

SURVEY DATA CERTIFICATION



PHOENIX
TECHNOLOGY SERVICES

Job #: 62808
 Client: COG Operating LLC
 County & State: Eddy County, NM
 Well: Chimay 6 Federal Com #15H
 API No: 30-015-43620
 Proposed Direction: 89.87

TIE-IN DATA

MD	TVD	INC	AZM	N/-S	E/-W	DATA SOURCE
1165.00	1164.94	1.05	88.11	2.06	9.14	Single Shot
Data Source Company:						Gyro/VES

SURVEY DATA

First Survey Date	First Survey Depth	INC	AZM
1-Jun-18	1,301 ft	1.82°	224.41°

Last Survey Date	Last Survey Depth	INC	AZM
10-Jun-18	9,403 ft	89.27°	91.15°

Survey Instrument Type

Phoenix MWD

Projected TD Survey Date	Projected TD Survey Depth	INC	AZM
10-Jun-18	9,450 ft	89.27°	91.15°

CORRECTION INFORMATION

Magnetic Declination Used	7.52	degrees
Grid Convergence Used	0.17	degrees
Total Correction	7.35	degrees

Corrected to True/Grid North

Grid North

TO THE BEST OF MY KNOWLEDGE, I
 CERTIFY THIS SURVEY DATA TO BE
 TRUE AND CORRECT.

Joshua Zeigler
 Signature

June 10, 2018
 Date



COG Operating LLC

**Eddy County, NM (NAD83 NME)
Chimay 6 Federal Com
15H**

OH / 62

Survey: Phoenix MWD Surveys

Standard Survey Report

10 June, 2018



Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 15H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	RKB @ 3702.00usft (Double K 7)
Site:	Chimay 6 Federal Com	MD Reference:	RKB @ 3702.00usft (Double K 7)
Well:	15H	North Reference:	Grid
Wellbore:	OH / 62	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Double K7)	Database:	USA Compass

Project	Eddy County, NM (NAD83 NME)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	New Mexico Eastern Zone		

Site	Chimay 6 Federal Com		
Site Position:		Northing:	677,697.20 usft
From:	Map	Easting:	637,643.40 usft
Position Uncertainty:	0.00 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 51' 45.42763 N
		Longitude:	104° 1' 10.86914 W
		Grid Convergence:	0.17 °

Well	15H		
Well Position	+N/-S	0.00 usft	Northing: 677,697.20 usft
	+E/-W	0.00 usft	Easting: 637,643.40 usft
Position Uncertainty	0.00 usft	Wellhead Elevation:	usft
		Latitude:	32° 51' 45.42763 N
		Longitude:	104° 1' 10.86914 W
		Ground Level:	3,685.00 usft

Wellbore	OH / 62		
Magnetics	Model Name	Sample Date	Declination (°)
	MVHD	5/31/2018	7.52
			Dip Angle (°) 60.65
			Field Strength (nT) 48,209.75031062

Design	Surveys (Double K7)		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)
	0.00	0.00	0.00
			Direction (°) 89.87

Survey Program	Date 6/10/2018		
From (usft)	To (usft)	Survey (Wellbore)	Tool Name
50.00	1,165.00	VES Gyro Surveys (OH / 62)	VES-ISCWSA-GYRO-3
1,301.00	9,450.00	Phoenix MWD Surveys (OH / 62)	MWD+HDGM
			Description
			Biaxial Semi-Cont. Gyro
			OWSG Rev.2 MWD + HDGM

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
1,165.00	1.05	88.11	1,164.94	2.06	9.14	9.14	0.00	0.00	0.00
Tie In									
1,301.00	1.82	224.41	1,300.92	0.56	8.87	8.88	1.97	0.57	100.22
First Phoenix MWD Survey									
1,490.00	4.63	228.34	1,489.60	-6.66	1.07	1.06	1.49	1.49	2.08
1,616.00	5.07	223.30	1,615.15	-14.09	-6.54	-6.58	0.49	0.35	-4.00
1,742.00	7.84	251.86	1,740.37	-20.82	-18.53	-18.58	3.30	2.20	22.67
1,931.00	11.61	289.80	1,926.80	-18.39	-48.72	-48.76	3.83	1.99	20.07
2,057.00	8.98	279.93	2,050.77	-12.40	-70.34	-70.37	2.51	-2.09	-7.83

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Survey

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2,182.00	8.11	270.84	2,174.39	-10.58	-88.77	-88.79	1.28	-0.70	-7.27
2,309.00	7.08	269.07	2,300.27	-10.58	-105.55	-105.57	0.83	-0.81	-1.39
2,435.00	6.56	268.60	2,425.38	-10.88	-120.51	-120.53	0.42	-0.41	-0.37
2,558.00	6.37	269.19	2,547.60	-11.15	-134.36	-134.38	0.16	-0.15	0.48
2,684.00	8.06	261.98	2,672.60	-12.48	-150.09	-150.12	1.52	1.34	-5.72
2,810.00	7.84	260.32	2,797.39	-15.16	-167.31	-167.34	0.25	-0.17	-1.32
2,935.00	7.92	259.58	2,921.21	-18.15	-184.18	-184.23	0.10	0.06	-0.59
3,061.00	9.57	268.21	3,045.74	-20.05	-203.19	-203.24	1.67	1.31	6.85
3,187.00	9.48	271.47	3,170.01	-20.11	-224.04	-224.08	0.43	-0.07	2.59
3,313.00	8.70	277.31	3,294.42	-18.63	-243.86	-243.90	0.96	-0.62	4.63
3,438.00	4.73	282.92	3,418.54	-16.27	-258.27	-258.30	3.22	-3.18	4.49
3,565.00	0.33	263.83	3,545.39	-15.14	-263.74	-263.77	3.48	-3.46	-15.03
3,628.00	1.63	85.74	3,608.38	-15.09	-263.02	-263.06	3.11	2.06	-282.68
3,659.00	2.44	82.42	3,639.36	-14.97	-261.93	-261.96	2.64	2.61	-10.71
3,691.00	4.41	81.14	3,671.30	-14.70	-260.04	-260.07	6.16	6.16	-4.00
3,723.00	7.30	79.31	3,703.13	-14.13	-256.82	-256.86	9.05	9.03	-5.72
3,754.00	10.81	79.36	3,733.74	-13.23	-252.03	-252.06	11.32	11.32	0.16
3,785.00	14.24	80.49	3,764.00	-12.06	-245.41	-245.44	11.09	11.06	3.65
3,817.00	17.80	83.00	3,794.75	-10.81	-236.67	-236.70	11.33	11.13	7.84
3,849.00	21.32	85.50	3,824.90	-9.76	-226.01	-226.04	11.30	11.00	7.81
3,880.00	24.53	89.11	3,853.45	-9.22	-213.96	-213.98	11.30	10.35	11.65
3,911.00	25.96	90.85	3,881.49	-9.22	-200.74	-200.76	5.20	4.61	5.61
3,943.00	26.66	91.75	3,910.17	-9.54	-186.56	-186.58	2.52	2.19	2.81
3,974.00	27.59	92.32	3,937.77	-10.04	-172.44	-172.46	3.11	3.00	1.84
4,006.00	28.66	92.94	3,965.99	-10.74	-157.37	-157.39	3.47	3.34	1.94
4,038.00	29.65	92.93	3,993.93	-11.54	-141.80	-141.82	3.09	3.09	-0.03
4,069.00	30.59	93.09	4,020.75	-12.35	-126.26	-126.29	3.04	3.03	0.52
4,101.00	30.71	92.94	4,048.28	-13.21	-109.97	-110.00	0.44	0.38	-0.47
4,132.00	31.04	92.39	4,074.88	-13.95	-94.08	-94.11	1.40	1.06	-1.77
4,163.00	32.52	91.66	4,101.23	-14.53	-77.77	-77.80	4.93	4.77	-2.35
4,195.00	34.11	91.52	4,127.97	-15.01	-60.20	-60.23	4.97	4.97	-0.44
4,227.00	35.68	91.31	4,154.22	-15.46	-41.90	-41.93	4.92	4.91	-0.66
4,258.00	36.76	91.06	4,179.23	-15.84	-23.58	-23.62	3.52	3.48	-0.81
4,289.00	37.23	90.34	4,203.99	-16.07	-4.93	-4.97	2.06	1.52	-2.32
4,320.00	38.90	89.02	4,228.39	-15.96	14.18	14.14	5.99	5.39	-4.26
4,352.00	41.89	88.36	4,252.76	-15.48	34.91	34.87	9.44	9.34	-2.06
4,384.00	45.01	87.48	4,275.99	-14.68	56.90	56.86	9.93	9.75	-2.75
4,416.00	48.59	87.72	4,297.89	-13.70	80.20	80.17	11.20	11.19	0.75
4,447.00	52.44	88.74	4,317.60	-12.97	104.11	104.08	12.68	12.42	3.29
4,479.00	56.14	90.04	4,336.28	-12.70	130.09	130.06	12.02	11.56	4.06
4,511.00	59.47	90.63	4,353.32	-12.86	157.16	157.13	10.52	10.41	1.84
4,542.00	61.75	90.35	4,368.54	-13.09	184.17	184.14	7.40	7.35	-0.90
4,574.00	63.87	89.89	4,383.16	-13.15	212.63	212.60	6.75	6.63	-1.44

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Wellbore:	OH / 62	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Double K7)	Database:	USA Compass

Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
4,606.00	67.76	89.99	4,396.27	-13.12	241.82	241.79	12.16	12.16	0.31
4,637.00	71.57	90.57	4,407.04	-13.26	270.88	270.85	12.41	12.29	1.87
4,668.00	75.99	90.64	4,415.69	-13.58	300.64	300.60	14.26	14.26	0.23
4,700.00	79.59	91.02	4,422.46	-14.03	331.90	331.87	11.31	11.25	1.19
4,732.00	81.81	91.62	4,427.63	-14.76	363.47	363.44	7.18	6.94	1.88
4,763.00	82.88	91.42	4,431.76	-15.57	394.19	394.15	3.51	3.45	-0.65
4,794.00	83.44	90.91	4,435.45	-16.20	424.96	424.92	2.44	1.81	-1.65
4,825.00	84.60	90.76	4,438.68	-16.65	455.79	455.75	3.77	3.74	-0.48
4,857.00	85.76	90.23	4,441.37	-16.92	487.67	487.63	3.98	3.63	-1.66
4,888.00	86.31	90.03	4,443.51	-16.99	518.60	518.56	1.89	1.77	-0.65
4,951.00	88.73	88.75	4,446.24	-16.32	581.53	581.49	4.34	3.84	-2.03
5,014.00	89.39	88.61	4,447.27	-14.87	644.50	644.47	1.07	1.05	-0.22
5,077.00	90.12	88.54	4,447.54	-13.31	707.48	707.45	1.16	1.16	-0.11
5,140.00	90.84	88.52	4,447.02	-11.69	770.46	770.43	1.14	1.14	-0.03
5,203.00	91.21	87.89	4,445.89	-9.72	833.42	833.39	1.16	0.59	-1.00
5,266.00	91.98	89.01	4,444.14	-8.01	896.37	896.35	2.16	1.22	1.78
5,329.00	91.28	91.31	4,442.34	-8.19	959.34	959.32	3.81	-1.11	3.65
5,392.00	89.01	93.09	4,442.18	-10.61	1,022.28	1,022.26	4.58	-3.60	2.83
5,456.00	88.58	93.53	4,443.53	-14.30	1,086.16	1,086.13	0.96	-0.67	0.69
5,519.00	88.61	94.41	4,445.07	-18.66	1,148.99	1,148.95	1.40	0.05	1.40
5,582.00	88.92	94.03	4,446.43	-23.30	1,211.81	1,211.75	0.78	0.49	-0.60
5,645.00	87.27	92.63	4,448.53	-26.95	1,274.66	1,274.60	3.43	-2.62	-2.22
5,708.00	87.22	90.23	4,451.55	-28.52	1,337.56	1,337.50	3.81	-0.08	-3.81
5,770.00	88.28	89.40	4,453.99	-28.32	1,399.52	1,399.45	2.17	1.71	-1.34
5,833.00	89.44	88.18	4,455.24	-26.99	1,462.49	1,462.42	2.67	1.84	-1.94
5,897.00	89.85	88.08	4,455.64	-24.91	1,526.45	1,526.39	0.66	0.64	-0.16
5,960.00	90.58	87.51	4,455.40	-22.48	1,589.40	1,589.35	1.47	1.16	-0.90
6,022.00	89.84	86.82	4,455.18	-19.42	1,651.33	1,651.28	1.63	-1.19	-1.11
6,086.00	89.39	87.48	4,455.61	-16.23	1,715.24	1,715.20	1.25	-0.70	1.03
6,149.00	90.02	87.68	4,455.93	-13.57	1,778.19	1,778.15	1.05	1.00	0.32
6,212.00	90.36	87.36	4,455.72	-10.85	1,841.13	1,841.10	0.74	0.54	-0.51
6,275.00	90.62	88.32	4,455.18	-8.47	1,904.08	1,904.06	1.58	0.41	1.52
6,338.00	89.53	90.28	4,455.10	-7.70	1,967.07	1,967.05	3.56	-1.73	3.11
6,402.00	89.02	90.07	4,455.91	-7.90	2,031.07	2,031.04	0.86	-0.80	-0.33
6,476.00	89.06	90.81	4,457.15	-8.47	2,105.05	2,105.03	1.00	0.05	1.00
6,539.00	89.51	90.86	4,457.94	-9.39	2,168.04	2,168.01	0.72	0.71	0.08
6,601.00	89.30	90.19	4,458.58	-9.95	2,230.03	2,230.01	1.13	-0.34	-1.08
6,664.00	88.90	90.13	4,459.57	-10.13	2,293.03	2,293.00	0.64	-0.63	-0.10
6,727.00	88.47	89.29	4,461.01	-9.81	2,356.01	2,355.98	1.50	-0.68	-1.33
6,789.00	85.23	88.93	4,464.42	-8.85	2,417.90	2,417.87	5.26	-5.23	-0.58
6,853.00	85.10	88.39	4,469.82	-7.36	2,481.65	2,481.63	0.86	-0.20	-0.84
6,916.00	88.21	88.22	4,473.49	-5.50	2,544.51	2,544.49	4.94	4.94	-0.27
6,979.00	89.88	88.19	4,474.54	-3.52	2,607.47	2,607.45	2.65	2.65	-0.05
7,042.00	89.61	89.22	4,474.82	-2.10	2,670.45	2,670.44	1.69	-0.43	1.63

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7,105.00	88.55	89.52	4,475.83	-1.41	2,733.44	2,733.43	1.75	-1.68	0.48
7,168.00	87.90	89.68	4,477.78	-0.97	2,796.41	2,796.40	1.06	-1.03	0.25
7,231.00	87.47	89.87	4,480.33	-0.72	2,859.35	2,859.35	0.75	-0.68	0.30
7,294.00	89.01	90.29	4,482.26	-0.81	2,922.32	2,922.31	2.53	2.44	0.67
7,357.00	88.89	90.27	4,483.42	-1.12	2,985.31	2,985.30	0.19	-0.19	-0.03
7,420.00	88.47	90.14	4,484.87	-1.34	3,048.29	3,048.28	0.70	-0.67	-0.21
7,484.00	89.87	89.29	4,485.80	-1.02	3,112.28	3,112.27	2.56	2.19	-1.33
7,547.00	89.59	89.61	4,486.09	-0.42	3,175.28	3,175.27	0.67	-0.44	0.51
7,611.00	88.76	89.10	4,487.02	0.30	3,239.27	3,239.26	1.52	-1.30	-0.80
7,674.00	89.89	88.20	4,487.76	1.78	3,302.25	3,302.24	2.29	1.79	-1.43
7,736.00	88.10	88.74	4,488.84	3.44	3,364.21	3,364.21	3.02	-2.89	0.87
7,799.00	89.79	86.90	4,490.00	5.84	3,427.15	3,427.15	3.97	2.68	-2.92
7,863.00	88.96	87.79	4,490.70	8.80	3,491.08	3,491.09	1.90	-1.30	1.39
7,925.00	87.56	87.87	4,492.59	11.15	3,553.00	3,553.02	2.26	-2.26	0.13
7,988.00	88.50	87.38	4,494.75	13.76	3,615.91	3,615.93	1.68	1.49	-0.78
8,052.00	89.04	86.16	4,496.13	17.36	3,679.79	3,679.82	2.08	0.84	-1.91
8,115.00	87.89	85.24	4,497.81	22.08	3,742.59	3,742.63	2.34	-1.83	-1.46
8,147.00	87.04	85.21	4,499.23	24.74	3,774.45	3,774.49	2.66	-2.66	-0.09
8,179.00	87.68	86.75	4,500.70	26.99	3,806.33	3,806.38	5.21	2.00	4.81
8,210.00	87.68	88.70	4,501.96	28.21	3,837.28	3,837.34	6.29	0.00	6.29
8,242.00	88.36	90.70	4,503.06	28.38	3,869.26	3,869.32	6.60	2.13	6.25
8,273.00	89.55	90.79	4,503.63	27.98	3,900.25	3,900.31	3.85	3.84	0.29
8,305.00	90.18	90.87	4,503.70	27.52	3,932.25	3,932.30	1.98	1.97	0.25
8,367.00	91.09	91.18	4,503.02	26.41	3,994.23	3,994.28	1.55	1.47	0.50
8,431.00	90.85	91.42	4,501.93	24.95	4,058.21	4,058.25	0.53	-0.38	0.38
8,493.00	90.68	92.26	4,501.11	22.96	4,120.17	4,120.21	1.38	-0.27	1.35
8,556.00	89.68	92.20	4,500.91	20.51	4,183.12	4,183.16	1.59	-1.59	-0.10
8,620.00	90.53	91.74	4,500.79	18.31	4,247.08	4,247.11	1.51	1.33	-0.72
8,683.00	88.92	91.75	4,501.09	16.39	4,310.05	4,310.08	2.56	-2.56	0.02
8,747.00	88.19	91.34	4,502.71	14.67	4,374.01	4,374.03	1.31	-1.14	-0.64
8,817.00	87.84	91.07	4,505.13	13.20	4,443.95	4,443.97	0.63	-0.50	-0.39
8,880.00	88.64	90.47	4,507.07	12.35	4,506.91	4,506.93	1.59	1.27	-0.95
8,943.00	87.73	92.06	4,509.06	10.96	4,569.86	4,569.88	2.91	-1.44	2.52
9,006.00	87.13	92.01	4,511.89	8.73	4,632.76	4,632.77	0.96	-0.95	-0.08
9,069.00	88.39	92.29	4,514.35	6.37	4,695.67	4,695.67	2.05	2.00	0.44
9,132.00	88.88	91.67	4,515.85	4.19	4,758.61	4,758.61	1.25	0.78	-0.98
9,195.00	89.33	91.90	4,516.83	2.23	4,821.57	4,821.56	0.80	0.71	0.37
9,258.00	89.99	91.34	4,517.21	0.45	4,884.54	4,884.53	1.37	1.05	-0.89
9,322.00	90.81	91.91	4,516.76	-1.37	4,948.52	4,948.50	1.56	1.28	0.89
9,384.00	90.50	91.71	4,516.05	-3.33	5,010.48	5,010.46	0.60	-0.50	-0.32
9,403.00	89.27	91.15	4,516.09	-3.80	5,029.48	5,029.45	7.11	-6.47	-2.95
Final Phoenix MWD Survey									
9,450.00	89.27	91.15	4,516.69	-4.74	5,076.46	5,076.44	0.00	0.00	0.00

Company:	COG Operating LLC	Local Co-ordinate Reference:	Well 15H
Project:	Eddy County, NM (NAD83 NME)	TVD Reference:	RKB @ 3702.00usft (Double K 7)
Site:	Chimay 6 Federal Com	MD Reference:	RKB @ 3702.00usft (Double K 7)
Well:	15H	North Reference:	Grid
Wellbore:	OH / 62	Survey Calculation Method:	Minimum Curvature
Design:	Surveys (Double K7)	Database:	USA Compass

Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
Projection to TD									

Survey Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
1,165.00	1,164.94	2.06	9.14	Tie In
1,301.00	1,300.92	0.56	8.87	First Phoenix MWD Survey
9,403.00	4,516.09	-3.80	5,029.48	Final Phoenix MWD Survey
9,450.00	4,516.69	-4.74	5,076.46	Projection to TD