 14:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
C10-C28 (DRO)	ND	50	mg/kg	1	1605168	05/17/16	05/17/16	8015M	

Date Sampled: **05/13/16 14:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: <i>o</i> -Terphenyl		109 %	30-150		"	"	"	"	

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

Date Sampled: **05/13/16 14:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Naphthalene	ND	0.010	mg/kg	1	1605151	05/16/16	05/16/16	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: **05/13/16 14:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		111 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		100 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		103 %	21-167		"	"	"	"	

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

Date Sampled: **05/13/16 14:30**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
<b>Specific Conductance (EC)</b>	<b>1.06</b>	0.0100	mmhos/cm	1	1605188	05/19/16	05/20/16	SM 2510B	

Summit Scientific

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

Project: Moore 31-24C

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 05/25/16 07:52

**SS01@6'**  
**1605133-01 (Soil)**

**Summit Scientific**

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

Date Sampled: **05/13/16 14:30**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
<b>pH</b>	<b>8.04</b>	0.100	pH Units	1	1605187	05/19/16	05/20/16	EPA 9045	

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

Project: Moore 31-24C

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 05/25/16 07:52

**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 1605168 - EPA 3550A**

**Blank (1605168-BLK1)**

Prepared & Analyzed: 05/17/16

C10-C28 (DRO)	ND	50	mg/kg							
<i>Surrogate: o-Terphenyl</i>	14.0		"	12.5		112	30-150			

**LCS (1605168-BS1)**

Prepared & Analyzed: 05/17/16

C10-C28 (DRO)	538	50	mg/kg	499		108	73-134			
<i>Surrogate: o-Terphenyl</i>	17.6		"	12.5		141	30-150			

**Matrix Spike (1605168-MS1)**

Source: 1605133-01

Prepared & Analyzed: 05/17/16

C10-C28 (DRO)	499	50	mg/kg	463	22.8	103	50-148			
<i>Surrogate: o-Terphenyl</i>	14.2		"	11.6		122	30-150			

**Matrix Spike Dup (1605168-MSD1)**

Source: 1605133-01

Prepared & Analyzed: 05/17/16

C10-C28 (DRO)	515	50	mg/kg	479	22.8	103	50-148	3.34	13	
<i>Surrogate: o-Terphenyl</i>	14.4		"	12.0		120	30-150			

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

Project: Moore 31-24C

Project Number: [none]  
Project Manager: Mark Longhurst

Reported:  
05/25/16 07:52

**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 1605151 - EPA 5030 Soil MS**

**Blank (1605151-BLK1)**

Prepared & Analyzed: 05/16/16

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>0.0393</i>		<i>"</i>	<i>0.0400</i>		<i>98.2</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0397</i>		<i>"</i>	<i>0.0400</i>		<i>99.2</i>	<i>21-167</i>			

**LCS (1605151-BS1)**

Prepared & Analyzed: 05/16/16

Naphthalene	ND	0.010	mg/kg				66-138			
Benzene	0.0877	0.0020	"	0.100		87.7	58-130			
Toluene	0.0917	0.0050	"	0.100		91.7	61-134			
Ethylbenzene	0.0820	0.0050	"	0.0992		82.6	74-139			
m,p-Xylene	0.149	0.010	"	0.200		74.7	73-137			
o-Xylene	0.0750	0.0050	"	0.0980		76.6	73-141			
Xylenes (total)	0.224	0.010	"				0-200			
Gasoline Range Hydrocarbons	1.84	0.50	"				30-150			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0404</i>		<i>"</i>	<i>0.0400</i>		<i>101</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0473</i>		<i>"</i>	<i>0.0400</i>		<i>118</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0410</i>		<i>"</i>	<i>0.0400</i>		<i>103</i>	<i>21-167</i>			

**Matrix Spike (1605151-MS1)**

Source: 1605133-01

Prepared & Analyzed: 05/16/16

Naphthalene	ND	0.010	mg/kg		ND		10-158			
Benzene	0.0916	0.0020	"	0.0899	ND	102	30-131			
Toluene	0.0965	0.0050	"	0.0899	ND	107	30-134			
Ethylbenzene	0.0913	0.0050	"	0.0892	ND	102	22-153			
m,p-Xylene	0.165	0.010	"	0.179	ND	91.8	10-159			
o-Xylene	0.0855	0.0050	"	0.0881	ND	97.0	31-151			
Xylenes (total)	0.250	0.010	"		ND		30-160			
Gasoline Range Hydrocarbons	2.09	0.50	"		ND		30-160			
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0380</i>		<i>"</i>	<i>0.0360</i>		<i>106</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0394</i>		<i>"</i>	<i>0.0360</i>		<i>110</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0360</i>		<i>"</i>	<i>0.0360</i>		<i>100</i>	<i>21-167</i>			

Summit Scientific

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

Project: Moore 31-24C

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 05/25/16 07:52

**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 1605151 - EPA 5030 Soil MS**

<b>Matrix Spike Dup (1605151-MSD1)</b>	<b>Source: 1605133-01</b>			<b>Prepared &amp; Analyzed: 05/16/16</b>						
Naphthalene	ND	0.010	mg/kg	ND	ND	107	10-158			42
Benzene	0.102	0.0020	"	0.0952	ND	107	30-131	11.0		34
Toluene	0.112	0.0050	"	0.0952	ND	118	30-134	14.8		30
Ethylbenzene	0.113	0.0050	"	0.0945	ND	120	22-153	21.3		24
m,p-Xylene	0.204	0.010	"	0.190	ND	107	10-159	21.3		68
o-Xylene	0.104	0.0050	"	0.0933	ND	112	31-151	19.9		38
Xylenes (total)	0.308	0.010	"		ND		30-160	20.8		30
Gasoline Range Hydrocarbons	3.04	0.50	"		ND		30-160	37.1		30
<i>Surrogate: 1,2-Dichloroethane-d4</i>	<i>0.0412</i>		<i>"</i>	<i>0.0381</i>		<i>108</i>	<i>23-173</i>			
<i>Surrogate: Toluene-d8</i>	<i>0.0395</i>		<i>"</i>	<i>0.0381</i>		<i>104</i>	<i>20-170</i>			
<i>Surrogate: 4-Bromofluorobenzene</i>	<i>0.0377</i>		<i>"</i>	<i>0.0381</i>		<i>99.1</i>	<i>21-167</i>			

Summit Scientific

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Project: Moore 31-24C

Project Number: [none]  
 Project Manager: Mark Longhurst

**Reported:**  
 05/25/16 07:52

**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 1605187 - General Preparation**

<b>LCS (1605187-BS1)</b>					Prepared: 05/19/16 Analyzed: 05/20/16					
pH	8.01	0.100	pH Units	8.00	100	95-105				
<b>Duplicate (1605187-DUP1)</b>					Prepared: 05/19/16 Analyzed: 05/20/16					
pH	8.29	0.100	pH Units	8.29	0.00	20				

**Batch 1605188 - General Preparation**

<b>Blank (1605188-BLK1)</b>					Prepared: 05/19/16 Analyzed: 05/20/16					
Specific Conductance (EC)	ND	0.0100	mmhos/cm							
<b>LCS (1605188-BS1)</b>					Prepared: 05/19/16 Analyzed: 05/20/16					
Specific Conductance (EC)	0.489	0.0100	mmhos/cm	0.500	97.8	90-110				
<b>Duplicate (1605188-DUP1)</b>					Prepared: 05/19/16 Analyzed: 05/20/16					
Specific Conductance (EC)	0.847	0.0100	mmhos/cm	0.857	1.17	20				

Summit Scientific

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1775 Sherman St. STE. 3000  
Denver CO, 80203

Project: Moore 31-24C

Project Number: [none]  
Project Manager: Mark Longhurst

**Reported:**  
05/25/16 07:52

### 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