

PDC Energy, Inc.
First Quarter 2019 Groundwater Monitoring Summary

March 18, 2019

Former JR #1 Tank Battery
SESW Section 13 T6N R65W
Spill Point ID # 460044
Remediation # 12319

This groundwater monitoring summary has been prepared by Tasman Geosciences, Inc. for the former JR #1 tank battery. On February 5, 2019, six monitoring wells (BH01 – BH06) were installed to delineate the extent of dissolved phase hydrocarbons associated with the release discovered on December 17, 2018. On February 22, 2019, groundwater monitoring was conducted at all six monitoring well locations (BH01 – BH06). Six groundwater samples were submitted to Summit Scientific Laboratory for analysis of benzene, toluene, ethylbenzene, and total xylenes (BTEX) by USEPA Method 8260B.

First quarter 2019 analytical results indicate that benzene concentrations were above the applicable COGCC Table 910-1 groundwater standards in monitoring wells BH01 and BH04. BTEX concentrations were below regulatory standards in four monitoring well locations.

Monitored natural attenuation (MNA) was selected as the remediation strategy for this site during the first quarter 2019 and will remain the selected remediation strategy for the second quarter 2019.

Second quarter 2019 groundwater sampling will be conducted during May 2019. Analytical results are summarized in Table 1 and the laboratory report is included as Attachment A. Sample locations and corresponding analytical results are illustrated on Figure 1. Groundwater elevation data is summarized in Figure 2.



DATE:	March 18, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	B. Nelson



TASMAN
GEOSCIENCES

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

PDC Energy, Inc. – DJ Basin
Former JR #1 Tank Battery
SESW, Section 13, Township 6 North, Range 65 West
Weld County, Colorado

**GROUNDWATER
ANALYTICAL RESULTS
MAP**

**FIGURE
1**



DATE:	February 25, 2019
DESIGNED BY:	C. Hamlin
DRAWN BY:	D. Cavinder



TASMAN
GEOSCIENCES

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

PDC Energy, Inc. – DJ Basin
Former JR #1 Tank Battery
SESW, Section 13, Township 6 North, Range 65 West
Weld County, Colorado

**GROUNDWATER
ELEVATION CONTOUR
MAP (02/22/2019)**

**FIGURE
2**

TABLE 1
FORMER JR #1 TANK BATTERY
GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	Depth to Water ⁽²⁾ (feet)	Groundwater Elevation (ft AMSL)
COGCC Table 910-1 Groundwater Standard (µg/L) ⁽¹⁾		5	560	700	1,400		
GW01	1/4/2019	5.2	<1.0	1.1	11	~ 16	NM
BH01	2/22/2019	81	7.7	88	1,300	15.12	4681.14
BH02	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.29	4681.30
BH03	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.11	4681.50
BH04	2/22/2019	8.5	<1.0	<1.0	<2.0	15.12	4680.82
BH05	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.43	4680.29
BH06	2/22/2019	<1.0	<1.0	<1.0	<2.0	15.29	4680.56

Notes:

1. Groundwater standards referenced from 2 CCR 404-1, Table 910-1, effective May 1, 2018.
2. Depth to water measurements were measured from ground surface for excavation samples. Monitoring well measurements were collected from top of casing and adjusted using survey data to reflect depth of water from ground surface.

COGCC = Colorado Oil and Gas Conservation Commission

µg/L = Micrograms per liter

(<) = Analytical result is less than the indicated laboratory reporting limit.

ft AMSL = Feet Above Mean Sea Level

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

ATTACHMENT A

Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

March 01, 2019

Mark Longhurst

PDC Energy

1775 Sherman St. STE. 3000

Denver, CO 80203

RE: JR #1

Enclosed are the results of analyses for samples received by Summit Scientific on 02/22/19 18:20. 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', with a stylized, cursive script.

Paul Shrewsbury

President



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

Project: JR #1

Project Number: [none]

Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	1902226-01	Water	02/22/19 11:44	02/22/19 18:20
BH02	1902226-02	Water	02/22/19 11:10	02/22/19 18:20
BH03	1902226-03	Water	02/22/19 11:35	02/22/19 18:20
BH04	1902226-04	Water	02/22/19 11:50	02/22/19 18:20
BH05	1902226-05	Water	02/22/19 11:25	02/22/19 18:20
BH06	1902226-06	Water	02/22/19 11:40	02/22/19 18:20

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.

1902226

Summit Scientific

S₂

4653 Table Mountain Drive ♦ Golden, Colorado 80403

303-277-9310

Page | of |

Client: PDC / Tasman Project Manager: Mark Longhurst
 Address: 6899 Pecos Street E-Mail: mark.longhurst@PDCE.com
 City/State/Zip: Denver / CO/ 80221
 Phone: 303-487-1228 Project Name: JR #1
 Sampler Name: Brian Gabel, Derek Givender Project Number:

ID	Sample Description	Date Sampled	Time Sampled	# of containers	Preservative				Matrix				Analysis Requested				Special Instructions
					HCl	HNO ₃	None	Other	Water	Soil	Air-Canister #	Other	8260 BTEX	8260B GBTEXN	8015 DRO	pH, EC, SAR	
1	BH01	2/22/19	1144	3	X				X				X				
2	BH02		1110														
3	BH03		1135														
4	BH04		1150														
5	BH05		1125														
6	BH06		1140														
7																	
8																	
9																	
10																	

Relinquished by: <i>B. Gabel</i>	Date/Time: 2/22/19 1500	Received by: Tasman's Lock Box	Date/Time: 2/22/19 1500	Turn Around Time (Check)	Notes:
				Same Day <input type="checkbox"/> 72 hours <input type="checkbox"/>	
				24 hours <input type="checkbox"/> Standard <input checked="" type="checkbox"/>	
				48 hours <input type="checkbox"/>	
Relinquished by: Tasman's Lock Box	Date/Time: 2-22-19 1620	Received by: <i>[Signature]</i>	Date/Time: 2-22-19 1620	Sample Integrity:	
Relinquished by:	Date/Time:	Received by:	Date/Time:	Temperature Upon Receipt: 7.5	
				Samples Intact: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Sample Receipt Checklist

S2 Work Order 1902226

Client: ADC Client Project ID: UR #1

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

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

Temp (°C)	<u>7.5</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⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
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⁾ ?	<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 checked="" type="checkbox"/>	<input type="checkbox"/>	
Are samples preserved that require preservation (excluding cooling) ⁽¹⁾ ?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hcl
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⁾ ?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Record the pH in Comments.				
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

2-22-19 1920
Date/Time



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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH01
1902226-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:44**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	81	1.0	ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	7.7	1.0	"	"	"	"	"	"	
Ethylbenzene	88	1.0	"	"	"	"	"	"	
Xylenes (total)	1300	200	"	100	"	"	02/25/19	"	

Date Sampled: **02/22/19 11:44**

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		101 %	23-173		"	"	02/25/19	"	
Surrogate: Toluene-d8		91.4 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		131 %	21-167		"	"	"	"	

Summit Scientific

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

Project: JR #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH02
1902226-02 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:10**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	2.0	"	"	"	"	"	"	

Date Sampled: **02/22/19 11:10**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		93.8 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		99.7 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		104 %	21-167		"	"	"	"	

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1775 Sherman St. STE. 3000
Denver CO, 80203

Project: JR #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH03
1902226-03 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:35**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	2.0	"	"	"	"	"	"	

Date Sampled: **02/22/19 11:35**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		91.7 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		99.5 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		104 %	21-167		"	"	"	"	

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

Project: JR #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH04
1902226-04 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:50**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	8.5	1.0		ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	2.0		"	"	"	"	"	"	

Date Sampled: **02/22/19 11:50**

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		84.7 %		23-173		"	"	"	"	
Surrogate: Toluene-d8		91.4 %		20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		118 %		21-167		"	"	"	"	

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

Project: JR #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH05
1902226-05 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:25**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	2.0	"	"	"	"	"	"	

Date Sampled: **02/22/19 11:25**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		89.6 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		99.5 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		101 %	21-167		"	"	"	"	

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

Project: JR #1
Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

BH06
1902226-06 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: **02/22/19 11:40**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	1902294	02/25/19	02/25/19	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	2.0	"	"	"	"	"	"	

Date Sampled: **02/22/19 11:40**

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		90.8 %	23-173		"	"	"	"	
Surrogate: Toluene-d8		97.6 %	20-170		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		100 %	21-167		"	"	"	"	

Summit Scientific

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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

Volatile Organic Compounds by EPA Method 8260B - Quality Control

Summit Scientific

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

Batch 1902294 - EPA 5030 Water MS

Blank (1902294-BLK1)

Prepared: 02/25/19 Analyzed: 02/26/19

Benzene	ND	1.0	ug/l							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	2.0	"							
Surrogate: 1,2-Dichloroethane-d4	11.4		"	13.3		85.3	23-173			
Surrogate: Toluene-d8	12.8		"	13.3		95.9	20-170			
Surrogate: 4-Bromofluorobenzene	12.7		"	13.3		95.3	21-167			

LCS (1902294-BS1)

Prepared: 02/25/19 Analyzed: 02/26/19

Benzene	34.2	1.0	ug/l	33.3		103	70-130			
Toluene	34.9	1.0	"	33.3		105	70-130			
Ethylbenzene	37.4	1.0	"	33.3		112	70-130			
m,p-Xylene	76.2	2.0	"	66.7		114	70-130			
o-Xylene	34.5	1.0	"	33.3		103	70-130			
Surrogate: 1,2-Dichloroethane-d4	12.9		"	13.3		96.5	23-173			
Surrogate: Toluene-d8	12.9		"	13.3		96.9	20-170			
Surrogate: 4-Bromofluorobenzene	12.8		"	13.3		96.1	21-167			

Matrix Spike (1902294-MS1)

Source: 1902225-01

Prepared: 02/25/19 Analyzed: 02/26/19

Benzene	35.0	1.0	ug/l	33.3	ND	105	70-130			
Toluene	36.1	1.0	"	33.3	ND	108	70-130			
Ethylbenzene	37.5	1.0	"	33.3	ND	112	70-130			
m,p-Xylene	77.0	2.0	"	66.7	ND	115	70-130			
o-Xylene	34.9	1.0	"	33.3	ND	105	70-130			
Surrogate: 1,2-Dichloroethane-d4	13.3		"	13.3		99.7	23-173			
Surrogate: Toluene-d8	13.1		"	13.3		98.3	20-170			
Surrogate: 4-Bromofluorobenzene	12.9		"	13.3		97.0	21-167			

Summit Scientific

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

Project: JR #1

Project Number: [none]
Project Manager: Mark Longhurst

Reported:
03/01/19 16:20

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

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

Batch 1902294 - EPA 5030 Water MS

Matrix Spike Dup (1902294-MSD1)		Source: 1902225-01			Prepared: 02/25/19 Analyzed: 02/26/19					
Benzene	34.8	1.0	ug/l	33.3	ND	104	70-130	0.602	30	
Toluene	35.5	1.0	"	33.3	ND	106	70-130	1.73	30	
Ethylbenzene	37.7	1.0	"	33.3	ND	113	70-130	0.611	30	
m,p-Xylene	77.2	2.0	"	66.7	ND	116	70-130	0.259	30	
o-Xylene	35.0	1.0	"	33.3	ND	105	70-130	0.172	30	
<hr/>										
Surrogate: 1,2-Dichloroethane-d4	13.4		"	13.3		101	23-173			
Surrogate: Toluene-d8	12.8		"	13.3		96.2	20-170			
Surrogate: 4-Bromofluorobenzene	13.4		"	13.3		100	21-167			

Summit Scientific

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PDC Energy

1775 Sherman St. STE. 3000

Denver CO, 80203

Project: JR #1

Project Number: [none]

Project Manager: Mark Longhurst

Reported:

03/01/19 16:20

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