



PDC Energy, Inc.
Fourth Quarter 2012 Groundwater Monitoring Summary

January 29, 2013

Cottonwood #1 Tank Battery
NESE Section 13 T6N R66W
Weld County, API # 05-123-11801

This groundwater summary has been prepared by Tasman Geosciences, LLC for the Cottonwood #1 tank battery. Seven temporary monitoring wells were installed on September 18, 2012, for groundwater monitoring and remediation purposes. On December 20, 2012 groundwater sampling was conducted at seven monitoring well locations. Groundwater samples were submitted for laboratory analysis of BTEX constituents using USEPA Method 8260B. Analytical results are summarized in Table 1 below and a complete lab report is included as Attachment A. Sample locations and corresponding analytical results from third and fourth quarters are illustrated on Figure 2. Fourth quarter analytical results indicate a significant site wide reduction in BTEX concentrations since the previous monitoring event. Constituent concentrations in monitoring well BH06 decreased below laboratory detection limits. However, elevated benzene, ethylbenzene, and total xylenes concentrations persist in monitoring wells BH01 through BH04. Dissolved phase petroleum hydrocarbon concentrations remained below laboratory detection limits in boundary wells BH05 and BH07.

Tasman commenced bi-weekly enhanced fluid recovery (EFR) and air sparging (AS) events on November 2, 2012. A summary of the EFR/AS operational data is provided in Table 2. The selected remediation strategy has been proven effective as supported by fourth quarter analytical data and consequently will continue through the first quarter 2013. Chemical oxidation injections are tentatively scheduled in March of 2013, if required.

First quarter 2013 groundwater sampling will be conducted during March 2013.

TABLE 1
COTTONWOOD #1
GROUNDWATER ANALYTICAL RESULTS SUMMARY TABLE

Sample ID	Date Sampled	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)	Depth to Water (feet)
GW01	8/21/2012	3,000	1.7	320	1,900	NM
BH01	9/24/2012	160	<1.0	40	<1.0	16.31
BH01	12/20/2012	5	<1.0	<1.0	6.8	16.13
BH02	9/24/2012	1,300	<1.0	190	1,100	18.42
BH02	12/20/2012	24	<1.0	3.9	8.1	17.35
BH03	9/24/2012	350	<1.0	120	300	18.28
BH03	12/20/2012	15	<1.0	6.7	7.9	17.04
BH04	9/24/2012	150	<1.0	96	400	16.58
BH04	12/20/2012	38	<1.0	40	170	13.95
BH05	9/24/2012	<1.0	<1.0	<1.0	<1.0	15.42
BH05	12/20/2012	<1.0	<1.0	<1.0	<1.0	16.86
BH06	9/24/2012	6.7	18	7.5	50	15.35
BH06	12/20/2012	<1.0	<1.0	<1.0	<1.0	16.79
BH07	9/24/2012	<1.0	<1.0	<1.0	<1.0	16.86
BH07	12/20/2012	<1.0	<1.0	<1.0	<1.0	18.32
COGCC standards for Groundwater (ug/L) ⁽¹⁾		5	560	700	1,400	

Notes:

1). The environmental cleanup standards for groundwater that are applicable to this site are the Colorado Oil and Gas Conservation Commission (COGCC) standards for contaminants in groundwater according to Table 910-1 of the COGCC 900 Series Rule for E&P Waste Management.

Bold red values indicate an exceedance of the COGCC groundwater standards for the Site.

ug/L= Micrograms per liter. NM - Not Measured

TABLE 2
COTTONWOOD #1
AIR SPARGE / EFR OPERATIONAL SUMMARY TABLE

Date	EFR Wells	Total EFR / AS Duration (hours)	Approximate Gallons Extracted	AS Wells	Injection Pressure (psi)
FOURTH QUARTER 2012					
11/2/2012	BH-01, BH-02, BH-03, BH-04	6.75	13.8	BH-01, BH-02, BH-03, BH-04	8
11/14/2012	BH-01, BH-02, BH-03, BH-04	6	110	BH-01, BH-02, BH-03, BH-04	8
12/12/2012	BH-01, BH-02, BH-03, BH-04	6	400	BH-01, BH-02, BH-03, BH-04	8

Notes:

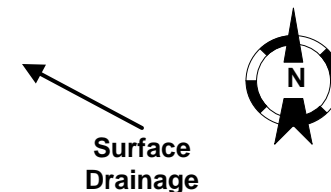
psi = pounds per square inch

Separator
Secondary
Containment

BH06		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	6.7	<1.0
Toluene	18	<1.0
Ethylbenzene	7.5	<1.0
Total Xylenes	50	<1.0

BH-07 ⊕

BH07		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0



Private Land

Native
Vegetation

⊕
BH-06

BH01		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	160	5
Toluene	<1.0	<1.0
Ethylbenzene	40	<1.0
Total Xylenes	<1.0	6.8

⊕
BH-01

BH02		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	1,300	24
Toluene	<1.0	<1.0
Ethylbenzene	190	3.9
Total Xylenes	1,100	8.1

⊕
BH-02

BH04		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	150	38
Toluene	<1.0	<1.0
Ethylbenzene	96	40
Total Xylenes	400	170

Irrigation Canal

Flow

BH05		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	<1.0	<1.0
Toluene	<1.0	<1.0
Ethylbenzene	<1.0	<1.0
Total Xylenes	<1.0	<1.0

⊗
SW01

⊕
BH-05

⊕
BH-04

100 bbl
PW Tank

300 bbl
Condensate Tank

300 bbl
Condensate Tank

BH03		
Compound (ug/L)	9/24/2012	12/20/2012
Benzene	350	15
Toluene	<1.0	<1.0
Ethylbenzene	120	6.7
Total Xylenes	300	7.9

⊕
BH-03

Access Road

Note: Surface drainage is approximated based on visual observation of the tank battery. It is not based on regional topography.

PROJECT
NO:

DRAWN BY: CAW

DATE: 1/13/2013

Facility Diagram
PDC Energy – DJ Basin
Cottonwood #1
NESE S13 T6N R66W
Weld County, CO



6899 Pecos Street
Unit C
Denver, CO 80221

LEGEND

- ⊕ Earthen Berm
- ⊗ Temporary Monitoring Well
- ⊗ Surface Water Sample Location Collected During Excavation Activities
- ⊗ Groundwater Sample Location Collected During Excavation Activities

FIGURE 2
GROUNDWATER
ANALYTICAL RESULTS

ATTACHMENT A

Summit Scientific

741 Corporate Circle – Suite I ♦ Golden, Colorado 80401

303.277.9310 - laboratory ♦ 303.277.9531 - fax

December 26, 2012

Brandon Bruns
PDC Energy
1775 Sherman St. STE. 3000
Denver, CO 80203
RE: Cottonwood #1

Enclosed are the results of analyses for samples received by Summit Scientific on 12/21/12 12:00. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Joseph J. Egry IV". The signature is fluid and cursive, with a distinct "IV" at the end.

Joseph J Egry IV
Laboratory Director



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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
BH01	R212140-01	Water	12/20/12 08:55	12/21/12 12:00
BH02	R212140-02	Water	12/20/12 09:00	12/21/12 12:00
BH03	R212140-03	Water	12/20/12 09:05	12/21/12 12:00
BH04	R212140-04	Water	12/20/12 09:10	12/21/12 12:00
BH05	R212140-05	Water	12/20/12 09:15	12/21/12 12:00
BH06	R212140-06	Water	12/20/12 09:20	12/21/12 12:00
BH07	R212140-07	Water	12/20/12 09:25	12/21/12 12:00

Summit Scientific

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

Project: Cottonwood #1

Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

R2/2/140
Summit Scientific

741 Corporate Circle Suite 1 • Golden, Colorado 80401
303-277-9310 • 303-374-5933 Fax

Client: PDC Energy Page 1 of 1
Address: 1775 Sherman St. STE. 3000
City/State/Zip: Denver CO 80203
Phone: 303-277-9310 E-Mail: brunbs@pdcenergy.com
Fax: 303-374-5933 Project Name: Cottonwood #1
Sampler Name: Brandon Bruns 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)				
B-101	12/2/12	8:55	2	X											
B-102	12/2/12	9:00	1												
B-103	12/2/12	9:05	1												
B-104	12/2/12	9:10	1												
B-105	12/2/12	9:15	1												
B-106	12/2/12	9:20	1												
B-107	12/2/12	9:25	1												
Relinquished by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 3:00</u> Received by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 13:00</u>															
Relinquished by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 3:00</u> Received by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 13:00</u>															
Relinquished by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 3:00</u> Received by: <u>Brandon Bruns</u> Date/Time: <u>12/2/12 13:00</u>															

Turn Around Time (Check): ☒ Same Day ☐ 24 Hours ☐ 48 Hours ☐ 72 Hours ☐ Standard

Notes: 5.1

Sample Integrity: ☒ Temperature Upon Receipt: 5.1 ☐ In tact: ☒ No

www.s2scientific.com



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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

BH01
R212140-01 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 08:55

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	5.0	1.0	ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	6.8	1.0	"	"	"	"	"	"	

Date Sampled: 12/20/12 08:55

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		95.3 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		95.9 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.5 %	45-146		"	"	"	"	

Summit Scientific

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Brunns

Reported:
12/26/12 15:01

BH02
R212140-02 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:00

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	24	1.0	ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	3.9	1.0	"	"	"	"	"	"	
Xylenes (total)	8.1	1.0	"	"	"	"	"	"	

Date Sampled: 12/20/12 09:00

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		95.7 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		94.2 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		94.1 %	45-146		"	"	"	"	

Summit Scientific

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Brunns

Reported:
12/26/12 15:01

BH03
R212140-03 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:05

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	15	1.0		ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	6.7	1.0		"	"	"	"	"	"	
Xylenes (total)	7.9	1.0		"	"	"	"	"	"	

Date Sampled: 12/20/12 09:05

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		106 %		37-154		"	"	"	"	
Surrogate: Toluene-d8		99.8 %		45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		91.3 %		45-146		"	"	"	"	

Summit Scientific

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

BH04
R212140-04 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:10

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Benzene	38	1.0	ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	40	1.0	"	"	"	"	"	"	
Xylenes (total)	170	1.0	"	"	"	"	"	"	

Date Sampled: 12/20/12 09:10

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: 1,2-Dichloroethane-d4		98.4 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		98.6 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		92.0 %	45-146		"	"	"	"	

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

BH05
R212140-05 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:15

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Benzene	ND	1.0		ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0		"	"	"	"	"	"	
Ethylbenzene	ND	1.0		"	"	"	"	"	"	
Xylenes (total)	ND	1.0		"	"	"	"	"	"	

Date Sampled: 12/20/12 09:15

Analyte	Result	Reporting		Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit								
Surrogate: 1,2-Dichloroethane-d4		98.1 %		37-154		"	"	"	"	
Surrogate: Toluene-d8		96.8 %		45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		95.6 %		45-146		"	"	"	"	

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

BH06
R212140-06 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:20

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Benzene	ND	1.0	ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/20/12 09:20

Analyte	Result	Reporting	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit							
Surrogate: 1,2-Dichloroethane-d4		98.8 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		96.0 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		94.3 %	45-146		"	"	"	"	

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

BH07
R212140-07 (Water)

Summit Scientific

Volatile Organic Compounds by EPA Method 8260B

Date Sampled: 12/20/12 09:25

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Benzene	ND	1.0	ug/l	1	2122304	12/23/12	12/24/12	EPA 8260B	
Toluene	ND	1.0	"	"	"	"	"	"	
Ethylbenzene	ND	1.0	"	"	"	"	"	"	
Xylenes (total)	ND	1.0	"	"	"	"	"	"	

Date Sampled: 12/20/12 09:25

Analyte	Result	Reporting		Dilution	Batch	Prepared	Analyzed	Method	Notes
		Limit	Units						
Surrogate: 1,2-Dichloroethane-d4		98.5 %	37-154		"	"	"	"	
Surrogate: Toluene-d8		98.4 %	45-149		"	"	"	"	
Surrogate: 4-Bromofluorobenzene		93.4 %	45-146		"	"	"	"	

Summit Scientific

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

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 2122304 - EPA 5030 Water MS

Blank (2122304-BLK1)

Prepared: 12/23/12 Analyzed: 12/24/12

Benzene	ND	1.0	ug/l							
Toluene	ND	1.0	"							
Ethylbenzene	ND	1.0	"							
Xylenes (total)	ND	1.0	"							
Surrogate: 1,2-Dichloroethane-d4	13.8		"	13.2	104	37-154				
Surrogate: Toluene-d8	13.0		"	13.3	97.6	45-149				
Surrogate: 4-Bromofluorobenzene	12.6		"	13.3	94.8	45-146				

LCS (2122304-BS1)

Prepared: 12/23/12 Analyzed: 12/24/12

Benzene	28.7	1.0	ug/l	33.3	86.1	51-132				
Toluene	33.4	1.0	"	33.3	100	51-138				
Ethylbenzene	41.3	1.0	"	33.3	124	58-146				
m,p-Xylene	75.0	2.0	"	66.7	112	57-144				
o-Xylene	40.5	1.0	"	33.3	121	53-146				
Surrogate: 1,2-Dichloroethane-d4	13.6		"	13.2	103	37-154				
Surrogate: Toluene-d8	13.2		"	13.3	99.0	45-149				
Surrogate: 4-Bromofluorobenzene	12.4		"	13.3	92.9	45-146				

LCS Dup (2122304-BSD1)

Prepared: 12/23/12 Analyzed: 12/24/12

Benzene	28.8	1.0	ug/l	33.3	86.3	51-132	0.209	17		
Toluene	33.3	1.0	"	33.3	99.8	51-138	0.450	17		
Ethylbenzene	41.9	1.0	"	33.3	126	58-146	1.37	16		
m,p-Xylene	76.7	2.0	"	66.7	115	57-144	2.29	16		
o-Xylene	41.2	1.0	"	33.3	124	53-146	1.71	15		
Surrogate: 1,2-Dichloroethane-d4	13.7		"	13.2	103	37-154				
Surrogate: Toluene-d8	13.4		"	13.3	100	45-149				
Surrogate: 4-Bromofluorobenzene	12.6		"	13.3	94.4	45-146				

Summit Scientific

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

Project: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

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 2122304 - EPA 5030 Water MS

Matrix Spike (2122304-MS1)		Source: R212133-01			Prepared: 12/23/12		Analyzed: 12/24/12			
Benzene	28.0	1.0	ug/l	33.3	ND	84.2	34-141			
Toluene	32.5	1.0	"	33.3	ND	97.4	27-151			
Ethylbenzene	41.7	1.0	"	33.3	ND	125	29-160			
m,p-Xylene	76.0	2.0	"	66.7	ND	114	20-166			
o-Xylene	40.3	1.0	"	33.3	ND	121	33-159			
Surrogate: 1,2-Dichloroethane-d4	13.7		"	13.2		103	37-154			
Surrogate: Toluene-d8	13.0		"	13.3		97.6	45-149			
Surrogate: 4-Bromofluorobenzene	12.4		"	13.3		93.2	45-146			
Matrix Spike Dup (2122304-MSD1)		Source: R212133-01			Prepared: 12/23/12		Analyzed: 12/24/12			
Benzene	29.1	1.0	ug/l	33.3	ND	87.4	34-141	3.74	32	
Toluene	34.2	1.0	"	33.3	ND	103	27-151	5.10	25	
Ethylbenzene	42.2	1.0	"	33.3	ND	127	29-160	1.31	50	
m,p-Xylene	77.7	2.0	"	66.7	ND	117	20-166	2.21	36	
o-Xylene	42.2	1.0	"	33.3	ND	126	33-159	4.54	26	
Surrogate: 1,2-Dichloroethane-d4	13.9		"	13.2		105	37-154			
Surrogate: Toluene-d8	13.6		"	13.3		102	45-149			
Surrogate: 4-Bromofluorobenzene	12.4		"	13.3		93.3	45-146			

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: Cottonwood #1
Project Number: [none]
Project Manager: Brandon Bruns

Reported:
12/26/12 15:01

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

A handwritten signature in black ink, appearing to read 'Daniel A. Bruns IV'.