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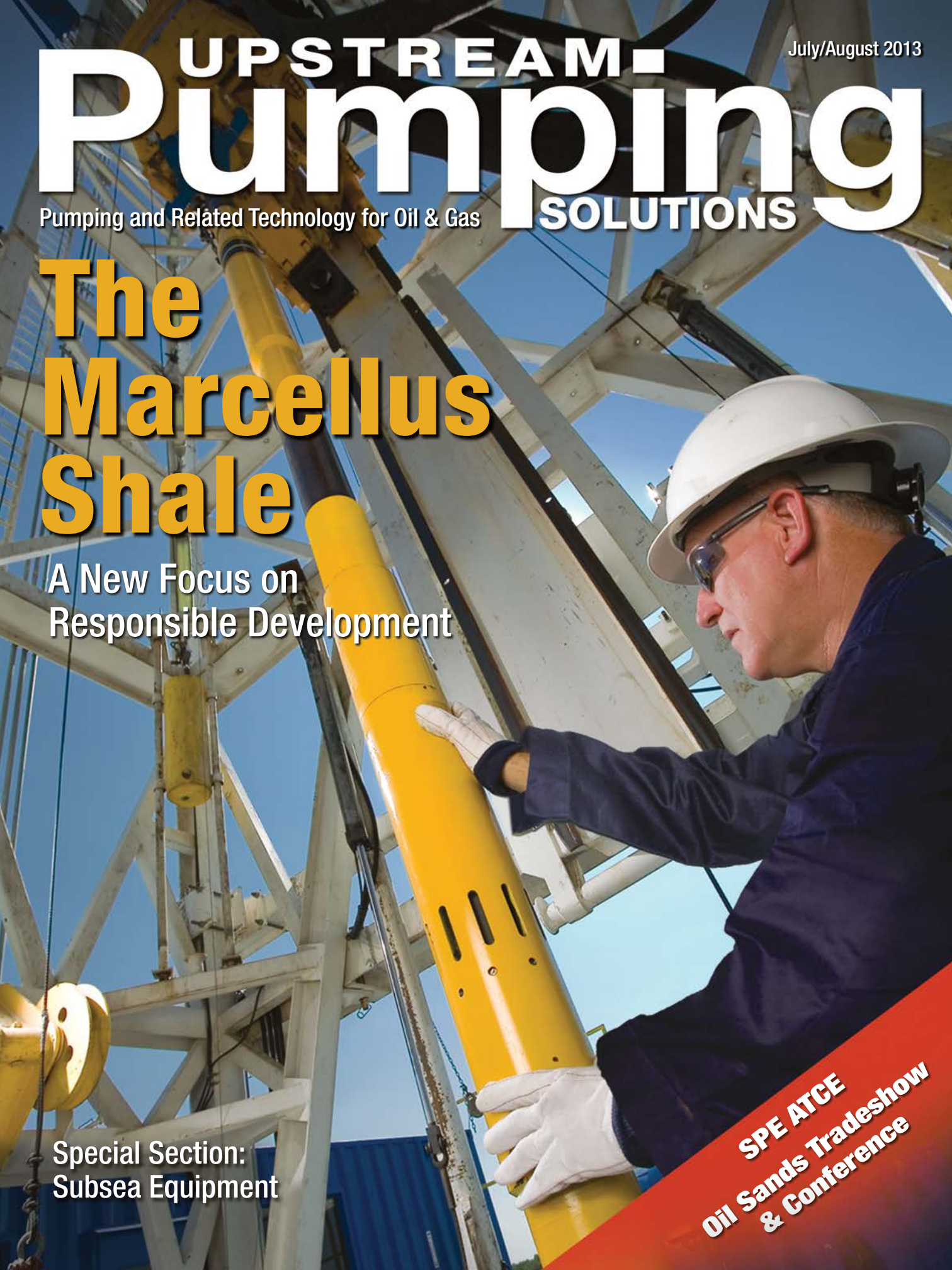

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A drilling rig in the Marcellus Shale, *image courtesy of Baker Hughes Inc.*

Rotary Lobe Pumps & Decanter Centrifuge Increase Solids Removal

By Bill Blodgett, LobePro Rotary Pumps

Operators can experience ease of use, cost savings and improved efficiency.

Dilute drilling fluid required to return the drilling fluid to within the original specification is a major drilling expense. Typically, 20 or more barrels of dilute drilling fluid are required to offset one barrel of drilled solids that is not removed from the drilling fluid. As a result, many operators now use a decanter centrifuge, in addition to the standard shaker and desander, to improve their solids removal efficiency (SRE).

The improvement in SRE comes from a decanter centrifuge's ability to remove drilled solids that are too small for a shaker, desander and desilter to separate. This article discusses how a centrifuge fed by a rotary lobe pump can improve solids removal. It also details an example of a savings calculation from a dilute drilling fluid calculator that shows the possible savings from using a decanter centrifuge with a rotary lobe pump.

Feeding with a Rotary Lobe Pump

A centrifuge can help remove solids that are too small to be eliminated by the standard shakers, desanders and desilters. The D50 cut-point for the shaker, desilter and desander combination is typically 70 microns. The D50 cut-point for a decanter centrifuge is typically 6 microns. A D50 cut-point of 6 microns means that the centrifuge will remove 50 percent of the 6 micron solids in the drilling fluid.

To obtain the maximum benefit, decanter centrifuges should be fed by a low-shear, positive displacement pump. The solids removal is improved with a rotary lobe pump because a centrifugal pump's shearing action results in a higher percentage of drilled

solids that are less than 6 microns and, therefore, unable to be removed by the centrifuge. The flow from a rotary lobe pump is not affected as much as a centrifugal pump by changes in viscosity, pressure and specific gravity. Therefore, a rotary lobe pump can be much more readily managed to feed enough drilling fluid to take full advantage of the centrifuge's capacity without overfeeding it.

Drilling rig personnel are generally occupied with other tasks and cannot constantly adjust a centrifugal pump or change impellers as required. As a result, many more barrels of drilling fluid will typically be processed by the centrifuge when fed by a rotary lobe pump.

This is also important because it is generally accepted that drilling solids not removed on the first pass will never be removed and will have to be controlled by dilution.

Rotary Lobe Pump Improvements Measured

Table 1 shows a substantial reduction in dilution drilling fluid required for a 7,000-foot hole that results from the addition of a decanter centrifuge to other solids separation equipment. In this example, the savings in dilution drilling fluid preparation and disposal net of the centrifuge rental expense is $70,548 for the one 10-day job. The example in Table 1 is taken from Chapter 13 of the *Drilling Fluids Processing Handbook* published by ASME Shale Shaker Committee.

The drilling fluid in this example was separated using a shaker, desilter and desander in combination, which removed 60 percent of the drilled solids. Then a centrifuge removed ⅓ of the 40 percent of drilled solids that remained. The improvement in SRE resulted from the decanter centrifuge's ability to remove particles between 6 to 70 microns that were not removed by the other solids separation equipment.

In the example, a well bore of 13.5 inches in diameter that is 7,000 feet deep will result in 1,237 barrels of drilled solids. The shaker, desilter and desander combination leaves 495 barrels (40 percent of 1,237) of drilled solids in the drilling fluid. Using Section 4 in Table 1, 32.1 barrels of dilute drilling fluid are required for each barrel of drilled solids to restore the drilling mud to specification. This equals 15,868 barrels of dilute drilling fluid (495 x 32.1) with a total cost of $238,025 ($15 x 15,868) for dilute drilling fluid if a decanter centrifuge is not used.

By using a decanter centrifuge fed by a rotary lobe pump to remove ⅓ of the 495 barrels of drilled solids remaining in the drilling fluid after processing by the shaker, desander and desilter combination, the cost of dilute drilling fluid can be reduced by $78,548 ($238,025 x ⅓).

Some drilled solids, primarily those less than 6 microns, remain after centrifuge treatment. Unfortunately, the solids that contribute most to poor hole conditions are colloids and ultra-fine solids under 6 microns. As a result, many experienced operators have switched to low-shear, positive displacement pumps to feed the decanter centrifuge in an effort to minimize colloids and ultra-fine drilled solids.

The dilute drilling fluid calculator, which was used to obtain the numbers in Table 1, helps determine the reduction in dilution drilling fluid required if the centrifuge is fed with a low-shear rotary lobe pump versus a centrifugal pump. (Email the author for a copy of the calculator.)

Using a centrifugal pump instead will reduce the percentage of drilled

	Green= Input Required
1. Calculate Drilled Solids (DS) Volume in Barrels:	
Diameter of Well Hole in Inches	13.5
Drilled Solids in Bbl/1,000 Ft	176.8
Depth of Hole in Feet	7000
Total Drilled Solids for Hole in Bbl	1,237
2. Drilled Solids Remaining (DSR) after Going through Shaker, Desander, Desilter:	
% Drilled Solids Remaining	40%
Barrels of Drilled Solids Remaining (DSR)	495.0
3. Drilling Fluid Weight Management [Low Gravity Solids (LGS) and Freshwater Based]	
Required Drilling Fluids Weight (DFW)	9
Calculated Required Solids % (7.5*(DFW-8.33))	5.0
Minus- % Bentonite Contained in Drilling Fluid	2.0
Maximum Drilled Solid Allowed % (MDSA)	3.0
4. Dilution Drilling Fluids Required (DDFR)	
DDFR per Bbl of Drilled Solid to maintain MDSA % [(100-MDSA)/MDSA]	32.1
Total New Dilution Drilling Fluid Required in Bbls (DSR*DDFR per Bbl of Drilled Solids)	15,868
5. Cost of Dilution Drilling Fluid	
Cost for Preparation per Bbl	$ 10.00
Cost for Disposal per Bbl	$ 5.00
Total Cost per Bbl	$ 15.00
Cost for Hole (Dilution Drilling Fluid Required * Cost per Bbl)	$ 238,025
6. Calculate Dilute Drilling Fluid Savings (DDFS) by Using a Centrifuge fed with Rotary Lobe Pump	
Drilled Solids Remaining(DSR) after Processing through Shaker, Desander and Desilter	495
Estimated % of Remaining Solids Which can Be Removed by a Centrifuge fed by Rotary Lobe Pump	33%
Additional Drilled Solids Removed by Centrifuge (Bbls)	163
Dilute Drilling Fluid Required per Bbl of Drilled Solid to Maintain Maximum Drilled Solids % (100-MDS)/MDS)	32.1
Dilute Drilling Fluid Saving (DDFS) in Bbls if Centrifuge fed by Rotary Lobe Pump	5,237
7. Calculate $ Savings In Dilution Drilling Fluid From Use of a Centrifuge fed by Rotary Lobe Pump	
Preparation and Disposal Cost per Bbl	$ 15.00
Dilute Drilling Fluid Savings (DDFS) if Centrifuge is fed by Rotary Lobe Pump (DDFS* Cost per BBl)	$ 78,548
Less: Cost of Centrifuge Rental During Drilling	$ 8,000
Net $ Saving if Centrifuge is fed by a Rotary Lobe Pump	**$ 70,548**
8. Reduction in Savings if Centrifuge is fed by Centrifugal Pump	
Additional Drilled Solids Remaining (DSR) if Centrifuge is fed by a Centrifugal Pump (8%*DSR)	39.6
Dilute Drilling Fluid Required per Bbl of Drilled Solids to Maintain Spec	32.1
Additional Dilute Drilling Fluid Required if the Centrifuge is fed by a Centrifugal Pump	1,269
Reduction in $ Savings if Centrifugal Pump is Used Instead of Rotary Lobe Pump	**$ (19,042)**

Table 1. Dilute drilling fluid calculator

solids removed from 33 percent to 25 percent. This reduces the savings from using a decanter centrifuge by $19,042 on just one 10-day job. Additional benefits of a rotary lobe pump are:

- Eliminating the annual overhaul cost for the centrifuge that can result from overfeeding of the centrifuge by a centrifugal pump, typically about $12,000 per year
- Avoiding priming problems at the drill site—a nuisance for operators—because rotary lobe pumps are self-priming and have strong vacuums

Case Study

In 2009, a pumping solution company was selected by a manufacturer of decanter centrifuges as a partner. Most operators using low-shear, positive displacement pumps selected progressive cavity pumps (PCPs). The decanter centrifuge manufacturer's management knew that several key operators were unhappy with the PCPs because of field failures caused by dry running for as little as 30 seconds, the time and difficulty to replace parts in the field, and the cost of repair parts.

After extensive testing by its engineering staff, one of these users selected the decanter centrifuge manufacturer's package featuring the rotary lobe pumps to feed their centrifuges and have replaced many of their PCPs with the pump solution company's low-shear, positive displacement pump. These rotary lobe pumps are well-suited for their drilling mud tasks because they can run dry, provide low shear, have a strong vacuum and are self-priming. An additional bonus to these pumps is the ability to perform pump maintenance in-place quickly and easily. One person can handle the maintenance on the company's average size pump in half the time of a comparable PCP.

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LobePro Rotary Pumps provides engineered pumping solutions in applications such as drilling mud, oil refining, corrosives and waste oil. To learn more about LobePro Rotary Pumps, please visit www.lobepro.com.