



# **Produced Gas Isotope and Compositional Analyses**

**Crestone Peak Resources Produced Gases  
Colorado**

**Crestone Peak Resources**

May 20, 2019

GeoMark

PRODUCED GAS ISOTOPE ANALYSIS

Crestone Peak ResourcesCrestone Peak Resources Produced Gases, Colorado

Sample ID	Cylinder ID Number	COGCC ID	Sampling Date	Sampling Time	Shipment	Casing Pressure (psia)	Stable Carbon Isotopes		$\delta^{13}\text{C}$ Propane (%)	$\delta^{13}\text{C}$ i-Butane (%)	$\delta^{13}\text{C}$ n-Butane (%)	$\delta^{13}\text{C}$ i-Pentane (%)	$\delta^{13}\text{C}$ n-Pentane (%)	$\delta\text{D}$ Methane (‰)	$\delta^{13}\text{C}$ CO2 (%)
							$\delta^{13}\text{C}$ Methane (%)	$\delta^{13}\text{C}$ Ethane (%)							
Baker C Unit 1 - Production CSG		246126	2/6/2019	8:00 AM	7th Shipment		-47.9	-32.4	-29.1	-31.4	-28.5			-247	0.4
Baker C Unit 1 - Surface CSG		246126	2/6/2019	8:00 AM	7th Shipment		-50.2	-32.6	-30.3	-32.6	-30.0			-240	-14.1
Cosslett 32-22 - Production CSG		420875	2/8/2019	10:30 AM	7th Shipment		-49.2	-32.8	-28.4	-31.4	-28.2			-241	-3.7
Cosslett 32-22 - Surface CSG		420875	2/8/2019	10:30 AM	7th Shipment		-51.9	-33.1	-29.0	-32.0	-29.0			-239	-15.2
Cosslett 4-0-22 - Production CSG		420763	2/6/2019	12:00 PM	7th Shipment		-48.7	-32.7	-28.4	-32.3	-28.3			-240	-1.2
Cosslett 4-0-22 - Surface CSG		420763	2/6/2019	12:00 PM	7th Shipment		-53.2	-33.9	-28.7	-32.0	-28.8			-247	-9.7
Cosslett 6-4-22 - Production CSG		420884	2/8/2019	11:00 AM	7th Shipment		-48.6	-32.1	-28.7	-31.5	-28.2			-240	0.7
Cosslett 6-4-22 - Surface CSG		420884	2/8/2019	11:00 AM	7th Shipment		-50.6	-33.6	-29.1	-32.8	-28.5			-241	-5.6
Costigan 43-20 - Production CSG		301574	1/31/2019	9:30 AM	7th Shipment		-48.2	-32.6	-28.8	-30.6	-27.5			-248	0.6
Costigan 43-20 - Surface CSG		301574	1/31/2019	9:30 AM	7th Shipment		-49.3	-32.8	-28.8	-31.8	-28.4			-249	-16.2
Davis 1B-9H - Production CSG		428589	2/1/2019	1:00 PM	7th Shipment		-46.4	-31.2	-28.2	-31.3	-27.9			-244	-12.5
Davis 1B-9H - Surface CSG		428589	2/1/2019	1:00 PM	7th Shipment		-49.4	-32.5	-28.6	-31.8	-27.7			-244	-16.2
Davis 1C-9H - Production CSG		428455	2/1/2019	2:00 PM	7th Shipment		-48.4	-32.5	-28.8	-31.4	-28.2			-245	-16.4
Davis 1C-9H - Surface CSG		428455	2/1/2019	2:00 PM	7th Shipment		-50.9	-33.1	-28.1	-31.5	-27.4			-239	-18.4
McPeck 4-8-10 - Production CSG		431853	2/13/2019	4:00 PM	7th Shipment			-32.0	-28.5	-31.6	-28.6				-14.1
Melbon Ranch 4J-17H - Surface CSG		457070	2/11/2019	10:30 AM	7th Shipment		-47.0	-32.2	-28.7	-31.2	-28.3			-244	-15.2
Melbon Ranch 4K-17H - Production CSG		457073	2/11/2019	10:00 AM	7th Shipment		-48.6	-32.9	-29.6	-31.2	-28.1			-248	0.7
Melbon Ranch 4K-17H - Surface CSG		457073	2/11/2019	10:00 AM	7th Shipment		-52.3	-34.1	-29.2	-30.1	-26.7			-249	-15.6
Nelson 23-32 - Production CSG		294549	1/31/2019	1:30 AM	7th Shipment		-47.4	-31.5	-28.8	-31.8	-28.6			-240	-0.1
Pratt 4-2-29 - Production CSG		420035	1/31/2019	12:00 PM	7th Shipment		-48.4	-31.8	-29.9	-31.8	-28.6			-243	-10.1
Pratt 4-2-29 - Surface CSG		420035	1/30/2019	12:00 PM	7th Shipment		-50.6	-34.2	-30.2	-32.6	-29.7			-242	-15.7
Regnier 33-19 - Production CSG		275675	1/31/2019	8:30 AM	7th Shipment		-49.4	-32.6	-29.6	-33.5	-30.6			-245	0.4
Regnier 33-19 - Surface CSG		275675	1/31/2019	8:30 AM	7th Shipment		-55.3	-33.9	-32.0	-32.9	-32.0			-263	-15.4
Regnier 4-4-19 - Production CSG		289889	1/30/2019	3:30 PM	7th Shipment		-49.3	-32.8	-30.9	-32.3	-29.9			-246	-4.5
Regnier 4-4-19 - Surface CSG		289889	1/30/2019	3:30 PM	7th Shipment		-54.7	-33.6	-32.2	-33.0	-32.0			-262	-17.2

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PRODUCED GAS ISOTOPE ANALYSIS

Crestone Peak Resources

Crestone Peak Resources Produced Gases, Colorado

Sample ID	Cylinder ID Number	COGCC ID	Sampling Date	Sampling Time	Shipment	Casing Pressure (psia)	Produce Gas Composition																	
							He Conc. (mole %)	H2 Conc. (mole %)	O2+Ar Conc. (mole %)	N2 Conc. (mole %)	CO2 Conc. (mole %)	H2S Conc. (mole %)	CO Conc. (mole %)	C1 Conc. (mole %)	C2 Conc. (mole %)	C2H4 Conc. (mole %)	C3 Conc. (mole %)	C3H6 Conc. (mole %)	IC4 Conc. (mole %)	nC4 Conc. (mole %)	iC5 Conc. (mole %)	nC5 Conc. (mole %)	C6+ Conc. (mole %)	Specific Gravity (Air = 1.0)
Baker C Unit 1 - Production CSG		246126	2/6/2019	8:00 AM	7th Shipment		0.00	0.11	0.64	2.21	2.07	0.00	0.09	74.47	12.50	0.00	5.30	0.00	0.67	1.58	0.20	0.15	0.01	0.738
Baker C Unit 1 - Surface CSG		246126	2/6/2019	8:00 AM	7th Shipment		0.00	0.00	0.64	4.33	0.01	0.00	0.09	78.68	7.64	0.00	5.25	0.00	0.75	1.56	0.36	0.37	0.30	0.719
Cosslett 32-22 - Production CSG		420875	2/8/2019	10:30 AM	7th Shipment		0.00	1.87	0.42	1.75	0.68	0.00	0.09	76.97	11.77	0.00	4.41	0.00	0.50	1.07	0.19	0.19	0.08	0.693
Cosslett 32-22 - Surface CSG		420875	2/8/2019	10:30 AM	7th Shipment		0.00	0.04	0.35	2.36	0.01	0.00	0.09	82.16	9.27	0.00	4.07	0.00	0.42	0.81	0.16	0.16	0.11	0.677
Cosslett 4-0-22 - Production CSG		420763	2/6/2019	12:00 PM	7th Shipment		0.00	1.04	0.70	3.05	0.99	0.00	0.09	76.52	11.51	0.00	4.45	0.00	0.48	0.93	0.12	0.10	0.04	0.699
Cosslett 4-0-22 - Surface CSG		420763	2/6/2019	12:00 PM	7th Shipment		0.00	0.00	0.51	3.65	0.01	0.00	0.08	80.15	8.65	0.00	4.60	0.00	0.61	1.19	0.23	0.21	0.12	0.696
Cosslett 6-4-22 - Production CSG		420884	2/8/2019	11:00 AM	7th Shipment		0.00	1.26	0.65	8.52	1.86	0.00	0.08	70.19	11.13	0.00	4.43	0.00	0.51	1.06	0.14	0.12	0.04	0.731
Cosslett 6-4-22 - Surface CSG		420884	2/8/2019	11:00 AM	7th Shipment		0.00	0.13	0.81	3.93	0.01	0.00	0.09	78.58	9.70	0.00	4.67	0.00	0.55	1.16	0.16	0.16	0.05	0.699
Costigan 43-20 - Production CSG		301574	1/31/2019	9:30 AM	7th Shipment		0.00	0.04	0.88	3.10	1.70	0.00	0.08	75.61	11.64	0.00	4.49	0.00	0.59	1.41	0.19	0.23	0.05	0.728
Costigan 43-20 - Surface CSG		301574	1/31/2019	9:30 AM	7th Shipment		0.00	0.01	0.38	1.65	0.02	0.00	0.09	81.17	8.17	0.00	4.21	0.00	0.66	1.63	0.47	0.41	0.14	0.702
Davis 1B-9H - Production CSG		428589	2/1/2019	1:00 PM	7th Shipment		0.00	0.25	1.90	7.48	0.07	0.00	0.09	70.27	11.43	0.00	4.70	0.00	0.69	1.57	0.43	0.50	0.61	0.762
Davis 1B-9H - Surface CSG		428589	2/1/2019	1:00 PM	7th Shipment		0.00	0.10	0.95	3.85	0.02	0.00	0.00	78.44	9.62	0.00	4.09	0.00	0.59	1.22	0.41	0.36	0.37	0.711
Davis 1C-9H - Production CSG		428455	2/1/2019	2:00 PM	7th Shipment		0.00	0.59	0.60	2.68	0.02	0.00	0.08	75.69	12.40	0.00	4.87	0.00	0.63	1.34	0.32	0.36	0.40	0.725
Davis 1C-9H - Surface CSG		428455	2/1/2019	2:00 PM	7th Shipment		0.00	0.07	0.67	6.25	0.01	0.00	0.08	80.10	7.69	0.00	3.44	0.00	0.52	0.75	0.19	0.12	0.10	0.681
McPeak 4-8-10 - Production CSG		431853	2/13/2019	4:00 PM	7th Shipment		0.00	0.00	20.62	79.15	0.09	0.00	0.00	0.06	0.02	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.996
Melbon Ranch 4J-17H - Surface CSG		457070	2/11/2019	10:30 AM	7th Shipment		0.00	89.30	0.54	9.44	0.01	0.00	0.00	0.54	0.11	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.01	0.165
Melbon Ranch 4K-17H - Production CSG		457073	2/11/2019	10:00 AM	7th Shipment		0.00	0.00	0.55	2.07	2.18	0.00	0.08	81.42	12.52	0.00	0.72	0.00	0.09	0.23	0.05	0.05	0.04	0.662
Melbon Ranch 4K-17H - Surface CSG		457073	2/11/2019	10:00 AM	7th Shipment		0.00	0.00	0.89	5.27	0.02	0.00	0.10	88.20	4.61	0.00	0.85	0.00	0.04	0.02	0.00	0.00	0.00	0.613
Nelson 23-32 - Production CSG		294549	1/31/2019	1:30 AM	7th Shipment		0.00	0.06	0.32	1.72	1.94	0.00	0.08	74.34	12.10	0.00	5.47	0.00	0.82	2.34	0.43	0.26	0.01	0.754
Pratt 4-2-29 - Production CSG		420035	1/31/2019	12:00 PM	7th Shipment		0.00	0.00	1.09	4.19	1.63	0.00	0.09	72.64	11.33	0.00	5.75	0.00	0.87	2.10	0.28	0.02	0.01	0.753
Pratt 4-2-29 - Surface CSG		420035	1/30/2019	12:00 PM	7th Shipment		0.00	0.01	0.34	2.17	0.01	0.00	0.10	82.57	8.39	0.00	4.29	0.00	0.53	1.07	0.19	0.20	0.14	0.681
Regnier 33-19 - Production CSG		275675	1/31/2019	8:30 AM	7th Shipment		0.00	0.77	1.29	4.96	1.42	0.00	0.07	72.13	11.86	0.00	5.12	0.00	0.62	1.35	0.19	0.17	0.04	0.735
Regnier 33-19 - Surface CSG		275675	1/31/2019	8:30 AM	7th Shipment		0.00	0.01	0.58	15.58	0.01	0.00	0.09	74.76	4.30	0.00	2.96	0.00	0.58	0.71	0.20	0.14	0.08	0.699
Regnier 4-4-19 - Production CSG		289889	1/30/2019	3:30 PM	7th Shipment		0.00	1.11	1.63	6.32	0.65	0.00	0.09	68.11	11.65	0.00	6.31	0.00	1.03	2.30	0.44	0.33	0.02	0.772
Regnier 4-4-19 - Surface CSG		289889	1/30/2019	3:30 PM	7th Shipment		0.00	0.00	0.52	4.14	0.01	0.00	0.10	84.25	4.77	0.00	3.84	0.00	0.83	0.96	0.26	0.18	0.13	0.672

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PRODUCED GAS ISOTOPE ANALYSIS

Crestone Peak ResourcesCrestone Peak Resources Produced Gases, Colorado

Sample ID	Cylinder ID Number	COGCC ID	Sampling Date	Sampling Time	Shipment	Casing Pressure (psia)	Hydrocarbon Gas Composition							
							C1 Conc. (mole %)	C2 Conc. (mole %)	C3 Conc. (mole %)	iC4 Conc. (mole %)	nC4 Conc. (mole %)	iC5 Conc. (mole %)	nC5 Conc. (mole %)	C6+ Conc. (mole %)
Baker C Unit 1 - Production CSG		246126	2/6/2019	8:00 AM	7th Shipment		78.49	13.17	5.59	0.71	1.66	0.21	0.16	0.01
Baker C Unit 1 - Surface CSG		246126	2/6/2019	8:00 AM	7th Shipment		82.89	8.05	5.53	0.79	1.65	0.38	0.39	0.31
Cosslett 32-22 - Production CSG		420875	2/6/2019	10:30 AM	7th Shipment		80.86	12.37	4.63	0.53	1.13	0.20	0.20	0.08
Cosslett 32-22 - Surface CSG		420875	2/6/2019	10:30 AM	7th Shipment		84.57	9.54	4.19	0.43	0.83	0.16	0.16	0.12
Cosslett 4-0-22 - Production CSG		420763	2/6/2019	12:00 PM	7th Shipment		81.29	12.23	4.72	0.51	0.99	0.12	0.10	0.04
Cosslett 4-0-22 - Surface CSG		420763	2/6/2019	12:00 PM	7th Shipment		83.70	9.04	4.81	0.63	1.24	0.24	0.22	0.13
Cosslett 6-4-22 - Production CSG		420884	2/6/2019	11:00 AM	7th Shipment		80.10	12.70	5.06	0.58	1.21	0.16	0.14	0.05
Cosslett 6-4-22 - Surface CSG		420884	2/6/2019	11:00 AM	7th Shipment		82.69	10.20	4.91	0.58	1.22	0.16	0.17	0.05
Costigan 43-20 - Production CSG		301574	1/31/2019	9:30 AM	7th Shipment		80.26	12.36	4.76	0.62	1.50	0.20	0.24	0.05
Costigan 43-20 - Surface CSG		301574	1/31/2019	9:30 AM	7th Shipment		82.94	9.37	4.31	0.67	1.67	0.48	0.42	0.14
Davis 1B-9H - Production CSG		428589	2/1/2019	1:00 PM	7th Shipment		77.90	12.67	5.21	0.77	1.74	0.47	0.56	0.68
Davis 1B-9H - Surface CSG		428589	2/1/2019	1:00 PM	7th Shipment		82.49	10.12	4.30	0.62	1.28	0.43	0.38	0.39
Davis 1C-9H - Production CSG		428455	2/1/2019	2:00 PM	7th Shipment		78.83	12.92	5.07	0.66	1.40	0.33	0.37	0.42
Davis 1C-9H - Surface CSG		428455	2/1/2019	2:00 PM	7th Shipment		86.22	8.28	3.70	0.56	0.80	0.20	0.13	0.11
McPhee 4-6-10 - Production CSG		431853	2/13/2019	4:00 PM	7th Shipment		88.22	14.46	10.10	1.87	5.64	2.06	3.12	4.52
Melbon Ranch 4K-17H - Surface CSG		457070	2/11/2019	10:30 AM	7th Shipment		76.32	15.07	5.42	0.42	0.82	0.16	0.16	1.61
Melbon Ranch 4K-17H - Production CSG		457073	2/11/2019	10:00 AM	7th Shipment		85.59	13.16	0.76	0.10	0.24	0.05	0.06	0.04
Melbon Ranch 4K-17H - Surface CSG		457073	2/11/2019	10:00 AM	7th Shipment		94.10	4.92	0.91	0.05	0.02	0.00	0.00	0.00
Nelson 23-32 - Production CSG		294549	1/31/2019	1:30 AM	7th Shipment		77.54	12.62	5.71	0.96	2.45	0.45	0.28	0.01
Pratt 4-2-29 - Production CSG		420035	1/30/2019	12:00 PM	7th Shipment		78.11	12.18	6.18	0.94	2.26	0.31	0.02	0.01
Pratt 4-2-29 - Surface CSG		420035	1/30/2019	12:00 PM	7th Shipment		84.80	8.61	4.40	0.55	1.10	0.19	0.21	0.14
Regnier 33-19 - Production CSG		275675	1/31/2019	8:30 AM	7th Shipment		78.85	12.97	5.59	0.68	1.48	0.21	0.18	0.04
Regnier 33-19 - Surface CSG		275675	1/31/2019	8:30 AM	7th Shipment		89.28	5.14	3.53	0.69	0.85	0.24	0.17	0.09
Regnier 4-4-19 - Production CSG		289889	1/30/2019	3:30 PM	7th Shipment		75.51	12.92	7.00	1.14	2.56	0.48	0.37	0.02
Regnier 4-4-19 - Surface CSG		289889	1/30/2019	3:30 PM	7th Shipment		88.48	5.01	4.03	0.87	1.00	0.27	0.19	0.14

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PRODUCED GAS ISOTOPE ANALYSIS

Crestone Peak ResourcesCrestone Peak Resources Produced Gases, Colorado

Sample ID	Cylinder ID Number	COGCC ID	Sampling Date	Sampling Time	Shipment	Casing Pressure (psia)	BTU Content		Calculated Ratios			
							Total Gas (BTU/lb3)	Hydrocar. Gas (BTU/lb3)	Total HC Gas (ppm by mole)	Wetness (C2 - nC5) / (C1 - nC5)	C1/C2 Ratio (mole/mole)	iC4/nC4 Ratio (mole/mole)
Baker C Unit 1 - Production CSG		246126	2/6/2019	8:00 AM	7th Shipment		1,194	1,259	948,808	21.50	6	0.43
Baker C Unit 1 - Surface CSG		246126	2/6/2019	8:00 AM	7th Shipment		1,181	1,244	949,182	16.85	10	0.48
Cosslett 32-22 - Production CSG		420875	2/8/2019	10:30 AM	7th Shipment		1,167	1,226	951,911	19.07	7	0.47
Cosslett 32-22 - Surface CSG		420875	2/8/2019	10:30 AM	7th Shipment		1,154	1,188	971,489	15.33	9	0.51
Cosslett 4-0-22 - Production CSG		420763	2/6/2019	12:00 PM	7th Shipment		1,145	1,216	941,381	18.68	7	0.51
Cosslett 4-0-22 - Surface CSG		420763	2/6/2019	12:00 PM	7th Shipment		1,160	1,211	957,525	16.19	9	0.51
Cosslett 6-4-22 - Production CSG		420884	2/8/2019	11:00 AM	7th Shipment		1,081	1,234	876,301	19.86	6	0.48
Cosslett 6-4-22 - Surface CSG		420884	2/8/2019	11:00 AM	7th Shipment		1,154	1,214	950,183	17.26	8	0.47
Costigan 43-20 - Production CSG		301574	1/31/2019	9:30 AM	7th Shipment		1,167	1,239	942,094	19.70	6	0.42
Costigan 43-20 - Surface CSG		301574	1/31/2019	9:30 AM	7th Shipment		1,204	1,231	978,578	16.94	9	0.40
Davis 1B-9H - Production CSG		428589	2/1/2019	1:00 PM	7th Shipment		1,170	1,297	902,047	21.56	6	0.44
Davis 1B-9H - Surface CSG		428589	2/1/2019	1:00 PM	7th Shipment		1,172	1,233	950,936	17.19	8	0.48
Davis 1C-9H - Production CSG		428455	2/1/2019	2:00 PM	7th Shipment		1,217	1,268	960,126	20.83	6	0.47
Davis 1C-9H - Surface CSG		428455	2/1/2019	2:00 PM	7th Shipment		1,090	1,173	929,103	13.69	10	0.69
McPhee 4-8-10 - Production CSG		431853	2/13/2019	4:00 PM	7th Shipment		2	1,766	1,320	39.02	4	0.33
Melbon Ranch 4J-17H - Surface CSG		457070	2/11/2019	10:30 AM	7th Shipment		9	1,304	7,059	22.43	5	0.51
Melbon Ranch 4K-17H - Production CSG		457073	2/11/2019	10:00 AM	7th Shipment		1,079	1,134	951,248	14.37	7	0.41
Melbon Ranch 4K-17H - Surface CSG		457073	2/11/2019	10:00 AM	7th Shipment		996	1,063	937,215	5.89	19	2.46
Nelson 23-32 - Production CSG		294549	1/31/2019	1:30 AM	7th Shipment		1,237	1,290	958,767	22.46	6	0.39
Pratt 4-2-29 - Production CSG		420035	1/31/2019	12:00 PM	7th Shipment		1,188	1,278	929,863	21.89	6	0.41
Pratt 4-2-29 - Surface CSG		420035	1/30/2019	12:00 PM	7th Shipment		1,164	1,196	973,696	15.08	10	0.50
Regnier 33-19 - Production CSG		275675	1/31/2019	8:30 AM	7th Shipment		1,148	1,254	914,792	21.12	6	0.46
Regnier 33-19 - Surface CSG		275675	1/31/2019	8:30 AM	7th Shipment		965	1,153	837,298	10.63	17	0.82
Regnier 4-4-19 - Production CSG		289889	1/30/2019	3:30 PM	7th Shipment		1,153	1,323	902,013	24.47	6	0.45
Regnier 4-4-19 - Surface CSG		289889	1/30/2019	3:30 PM	7th Shipment		1,114	1,170	952,189	11.40	18	0.87