

## PCGK - Pressure Case Gamma



1 : 240

Country	: USA
Field	: Wattenberg
Location	: 40° 45' 34.47" North 103° 49' 9.65" West
Well	: Castor Federal LD13-78HN
Company	: Noble Energy
Rig	: H&P 322
LOCATION	
Latitude : 40° 45' 34.47" North Longitude : 103° 49' 9.65" West UTM Easting = 3465568.525 ft UTM Northing = 1523970.548 ft	Company : Noble Energy Rig : H&P 322 Well : Castor Federal LD13-78HN Field : Wattenberg Country : USA API Number : 05-123-37097
Other Services Directional Drilling	

## WELL INFORMATION

<b>MWD Run Number</b>	100	200	300		
<b>Date run completed</b>	25-May-13	25-May-13	26-May-13		
<b>Rig Bit Number</b>	2	3	4		
<b>Bit Size (in)</b>	8.750	8.750	8.750		
<b>Tool Nominal OD (in)</b>	6.750	6.750	6.750		
<b>Log Start Depth (MD, ft)</b>	1,242.00	4,747.00	5,313.00		
<b>Log End Depth (MD, ft)</b>	4,747.00	5,313.00	5,876.00		
<b>Drill or Wipe</b>	Drill	Drill	Drill		
<b>Drill/Wipe Start Date and Time</b>	24-May-13 14:54	25-May-13 07:34	25-May-13 21:37		
<b>Drill/Wipe End Date and Time</b>	25-May-13 00:15	25-May-13 13:03	26-May-13 06:02		
<b>Min Inc (deg) @ Depth (MD, ft)</b>	0 @ 1,242.00	.49 @ 4,781.00	33.97 @ 5,316.00		
<b>Max Inc (deg) @ Depth (MD, ft)</b>	13.45 @ 2,130.00	27.46 @ 5,256.00	81.96 @ 5,824.00		
<b>Bit TFA(in2) / Bit Type</b>	.75 / PDC	.86 / PDC	.86 / PDC		
<b>Flow Rate (gpm)</b>	585.00	528.00	540.00		
<b>Max AV (fpm) / CV (fpm) @ MWD</b>	477.1 / 477.1	477.1 / 477.1	477.1 / 477.1		
<b>Fluid Type</b>	Fresh Water Gel	Fresh Water Gel	Fresh Water Gel		
<b>Density (ppg) / Viscosity (spqt)</b>	8.43 / 27.00	9.65 / 38.00	9.65 / 38.00		
<b>Filtrate CL (ppm)</b>	2,100.00	1,900.00	1,900.00		
<b>pH / Fluid Loss (mptm)</b>	11.50 / N/A	10.00 / N/A	10.00 / N/A		
<b>PV (cP) / YP (lbf2)</b>	1 / 3.00	14 / 9.00	14 / 9.00		
<b>% Solids / % Sand</b>	0.40 / 0.10	8.50 / 0.35	8.50 / 0.35		
<b>% Oil / Oil:Water Ratio</b>	N/A / N/A	N/A / N/A	N/A / N/A		
<b>Rm @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Rmf @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Rmc @ Measured Temp (degF)</b>	N/A @ N/A	N/A @ N/A	N/A @ N/A		
<b>Max Tool Temp (deg F) @ 100 ft</b>	127.50 / ROM	150.47 / ROM	150.47 / ROM		

Max Tool Temp (degF) / Source	137.50 / PCM	158.47 / PCM	158.47 / PCM		
Rm @ Max Tool Temp (degF)	.7401 @ 137.50	.6462 @ 158.47	.6462 @ 158.47		
Lead MWD Engineer	Osahon Igunbor	Osahon Igunbor	Osahon Igunbor		
Customer Representative	Jeremy Stolz	Jeremy Stolz	Jeremy Stolz		

## SENSOR INFORMATION

### Downhole Processor Information

Tool Type	PCM	PCM	PCM		
Software Version	5.84	5.84	5.84		
Sub Serial Number	161211	161211	161211		
Insert Serial Number	11145581	11145581	11145581		
Date and Time Initialized	23-May-13 21:27	23-May-13 21:27	23-May-13 21:27		
Date and Time Read	26-May-13 20:58	26-May-13 20:53	26-May-13 20:47		
ECMB SW Version	N/A	N/A	N/A		

### Directional Sensor Information

Tool Type	PCDC	PCDC	PCDC		
Distance From Bit (ft)	54.00	55.00	52.00		
Software Version	6.21	6.21	6.21		
Sub Serial Number	161211	161211	161211		
Sonde Serial Number	11833052	11833052	11833052		
Sensor ID Number	N/A	N/A	N/A		
Toolface Offset (deg)	10.13	349.14	158.70		

### Gamma Ray Sensor Information

Tool Type	PCG	PCG	PCG		
Distance From Bit (ft)	47.69	48.25	45.48		
Recorded Sample Period (sec)	10	10	10		
Software Version	8.15	8.15	8.15		
Sub Serial Number	161211	161211	161211		
Insert/Sonde Serial Number	11579768	11579768	11579768		

## REMARKS

1. All depths are true vertical depths and are calibrated to the driller' pipe tally and are measured from the drill floor.
2. No depth corrections have been made for pipe stretch or compression.
3. All data presented is recorded (memory data) unless otherwise stated.
4. The Following smoothing parameters have been applied to the data"

PGRC (Gamma Ray):  
Interval Resolution: 0.5 feet  
Coercion Distance: 0.6 feet  
Gap Fill: 3.0 feet

ROPA (Rate of Penetration):  
Interval Resolution: 0.5 feet  
Coercion Distance: 1.2 feet

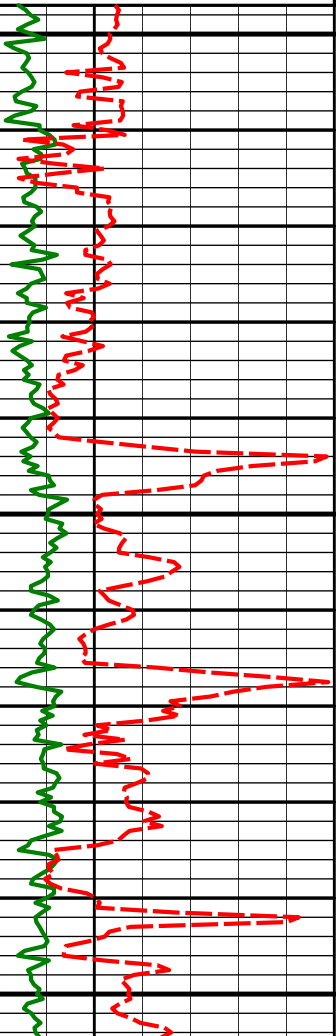
## WARRANTY

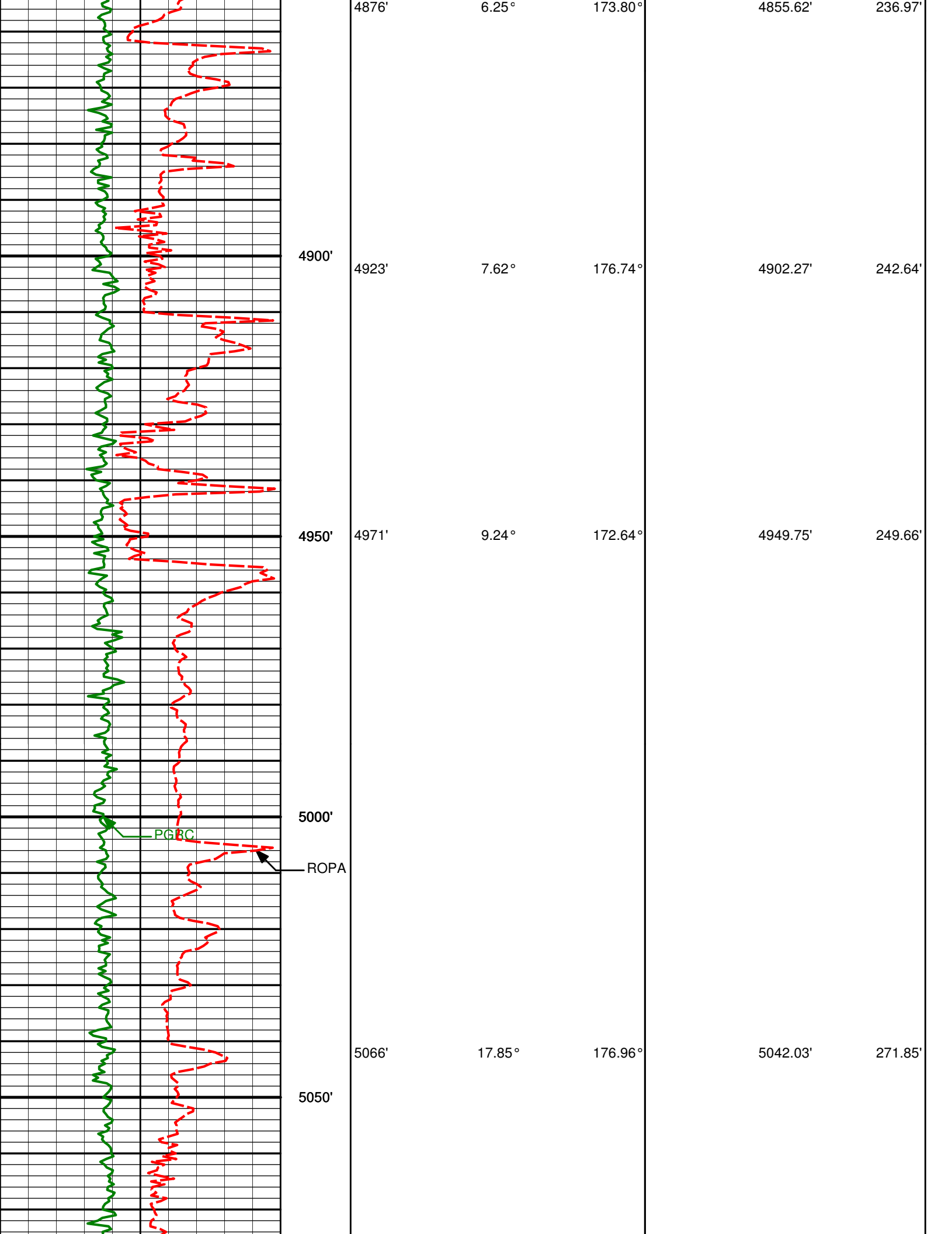
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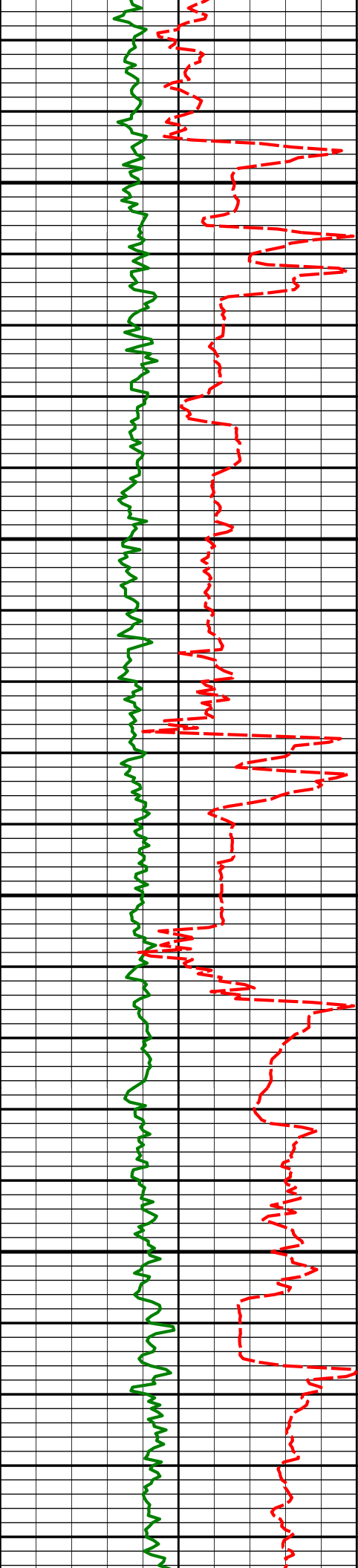
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## TVD Detail Log 1:240

Gamma Ray (PGRC) (Api)						
0300						
Avg Rate of Penetration feet per hr	Feet					
6000		Depth	Inc	Azm	TVD	Vsec
	4750'					
		4781'	0.49°	141.20°	4760.80'	231.85'
	Run 200					
	4800'					
		4828'	2.87°	171.02°	4807.78'	233.17'
	KOP					
	4850'					





5100'

5161'

22.18°

180.89°

5131.27'

304.33'

5150'

5200'

5256'

27.46°

175.94°

5217.48'

344.16'

5250'

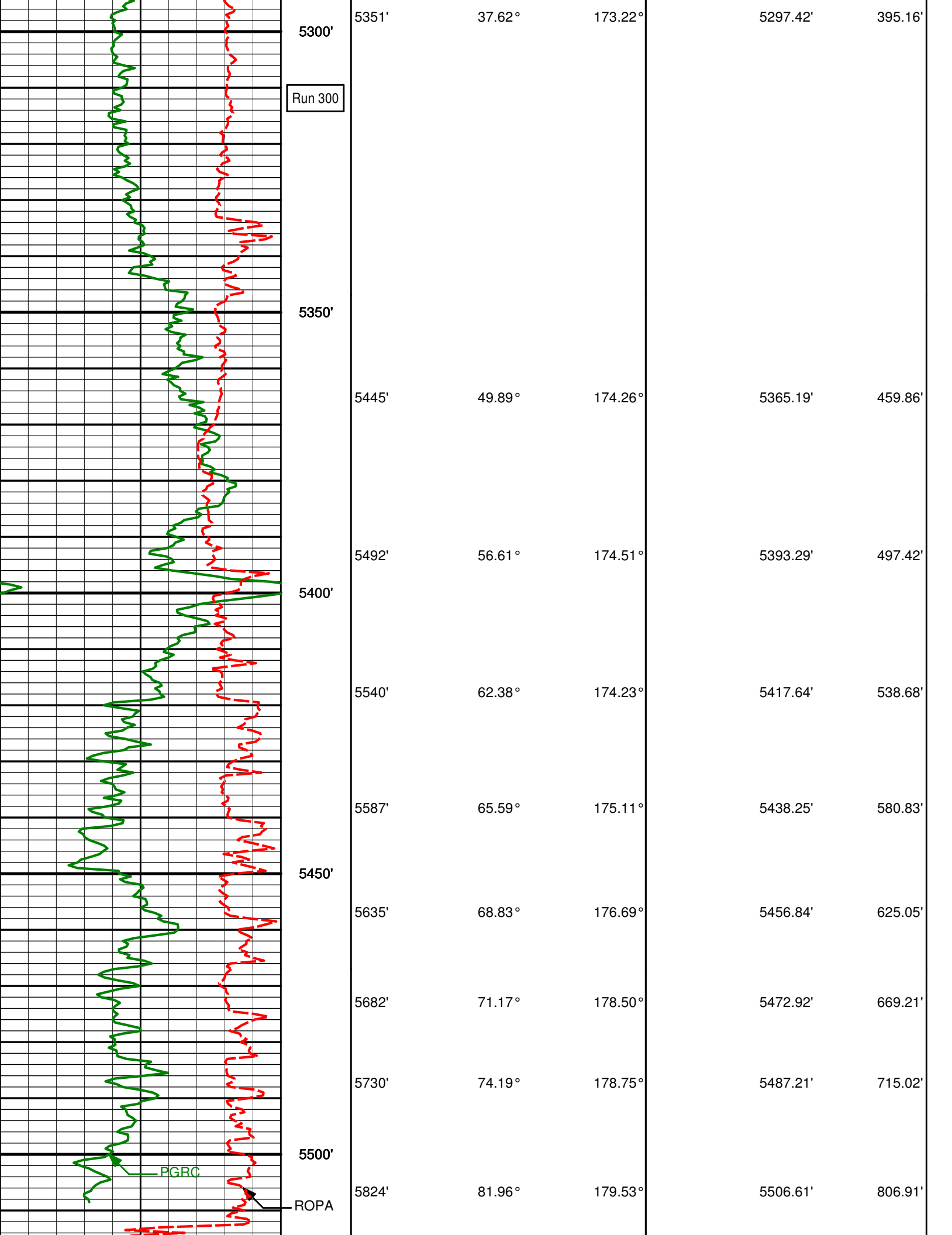
5316'

33.97°

174.63°

5269.03'

374.75'



<div> <div>TD Build @ 5876' MD or 5506.61' TVD</div> </div>			5550'		
<div> <div>Avg Rate of Penetration</div> <div>feet per hr</div> <div>6000</div> </div>			Feet		
<div> <div>Gamma Ray</div> <div>(PGRC)</div> <div>(Api)</div> <div>0300</div> </div>			Depth	Inc	Azm
					TVD
					Vsec



## HALLIBURTON

### DIRECTIONAL SURVEY REPORT

**Noble Energy**  
**Castor Federal LD13-78HN**  
**Wattenberg**  
**Weld Colorado**  
**USA**  
**CA-XX-0900391394**

Measured Depth (feet)	Inclination (degrees)	Direction (degrees)	Vertical Depth (feet)	Latitude (feet)	Departure (feet)	Vertical Section (feet)	Dogleg (deg/100ft)
0.00	0.00	0.00	0.00	0.00 N	0.00 E	0.00	TIE-IN
275.00	0.30	248.20	275.00	0.27 S	0.67 W	0.24	0.11
597.00	0.20	281.70	597.00	0.47 S	2.00 W	0.40	0.05
900.00	0.20	194.80	899.99	0.87 S	2.65 W	0.78	0.09
1242.00	0.00	72.70	1241.99	1.45 S	2.81 W	1.35	0.06
1280.00	0.45	208.68	1279.99	1.58 S	2.88 W	1.48	1.18
1373.00	1.76	175.33	1372.97	3.32 S	2.94 W	3.22	1.52
1466.00	1.59	164.58	1465.94	5.99 S	2.48 W	5.91	0.39
1561.00	1.97	163.39	1560.89	8.83 S	1.66 W	8.77	0.41
1655.00	5.49	182.90	1654.68	14.87 S	1.42 W	14.81	3.92
1750.00	7.11	172.21	1749.11	25.23 S	0.86 W	25.19	2.10
1845.00	9.62	175.13	1843.09	38.96 S	0.61 E	38.96	2.68
1940.00	13.06	181.93	1936.22	57.61 S	0.93 E	57.60	3.88
2035.00	12.21	179.91	2028.92	78.38 S	0.58 E	78.36	1.00
2130.00	13.45	175.30	2121.55	99.44 S	1.51 E	99.44	1.69
2225.00	12.69	172.70	2214.09	120.81 S	3.74 E	120.87	1.02
2319.00	12.43	173.61	2305.84	141.10 S	6.17 E	141.23	0.35
2414.00	13.27	177.55	2398.46	162.15 S	7.78 E	162.32	1.28
2509.00	11.37	184.45	2491.27	182.39 S	7.52 E	182.54	2.52
2604.00	8.28	179.64	2584.87	198.57 S	6.83 E	198.69	3.37
2700.00	5.06	173.94	2680.21	209.70 S	7.33 E	209.83	3.41
2795.00	3.08	190.66	2774.97	216.38 S	7.30 E	216.50	2.41
2890.00	1.80	179.05	2869.88	220.38 S	6.85 E	220.49	1.44
2985.00	0.81	235.76	2964.86	222.25 S	6.31 E	222.34	1.59
3080.00	0.66	233.65	3059.85	222.95 S	5.32 E	223.01	0.17
3175.00	0.39	281.90	3154.85	223.21 S	4.56 E	223.24	0.52
3270.00	0.32	269.85	3249.84	223.14 S	3.97 E	223.15	0.11
3365.00	0.47	271.90	3344.84	223.13 S	3.32 E	223.12	0.15
3460.00	0.43	246.86	3439.84	223.26 S	2.61 E	223.22	0.21
3555.00	0.31	199.38	3534.84	223.64 S	2.19 E	223.59	0.34
3650.00	0.71	159.72	3629.83	224.43 S	2.31 E	224.39	0.54
3745.00	0.57	196.97	3724.83	225.44 S	2.38 E	225.39	0.45

<b>3839.00</b>	<b>0.35</b>	<b>181.56</b>	<b>3818.82</b>	<b>226.17 S</b>	<b>2.23 E</b>	<b>226.12</b>	<b>0.26</b>
<b>3934.00</b>	<b>0.38</b>	<b>169.88</b>	<b>3913.82</b>	<b>226.77 S</b>	<b>2.28 E</b>	<b>226.72</b>	<b>0.08</b>
<b>4030.00</b>	<b>0.48</b>	<b>158.85</b>	<b>4009.82</b>	<b>227.46 S</b>	<b>2.48 E</b>	<b>227.41</b>	<b>0.14</b>
<b>4124.00</b>	<b>0.48</b>	<b>158.99</b>	<b>4103.82</b>	<b>228.19 S</b>	<b>2.77 E</b>	<b>228.16</b>	<b>0.00</b>
<b>4219.00</b>	<b>0.67</b>	<b>173.78</b>	<b>4198.81</b>	<b>229.12 S</b>	<b>2.97 E</b>	<b>229.09</b>	<b>0.25</b>
<b>4314.00</b>	<b>0.40</b>	<b>211.30</b>	<b>4293.81</b>	<b>229.96 S</b>	<b>2.86 E</b>	<b>229.93</b>	<b>0.45</b>
<b>4409.00</b>	<b>0.35</b>	<b>248.77</b>	<b>4388.81</b>	<b>230.35 S</b>	<b>2.42 E</b>	<b>230.30</b>	<b>0.26</b>
<b>4503.00</b>	<b>0.07</b>	<b>168.86</b>	<b>4482.81</b>	<b>230.51 S</b>	<b>2.16 E</b>	<b>230.45</b>	<b>0.36</b>
<b>4598.00</b>	<b>0.28</b>	<b>150.38</b>	<b>4577.81</b>	<b>230.76 S</b>	<b>2.29 E</b>	<b>230.71</b>	<b>0.22</b>
<b>4693.00</b>	<b>0.46</b>	<b>147.73</b>	<b>4672.80</b>	<b>231.28 S</b>	<b>2.60 E</b>	<b>231.24</b>	<b>0.19</b>
<b>4781.00</b>	<b>0.49</b>	<b>141.20</b>	<b>4760.80</b>	<b>231.87 S</b>	<b>3.03 E</b>	<b>231.85</b>	<b>0.07</b>
<b>4828.00</b>	<b>2.87</b>	<b>171.02</b>	<b>4807.78</b>	<b>233.19 S</b>	<b>3.34 E</b>	<b>233.17</b>	<b>5.22</b>
<b>4876.00</b>	<b>6.25</b>	<b>173.80</b>	<b>4855.62</b>	<b>236.98 S</b>	<b>3.81 E</b>	<b>236.97</b>	<b>7.05</b>
<b>4923.00</b>	<b>7.62</b>	<b>176.74</b>	<b>4902.27</b>	<b>242.64 S</b>	<b>4.26 E</b>	<b>242.64</b>	<b>3.02</b>
<b>4971.00</b>	<b>9.24</b>	<b>172.64</b>	<b>4949.75</b>	<b>249.64 S</b>	<b>4.93 E</b>	<b>249.66</b>	<b>3.59</b>
<b>5066.00</b>	<b>17.85</b>	<b>176.96</b>	<b>5042.03</b>	<b>271.78 S</b>	<b>6.69 E</b>	<b>271.85</b>	<b>9.12</b>
<b>5161.00</b>	<b>22.18</b>	<b>180.89</b>	<b>5131.27</b>	<b>304.26 S</b>	<b>7.18 E</b>	<b>304.33</b>	<b>4.77</b>
<b>5256.00</b>	<b>27.46</b>	<b>175.94</b>	<b>5217.48</b>	<b>344.07 S</b>	<b>8.45 E</b>	<b>344.16</b>	<b>5.97</b>
<b>5316.00</b>	<b>33.97</b>	<b>174.63</b>	<b>5269.03</b>	<b>374.59 S</b>	<b>11.00 E</b>	<b>374.75</b>	<b>10.91</b>
<b>5351.00</b>	<b>37.62</b>	<b>173.22</b>	<b>5297.42</b>	<b>394.94 S</b>	<b>13.18 E</b>	<b>395.16</b>	<b>10.70</b>
<b>5445.00</b>	<b>49.89</b>	<b>174.26</b>	<b>5365.19</b>	<b>459.44 S</b>	<b>20.19 E</b>	<b>459.86</b>	<b>13.07</b>
<b>5492.00</b>	<b>56.61</b>	<b>174.51</b>	<b>5393.29</b>	<b>496.90 S</b>	<b>23.87 E</b>	<b>497.42</b>	<b>14.31</b>
<b>5540.00</b>	<b>62.38</b>	<b>174.23</b>	<b>5417.64</b>	<b>538.04 S</b>	<b>27.93 E</b>	<b>538.68</b>	<b>12.03</b>
<b>5587.00</b>	<b>65.59</b>	<b>175.11</b>	<b>5438.25</b>	<b>580.09 S</b>	<b>31.85 E</b>	<b>580.83</b>	<b>7.03</b>
<b>5635.00</b>	<b>68.83</b>	<b>176.69</b>	<b>5456.84</b>	<b>624.23 S</b>	<b>35.01 E</b>	<b>625.05</b>	<b>7.40</b>
<b>5682.00</b>	<b>71.17</b>	<b>178.50</b>	<b>5472.92</b>	<b>668.35 S</b>	<b>36.86 E</b>	<b>669.21</b>	<b>6.14</b>
<b>5730.00</b>	<b>74.19</b>	<b>178.75</b>	<b>5487.21</b>	<b>714.15 S</b>	<b>37.96 E</b>	<b>715.02</b>	<b>6.31</b>
<b>5824.00</b>	<b>81.96</b>	<b>179.53</b>	<b>5506.61</b>	<b>806.04 S</b>	<b>39.34 E</b>	<b>806.91</b>	<b>8.31</b>

**CALCULATION BASED ON MINIMUM CURVATURE METHOD**

**SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT  
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT**

**VERTICAL SECTION RELATIVE TO WELL HEAD  
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 178.08 DEGREES (GRID)  
A TOTAL CORRECTION OF 7.09 DEG FROM MAGNETIC NORTH TO GRID NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.  
HORIZONTAL DISPLACEMENT(CLOSURE) AT 5824.00 FEET  
IS 807.00 FEET ALONG 177.21 DEGREES (GRID)**

**Casing set at 5871 ft.**

**Surveys at 275 ft, 597 ft, 900 ft and 1242 ft were taken and provided by HP 322 while they were drilling the surface hole.**