



LWD MEMORY LOG

Gamma Ray

Scale:		Company: Noble Energy				
1:1200 MD		Well: Constitution Federal LC21-655				
Depth Reference:		Field:		Weld County		
Driller's Depth		County:		Country: United States		
Status:		State: Colorado		Other Services:		
Final Print		Surface Location:		Wellbore Surveys		
API No: 05123426320000		Latitude: 040° 44' 14.820" N Longitude: 103° 58' 19.632" E				
Job ID: 8595315		SEC: 22 TWN: 9N RGE: 59W				
Permanent Datum (P.D.): Mean Sea Level		Elevation: 4907.00 ft		Elev. KB: N/A		
Log Measured From: Rig Floor		Above P.D. 30.00 ft		Elev. DF: 4937.00 ft Elev. GL: 4907.00 ft		
Dates		Interval Logged		Magnetic Field Reference		
Date From: 2017-06-13 Date To: 2017-06-15 Spud Date: 2017-06-12		Top: (ft) 1952.00 Bottom: (ft) 11121.00		Azi Reference North: Grid Total Magnetic Field Strength: (nT) Mag to Reference North Correction: (deg)		
				Dip Angle: (deg) 67.08 52633 6.71 E		
Borehole Record				Casing Record		
Hole Size (in)	From (ft)	To (ft)	Size (in)	Weight (lb/ft)	From (ft)	To (ft)
8.500	1952.00	11121.00	9.625	36.00	30.00	1942.00
Mud Record						
Type	From (ft)	To (ft)	Hole Size (in)	Interval (ft)	Inc Az (Start)	Inc Az (End)
Oil Based Mud	1952.00	11121.00	8.500	9169.00	0.47 272.83	90.34 267.66
Acquisition System						
Baker Hughes Cadence	Software Version RT4.1		Rig: H&P 524	Other		
Pilot Studio	4.0.7570.8		Contractor: Helmerich & Payne Drilling Co	District: RMA Unit: D&E		

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Log Run Summary

Run No	Bit Run No.	Bit Size (in)	Bit Type	Bit Gauge Length (in)	Assembly Type	Logged Interval		Bit Depth Interval		Date / Time		Circ. Hours (h)
						Top	Bottom	From	To	Start Logging	End Logging	
						(ft)	(ft)	(ft)	(ft)			
1	1	8.500	PDC	2.00	AutoTrak Curve	1929.62	11108.62	1942.00	11121.00	2017-06-13 15:36	2017-06-15 05:08	30.17

Crew

Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite	Name	Arrive Wellsite	Depart Wellsite
Ryan Wuderlich	2017-06-12	2017-06-15	Steven Cano	2017-06-12	2017-06-15			

Mud Properties Record

Date / Time	Run No.	Measured Depth (ft)	Mud Type	Density (ppg)	Viscosity (cP)	pH	Fluid Loss (cm3)	Oil / Water	Source	Total Chlorides (ppm)	K+ (%)
2017-06-13 01:47	1	1900.00	Oil Based Mud	9.0	9	N/A	N/A	77.5/22.5	Active Pit	27000	0.00
2017-06-14 07:20	1	6222.00	Oil Based Mud	9.3	10	N/A	N/A	74.7/25.3	Active Pit	32300	0.00
2017-06-15 13:48	1	10738.00	Oil Based Mud	9.3	11	N/A	N/A	74.8/25.2	Active Pit	25000	0.00

Equipment and Service Data

Run No.	Tool	Serial Number	Measurement	Sensor Offset (ft)	Bit Offset (ft)	Max O.D. (in)	Min I.D. (in)
1	ATC_SU	12480108	Near Bit Inclination	5.93	6.76	7.000	4.330
1	ATC_SU	12480108	Near Bit VSS	5.93	6.76	7.000	4.330
1	ATC_MWD	12375741	Gamma (single)	2.18	12.38	7.000	3.250
1	ATC_MWD	12375741	Directional (mag)	12.25	22.45	7.000	3.250

Service and Tool Mnemonics

Mnemonic	Name	Description
ATC_SU	ATC_SU	Auto Trak Curve Steering Unit
ATC_MWD	ATC_MWD	Auto Trak Curve MWD
ATC_LCPM	ATC_LCPM	Auto Trak Curve LCPM

Comments

- 1
- Depth measurements obtained from a depth control system not supplied or operated by Baker Hughes. Due to lack of control by Baker Hughes logging engineers, depth calibrations and measurements could not be independently verified.
- 2
- Baker Hughes LWD run 1 utilized a 6 3/4 inch Navigamma Service (Gamma Ray, and Directional) behind a 8 1/2 inch bit and rotary steerable from 1952 to 11121 feet MD (1952 to 6166 feet TVD).

Remarks

Number	Measured Depth (ft)	Hole Section (in)	Run No.	Remark
1	11121.00	8.500	1	The interval from 11109 to 11121 feet MD (6115 feet TVD) was not logged due to sensor offset at well TD.

Curve Mnemonics

Presented Curves	Description	Units
ROPA	Depth Averaged ROP 10 ft Average	ft/h
TVD	True Vertical Depth	ft
WOBA	Weight On Bit, Average 1 ft Average	klb
GRAM	Gamma Ray - Apparent 3 ft Average	API
GRTM	Gamma Time Since Drilled	min
TCDM	Downhole Temperature	degF













