

### QCORE

**Generic System Name:** Water-based drilling fluid using amine for clay inhibition.

#### **Introduction:**

Category: Water-based specialty fluid for drilling core holes – 1 sack approach with additional clay and shale inhibitor and increased fluid loss control.

Application: QCORE fluid is used for drilling shallow wells where the operations move quickly, mixing equipment is not of high quality and rig crews have a relatively low level of experience. This includes core-wells and other shallow wells drilled for gas, heavy oil or oil sands. QCORE fluid is based on QCORE product, a one-sack product designed to provide rheology and filtration control for most standard drilling operations. QCORE contains polymeric viscosifiers and filtration control agents, along with  $\text{CaCO}_3$  bridging particles. This product and fluid were designed for ease of mixing on small rigs. Its component materials are blended in appropriate proportions, thus simplifying mixing instructions for the benefit of rig crews. QMAXDRILL amine can be added to QCORE drilling fluid to provide shale inhibition when drilling through reactive shale. A mixing chart is available to guide the rig crew in building the required mud volume, with corresponding product usage for the desired funnel viscosity.

QCORE provides good hole cleaning properties adjustable with the addition of QXAN XCD as required, minimal fluid and solids invasion, good borehole stabilization and shale inhibition with use of QMAXDRILL amine. QCORE performance was demonstrate by good core recovery and preservation of core integrity. This fluid can be re-used on multiple wells in batch drilling. Solids stripping for water re-use is easily done when the fluid accumulated high levels of low gravity solids.

The components of QCORE fluid pass Microtox and other environmental requirements in Alberta CAN and are therefore disposal-friendly. The cuttings and drilling fluid are land-spreadable without further testing (unless a non-approved product has been added). The incorporation of oil into the system will cause a Microtox failure.

#### **Key aspects**

- Q Used for drilling core holes
- Q Good core recovery
- Q Easy to mix and maintain
- Q Can be re-used on multiple wells

## Water-Based Drilling Fluids

Replacement for: Polymer WBM and “Mud-in-a-bag” based fluids (Kim Mud, Core Mix).

### Components: QCORE system

<i>QMax Product</i>	<i>Function</i>
<i>Water</i>	Continuous phase
<i>*QCORE</i>	Viscosifier and fluid loss additive
<i>*QMAXDRILL</i>	Clay inhibition

<i>Additional Products</i>	<i>Function</i>
<i>*QSTAR ENV</i>	Fluid loss control
<i>Calcium Carbonate</i>	Bridging agent
<i>Caustic soda</i>	Alkalinity control
<i>*T352</i>	Bactericide
<i>*CLEAREX</i>	Low solids polymer LCM

\* Proprietary or brand name products

### Key aspects

- Q Faster mixing rate
- Q Maintain concentration of QMAXDRILL
- Q Use QCORE mixing chart for viscosity
- Q Avoid using anionic products

## Typical System Properties

<b>QCORE</b>		
<i>Property</i>	<i>Range</i>	<i>Min/Max Recommended</i>
<i>Mud Weight, ppg (kg/m<sup>3</sup>)</i>	8.4 - 10.0 (1,000 - 1,200)	< 9.0 (< 1,080)
<i>Plastic Viscosity, cP</i>	12 - 22 cP	< 30 cP
<i>Yield Point, lb/100ft<sup>2</sup> (Pa)</i>	24 - 40 (12 - 20)	< 40 (20)
<i>Gels, lb/100ft<sup>2</sup> (Pa)</i>	4/4 - 7/8 (2/2 - 3.5/4)	As required
<i>API Fluid Loss, cc/30min</i>	8.0 - 10.0	As required
<i>pH</i>	7.0 - 9.0	< 9.5
<i>Calcium, mg/l</i>	0 - 200	< 200
<i>MBT, ppb-eq (Kg/m<sup>3</sup>)</i>	0 - 5 (0 - 15)	< 3.5 (< 10.0)

### Key aspects

- Q Monitor QMAXDRILL concentration and maintain required concentration
- Q Monitor aerobic bacteria especially for multiple well use

## Field Operations

### Mixing Procedures

For New System: Start with clean tanks and fresh water. Reduce calcium content to below 200 mg/L with soda ash. Mix QCORE to desired concentration and let hydrate. Add QMAXDRILL™. If fluid loss control is higher than programmed level, mix additional QSTAR ENV. Add caustic soda to desired pH. Circulate system to homogenize the concentrations. Recommend to drill out cement with water and viscosified sweeps from a short circulating system. If drilling out with the mud system, pre-treat with soda ash and add citric acid as required when drilling to maintain pH below 10.5.

For mix “on the fly”: Not recommended

### Maintaining Properties

Add QMAXDRILL™ to the suction tank to maintain the inhibitive concentration as per depletion rates. Small additions of QCORE may be required to maintain or improve rheology and fluid loss control. Maintain calcium below 200 mg/L with additions of soda ash.

### Fluid Specific Tests and Equipment

- Complete WBM testing kit
- Amine test kit to measure excess amine for inhibition

## Contaminants: effect and treatment

<i>Contaminant</i>	<i>Mud Effect</i>	<i>Treatment</i>
<i>Aeration</i>	Aerated mud	Turn off surface mixing equipment
<i>Bacteria</i>	Odour	Bactericide
<i>Calcium</i>	NA	Reduce with additions of soda ash
<i>Cement</i>	High pH	Citric or sulfamic acid, bicarbonate
<i>CO<sub>3</sub><sup>2-</sup>/HCO<sub>3</sub><sup>-</sup>/CO<sub>2</sub></i>	NA	Caustic soda
<i>H<sub>2</sub>S</i>	Odour, lower alkalinity, surface release	Zinc carbonate
<i>LGS</i>	High PV's, amine depletion	Centrifuge and / or dilution
<i>Salt</i>	Density increase, chloride increase	Live with the effects or convert to a salt system
<i>Surfactant</i>	Foaming	Antifoam agents premixed in the water and/or defoamers
<i>Water influx</i>	Dilutes concentrations	Replenish to recommended levels, density increase may be required to stop flow

### Operational Recommendations and “Best Practices”

- If the quality of make-up water is questionable, it should be tested for bacteria in the lab and treated out on location using bleach and ascorbic acid according to the lab data.
- System may be stored for short periods and re-used. Decision should be based on relative freshness of the mud and physical properties such as LGS and MBT.
- Residual bentonite or solids in the rig tanks deplete QMAXDRILL™ concentration before drill out.
- Use of an antifoam agent in the premix water may alleviate subsequent foaming issues.
- Run LGS as low as possible to prevent artificial depletion of the QMAXDRILL™.
- Thin fluid while drilling with solids control equipment and dilution. Use chemical thinners only in preparation for cementing as QMAXDRILL™ concentration will be reduced.
- Diligently measure QMAXDRILL™ concentration, especially in new wells/areas as depletion rates may be high.
- Heated storage for QMAXDRILL™ containers (drums/pails) may be required in the winter.