ERD Hole Cleaning
Best Practices
Speaker Information

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Introduction

– K&M Technology Group
– 18 years in Oil & Gas (Drilling & Completions)
– Dalhousie University (TUNS); BSc. Civil Engineering
– University of Rhode Island; MS Ocean Engineering
– Based in The Woodlands, TX
– Specialized in
  • Extended Reach Drilling
K&M Technology Group

- Extended Reach, Horizontal and Complex Well Consulting Group

- Provide support to our clients through:
  - Engineering Studies
  - Industry Training (Private & Public)
  - Wellsite Services
  - Software Rentals
Outline

- Why is Hole Cleaning Important?
- Hole Cleaning Environments
  - Laminar Flow
  - Turbulent Flow
- BHA: Rules of Thumb
- Common Unconventional Issues
- Hole Cleaning Success (Hint: It takes some planning!!)
Bad Hole Cleaning: When is it a Problem?

- Trips
  - Overpulls
  - Stuck Pipe
  - Packoffs
  - $$$
Bad Hole Cleaning: When is it a Problem?

- High friction when running casing
- Extra time washing/reaming
- Setting Casing in buckled state
- Not reaching TD

5½” Casing Run

Excess drag/friction due to poor cleanup
Hole Cleaning: Distinction Required!

- **Laminar Flow**
  - Drilling With MUD
  - Lower “Energy” environment
  - Fluid flow concentrates on high side (away from pipe AND cuttings)

- **Turbulent Flow**
  - Drilling with Brine
  - Small annular spaces
  - High “Energy” environment
  - Fluid does not concentrate on high side

- How do we know which environment? MODEL it!
Hole Cleaning: Distinction Required!

- 6\(\frac{1}{8}\)" Hole
- 4" Drill Pipe

- 9.0 ppg Brine
- Fann Readings:
  - 1.3/0.6/0.4/0.2/0/0
Hole Cleaning: Laminar Flow

- Cuttings on Low Side of Hole
- Fluid Flow on High Side of Hole
  - Even Sweeps!
- Need Energy!!
Hole Cleaning: Laminar Flow

- Additional Energy
  - RPM
  - Annular Velocity
  - Fluid Rheology
  - Multiple Circulations

- How Much?
  - 70-80 RPM
  - 200’/min AV
  - Fann 6 rpm reading:
    - 0.8-1.0 * Hole Size (in)
  - Depends on Lateral Length
Hole Cleaning: Turbulent Flow

- Pretty Easy!
- Stay in Turbulent Flow!!
  - Additives can add viscosity
  - Even Sweeps!
- Be aware of Geometry
  - What is your AV downhole?
  - What is your AV in vertical?
- How long to Circulate?
  - 2 BU Should be good!
  - (Check the shakers…)
  - Good Idea to Circulate another BU at EoC (OK to pump sweep here….)
Hole Cleaning: How Clean is Clean Enough?

- What is your next activity?
  - Trip out to pick up new BHA?
  - Trip out to run casing?
  - Trip out to FLOAT casing?

- Be Aware!
  - Even with good hole cleaning: some cuttings remain
  - When tripping out and it pulls tight.....always assume it is cuttings!
  - STOP, DROP & ROLL
Hole Cleaning: BHA interaction with cuttings

- This is how “tight hole” is often visualized....

- BUT....we forget that there is some “dirt” on the low side
Hole Cleaning: BHA interaction with cuttings

- Dirt on low side of hole should flow around BHA components
- BUT...poorly chosen BHA components can BLOCK the flow.....

If this component blocks the flow of dirt, then tight hole looks like this ...
Hole Cleaning: BHA interaction with cuttings

- **BHA “Flow By Area”**
  - 25% - 30% of Hole Size
  - IBS vs. Sleeve Stabilizers

- **BHA Tortuosity**
  - Must pass “Daylight” Test
Hole Cleaning: Common USL Issues

- **Not enough RPM**
  - Too High Motor Bend
    - Fatigue concerns
  - RSS run with “motor assist”
    - Motor too fast so string RPM is limited
- **Not enough Time**
  - Limiting circulations prior to tripping
    - After TD AND unplanned trips
    - Tool wear / vibration concerns with high RPM off bottom
- **Changing Flow Regime**
  - Fluid Becomes Viscous “Enough”
    - Lubricants
    - Frequent Sweeps
Hole Cleaning: Common USL Issues

- Issues “Blamed” on Hole Cleaning
  - Wellbore Instability
    • This is “dirt generation” problem
    • This is (usually) a mud weight solution!
  - Drill string buckling
    • Time spent (wasted) on excessive hole cleaning
- Model it!
Hole Cleaning Success

- **Understand the Flow Regime**
  - Model it! Before & During Drilling

- **Focus on BHA**
  - Motor Bend Settings
  - Motor Speed
  - Stabilization
  - Design to Minimize Vibrations
    - (On AND Off Bottom)

- **Focus on Fluids**
  - Either laminar or turbulent
  - Frequently measure fluid rheology
Hole Cleaning Success

- **Budget the TIME**
  - Set the expectation for all that time will be spent circulating before tripping
  - How much time does an extra BU take?? How much time does stuck pipe cost??

- **Check the Shakers!**
  - Circulate until shakers are clean + 1 additional bottoms up

- **Laminar Flow**
  - STOP Pumping Sweeps (Please?!)  

- **Turbulent Flow**
  - Monitor the viscosity! Keep the flow turbulent (or accept that you are laminar and need to add energy….)
Conclusion
Thank You