GEOTECH NEWS

MUD ADDITIVES AND DRILLING FLUIDS – THEIR IMPACT ON GEOCHEMICAL DATA AND THE ENVIRONMENT.

Background

The use of water-based muds (WBMs) and synthetic based muds (SBMs) in oil and gas exploration has increased considerably over the past years. New mud systems are continuously being developed and existing systems are refined to reduce exploration and production costs.

While the benefits of these systems to drilling engineers (and finance managers) appear to be obvious, geologists and geochemists have to deal with potential complications caused by these additives when interpreting geochemical data.

Furthermore, different mud additives have different effects on the environment, from their impact on marine organisms to their effects on rig workers coming into close contact with them.

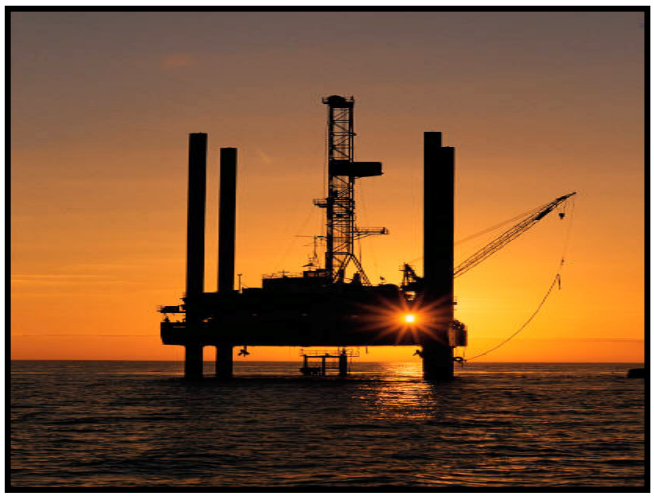
GEOTECH has, over the past 15 years, developed considerable experience in the impact of mud additives on geochemical source rock and oil data as well as the effect of mud additives on the environment.

Petroleum Geochemistry

GEOTECH's Petroleum Geochemistry Division has developed a number of techniques and protocols to maximise the quality of geochemical data obtained from contaminated samples.

In the past, wells were drilled using 'water based' mud systems or 'oil based' mud systems, with the latter often containing diesel or other petroleum based fluids. Today, oil based mud systems have largely been replaced by synthetic based muds (SBMs) which contain a synthetic base fluid (usually based on paraffins, olefins or esters - EBMs), together with a number of other components, both organic and inorganic. Water based mud systems are still widely in use, but include more additives containing hydrocarbons/ organic components (e.g. glycol) than they did in the past.

Contamination of geochemical samples can occur to varying extents, depending on the nature of the sample and the drilling conditions. Contamination may also occur in samples if recycled mud containing a high amount of organic compounds is used to drill a well. It is therefore important to recognise the occurrence of contamination and to determine if the extent of contamination is sufficient to influence the interpretation of the geochemical data.



Contamination Study

In 1998, GEOTECH completed a comprehensive Contamination Study in which a number of common mud additives were characterised and their effect on geochemical data was determined. A second Contamination Study was completed in 2004. Both reports are available for purchase from GEOTECH.

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The data obtained from the contamination studies, together with daily experience built up over many years, have increased our knowledge and awareness of contamination. The preliminary analysis of mud reports and mud samples has become an integral part of all GEOTECH's analytical programmes. Known mud additives are identified and various protocols have been established to determine the effect of the additive on both source rock data (eg TOC and Rock-Eval) and oil/extract data (eg saturate GC-MS, aromatic GC-MS). Special sample preparation techniques have been devised and implemented by GEOTECH in order to remove specific contaminants (namely alkenes and glycols) from geochemical samples. The final analytical programme is tailor-made for each well, depending on the results of the preliminary investigation and the client's requirements.

GEOTECH has significant experience with a wide range of contaminants including:

- Alkane-based systems, e.g. New Drill Liquid, XP-07
- Alkene-based systems, e.g. Isoteq, LAO
- Glycol-based systems, e.g. Aquacol, Glydril
- Ester-based systems, e.g. Nexes 3500

Environmental Chemistry/Ecotoxicology

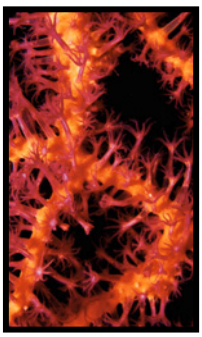
The persistence of drilling fluids in the environment and the rate of their biodegradability are critical measures of their environmental "friendliness". To assess how those fluids behave in the environment over time, a suite of aerobic and anaerobic tests can be performed.

These tests follow OECD guidelines and/or ISO procedures and can be aqueous– or solid-phase.

Bioaccumulation of drilling fluids is an equally serious issue as long-term effects on local fish or other marine species should be minimised or avoided. Analysing different parts of local species (flesh, liver, bile or gonads) allows an assessment of the possible accumulation of compounds present in drilling muds in critical organs of marine wildlife.

A suite of ecotoxicity bioassays has been developed using species which are endemic to Western Australia and which are recommended by the Department of Industry Resources.

The chronic bioassays, e.g. the EC50 bioassays, are regarded as the most sensitive and are recommended over the LC50 bioassays which are regarded as a worst case scenario according to G.L. Cobby, DoIR, "Changes to the Environmental Management of Produced Formation Water, Offshore Australia." APPEA Journal 2002. 677-682. These tests are usually performed on the water soluble fraction of the test substance. The results of these bioassays are used to determine the acceptability of the drilling fluid by the DoIR-Minerals and Petroleum. A suite of assays is usually performed as the sensitivity of different species to the drilling fluid can vary significantly. Futher, a better understanding of the impacts on the ecosystem can be assessed by using species from different trophic levels (feeding levels) within the ecosystem.



Biodegradation/accumulation studies as well as ecotoxicity bioassays can provide useful insights into toxicity levels in different products as well as spatial relationships between drilling operations and effects on marine faunas. This information benefits mud companies as well as oil exploration/production companies and regulators in their attempt to supply and use environmentally friendly drilling fluids.

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