



Directional Drilling in the Lower Huron, Berea, and Cleveland – Past, Present, and Future

Slides Compiled By:

Gary King
MWD/LWD Coordinator
Sperry Drilling Services
Gary.King@halliburton.com

Presented By:

Brian Ziemke
Senior Account Representative
Sperry Drilling Services

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Topics of Discussion

- Formations
- Air Drilling
- MWD Telemetry
- Past/Present/Future
- Questions and Answers

Formations

	Berea Sandstone	Gas
Devonian Shales	Cleveland	Gas
	Upper Huron	
	Middle Huron	
	Lower Huron	Gas
	L.H. Siltstone	Gas
	Olentangy	

Formations Continued

- **Berea Sandstone**
 - Hardest of the formations
 - Slow drilling with a tri-cone bit
- **Cleveland Shale**
 - Soft shale
 - Stringers of Berea
- **Lower Huron Shale**
 - Softest and fastest drilling
- **L. H. Siltstone**
 - Hard and slower drilling

Horizontal Air Drilling

- **Speed**
 - Flow rates
 - WOB
- **Foaming**
 - Early in build
 - Wet hole
- **Torque**
 - 1000 - 8000 ft-lbs
- **Hole Cleaning**

Horizontal Air Drilling

Continued

- **Advantages**
 - No mud costs
 - No formation damage
 - Faster
- **Differences from Drilling with Mud**
 - Vibrations
 - Annular pressure
 - Hole cleaning

MWD Telemetry

	Wireline	Electromagnetic	Acoustic
Survey Speed		X	X
Vibration Control	X		
Drilling Speed		X	
Communication	X	/	
Lateral Extension	X	X	
Cleanliness		X	X

Horizontal Air Drilling in the Past

- **BHA**
 - No stabilization
- **Flow Rates**
 - 2000 - 2300 cfm
- **SPP**
 - 470 - 500 psi
- **ROP**
 - Sliding = 15 - 30 ft/hr
 - Rotating = 50 - 70 ft/hr
- **Type**
 - Single leg laterals up to 3500' in vertical section

Horizontal Air Drilling Today

- **BHA**
 - Motor and string stabilizer
 - Shock sub
- **ROP**
 - Sliding = 100 ft/hr
 - Rotating = 225 ft/hr
- **Flow rates**
 - 2200 - 2700 cfm
- **Stand Pipe Pressure**
 - 475 - 650 psi
- **Foaming**
 - When building in Berea
- **Multi-laterals**
 - 6 – 11 legs

Horizontal Air Drilling in the Future

- **Extended Lateral**
 - Vertical sections over 8000 feet
- **RST**
 - 5200 Geo-Pilot

Questions and Answers