Torque & Drag

Common Causes for a Preventable Problem

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What is torque and drag?

Torque is the force require to rotate an object across an opposing surface.

- Torque indicates the friction between the rotating object (drill pipe) and the stationary object (soil).
- Torque increases when friction is greater and decreases as friction declines.

Drag is the force required to slide an object across an opposing surface.

- Drag indicates the friction between the sliding object (drill pipe) and the stationary object (soil).
- Drag increases when friction is greater and decreases as friction declines.

Causes

Most common cause for high torque and drag in HDD is

Poor Hole Cleaning

Poor Hole Cleaning most commonly occurs because:

- Drilling too fast (drilling hole faster than pump output can handle)
- Improperly designed drilling fluid (Yield Point and Low Shear Rate Viscosity are too low)
- Drilling fluid is laden with drilled solids (Dirty Mud)

Other Causes

- Hole instability
  - Sands/Gravels collapse
  - Clays swell

- Lost circulation
  - Fluid lost to formation resulting in a dry borehole

Effects

- ROP Reduced
- Increased wear and tear on tooling
  - BHA, Tool Joints, Drill Pipe, etc
- Increased wear and tear on equipment
  - Travel motors, Planetary motors
- Increased likelihood of Stuck Pipe, Twist-Off,
  Other Major Financial Loss
- Increasing Rig Time and Non-Productive Time (NPT)
  - Tripping, Circulating, Pumping Sweeps,
    Lost Circulation, Fishing

Using drilling fluids to minimize torque and drag and its effects

Know the Ground Conditions before you drill.

- Is the HDD in sands and gravels, reactive clays, cobble, rock?
- How well will my fluid design remove cuttings from the bore?
- What should my penetration rate be based upon my pump capabilities?
- What types of problems will I face in those conditions?
  - Hole collapse
  - Hole swelling
  - Fractures/Lost Circulation

Using drilling fluids to minimize torque and drag and its effects

MAKE A PLAN

- Increase viscosity as needed to carry cuttings from the bore
- Use Filtration Control Additives and/or bridging materials to stabilize sands/gravels
- Use Inhibitors to stabilize clays and shales
- Surfactants and Lubricants to prevent sticking and reduce friction

Yield Point Funnel Viscosity

Carrying Capacity THICK

PAC's Starches LCM

PHPA's Amine Inhibitors

Drilling Detergent Rod Ease

Benefits of Mud Program

- Increased ROP
- Increased life in tools
  - BHA, Tool Joints, Drill Pipe, etc
- Lower maintenance costs on equipment
  - Travel motors, Planetary motors
- Reduces likelihood of Stuck Pipe, Twist-Off,
  Other Major Financial Loss
- Optimizes Rig Time and Minimizes Non-Productive Time (NPT)
  - Time wasted Tripping, Circulating, Pumping Sweeps, Lost Circulation, Fishing is Eliminated

How can we reduce the risk of torque and drag?

Risk Management Assessment, Planning, and Execution

Assess the Likelihood of Risks and Potential Impact on the Scope, Time, Cost and Quality of the HDD

- PLAN
  - Directional Profile and Geometry
  - Know what formations will be encountered
  - Equipment capabilities (rig, pumps, solids control, BHA, tooling)
  - Design a mud program to meet needs of project and minimize risks
    - Hole Cleaning, Hole Stability (sands, clays, gravels??), Lubricity, Etc
- Implement the Plan
- Controlled Drilling
- Monitor while drilling
- Maintenance
- Make adjustments as necessary

The best way to control torque and drag, minimize its effects on your project, and reduce torque and drag related costs is by designing and implementing a drilling fluid plan to

- clean the hole
- stabilize the formation
- reduce the friction and pressures on the drill string and downhole tooling