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THUSLICK Can Reduce Torque in Directional and Extended Reach Wells!

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Authors' Key Points:
- New lubricant successfully run in Trinidad and Egypt.
- Amoco EPTG Drilling, Tulsa Drilling Technology, instrumental in product testing.

A new lubricant has been tested successfully in Trinidad and Egypt!

Finding a lubricant for water-based muds that works under a variety of conditions is difficult. Conventional, or "chemical," lubricants generally act by forming a film on the steel and rock surfaces. However, they will also adsorb on solids in the mud, and they must compete with other surface-active components of the mud for the steel and rock surfaces. Furthermore, at high shear rate the emulsified lubricant tends to become so stabilized that adsorption is prevented, and often the film that is formed is too weak and/or thin to provide much lubrication. All of these factors may cause the performance of a chemical lubricant to suffer.

A different class of lubricants, called "physical" or "mechanical" lubricants because they tend to act as ball bearings rather than by forming a film, have significant promise as replacements for conventional lubricants, particularly in extended reach wells and in muds that contain polymers and other surface-active components, e.g. lignosulfonates.

In January of this year, Amoco EPTG Drilling, Tulsa Drilling Technology conducted several torque reduction tests in a horizontal well at Catoosa using a PAC mud and three lubricant candidates. THUSLICK, a powdered graphite coated with silicon carbide was added at the recommended concentration of 4 lb/bbl and outperformed the other two additives. Compared to the base mud, THUSLICK reduced the surface torque by 10 to 20% over the torque range of 1,000 to 3,200 ft-lb.

Before testing THUSLICK in the field, however, another concern needed to be addressed: if THUSLICK were to be used in horizontal wellbores, would it cause formation damage? Particle size analysis indicated that THUSLICK has a similar size distribution as conventional barite. Laboratory tests indicated, however, that although THUSLICK can travel into the pore network of a sandstone in a manner similar to barite, it is also easily produced back, with the result that no incremental damage is expected directly from the addition of THUSLICK to a mud.

On the basis of these results, THUSLICK has been recommended for use in extended reach wells. Amoco Trinidad Oil Company tried THUSLICK on the Samaan C 5XX horizontal well. A fresh-water PAC mud containing substantial levels of lost-circulation materials (RESINEX, GRAN-SEAL, E-SEAL and KWIK-SEAL fine) was used to drill an 8½" hole from the kick-off point at 6,100 ft MD, building angle to 90° at the rate of 8°/100 ft from 7,600 ft to 8,900 ft. However, at 8,372 ft MD, the torque increased to about 680 amps, causing sliding problems. Treatment of the active mud system with 4 lb/bbl THUSLICK reduced the torque to 450 amps. At 8,800 ft MD, the angle reached 89°, and lateral drilling was begun. The angle, however, continued to increase, reaching 90 to 93.7° at 9,393 ft MD. The decision was made to reduce angle and increase TVD, but this proved difficult due to erratic torque which exceeded 600 amps. Increasing the concentration of THUSLICK to 5 lb/bbl solved the problem, and the torque backed down to 500 amps.

Slug treatments of THUSLICK were also found to be helpful at other times. For example, while sliding/rotary drilling to 8,820 ft., erratic torque (450 to 650 amps) was brought under control (at 450 amps) to permit sliding. While back reaming out of a tight hole at 8,447 ft, slug-treating with THUSLICK brought the torque down from 650 amps to 550 amps. Beyond 9,500 ft MD, erratic torque of 600 to 800 amps was observed and reduced to 530 amps with a high-concentration THUSLICK pill.

The success experienced with THUSLICK in Trinidad was repeated, though not as emphatically, in the Nile Delta on the Jj 69-2 Ha'py No. 4. An appraisal well, Ha'py No. 4 was planned as a highly deviated well drilled from a diverless template set over the discovery well Ha'py No. 1. The well plan had a kick off point just below the 30" drive pipe at 574 ft (175m) building at 4°/100 ft using a 17½" bit and 9½" AKO steerable assembly, to a terminal angle of 57.5°. The inherent problem with this design was the high torque and drag associated with the normal forces acting at the kick off point as the well got deeper and the drill string tensions increased. The intermediate hole section had been finished by setting 9⅝" casing at the top of the reservoir and a PAC/glycol mud was being used to drill the 8½" section through the pay zone.

A slick BHA was tripped in the hole and the top of the cement was tagged at 8,563 ft (2,610m) MD, and drilling of the shoe track was attempted. However, the drill string could not be rotated without axial motion, and circulating/conditioning the mud did not improve the friction factor. A decision was made to change out the BHA in order to reduce normal forces in the build section. The string was pulled out of the hole and run back in with

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the new steerable BHA with HWDP used for bit weight, which brought about a immediate reduction of about 250 amps (6,250 ft-lbs total @ 25 ft-lbs/amp), or 25% in rotational torque with the pumps on. Drilling of the cement, float collar and the shoe track ensued. However, in the shoe track the measured torque was still high: 600 to 700 amps. So, during the last 16 ft (5m) of shoe track the mud was displaced with mud containing 4 lb/bbl THUSLICK, whereupon the surface torque dropped by an additional 50 to 100 amps (11%), and P/U and S/O drag was also reduced 10-20 klbs (10%). The effect was continued as the well was drilled (currently conventional coring sections of the payzone).

The apparent success of THUSLICK in these two wells suggests that use of this mud additive should be considered in other extended reach or directional wells where drilling operations may be compromised by high or erratic torque. In contrast to conventional lubricants, the performance of inert physical lubricants like THUSLICK is expected to be relatively independent of the mud system. MPI

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