Summit Scientific

4653 Table Mountain Drive, Golden, Colorado 80403

303.277.9310

November 15, 2021

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

RE: DWR Permit #137465
Work Order #2111170

Enclosed are the results of analyses for samples received by Summit Scientific on 11/09/21 15:32. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Paul Shrewsbury
President

S2

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 11/15/21 15:19

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
EFF-110921-1304	2111170-01	Water	11/09/21 13:04	11/09/21 15:32
INF-110921-1329	2111170-02	Water	11/09/21 13:29	11/09/21 15:32

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.

Summit Scientific

2111170

S_2

4653 Table Mountain Drive ♦ Golden, Colorado 80403
303-277-9310

Client:	PDC Energy / Tasman Geosciences	Project Manager:	Karen Olson
Address:	6855 W. 119th Ave.	E-Mail:	Karen.Olson@pdce.com; chamlin@tasman-geo.com
City/State/Zip:	Broomfield / CO / 80020		
Phone:	303-487-1228	Project Name:	DWR Permit # 137465
Sampler Name:	Brock Nelson	Project Number:	AFE # EX-000335

					Preservative				Matrix				Analysis Requested								Special Instructions
ID	Sample Description	Date Sampled	Time Sampled	# of containers	HCl	HNO3	None	Other ____	Water	Soil	Air-Canister #	Other ____	RSK-175 (Dissolved Gases)		DIG Gas Composition	DIG Methane (carbon)	DIG Methane (Hydrogen)				
1	EFF-110921-1304	11/9/21	1304	3			X		X				X								
2	INF-110921-1329	11/9/21	1329	4			X		X				X		X	X	X				4th container for INF-110921-1329 is ISO-FLASK S/N FOG 5R
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

Relinquished by:	Date/Time: 11/9/21 1532	Received by: Tasman Lock Box	Date/Time: 11/9/21 1532
Relinquished by: Tasman Lock Box	Date/Time: 11.9.21 1532	Received by:	Date/Time: 11.9.21 1532
Relinquished by:	Date/Time:	Received by:	Date/Time:

Turn Around Time (Check)

Same Day	___	72 hours	___
24 hours	X	Standard	___
48 hours	___		

Sample Integrity:

Temperature Upon Receipt: 3.9

Samples Intact: (Yes) No

Notes:

Please provide data in PDF and COGCC EDD formats.

COGCC Facility No.: 765500

S2

Sample Receipt Checklist

S2 Work Order# 211170

Client: PDC Energy/Tasman Client Project ID: DWR Permit #1374605

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

☐ ☑ ☐ ☐ ☐

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

Temp (°C)	3.9

Thermometer ID: G86A9201901378

	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature at 4°C +/- 2°C [1]? NOTE: If samples are delivered the same day of sampling, this requirement is met if there is evidence that cooling has begun.	✓			on ICE
Were all samples received intact [1]?	–			
Was adequate sample volume provided [1]?	–			
If custody seals are present, are they intact [1]?	–			
Are samples with holding times due within 48 hours sample due within 48 hours present?	✓			24 hrs
Is a chain-of-custody (COC) form present and filled out completely [1]?	✓			
Does the COC agree with the number and type of sample bottles received [1]?	–			
Do the sample IDs on the bottle labels match the COC [1]?	–			
Is the COC properly relinquished by the client w/ date and time recorded [1]?	–			
For volatiles in water – is there headspace present? **If yes, contact client and note in narrative.**		✓		
Are samples preserved that require preservation **(excluding cooling)** [1]? Note the type of preservative in the Comments column – HCl, H2SO4, NaOH, HNO3, etc.			✓	
If samples are acid preserved for metals, is the pH ≤ 2[1]? Record the pH in Comments.			✓	
If dissolved metals are requested, were samples field filtered?			–	
Additional Comments (if any):				

[1] If NO, then contact the client before proceeding with analysis and note in case narrative.

Custodian Printed Name or Initials

11.9.21
Date/Time

PDC Energy	Project: DWR Permit #137465	
1775 Sherman St. STE. 3000	Project Number: AFE #EX-000335	**Reported:**
Denver CO, 80203	Project Manager: Karen Olson	11/15/21 15:19

EFF-110921-1304

2111170-01 (Water)

Summit Scientific

Dissolved Gases by RSK-175

Date Sampled: **11/09/21 13:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Methane	**2.1**	1.0	mg/L	100	BEK0241	11/10/21	11/15/21	RSK-175 mod	
Ethane	ND	0.10	"	10	"	"	"	"	R-01
Propane	ND	1.0	"	100	"	"	"	"	R-01

Date Sampled: **11/09/21 13:04**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Ethene		*54.9 %*	*70-130*		*"*	*"*	*"*	*"*	*S-04*

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 11/15/21 15:19

INF-110921-1329

2111170-02 (Water)

Summit Scientific

Dissolved Gases by RSK-175

Date Sampled: **11/09/21 13:29**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Methane	**12**	1.0	mg/L	100	BEK0241	11/10/21	11/15/21	RSK-175 mod	
Ethane	**3.9**	1.0	"	"	"	"	"	"	
Propane	**3.9**	0.10	"	10	"	"	"	"	

Date Sampled: **11/09/21 13:29**

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Surrogate: Ethene		*110 %*	*70-130*		"	"	"	"	

PDC Energy	Project: DWR Permit #137465	
1775 Sherman St. STE. 3000	Project Number: AFE #EX-000335	**Reported:**
Denver CO, 80203	Project Manager: Karen Olson	11/15/21 15:19

Dissolved Gases by RSK-175 - Quality Control

Summit Scientific

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch BEK0241 - GC										
Blank (BEK0241-BLK1)				Prepared: 11/10/21 Analyzed: 11/15/21						
Methane	ND	0.010	mg/L							
Ethane	ND	0.010	"							
Propane	ND	0.010	"							
Surrogate: Ethene	*0.0453*		*"*	*0.0364*		*124*	*70-130*			
LCS (BEK0241-BS1)				Prepared: 11/10/21 Analyzed: 11/15/21						
Methane	0.031	0.010	mg/L	0.0428		72.3	70-130			
Ethane	0.078	0.010	"	0.0798		97.2	70-130			
Propane	0.12	0.010	"	0.139		85.3	70-130			
Surrogate: Ethene	*0.0705*		*"*	*0.0728*		*96.8*	*70-130*			
Duplicate (BEK0241-DUP1)		**Source: 2111170-01**		Prepared: 11/10/21 Analyzed: 11/15/21						
Methane	1.9	1.0	mg/L		2.1			9.09	30	
Ethane	0.12	1.0	"		0.089			29.7	30	R-01
Propane	2.0	1.0	"		0.43			129	30	QR-03
Surrogate: Ethene	*0.0100*		*"*	*0.0364*		*27.5*	*70-130*			*S-04*
Matrix Spike (BEK0241-MS1)		**Source: 2111170-01**		Prepared: 11/10/21 Analyzed: 11/15/21						
Methane	4.3	1.0	mg/L	0.0428	2.1	NR	70-130			QM-02
Ethane	0.96	0.10	"	0.0798	0.089	NR	70-130			QM-02
Propane	0.19	0.10	"	0.139	0.43	NR	70-130			QM-02
Surrogate: Ethene	*0.102*		*"*	*0.0728*		*140*	*70-130*			*QM-02*

Dolan Integration Group
Geochemistry for Energy
11025 Dover Street Unit 800
Westminster, CO 80021
p: 303.531.2030

Hydrocarbon Gas Composition and Stable Isotopes
Data and Interpretation

Job #:	**21116702**
Lab #:	**DIG-026672**
Client:	**Summit Scientific**
Sample Name(s):	**INF-110921-1329**

Analytical Report

Job #:	21116702
Lab #:	DIG-026672
Client:	Summit Scientific
Sample Name:	INF-110921-1329
Date Sampled:	11/09/21
Time Sampled:	13:29
Sample Description:	Isoflask
Sampling Notes:	
Date Received:	11/10/21
Date Analyzed:	Gas Composition: 11/10/21 δ13C: 11/10/21 δD: 11/11/21
Date Reported:	11/12/21
Comments:	

Measured Values:	**Measured ppm**	**Analyte mol %[a]**	**HC mol %**	**$\delta^{13}C$ ‰ VPDB**	**δD ‰ VSMOW**	**Comments**
Nitrogen (N_2)	244654	24.47	-	-	-	
Oxygen + Argon (O_2+Ar)	8309	0.83	-	-	-	
Carbon Dioxide (CO_2)	1107	0.11	-	-	-	
Helium (He)[b]	1046	0.10	-	-	-	
Hydrogen (H_2)	nd	nd	-	-	-	
Methane (CH_4)	654125	65.41	87.82	-58.0	-269	
Ethane (C_2H_6)	57239	5.72	7.68		-	
Ethene (C_2H_4)	nd	nd	nd		-	
Propane (C_3H_8)	24796	2.48	3.33		-	
iso-Butane (C_4H_{10})	2917	0.29	0.39		-	
n-Butane (C_4H_{10})	4391	0.44	0.59		-	
iso-Pentane (C_5H_{12})	712	0.07	0.10		-	
n-Pentane (C_5H_{12})	515	0.05	0.07		-	
Hexanes + (C_6H_{14})	177	0.02	0.02		-	

Calculated Values:	
Total HCs (ppm)	744872
Gas Wetness (mol % C_2+/C_1+)	12.18
$C_1/(C_2+C_3)$ (mol/mol)	8

[a] Analyte concentrations normalized to 100% (Mol. % is approximately equal to Vol. %)

[b] Addition of helium negates the ability to detect native helium and may negate the ability to detect hydrogen.

HC= Hydrocarbons

nd = not detected

na = not analyzed

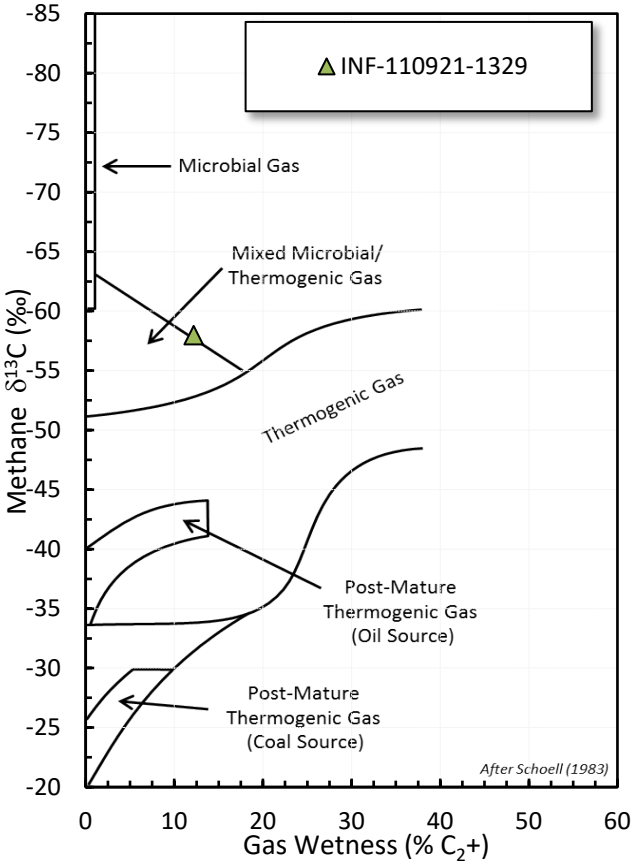
Stable isotope results based on multi-point laboratory calibration

Error $\delta^{13}C$ < 0.5 ‰

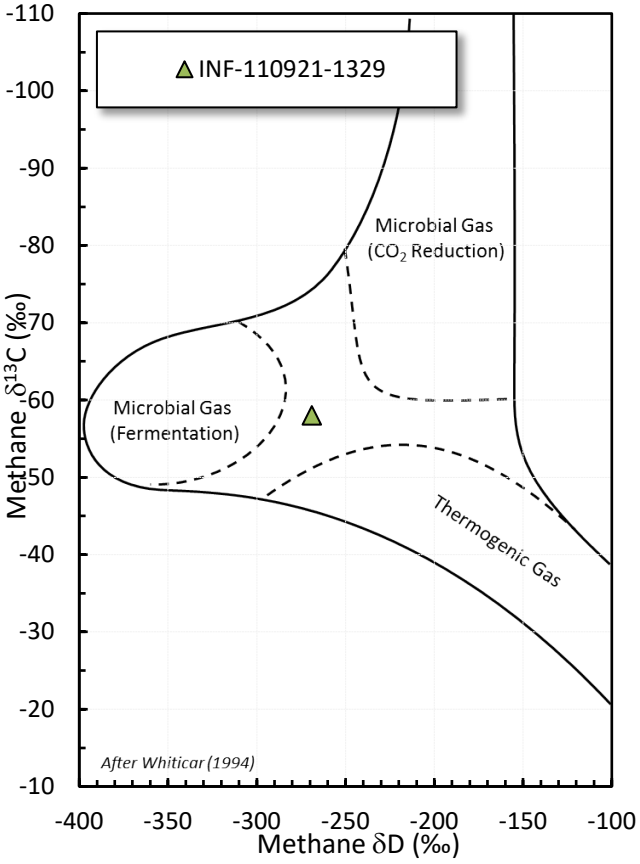
Error δD < 5.0 ‰

Stable Isotope Interpretive Plots

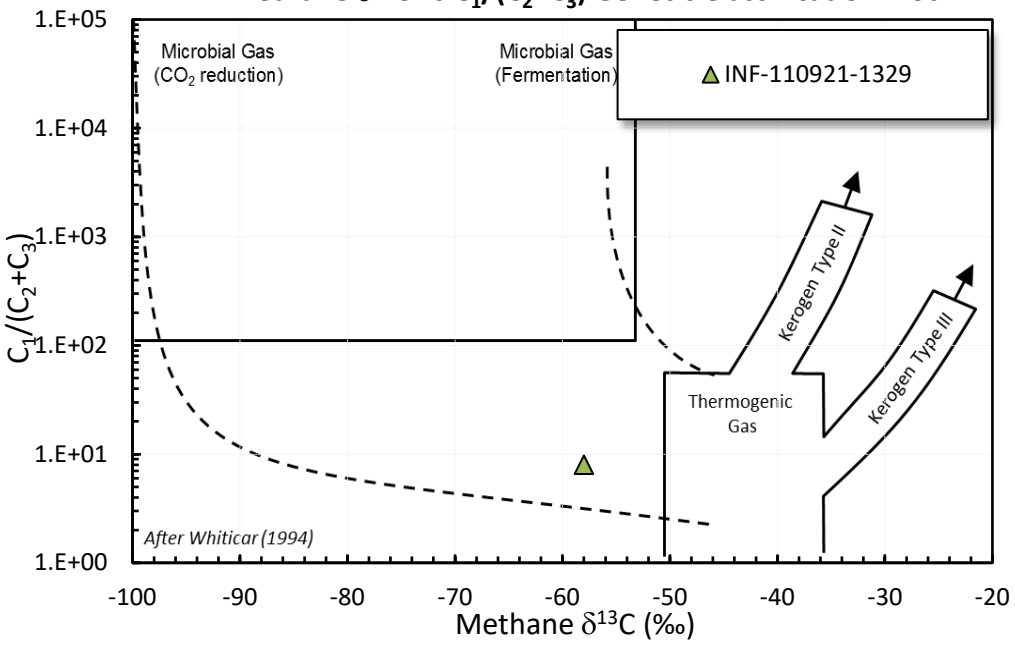
Methane vs Gas Wetness Genetic



Methane $\delta^{13}C$ vs δD Genetic Classification Plot



Methane $\delta^{13}C$ vs $C_1/(C_2+C_3)$ Genetic Classification Plot



JOB 2111670L DIG-026672

dig Geochemistry for Energy
Dolan Integration Group

main 303.531.2030 • info@digforenergy.com • digforenergy.com
Office and Lab 11025 Dover St • Ste 800 • Westminster, CO 80021

Send Data to:	Send Invoice to (if different):	Additional Information:
Name: Muri Premer / Paul Shrewsbury	Name: Ben Shrewsbury	AFE #:
Company: Summit Scientific	Company: Summit Scientific	Project: 2111170
Address: 4653 Table Mountain Drive	Address: 4653 Table Mountain Drive	PO #:
City, State: Golden, CO 80403	City, State: Golden, CO 80403	Location:
Phone: 303-277-9310	Phone: 303-277-9310	Sampled By:
Email: mpremer@s2scientific.com / pshrewsbury@s2scientific.com	Email: bshrewsbury@s2scientific.com	API #:

Turnaround Time**: ○ Standard (≤ 10 Business days) ○ Rush (≤ 5 Business days) ● Expedited Rush (≤ 3 Business days)

Container Number	Sample Identification	Date Sampled	Time	Sample Type*	Gas Composition	d13C of Methane (C1)	d13C of Ethane (C2)	d13C of Propane+ (C3+)	d13C of Carbon Dioxide (CO2)	dD of Methane (C1)	Whole Oil Gas Chromatography	d18O and dD Isotopes of Water	RSK 175 Dissolved Gas Quantification
	INF-110921-1329	11/9/21	13:29	Other	●	●	☐	☐	☐	●	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Other	☐	☐	☐	☐	☐	☐	☐	☐	☐

Chain of Custody Record

Comments:

Relinquished by Signature	Company	Date	Time	Received by Signature	Company	Date	Time
[signature]	SummitScientific	11-10-21	12:41	[signature]	DIG	11-10-21	1341

*Gas composition vs RSK-175 - Gas composition is a basic analysis of the concentration (ppm) of gases within the headspace of the sample (headspace is created at the lab). RSK-175 is a specific analysis technique combined with calculations to give the total dissolved gas of each species in the water sample (mg/L). Why one or the other? Gas composition gives us a quick, general look at relative concentrations and ratios (e.g., gas wetness). RSK-175 gives us an exact total of gas present in the sample (headspace and dissolved in the water). Questions? Give us a call at 303-531-2030.

** Rush and Expedited Rush turnaround time analysis will incur additional costs at 2x and 3x the standard turnaround time pricing.

Organization	Reporting Organization	Reporting Organization Name	Order Number	Entity Requesting Analysis	Purpose	Project																
	10206	Dolan Integration Group		Summit Scientific																		
Sample	COGCC Facility No.	Sample Date and Time	API #	LAB Sample ID	Sample Type	Matrix	Comments	Project Number	Chain of Custody ID	Date Received by Lab												
		11/9/21 1:29 PM		DIG-026672		GAS			INF-110921-1329	11/10/2021												
Batch	LabID	Lab Batch Identifier	Leach Date	Extract Date and Time	Extract Method	Start Date and Time	Conc Method	Init Vol	Final Vol	Init Vol Units	Final Vol Units	Analysis Date and Time	Report Basis	Comments	File Name	Column #						
	10206																					
Result	CAS Number	Analysis Name	Analysis Method	Analytical Method Modifier	Unit	Result Value	Qualifier	Test Type	Result Text	Data Flag	Dilution	Fraction Type	MDC	Requested MDC	Detection Limit	Instrument Detection Limit	Method Detection Limit	Comments	AnalyticalBatchID			
	O2+AR	OXYGEN + ARGON	SOP		MOL %	0.830									0.005	0.005	0.005		21116702			
	124-38-9	CARBON DIOXIDE	SOP		MOL %	0.110									0.005	0.005	0.005		21116702			
	7727-37-9	NITROGEN (N2)	SOP		MOL %	24.470									0.005	0.005	0.005		21116702			
	7440-59-7	Helium	SOP		MOL %	0.100									0.005	0.005	0.005		21116702			
	1333-74-0	HYDROGEN	SOP		MOL %	0.005	ND								0.005	0.005	0.005		21116702			
	74-82-8	METHANE	SOP		MOL %	65.410									0.005	0.005	0.005		21116702			
	74-84-0	ETHANE	SOP		MOL %	5.720									0.005	0.005	0.005		21116702			
	74-85-1	ETHENE	SOP		MOL %	0.005	ND								0.005	0.005	0.005		21116702			
	74-98-6	PROPANE	SOP		MOL %	2.480									0.005	0.005	0.005		21116702			
	75-28-5	ISOBUTANE	SOP		MOL %	0.290									0.005	0.005	0.005		21116702			
	106-97-8	N-BUTANE	SOP		MOL %	0.440									0.005	0.005	0.005		21116702			
	iC5	ISOPENTANE	SOP		MOL %	0.070									0.005	0.005	0.005		21116702			
	109-66-0	N-PENTANE	SOP		MOL %	0.050									0.005	0.005	0.005		21116702			
	92112-69-1+	C6+ (hexanes +)	SOP		MOL %	0.020									0.005	0.005	0.005		21116702			
	delta13C_C1	DELTA 13C C1	SOP		per mil	-58.0													21116702			
	deltaD_C1	DELTA D C1	SOP		per mil	-269													21116702			

PDC Energy 1775 Sherman St. STE. 3000 Denver CO, 80203	Project: DWR Permit #137465 Project Number: AFE #EX-000335 Project Manager: Karen Olson	**Reported:** 11/15/21 15:19

Notes and Definitions

S-04	A sample matrix effect prevented complete surrogate recovery.
R-01	The Reporting Limit for this analyte has been raised to account for matrix interference.
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.
QM-02	The RPD and/or percent recovery for this QC sample cannot be accurately calculated due to the high concentration of analyte inherent in the sample.
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