Shale Plays Driving Drilling Fluid R&D

By Al Pickett
Special Correspondent

The mud system is “the lifeblood of the entire drilling operation,” which means the success of any drilling project begins with selecting the right engineered fluid system for the job at hand.

So says Kerry Redmann, the Gulf Coast division drilling superintendent for BOPCO Inc. in Metairie, La., and director emeritus of the American Association of Drilling Engineers. One of the first issues independent operators must consider in drilling mud selection is lubricity, especially in horizontal and directional drilling applications where friction is a major concern. “The newest generations of drilling fluids provide significant improvements in lubricity, reducing friction by as much as a 30 percent in some cases,” he states.

“Another challenge is finding a water-based mud (WBM) that is competitive with oil-based mud (OBM) in terms of drilling performance, especially in shales, which tend to absorb water,” Redmann explains. “Drilling fluid companies have spent a lot of time finding the right combination of fibers for hole cleaning and lost circulation control. And, of course, finding drilling fluids that can work in high temperatures continues to be a challenge. By the very nature of mud circulating, it can drop the temperature of the rocks in deep wells by 200 degrees. That causes stress fractures, which causes mud loss and well bore instability.”

Redmann says good working relationships with drilling fluid companies are crucial for midsized and small independents such as BOPCO. “An independent relies on the fluids company to design the best mud program for a given drilling operation,” he says. “We need an experienced mud engineer with good mud knowledge, who can come in and study what is going on and make a proposal within a day or two to help put a proper mud program together. Good mud engineers are invaluable to us.”

Innovative New Solutions

To meet the demands of operators in the field, the research and development departments within drilling fluid companies are designing a range of innovative new solutions, according to Greg Perez, the global research and development manager for Halliburton’s Baroid business line. “Drilling fluids today are high-performance systems engineered to overcome the operational challenges that oil and gas companies are facing in the field,” he remarks.

Increasingly, those challenges are taking the form of long-lateral drilling in unconventional rock formations and deeper geology with high temperatures and pressures, according to Perez. “We are continually pushing the envelope in regard to developing high-performance fluids that can tolerate higher temperatures, reduce formation damage, improve stability and lubricity in horizontal well bores, and of course, be more environmentally friendly,” he says.

Given the demands that today’s drilling campaigns are placing on well bore hydraulics, Jim Friedheim, corporate director for fluids research at M-I SWACO, a Schlumberger company, says fluids technology is advancing on all fronts to not only deliver improved drilling results, but also to enhance well performance and safeguard the environment.

“We are in the business of selling technology to do things better, more efficiently, and environmentally safer,” he notes. “We are focusing on what we can do to change the face of drilling fluids over the next two or three years with new methods and new technologies.”

Of course, the pace of drilling activity in basins across North America is being set by horizontal drilling in shale plays. Six of every 10 active U.S. rigs are drilling horizontally any given week, representing a doubling of horizontal drilling’s share of the total U.S. rig count over the past five years.

Automated Analysis

M-I SWACO’s Friedheim says his company is focusing on next-generation automated solutions, and is conducting trials with a new automated fluid measurement and analysis system in the North Sea.

“The drivers for drillers are better technology sensors, well integrity, and reducing people on rigs,” he offers. “We are looking at automated fluid measurements to analyze the chemistry and physical components of the fluids in real time 24 hours a day, seven days a week.”

Measuring devices control continuous particle size distribution with real-time automated analysis tools, and the results are made available around the clock over mobile computing devices, says Catalin Aldea, director of new technology for M-I SWACO.

“We are witnessing a generation change in the industry, and we now are living in

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a digital world. Drilling engineers used to check the mud several times a day, but now they can receive real-time measurements on their mobile devices. There is also a renewed interest in automated hydraulics modeling,” Aldea observes.

“Drilling management is no longer an isolated unit,” adds Jim Bruton, vice president of research and engineering. “Drilling engineers have an opportunity for 24/7 data and can make the necessary changes.”

The company has developed the PressPro™ RT well site service that provides remote and well site engineering support with a unique, specifically designed suite of software programs that use surface measurements to calculate downhole pressure profiles and fluid properties in real time during drilling, tripping and other critical operations, according to Bruton.

High-Temperature WBM

M-I SWACO has developed a number of other new products to meet the changing demands of operators. Aldea says an example is the EnviroTherm™ NT system, which is designed to optimize drilling and minimize environmental impact in high-temperature applications with the next generation water-based drilling fluid system.

“We have received requests consistently for a single drilling fluid system that is chrome-free for environmental reasons, that can resist bottom-hole temperatures in excess of 450 degrees F, and uses water-based chemistry,” Aldea points out. “The EnviroTherm NT system is now fully commercialized and is a lot more environmentally friendly because it removes all chromium-based products.”

Bruton notes that it is critical for drilling fluids to maintain their properties as they go through the various stages of the circulation process. Accordingly, he says flat rheology invert drilling fluids that were engineered originally for deepwater applications now are being used in extended-reach drilling, cold-weather drilling, and high-angle wells.

Aldea says his company also has developed the Lube OB-1017™ lubricant, which is an oil-soluble additive specifically engineered for use in all invert-emulsion drilling fluids to decrease the coefficient of friction. “We have seen great success with Lube OB-1017 to enhance drilling performance in long horizontal wells where torque and drag is an issue,” he states.

According to Daryl Cullum, corporate director of technical services for M-I SWACO, the key question from operators for any new product is, “How will it perform in the field?”

“We have taken these new products to the field, from low temperatures in North Dakota to very high temperatures in Central Europe,” he claims. “We have seen performance exceeding the systems they are replacing. That is a very good sign.”

Cullum says part of developing these new products is to simplify the drilling and fluids management processes. “Our philosophy is that we can replace two products with one, in some cases,” he explains. “That way we can reduce the material operators have to store on site. It is part of our philosophy of how to manage drilling fluid systems. All these new systems and methods represent a different way of looking at things.”