

Effective Drilling-Waste Management Reduces Well-Construction Costs

The increasing amount of environmental legislation affecting drilling operations has resulted in a rapid increase in drilling-waste-management spending. While traditional perception is that this increased spending adds to well-construction costs, many technologies now available are cost-effective when the entire well-construction cost is evaluated. The full-length paper reviews deployment of both new and traditional drilling-waste-management technologies and demonstrates that correct application of these technologies can result in a reduction in well-construction costs.

Introduction

Although there are other waste products attributable to drilling operations, most waste-reduction efforts focus on drill cuttings and excess or spent drilling fluids as well as the treatment and/or disposal of these waste products in compliance with governing regulations for the area of operation. All costs associated with treatment and disposal usually are considered part of the overall well-construction costs. Evidence from the case histories presented demonstrates that appropriate waste management and technology applications actually can reduce rather than increase well-construction costs.

Time Line

Until the 1980s, there was little or no drilling-waste management as we know

This article, written by Assistant Technology Editor Karen Bybee, contains highlights of paper SPE 96775, "Drilling-Waste Management: Case Histories Demonstrate That Effective Drilling-Waste Management Can Reduce Overall Well-Construction Costs," by K. Browning, SPE, and S. Seaton, SPE, Halliburton Fluid Systems, prepared for the 2005 SPE Annual Technical Conference and Exhibition, Dallas, 9–12 October.

it today. In offshore operations, cuttings and excess fluid typically were discharged overboard and spread on the lease sites or buried in land operations. There was little, if any, legislation regarding disposal of these materials. Discharge and land spreading were low-cost solutions that allowed the operator to remain in compliance with existing regulations. Consequently, the actual amount of waste generated and subsequently disposed of was of little consequence to the operator or service company.

New Regulations. In the 1980s and early 1990s, because of increased global awareness and understanding of environmental issues, the effects of drilling operations and in particular drilling waste became a subject of interest to operators, service companies, and regulators. Early regulations typically restricted what could be disposed of by setting limits on oil or chloride content or the location of disposal sites. The fluid types used also came under closer scrutiny, and fluid and cuttings toxicity was evaluated and regulated.

Costs. The new regulations inevitably affected well-construction costs. Fluid selection and cuttings treatment and disposal incurred a cost increase associated with meeting new regulations. The quantity of waste generated received increased attention, and source reduction became one of the pillars of waste management.

The initial cost of switching to less-toxic additives, such as switching from diesel to a mineral oil, or reducing oil-on-cuttings by improving solids-control performance or using cuttings fixation or other simple waste-management techniques available at the time, still represented a very small percentage of the total fluids costs and an even smaller percentage of total well-construction costs.

Increasing Regulation. In the mid-1990s and early 2000s, drilling-waste-management costs continued to increase as regulations were tightened in some parts of the world and new regulations introduced in others. This drove the next evolution in drilling-waste management, which was recognition that drilling fluids, solids-control equipment, and drilling-waste-management services were so interdependent that a holistic approach to drilling was necessary to optimize performance, ensure operator compliance with all regulations, and reduce the cost effect of these regulations on well-construction costs. This led to emergence of integrated fluid- and waste-management services, sometimes known as total fluids management. These holistic approaches vary slightly among operators and service companies but are generally recognized as a best practice.

Technology. Increasing drilling-waste-management costs also drove technology development. Use of thermal desorption units (TDUs) and cuttings-injection techniques is well documented, and as these technologies became available, some offshore areas moved toward zero-discharge policies (i.e., all cuttings and drilling waste had to be injected on location or collected and shipped to shore for further treatment or disposal). Additionally, where cuttings discharge was permitted offshore, guidelines reducing the amount of oil (or synthetic oil) that could be associated with cuttings were strictly enforced. Retained-oil-on-cuttings (ROC) specifications drove the development of cuttings dryers that can reduce ROC to 3 wt% or even less.

Drilling Fluids. Over this same time period, well complexity increased. High-performance (and high-cost) drilling fluids were required to drill extended-reach, deepwater, multilater-

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al, and high-pressure wells. Emergence of reservoir-friendly drill-in fluids also increased drilling-fluids costs. Drilling-fluids recovery acquired significant commercial as well as environmental importance, and that drove further improvements in technology and drilling-waste-management services.

Drilling-Waste Management. Today, nearly all drilling operations use some drilling-waste-management techniques, ranging from selection of the least-toxic fluid and improved solids control to complex ship-to-shore and TDU operations. Cost effects of waste-management systems can be significant and have increased relative to drilling-fluids costs. There are examples of operations where drilling-waste costs exceed drilling-fluid costs. These costs are considered costs required to meet local or corporate environmental standards—the cost of doing business—and are built into well-construction costs.

This perception means that use of these techniques when there are no compliance drivers (whether internal corporate standards or external regulatory requirements) is still in its infancy. This is the result of the traditional view of drilling-waste-management services as an additional cost. In the absence of compliance drivers, operators may choose not to use waste-management services and, thus, overlook potential well-construction cost savings.

Cost Drivers

Drilling-waste-management costs and cost drivers can be categorized into tangible (i.e., costs that can be identified clearly and measured) and intangible (i.e., costs that cannot be measured as easily) costs. Tangible costs include additional personnel required at the rig-site, rental of additional equipment, and established fines or penalties for non-compliance with regulations. Intangible costs can include future liabilities associated with disposal-site remediation or changes in regulations, potential shutdown time because of noncompliance, potential cleanup cost in the event of an accidental spill or discharge, and the value associated with a corporate image.

The cost of equipment and personnel at the rigsite is the most obvious cost, but in many cases even the most effective drilling-waste reduction strategies or reusable-fluids recovery techniques will not pay for the extra people and equipment. Therefore, the simple value

equation of waste-management technology costs vs. savings does not support use of waste-management techniques.

The cost of off-site transport, treatment, and disposal of drilling waste usually is captured in the well-construction costs. Although intangible costs are genuine, most engineers planning a project prefer not to include them. Unless the additional waste-management costs can be offset by tangible well-construction cost savings or clearly defined penalties or fines for noncompliance, chances are they will not be included.

Now it is possible to show that the value equation can favor the use of waste-management services without addition of the intangible costs. Examples of this can be found in Asia and South America and are documented in the full-length paper. This means that drilling-waste management is no longer only about ensuring environmental compliance but also can be applied proactively to reduce well-construction costs. In addition, the reduction of drilling wastes can help reduce any long-term liabilities associated with the well or project. Compliance with regulations at the time the well is drilled does not guarantee immunity in the future from the burden of site remediation.

Case History—Southeast Asia

A major operator wanted to improve solids-control efficiency, gain control over drilling-waste streams, and ensure compliance with Intl. Organization for Standardization (ISO) 14001 requirements for their land-rig drilling campaign. The wells were drilled with a conventional, relatively low-cost potassium chloride water-based fluid, and cuttings were disposed of at a commercial landfill site. Excess drilling fluid was taken to a local sewage works for disposal. These services were supplied by multiple service companies. All disposal was in compliance with local regulations.

Upon operations review, improved waste-management practices were adopted including improving performance and reducing surface volumes of drilling fluid, replacing existing rig solids-control equipment, establishing single-service-company management of all third parties, assigning dedicated personnel to the location, building a dedicated waste-water treatment plant at a central location, and improving drill-cuttings management.

The processes implemented increased rigsite costs because of additional per-

sonnel, high unit fluid costs, and new and additional solids-control equipment. However, the reduction in disposal costs and savings in fluid consumption and recovered fluid resulted in a U.S. \$33,328 net savings in well-construction costs. Over the course of 1 year, savings to the operator were calculated to be 6.8% per meter drilled or 13% per well drilled.

Case History—Latin America

A major service company working on a fixed-price, turnkey drilling contract for a national oil company was faced with the challenge and associated costs of trucking oil-based-fluid (OBF) drilling wastes 400 km to an approved disposal facility. Trucking and disposal costs were driven by volume. Average trucking and disposal costs for this project were U.S. \$99 per tonne of cuttings. Because fluid costs were fixed, there was a strong economic incentive to recover and reuse as much fluid as possible.

The decision was made to use readily available cuttings dryers to recover OBF from the cuttings. This would reduce significantly the waste volumes requiring transport and disposal, and also recover OBF that otherwise would have to be replaced with new fluid.

After three wells, a cost analysis was performed. Net savings to well-construction costs was U.S. \$158,894.

Conclusions

Case histories show that technology and systems are available to lower well-construction costs while ensuring environmental compliance and reducing long-term liability. Environmental compliance, whether internally or externally driven, is not the only reason to use these technologies and services.

The next step is to re-evaluate the commercial models currently used to compensate the service providers who deliver these integrated services. Currently, many operators compensate on the basis of actual chemicals and fluid consumed and waste volume generated, transported, treated, and disposed of. This results in service company goals that are not aligned with those of the operator. One alternative model may be a flat-fee or turnkey approach that provides total fluids-management services. The service company then has an incentive to reduce waste volumes and fluid consumed significantly and to recycle as much fluid as possible. JPT