Minimizing environmental risk at the wellsite

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THE DRILLING INDUSTRY today finds itself under increasing scrutiny from government regulators, non-government organizations, stockholders, and employees as these stakeholders voice their concern that drilling operations have a minimal impact on the environment. Consequently, environmental performance reporting is becoming part of everyday operations and business. As a result, sensitivity regarding risk and environmental impact at the well site has never been greater.

AGREEING ON OBJECTIVES

The oil and gas well construction process, from research and development, to project planning, through all phases of drilling, completion and production, is very complex. In order to demonstrate to their stakeholders and the communities in which they operate their commitment to protecting the environment, operators need to approach fluids management in a flexible, knowledgeable and objective manner from project commencement to completion.

The onus is therefore on the fluids companies to understand the operators' needs and to recommend the fluids program that will deliver their expectation. This onus requires that the integrity of the fluids, from their research and development through to 'real-time' decision making during their use in drilling and production in the field, be based on practical, appropriate and rational scientific principles and insights.

OPERATIONAL IMPACT

Opportunities for eliminating or reducing environmental impact during the use of drilling and completion fluids are being examined in three areas:

- Waste minimization, reuse and recycling/recovery of fluids and fluid components.
- Cleanup/disposal of drilled cuttings with adhering materials.
- Spill risk and damage minimization.

As a result of this interest, drilling fluids companies have been tasked not only with making technical improvements by developing increasingly sophisticated systems, but also with designing fluids and systems that reduce environmental impact on disposal. Reduction can be achieved in two principal ways:

- Designing methods to remove more material from cuttings or treat cuttings before disposal.
- Making fluids less toxic/more biodegradable.

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In addition to the materials and processes surrounding the development and use of the fluids themselves is the whole philosophy of how wells are drilled and wastes minimized.

This philosophy has been variously labeled "Total Fluids Management", "Integrated Fluids Engineering", etc whereby the fluids aspects of the operation are examined and managed.

This approach places fluids management squarely in its actual physical context, maximizing overall project success and minimizing negative economic and ecological impact. It results in an operator making concerted efforts to reduce the cost of fluids and waste-related activities, reduce the risk of spills and accidents, improve environmental performance by reducing waste at its source and improve recovery and recycling of drilling fluids and water.

According to a major operator's internal document on total fluids management, the above benefits "are achieved by improving the management of the entire fluids, solids controls, and waste management process as a whole and by focusing on efficient practices at the well-site and supporting logistics."

Many fluids and waste activities are synergistic in the sense that an individual activity may impact another. Because this impact may be substantial, it is important that each activity be carefully managed. An example of such synergy is the practice of running the finest gauge screens to improve solids removal efficiency. This practice is a simple solution from the point of view of managing the drilling fluid, however, its impact on cuttings processing costs and rates is huge, especially if the fluid is non-aqueous based.

In a similar vein, a central issue of Total Fluids management involves ensuring that personnel who work at the well site understand how their actions and choices affect the costs and performance of the entire system. Controlling the use of water and the recovery of base oils when running invert emulsion fluids is an example of this issue.

Using water can substantially increase the cost of processing and transportation of oil-based cuttings. Preventing this problem involves having contractors at the well-site ensure that there is no water contamination of fluids and cuttings.

It is of vital importance that each person and function involved in any project be aware of how each decision taken, from planning through completion and production, will impact the economic and environmental costs of fluids use.

A particular fluid, for example, may cost more or deliver a slower rate of penetration than a less expensive option available for the formation. However, cuttings disposal may be less expensive and deliver a smaller environmental effect compared with disposal of cuttings involving the less expensive fluid.

The key to success with all Total Fluids Management efforts is that each person involved in managing fluids must recognize that every decision, choice and action has consequences in terms of cost and environmental impact as well as in terms of the overall success of the project. Everyone involved becomes a strategist, a thinking participant in projects, where previously the individual largely viewed such decisions, choices and actions in isolation. By adopting such an approach, it is possible to not only address one aspect of the operation, but to ensure that all personnel work in concert to gain better control of the entire well construction process.

In taking a Total Fluids Management approach, there are options available that allow drilling and completion of wells with less environmental impact. As a simple example, reducing hole diameter produces less drilled material.

Furthermore, optimizing the chance of technical success plays a key role. Having to sidetrack or, worse still, losing a well due to otherwise avoidable mistakes has an impact on the environment without any return in terms of produced target materials.

It is important to understand what optimum fluid characteristics are required in order to:

• Maintain hole stability and minimize washout.

• Achieve the greatest rates of penetration with the lowest number of hole problems, bit problems and unplanned trips.

• Gain the greatest access to pay, allowing the hydrocarbons to flow at a rate that satisfies the well's economic goals.

Based on data from similar formations' seismic, core sample, wire line and measurement while drilling analyses, a proposed well's lithological and petrographical characteristics need to be examined. Other features for examination include structural features, dip angles of bedding plains, planned well profile, reservoir pore pressure, types of drilling mud previously used and the stability period of the formation under consideration.

The more accurate, relevant data gathered, correlated and analyzed up front, the clearer becomes the interrelationship between the various drilling mud systems used previously and the anticipated ability of the proposed system to deliver the well in a cost-effective and environmentally sensitive manner.

CHEMICAL RISK ASSESSMENT

In order to minimize risk of environmental damage, European regulator OSPAR has introduced a tool called "CHARM" (Chemical Hazard Assessment and Risk Management). CHARM enables the assessment of risk posed by different materials upon discharge.

It uses existing toxicity, biodegradability and bioaccumulation data in conjunction with discharge rates and volumes, local physical and oceanographic features and rig details to provide a numerical risk assessment factor.

This concept was developed for offshore operations, but it is also possible to minimize risk of environmental impact on land by adopting practices according to which types of materials are used. For example, one area of particular interest in land usage and disposal is the threat posed by salinity. The characteristics (salinity) of the receiving environment, tolerance of plant species present, salt content/conductivity of disposed material and application rates can all be used to carry out a risk assessment of the application to the land of cuttings and drilling fluids containing salt.

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ZERO DISCHARGE

In some offshore areas, for example the North Sea, Alaska and the Mediterranean, and in the onshore coastal regions of the United States, a zero discharge regulation has been applied to invert based drilling fluids. Used cuttings and drilling fluids are either injected subsurface or, alternatively, shipped to shore.

In such areas, operators may be inclined to go for the cheapest possible fluid, perhaps diesel where the use of that material is allowed. However, risk of spillage and health and safety concerns surrounding the use of diesel as a base fluid may very well outweigh the benefits of its use.

Such risks have lead to a ban on the use of diesel in some zero discharge areas, for example in the North Sea. In these areas, operators tend towards the use of low toxicity mineral oils, paraffins and even olefins. Selection of more environmentally responsible materials, even with a zero discharge or closed system approach, makes sense.

Spills and also the inevitable small drips and seemingly insignificant losses make for greater environmental impact than does the use of environmentally benign materials.

BEST MANAGEMENT PRACTICES

The use of "Best Management Practices" is also becoming increasingly prevalent. The principal reasons for its increased use are twofold.

First, many operators and suppliers are turning to environmental management systems, such as ISO 14001 or similar internally driven 'self-regulation'. Internal review of an operation's environmental aspects and impacts followed by the setting of targets and development of environmental management programs has proven to be an excellent way to achieve achieve a sensible balance between concern for protecting the environment and profitably carrying on one's business.

This continuous improvement can be aided by adopting and implementing Best Management Practices (BMP). These practices may be developed internally of by using guidelines that are available from such organizations as OGP or the World Bank.

Secondly, regulators have begun to expect the adoption of Best Management Practices. Recent rulemakings in the United States by the Environmental Protection Agency have given an option to use BMP with a reward for such behavior in the form of a reduced monitoring requirement.

Total Fluids Management is a philosophy whereby everyone involved in a project's design and execution recognizes the influence of one fluids-related activity on another.

By the careful design, selection and proper use of well construction fluids and by adopting the Total Fluids Management philosophy, it is possible to substantially reduce the environmental impacts and cost of a project. This approach is enhanced by the timely use of risk assessment, particularly in the well planning and engineering phase, and by the adoption of Best Management Practices. ■