

Quantum EF: Green Chemistry That Works

Fact Sheet

January 2010

The Green Evolution of Drilling Mud

Drilling muds have gone through many generational changes. In areas with little or no water hydratable shale, water-based muds perform adequately. However, in the new shale plays of North America, drillers are having to use an array of supplemental chemical treatments to minimize the effect of water entering the shale. Left untreated, the shale can cause severe borehole problems, slowing penetration rates to a crawl. There are a range of single additive “fixes” offered by mud companies; however, these additives are typically not pre-engineered into the mud program, only called out after drilling problems occur. These “fixes” represent only a temporary patch to a bigger, recurring problem.

Traditional OBM & Synthetic Muds Face New Challenges

Oil-based muds and higher priced synthetic-based muds solve a number of the problems associated with water hydratable shales. However, they bring with them significant handling and disposal issues. At onshore drilling locations using oil-based mud, surface contamination is common, as is pronounced

odor from the diesel mud. The odor is a “tell” for common ingredients in #2 diesel such as xylene, benzene, and toluene, to which rig workers face prolonged exposure on a routine basis.

Once a drilling project using diesel mud is completed, drillers are faced with equipment and location cleanup. These costs can easily exceed \$100,000 on even an average job.

Because of a perceived lack of cost-effective alternatives, even with these operational hurdles, drillers have continued to use diesel-based muds in shale plays.

Unconventional Shale Needs Green Drilling Fluid Solution

In the new unconventional gas shale areas, drillers are seeing higher costs associated with disposal of the oil-based mud. Unlike regions where drilling activity with oil-based mud has been high for decades, new exploration regions such as the Marcellus Shale offer limited sites suitable for oil mud disposal. As a result, drillers are facing higher storage and transportation costs associated with handling diesel mud and diesel-soaked drill cuttings.

Growing environmental awareness by the public and regulatory agencies will likely further impact oil-based drilling mud

Key Points

- Drilling muds are evolving to meet environmental requirements.
- Drilling + Environmental performance are required for drilling muds to be considered effective.
- Traditional OBM and SBM no longer meet environmental needs in new regions.
- Biodegradable, clean, high performance drilling muds are meeting the challenge.



operations. What were once acceptable procedures for diesel muds are being challenged. Lowering the carbon footprint of drilling site operations has gained new emphasis. In this environment, exposing the environment and workers by continuing to use diesel-based mud stands out. Many are asking, “What are the alternatives?”

Rapid Develops Green Alternative

That’s the same question Rapid asked several years ago. The ideal alternative was a water-based mud with no petroleum-based ingredients, but able to perform in the field like a diesel oil mud. Nothing like that existed. We spent several years identifying and testing a range of ingredients, many from other industries, to produce a sustainable drilling fluid that met oilfield performance requirements.

The result: Quantum EF, a fluid with a water external phase, plant-based oil internal phase. Even the emulsifiers and surfactants are plant-based. Quantum contains no diesel oil fractions and is highly biodegradable and safe for the environment. Critically, prolonged exposure to Quantum EF poses no risk to rig workers.

Early development work on Quantum EF focused on lower density applications (those requiring less than 13 pounds per gallon). Subsequent work allowed Quantum EF to

function effectively at densities as high as 16.5 pounds per gallon and temperatures as high as 350°F.

A prime advantage of oil-based mud had been its superior shale stability and lubricity over water-based alternatives. This is no longer the case, as Quantum EF has proven in side-by-side testing with diesel-based mud to offer superior shale stability and lubricity. Field

results verified initial third-party lab testing.

With many things “green,” the good news is that they’re sustainable, the bad news is that the budget isn’t. Drum roll here: with all its benefits, Quantum is no more expensive than diesel-based mud. In fact, taking disposal costs into account, Quantum EF can be cheaper than diesel mud. Greener and cheaper- now there’s an idea.



Quantum EF Improves Drilling Operations in Several Ways

Following are highlights of Quantum EF’s practical “greenness,” by stage of a job:

1. Pre-job: lowering carbon footprint begins even before the Quantum EF job begins. We are able to source plant-based oils on a regional basis, minimizing truck traffic (and thus carbon footprint) getting Quantum EF to the jobsite.

2. During Drilling: with Quantum EF, no diesel in the mud means no xylene, toluene, or benzene in the hole, on the rig floor, or in the air. Increased rates of penetration means reduced rig time, which means lower rig and equipment rental costs. Quantum EF-soaked drill cuttings are not considered hazardous, and are suitable for onsite mix, bury, and cover disposal procedures. With Quantum EF, drillers can process drill cuttings during the actual drilling of the well on a nearby plot of land.

3. During Post-job Cleanup: Once the drilling job is completed, Quantum EF can be returned to a process center, where it undergoes

reconditioning for its next application.

Biodegradation of the Quantum EF on cuttings (which have been safely incorporated into surface soil onsite) produces a soil growth stimulant, allowing for immediate re-

vegetation. Biodegradation testing shows that residual from Quantum EF is non-detectable in as short as only a few days, making Quantum EF a superior alternative to diesel oil muds (and a hit with regulators and operators' HS&E departments). Quantum EF-treated synthetic soils prove test worms not only survive but actually gain weight. In tests for soil fertility, wheat sprouts treated with

Quantum EF grow at rates that exceed the control group.

Through every stage of the job, **Quantum EF is truly green chemistry that works**, ideal for the oil & gas industry and its next generation shale plays.

