Efficiency grows in waste, fluid management

AUTOMATIC SHAKER CONTROL

SHALE SHAKERS traditionally have been manually operated machines. Basket angles are either fixed or manually adjustable. Acceleration is also typically fixed, or in some cases manually adjustable. These manual features tend to cause problems with a shaker's screen life, flow capacity, operator intervention and increased HSE exposure. This work proposes an automated shale shaker to adjust the basket angle and acceleration according to drilling conditions.

Sensors have been added above the first screen to measure the fluid level in the basket. Additional sensors measure incoming flow rate and the basket angle. An onboard computer controls the basket angle to place the fluid near the optimum position in the basket. This allows for increased screen life because each screen maintains lubrication. The automatic basket angle control also results in less operator intervention. As the flow to the shaker is increased, the basket automatically adjusts to a more uphill position, which maintains a constant fluid level and allows for increased flow capacity. As the flow to the shaker is decreased, the basket automatically adjusts to a more downhill position, which keeps the screens lubricated.

Another feature of the automated shaker is the automatic boost. This temporarily increases the g force applied to the basket in order to process higher flow rates. As the flow rate is increased, the basket automatically moves to a more uphill position. When the basket has reached its fully uphill position and the fluid level remains above the optimum value, then the speed of the motors is increased, which increases the basket acceleration. This "boost" in g force level is maintained for a set length of time and then returns to normal. This increases the temporary maximum flow capacity of the shaker.

Results have shown that the automated shaker increases screen life, helps prevent whole mud loss and decreases operator intervention.

The automated shaker will increase performance and decrease operating costs by operating the shaker near optimum. This maintains screen lubrication, which increases screen life, and helps prevent the loss of whole mud. In addition, shaker automation reduces operator HSE exposure.

Automatic Shaker Control (IADC/SPE 99035) E Scott, Brandt.

99113: There is still enormous opportunity for cost reduction through hydraulics optimization if the solids transport phenomenon is carefully understood.

PNEUMATIC FLUIDS

Most of the technological improvements seen in the drilling of wells with a "pneumatic fluid" have come from the mining industry. Improved technology has been lagging compared with wells drilled with a liquid system. Liquid components linked together are evaluated in a system. However, in-air drilling components are pieced together with little regard to the remaining parts in the system. Drilling using a pneumatic fluid is complex and requires proper engineering to be successful. Because the fluid is compressible, there many improvements that can be made to manipulate downhole pressure and velocity, which cannot be done in a liquid system. It is advantageous to divert a portion of the pneumatic fluid into the wellbore before it reaches the bit. To do this, consistently diverting the proper volumes a Pneumatic Fluids Drilling Model must be utilized. This paper presents new technology that has been proven in theory and demonstrated in the field.

This technology includes a model which accurately demonstrates downhole pressures, velocities and kinetic energy so that various drillstring and wellbore geometries. The model demonstrates the effects of diverting a portion of the pneumatic fluid into the wellbore above the bit.

The paper also describes a new tool — the "downhole air diverter" or DHAD — which is deployed in the drillstring that can accurately divert the optimum amount of fluid based on model recommendations. As a result of using this new technology to manipulate bottomhole pressures at the bit, the energy normally lost to friction can be used beneficially, resulting in lower surface compression cost, less hole erosion, higher penetration rates, longer bit life and a higher percentage of wells reaching TD without converting to incompressible fluids.

This paper presents data from bottomhole pressure tests demonstrating that the DHAD creates a Venturi Effect downhole reducing bottomhole pressures. By lowering bottomhole pressure, velocity is increased with less air and less friction. Case studies are included to demonstrate how this technology has been used successfully in the field under various wellbore conditions reducing drilling cost.

Technological Improvements in Wells Drilled Utilizing a Pneumatic Fluid as the Primary Circulating Medium (IADC/SPE 99162) JC Mellott, AVB Systems.

OIL-BASED DRILL CUTTINGS

As Yogi Berra is fond of saying, "It's not over till is over." During any oil-based mud drill cuttings treatment project, the task is not complete until the solids are clean and permanently disposed, the oil is clean and re-used, and the water is clean and discharged. The project is over when the wastes pass the auspices of the local environmental rules and are no longer an environmental risk.

Thermally desorbing the liquids from the drilled solids is easiest part of the job. It's the little things that really make the difference between a successful project and a failure. This is true not only for the treatment company but also for the oil company and drilling contractor that is generating the cuttings.

In most cases, for these projects to benefit all, they must be approached as a partnership between the waste generator, the treatment company and the environmental agency. Anything else leads to problems.

Our experience covers five continents and the successful treatment of more than 500,000 tons of oil-based drill cuttings. We will share data concerning many of our projects. Some projects will tend to be light-hearted while others will be more complicated.

Problems have arisen due to inadequate planning while others have been born due to an interpretation of the regulations. This paper will cover topics including transporting and storing oil-based drill cuttings, the need to pre-treat for a consistent homogeneous feed, rehydrating the dried solids and separating the liquids into usable oil and dischargeable water. All of these pre- and post-treatment activities have a great deal to do with the success of a project.

Understanding the complete job and having an agreement between the treatment company, the oil company and the regulatory agencies prior to beginning the project is essential.

Even when you have done your homework, unexpected problem arise. We will share some of our problems and how they were overcome, thereby decreasing the environmental risks as well as the financial risks associated with oil contaminated cuttings.

Lessons Learned From Treating 500,000 Tons of Oil Based Drill Cuttings on Five Continents (IADC/SPE 99027) DA Pierce, B Wood, D Guthrie, National Oilwell Varco.

OPTIMIZED HYDRAULICS

The use of lightweight fluids is an effective way of drilling through hard formations, depleted reservoirs and lost circulation zones. Although practical experience is guiding technological improvements, the limited knowledge of the physical phenomena is leading to conservative design.

In this scenario, cuttings transport may not be seen as a major problem while drilling with lightweight fluids, especially in vertical wells, due to the excessive liquid and gas flow rates pumped. There is still an enormous opportunity for cost reduction through hydraulics optimization and its related drilling practices if the solids transport phenomenon is carefully understood. The three-phase flow involved is complex, and reduced scale results are questionable since dynamic similarity is difficult to be achieved.

Based on that, a group of real-scale tests was performed at the Petrobras training center. The tests consisted in the measurement of solids return time in a 1,270 m depth, 6.28-in. diameter and fully instrumented vertical well. Solids' return time was measured by commercial equipment for monitoring sand production at surface in production operations. The tests aimed the evaluation of the cuttings transport capacity of lightweight fluids in several flow rates, which could be verified from the measured solids' return time.

The effects of gas/liquids rates, liquid phase viscosity, back pressure, depth and particle size were detailed assessed based on the experimental path. A mechanism of solids transport by aerated fluids, coupled with concepts of particle sedimentation in non-Newtonian fluids and gas liquid flows was proposed and implemented in Petrobras' lightweight fluid drilling hydraulics software. This model constitutes an important foundation for an optimized hydraulics project of field operations, seeking enhancement of drilling performance and cost reduction with safety. Basics of the model and unique experimental real-scale data will be presented.

Investigating Solids Carrying Capacity for an Optimized Hydraulics Program in Aerated Polymer Based Fluid Drilling (IADC/SPE 99113) AM Lourenco, AL Martins, PH Andrade, Petrobras; EY Nakagawa, Csiro Petroleum.