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Integrated Approach Optimizes Results

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HOUSTON–With the uncertainty that characterizes today's oil and gas market in tandem with ever-tightening rules for protecting the environment, operators must find new ways to balance drilling and production efficiency and environmental stewardship. On both fronts, drilling and completion fluids and waste management can significantly impact a drilling operation.

A new approach aimed at optimizing the design, delivery and management of well site fluids and wastes exploits the natural grouping of all fluid-related products and services. Owing to the improved drilling efficiency and the synchronized approach to solids control and waste management it propagates, the initiative is helping operators realize significant savings in drilling costs, while simultaneously increasing production and enhancing their environmental protection efforts.

The new approach is based on the belief that fluids and fluids-related equipment represent a natural grouping of products and services at the well site. This grouping is natural to the extent that the performance of individual components is interdependent, meaning significant opportunities exist to achieve better results by managing these processes jointly and using combined resources to execute them. The natural grouping includes drilling, drill-in and completion fluids; solids control and filtration equipment; and waste treatment and remediation services.

True Integration

The truly integrated service incorporates total fluid and waste management planning procedures, best practices, benchmarking, newly-developed software and other fluid technologies, thereby differentiating it from simple service bundling approaches. The completely linked product and service approach includes an integrated data management system, featuring a common data base to analyze the interactions between the fluid system components. This approach is viewed as fundamental for continuous analysis and improvement.

Critical to the success of an integrated approach to fluids and fluid management is proficient well site engineering capabilities. Thus, an extensive cross-training program was developed that includes the full gamut of drilling and completion fluids and waste management. The curriculum includes such topics as completion fluids, drilling technologies, drilling systems, drilling fluid economics, rig data acquisition, mud relationship to solids, solids control systems, and waste minimization and treatment services.

The objective of the training program is to provide the customer with total fluid expertise at the well site. By sharing knowledge and experience, combining perspectives, and aligning objectives, a detailed fluids plan is designed that facilitates the optimization of the selected drilling and completion fluids, the equipment and rig personnel that handle the fluids, the reservoir they contact, and the environment they impact.

One of the primary roles of the integrated initiative is helping operators protect the environment before, during, and after drilling. Prior to drilling, an environmental assessment of the drilling plan is conducted, including a review of local regulations and available options for fluid waste disposal. During drilling, the assigned project engineer is responsible for ensuring that the environmental goals outlined in the fluids plan are achieved. After drilling, the approach handles the fluid disposal, site remediation and post-well reporting.

The approach utilizes on-going benchmarks of parameters affecting environmental compliance and documents environmental practices. To that end, it is imperative to maintain good communication and cooperation with the environmental departments of both the various operators and national, state and local authorities.

As mentioned, the fluid integration process begins in the well planning stages and extends through the completion of the well, including the ultimate disposal of fluid waste. The process goes well beyond shared infrastructure and personnel to exploit synergies in technology and delivery inherent in this natural grouping of products and services.

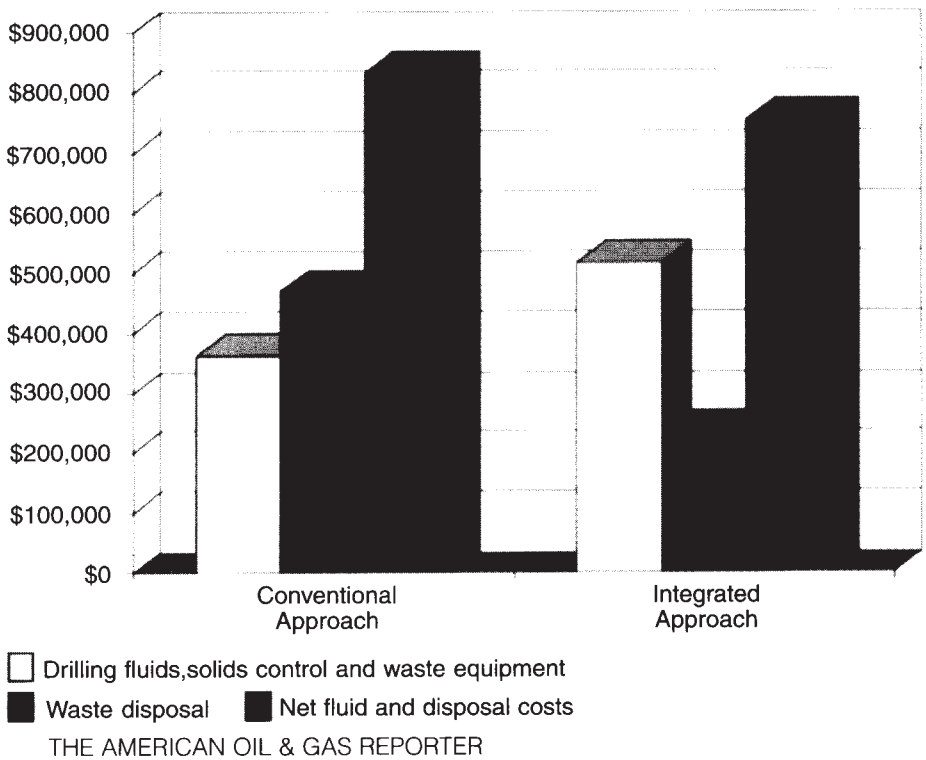
Reduce Operator's Cost

The potential cost savings from optimizing solids control efficiency and fluid performance are well documented. As shown in Figure 1, the approach is designed to reduce the operator's cost per equivalent barrel of oil and natural gas produced.

Evaluating the solids control and waste management equipment on individual rigs plays a critical role in a successfully integrated fluid engineering approach. Through rig evaluations, steps are implemented to routinely reduce the amount of waste generated.

FIGURE 1

Integrated Fluids Engineering versus Conventional Approach



As a case in point, a survey of an inland barge location in Louisiana successfully tracked the source of waste disposal cost. It was discovered that 50 percent of the waste volume during intervals drilled with an oil-based system came from rig wash and waste water.

In another operation in South Louisiana, a customer saved $80,000 through a 10 percent reduction in net fluid and disposal costs. Furthermore, the amount of waste volume and associated liability were also dramatically reduced.

In another field case, a fluids and waste management engineer monitored the mud-to-cuttings retention on a semisubmersible in the Gulf of Mexico. In so doing, it was discovered that two shakers were not performing up to standard. Since the rig was running an expensive synthetic fluid system that was being depleted rapidly, the engineer worked with the shaker manufacturer to upgrade the two shakers, resulting in significant savings in mud costs.

Benefits Of Integration

To better understand the benefits of an integrated approach to fluids and waste management compared to traditional and bundled services approaches, consider three hypothetical scenarios. In each case, assume the operator has a $5.2 million cap budget to drill the same well. The drilling rig, logging/measurement while drilling, cement/casing and directional drilling contracts have been let, and all that remains to be contracted for are the drilling and completion fluids and solids control and waste management services.

In the first project, the drilling supervisor awarded the drilling fluids to company A, the completions fluids to company B, and the solids control and waste management services to company C. Each of these contracts were awarded on the basis of past relationships.

While drilling the surface hole, the water returned to the pit for building the spud mud was much cleaner than required, indicating the dewatering unit was in operation far too long. At the end of the interval, the dewatering cost was 20 percent higher than what the solids control company projected.

In the intermediate hole, the centrifuge broke, requiring additional dilution to keep the MBT in range. It took a day before the assigned mud engineer could inform the company man, and another day was lost waiting for the solids control representative to arrive on location. Between rig down time and extra mud and disposal costs, an additional $70,000 was required to TD the section.

While drilling depleted sand in the lower hole, the pipe stuck, requiring a four-day spotting operation. However, rather than capturing the spot in a separate pit, it was placed in a reserve pit with other waste mud, increasing the dewatering and disposal costs. Once the pipe was freed, daily additions of plugging additives were required to prevent a repeat. The mud engineer failed to check with the MWD/LWD company representative on how much lost circulation material its tool could handle. As a result, a poorly-mixed sweep plugged the LWD tool, leading to seven days of extra rig time to correct the problem and another stuck pipe.

It is finally time to complete the well, but during displacement to the completion fluid, a petroleum-based solvent was used to clean the well bore. Like before, the fluid was placed in the reserve pit with normal waste. Subsequently, the entire pit was contaminated, requiring all the fluid to be hauled to an injection well and adding $50,000 to the waste disposal bill.

Upon completion, the well was $260,000 over budget.

Single Company Approach

In the second project, the operator elected to award the drilling and completion fluids and waste management to company A, which assigns project engineers for each segment. Again, the operator has a $5.2 million budget to drill a well identical to the one in the first project.

Although the well was spudded uneventfully, the dewatering unit did not work properly, requiring a pump replacement. Without sufficient water, the mud weight could not be maintained, forcing a reduced drilling rate. The higher mud cost and the extra drilling day combined to add $40,000 to the cost of drilling the interval.

In the intermediate zone, poor coordination between the mud and solids control engineer led to ineffective use of the solids control equipment. As such, 30 percent dilution is required before the mud is capable of drilling a depleted sand. Since the extra mud had to be trucked to location, the transportation costs, and extra mud, rig and disposal costs tack another $90,000 onto the drilling costs.

Meanwhile, the delay in mud conditioning contributes to a stuck pipe, which adds $40,000 in mud (spot) costs and three additional rig days. At total depth, lost circulation occurs while running the liner, and the cement job is performed without proper circulating time. Three days and two cement squeezes are required to return circulation.

Upon completion, the company man receives three recaps: one from the mud engineer, another from the completions fluid representative, and a third from the solids control engineer. Even though they represent the same company, the three engineers have divergent explanations for the problems that occurred during the well, leaving the matter of ownership in doubt.

Integrated Approach

In the third project, the operator elects to experiment with the integrated approach on a risk/reward basis. The budget and well parameters are the same. A project engineer was assigned to oversee drilling/completion fluids and solids control/waste management activities. A predrilling survey of the location and available equipment was undertaken, followed by a detailed plan that included other third-party suppliers. Prior to spudding, all procedures and practices were blended into the drilling program and accepted by all parties.

In this well, trouble time was reduced dramatically. For instance, dewatering was coordinated to balance reclamation with operational needs, solids control equipment was properly monitored and utilized, and dilution volumes and waste volumes were minimized. On the fluid side, an unplanned change in the well path required fluid modification. Coordination between the assigned project engineer, the directional driller, and the MWD representative produced a joint hydraulics plan with rheology and flow rate adjustments and maximum penetration rates.

At completion, the operator received one recap, summarizing the drilling, completion and solids control activities. By following an integrated approach, the operator realized $770,000 savings in total drilling costs. ❐

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