



COG OPERATING LLC

Eddy County, NM (NAN27 NME)

Firecracker State #9

Firecracker State #9

OH

30-015-37039

Survey: MWD Survey

SDI Standard Survey Report

21 February, 2011



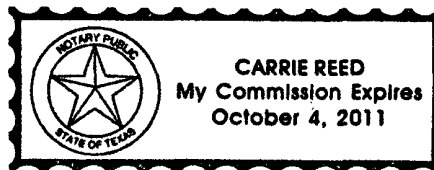
This survey is correct to the best of my knowledge and is supported by actual field data.

Subarto

Notarized this date 21st of February, 2011.

Carrie Reed

Notary Signature
County of Midland
State of Texas



Scientific Drilling
Directional Drilling Operations



Scientific Drilling International, Inc.
SDI Standard Survey Report



Company:	COG OPERATING LLC	Local Co-ordinate Reference:	Site Firecracker State #9
Project:	Eddy County, NM (NAN27 NME)	TVD Reference:	KB Elev (12') @ 3627.0usft (Cavalos #2)
Site:	Firecracker State #9	MD Reference:	KB Elev (12') @ 3627.0usft (Cavalos #2)
Well:	Firecracker State #9	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project	Eddy County, NM (NAN27 NME)		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site	Firecracker State #9		
Site Position:		Northing:	666,826.00 usft
From:	Map	Easting:	557,707.60 usft
Position Uncertainty:	0.0 usft	Slot Radius:	0"
		Latitude:	32° 49' 58.980 N
		Longitude:	104° 8' 43.650 W
		Grid Convergence:	0.10 °

Well	Firecracker State #9, BHL: 1660' FSL, 2280' FEL, Sec 14, T17S, R28E, Unit J		
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	Easting:
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 58.980 N
		Longitude:	104° 8' 43.650 W
		Ground Level:	3,615.0 usft

Wellbore	OH				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	1/25/2011	7.94	60.66	48,956

Design	Actual			
Audit Notes:				
Version:	1.0	Phase:	ACTUAL	Tie On Depth: 0.0
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)
	0.0	0.0	0.0	166.92

Survey Program	Date 2/21/2011			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description
100.0	812.0	Gyro Survey (OH)	Keeper	Standard Wireline Keeper ver 1.0.2
865.0	4,140.0	MWD Survey (OH)	MWD	MWD - Standard

Survey								
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)	
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.0	
100.0	0.34	320.52	100.0	0.2	-0.2	320.52	0.3	
200.0	0.36	314.95	200.0	0.7	-0.6	318.59	0.9	
300.0	0.19	344.80	300.0	1.1	-0.9	320.82	1.4	
400.0	0.42	352.54	400.0	1.6	-1.0	328.90	1.9	
500.0	0.30	335.06	500.0	2.2	-1.1	332.99	2.5	
600.0	0.09	338.74	600.0	2.5	-1.3	333.34	2.8	
700.0	0.20	15.21	700.0	2.7	-1.2	335.71	3.0	
800.0	0.18	1.49	800.0	3.1	-1.2	338.84	3.3	
812.0	0.23	353.38	812.0	3.1	-1.2	339.07	3.3	



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Site:	Firecracker State #9	MD Reference:	KB Elev (12') @ 3627.0usft (Cavalos #2)
Well:	Firecracker State #9	North Reference:	Grid
Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Project	Eddy County, NM (NAN27 NME)		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site	Firecracker State #9		
Site Position:		Northing:	666,826.00 usft
From:	Map	Easting:	557,707.60 usft
Position Uncertainty:	0.0 usft	Slot Radius:	0"
		Latitude:	32° 49' 58.980 N
		Longitude:	104° 8' 43.650 W
		Grid Convergence:	0.10 °

Well	Firecracker State #9, BHL: 1660' FSL, 2260' FEL, Sec 14, T17S, R28E, Unit J		
Well Position	+N/-S	0.0 usft	Northing:
	+E/-W	0.0 usft	Easting:
Position Uncertainty	0.0 usft	Wellhead Elevation:	usft
		Latitude:	32° 49' 58.980 N
		Longitude:	104° 8' 43.650 W
		Ground Level:	3,615.0 usft

Wellbore	OH		
Magnetics	Model Name	Sample Date	Declination
			(°)
	IGRF2010	1/25/2011	7.94
			Dip Angle
			(°)
			60.66
			Field Strength
			(nT)
			48,956

Design	Actual		
Audit Notes:			
Version:	1.0	Phase:	ACTUAL
		Tie On Depth:	0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction
			(°)
			166.92

Survey Program	Date 2/21/2011		
From	To	Survey (Wellbore)	Tool Name
(usft)	(usft)		
100.0	812.0	Gyro Survey (OH)	Keeper
865.0	4,046.0	MWD Survey (OH)	MWD
			Description
			Standard Wireline Keeper ver 1.0.2
			MWD - Standard

Survey	Measured Depth	Inclination	Azimuth	True Vertical	North/South	East/West	Closure Azimuth	Closure Distance
	(usft)	(°)	(°)	Depth	(usft)	(usft)	(°)	(usft)
	812.0	0.23	353.38	812.0	3.1	-1.2	339.07	3.3
	865.0	0.32	322.74	865.0	3.3	-1.3	338.82	3.6
	960.0	1.28	126.03	960.0	2.9	-0.6	348.51	3.0
	1,053.0	2.73	142.16	1,052.9	0.6	1.6	70.88	1.7
	1,148.0	4.51	146.60	1,147.7	-4.3	5.1	130.73	6.7
	1,242.0	5.08	150.10	1,241.4	-11.0	9.2	140.32	14.3
	1,338.0	6.34	150.80	1,336.9	-19.4	13.9	144.38	23.8
	1,433.0	6.97	160.30	1,431.3	-29.4	18.4	147.97	34.6
	1,525.0	6.81	166.60	1,522.6	-39.9	21.5	151.68	45.3
	1,618.0	6.30	165.30	1,615.0	-50.2	24.1	154.38	55.7
	1,713.0	7.10	170.60	1,709.4	-61.1	26.4	156.64	66.5



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Wellbore:	OH	Survey Calculation Method:	Minimum Curvature
Design:	Actual	Database:	EDM-Regulatory

Survey							
Measured Depth (usft)	Inclination (°)	Azimuth (°)	True Vertical Depth	North/South (usft)	East/West (usft)	Closure Azimuth (°)	Closure Distance (usft)
1,808.0	6.42	170.13	1,803.7	-72.1	28.2	158.61	77.4
1,902.0	5.75	170.44	1,897.2	-81.9	29.9	159.93	87.2
1,998.0	5.59	171.33	1,992.7	-91.3	31.4	161.00	96.5
2,091.0	5.30	169.12	2,085.3	-100.0	32.9	161.77	105.2
2,186.0	5.33	170.22	2,179.9	-108.6	34.5	162.38	114.0
2,280.0	5.24	171.23	2,273.5	-117.2	35.9	162.97	122.5
2,376.0	5.15	172.10	2,369.1	-125.8	37.2	163.54	131.1
2,469.0	4.74	170.10	2,461.7	-133.7	38.4	163.98	139.1
2,563.0	4.79	168.33	2,555.4	-141.4	39.8	164.26	146.9
2,657.0	4.89	171.06	2,649.1	-149.2	41.3	164.54	154.8
2,753.0	4.70	169.45	2,744.7	-157.1	42.6	164.82	162.7
2,848.0	5.66	164.31	2,839.4	-165.4	44.6	164.91	171.3
2,942.0	5.55	165.44	2,932.9	-174.3	47.0	164.91	180.5
3,036.0	5.33	164.61	3,026.5	-182.9	49.3	164.91	189.4
3,133.0	6.41	166.83	3,123.0	-192.5	51.7	164.96	199.3
3,228.0	6.22	166.86	3,217.4	-202.7	54.1	165.05	209.8
3,322.0	6.14	167.06	3,310.8	-212.5	56.4	165.14	219.9
3,417.0	6.30	168.81	3,405.3	-222.6	58.5	165.27	230.2
3,514.0	4.89	180.11	3,501.8	-231.9	59.6	165.60	239.5
3,606.0	2.96	190.75	3,593.6	-238.2	59.1	166.06	245.4
3,702.0	1.55	232.35	3,689.5	-241.4	57.6	166.58	248.2
3,796.0	1.41	283.70	3,783.5	-241.9	55.5	167.08	248.2
3,890.0	0.68	338.69	3,877.5	-241.1	54.2	167.34	247.1
3,984.0	0.71	342.22	3,971.5	-240.1	53.8	167.37	246.0
4,046.0	0.53	2.48	4,033.5	-239.4	53.7	167.36	245.4

Survey Annotations				
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
812.0	812.0	3.1	-1.2	Gyro Tie-in
4,046.0	4,033.5	-239.4	53.7	Last MWD Survey
4,140.0	4,127.5	-238.5	53.7	Projection to Bit

