

# FORMATE MATTERS

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News and opinion from Cabot Specialty Fluids

www.formatebrines.com

## Cabot honoured with UNIDO chemical leasing award



**Cabot Specialty Fluids (CSF) is recognised for its sustainable business model at this year's UNIDO (United Nations International Development Organisation) chemical leasing awards.**

Traditionally, oilfield chemical companies sell their products to oil companies and hope that the user's inefficient management of the chemicals creates high consumption and increased sales opportunities for the chemical provider. This out-dated business model encourages inefficiency and waste. Starting in 1997, CSF broke with tradition by leasing cesium formate brines to oil companies as HPHT well drilling and completion fluids. With this model, CSF retains ownership and stewardship of the chemicals at all times and charges the client for the number of days they are used in the field. At the end of the project, the fluids are returned to CSF for reclamation and leased out to the next client. By careful management, CSF normally recovers and re-uses around 80 to 85% of the brine. The virtual decoupling of payment from consumption encourages better chemical management, with the end user and the chemical provider both having a common interest in:

- Conserving chemicals, which reduces overall raw material, water and energy use

- Minimising waste, as the cost of disposal is moved from the user to the chemical provider.

The chemical leasing business model allows the user to concentrate fully on the project knowing that the chemical provider carries the responsibility for managing the enabling technology from cradle to grave.

UNIDO is devoted to reducing unnecessary consumption of finite chemical resources. Encouraging innovative concepts, such as CSF's sustainable chemical leasing model, is an integral element of UNIDO's Green Industry initiative, hence the creation of the Global Chemical Leasing Awards with the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management. Ms. Petra Schwager, Project Director for the UNIDO Global Chemical Leasing programme, says: "Chemical Leasing has proven to bring economic and environmental improvements to participating companies as it allows them to be more competitive. The award system

recognises companies and consultants who have made outstanding contributions towards the development and advancement of chemical leasing programmes."

CSF has leased cesium formate brine to over 250 well construction operations around the world. Clients and leasing partners are the major oil companies, including Statoil, Shell, BP, ExxonMobil, ENI and Total. Jim Turner, General Manager of CSF, says: "As long-time champions of the chemical leasing model in the oil segment, we are delighted to receive the UNIDO Chemical Leasing Award in recognition of our sustainable approach to business".

UNIDO is hopeful that its Chemical Leasing awards will further enhance the global visibility of chemical leasing and encourage more widespread application of the concept by the oil industry.

For more information go to [www.chemicalleasing.com](http://www.chemicalleasing.com).

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#### 5 TO WIN!



Brine reclamation is at the heart of Cabot Specialty Fluids's sustainable business model

Does your completion brine have **hidden costs?**



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## PEOPLE



Alistair Macfarlane

**New Finance Director**

Alistair Macfarlane (43) joins Cabot Specialty Fluids as Finance Director.

Alistair is a qualified accountant (ACMA) who holds an MBA from Heriot-Watt University and a BA (Hons) in business studies. He has over 20 years' experience in the oil and gas industry, including roles in planning, strategic development, business finance support and internal audit for Mobil North Sea, Accenture (BP & Conoco) and, most recently, Shell.

Married with two children, aged thirteen and ten, Alistair lives in Banchory, Scotland. He enjoys all sports, particularly triathlon, and is a keen supporter of Scottish Rugby.

# Thanks a billion

## A single offshore HPHT well perforated in cesium formate brine produces gas and condensate worth US\$ 1 billion in seven years from a low permeability reservoir.

Constructing deep offshore HPHT gas wells is an expensive and risky business, and remedial interventions are costly. For this reason, operators need to ensure that they get the job done right first time and create durable high-performance wells that quickly recover their investment.

Since 1999, North Sea operators have used cesium formate brines as well construction fluids in their offshore HPHT gas field developments to maximise production efficiency. But what does 'production efficiency' mean in terms of hard cash? We can learn more by looking at the production performance of a single subsea HPHT gas/condensate well completed in cesium formate brine in 2003.

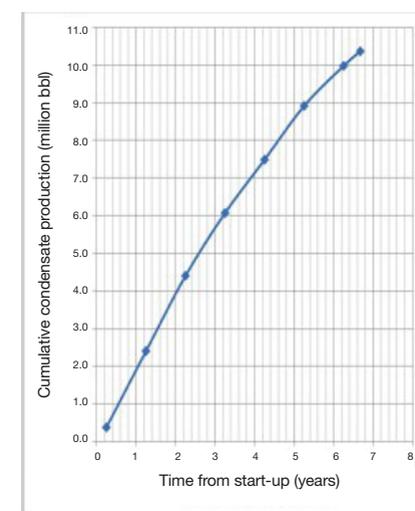
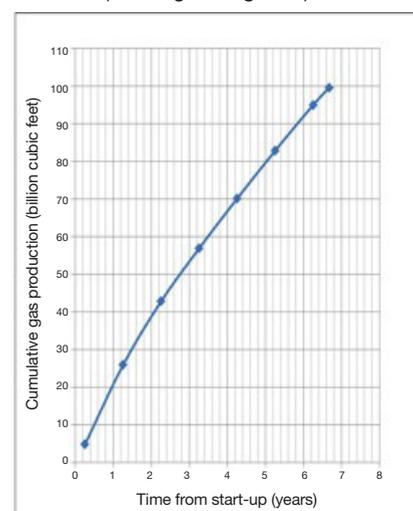
The well was initially drilled in 1985 and re-entered in 1995 to appraise the reserve. The DST results indicated recoverable reserves of 116 billion cubic feet of gas and 10 million barrels of condensate within low-permeability (20 mD) sandstone. The well was then killed by a bull-heading operation with oil-based mud prior to abandonment.

Eight years later a programme was developed to access the reserves by re-perforating the suspended subsea well. The re-perforation operation was conducted in 1.856 s.g. (15.5 ppg) cesium formate brine at 825 psi overbalance. No kill pills or other blocking technologies were used to control fluid losses, yet only 14 barrels of formate brine were lost to the formation during the operation. In fact, only 8% of the cesium formate brine was lost during use, with the result that the final bill for brine rental and losses was under US\$ 1 million.

Production figures from the UK DECC website ([www.og.decc.gov.uk](http://www.og.decc.gov.uk)) show that

this single subsea well has produced 100 billion cubic feet of gas and 10 million barrels of condensate since production start-up in September 2003 (see figures).

Converting these volumes into cash equivalents using day-of-production pricing suggests that the revenues generated from this one well over the past seven years may have amounted to US\$ 1.2 billion (US\$ 550 million of gas, US\$ 652 million of condensate). Altogether, not a bad result from a long-abandoned appraisal well!



**100 billion ft<sup>3</sup> of gas and 10 m barrels of condensate have been produced since 2003**



Crowds gather to watch a hanging from the 'Tyburn tree' in 1696

## DID YOU KNOW?

## Who was Derrick?

The oil derrick is an industry 'symbol' typifying oilfields the world over. We've all seen them, but have you ever wondered how they got their name?

Derrick originated as a given (first) name in English and is derived from the Dutch "Diederik", meaning 'chief of the people'. There's a certain irony in this, as the man who devised the first derrick was an Elizabethan Englishman by the name of Thomas Derrick, one of the country's most famous hangmen. Not a popular profession at the time due to the threat of reprisals, many had to be coerced into the role. Derrick was convicted of rape and risked execution when Robert Devereux, the 2nd Earl of Essex, pardoned him on the condition that he become hangman at Tyburn,

near the current location of Marble Arch in London.

Not content with the traditional rope over the beam method he invented a new structure using a movable beam and pulley system, and lent this new invention his name. Consequently, 'derrick' became synonymous with the support frame for the hangman's noose from the 1600s and through general usage to cranes and derricks of today.

Derrick executed over 3,000 people during his prolific career, one of the most notable being his own pardoner, the Earl of Essex, for a botched coup d'état against the government of the day. Now there's thanks for you.



# Getting heavy with oil-based completion fluids

**Cesium formate brine has been extending the density range of low-solids oil-based completion fluids since 2001.**

It is generally accepted that well completion operations are best conducted in a low-solids fluid environment. A low level of solids in the well bore fluid during completion improves field development economics by reducing formation damage and non-productive time (NPT).

To avoid formation damage, it's advantageous to use water-based completion fluids in wells that have been drilled with water-based mud, and oil-based completion fluids in wells drilled with oil-based mud. But how do you increase and control the density of a solids-free oil-based completion fluid where the oil phase has a density of 0.80 s.g.?

The answer is to emulsify brine into the oil phase of the fluid. The weight of this water-in-oil emulsion can be altered up and down by changing brine density. Using cesium formate brine as the internal brine phase of these emulsions increases fluid density up to 1.70 s.g.

## Perforating kill pill

Cesium formate brine was first used to weight up an oil-based completion fluid in 2001 on Norsk Hydro's Visund field development in the Norwegian North Sea. The long horizontal wells in this field were drilled with OBM and needed perforating in a 1.65 s.g.

low-solids oil-based kill pill (LS OBM). Previous attempts to complete these wells in calcium bromide water-based kill pills had resulted in low productivity indices of 60-70 m<sup>3</sup> oil /day/bar.

M-I SWACO provided Norsk Hydro with a LS OBM kill pill weighted with 2.20 s.g. cesium formate brine for the next well perforation. The operator also changed the perforating system, going for dynamic under-balance with 35-bar over-balance at static. The result was a well (A-23) with a production index of 250 m<sup>3</sup> oil /day/bar and a production rate of 7,700 m<sup>3</sup> oil /day (48,400 bbl/day)<sup>1</sup>. A further five wells were completed in this way, resulting in up to six-fold increases in well productivity indices (300-900 m<sup>3</sup> oil /day/bar) and initial flow rates of up to 8,500 m<sup>3</sup> oil /day (53,460 bbl/day)<sup>2</sup>.

## Open-hole completion fluid for use with sand screens

Statoil was the next operator to use cesium formate brine in an oil-based completion fluid. Statoil had drilled three oil production wells in the Statfjord Satellites with OBM and needed an oil-based 1.66 s.g. completion fluid in the hole while installing sand screens. M-I SWACO supplied Statoil with LS OBM fluids weighted with cesium formate brine for the three completion operations, which took

place from July 2002 to April 2003. The applications were considered successful by the operator, "giving production at the high end of expectations"<sup>3</sup>.

## Unique oil-based completion fluid

LS OBM weighted with cesium formate brine has been used in 18 completion operations in the Norwegian North Sea over the past nine years. The oilfield developments where this unique fluid has been deployed include

**LS OBM with cesium formate brine as the internal phase is helping to improve production in challenging North Sea wells**

Visund, Statfjord, Njord, Gullfaks (A, B, C and satellites), Rimfaks, Oseberg, Snorre and, most recently, Alve.

Arne Askø, Technical Service Manager Eastern Hemisphere at M-I SWACO Drilling Solutions, says: "M-I SWACO VERSAPRO LS<sup>®</sup> with cesium formate as the internal phase will continue to be the optimum solution for high-density LS OBM. The use of low-solids or no-solids OBM has been so successful that these fluid options are the preferred choice in open hole completions for several of our clients in the North Sea."

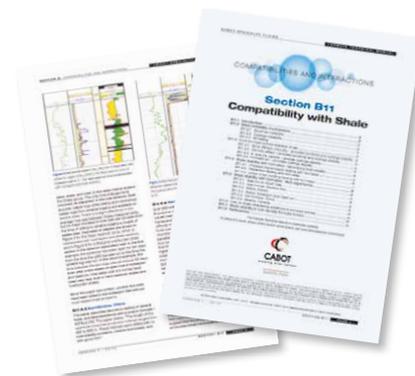
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## COMPATIBILITY WITH SHALE

### Hail shale

A new Formate Technical Manual chapter entitled 'Compatibility with Shale' is now available. It explains the mechanisms involved in borehole instability and how formate brines prevent these from occurring. Methods for testing borehole stability are described and results of shale stability testing in formate brines shown. The review includes interesting field experience from Agip in South Italy and the Barents Sea, Statoil in Huldra, Kvitebjørn and Valemon, and KerrMcGee in China. Go to [www.formatebrines.com/manual](http://www.formatebrines.com/manual) for your free copy.



**'Compatibility with Shale' is the latest edition to the Formate Technical Manual**

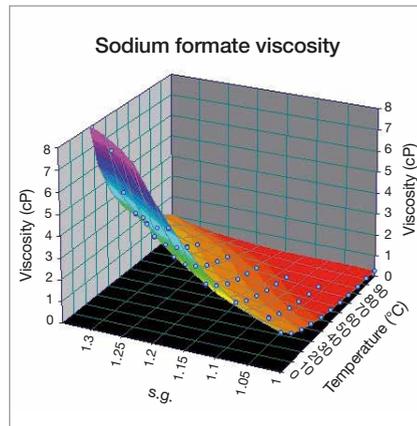
**TECHNICAL FORUM**

# New insights into formate brines' viscosity

In drilling, completion and workover operations it is important to know the viscosity of the fluids in the wellbore. Viscosity is a measure of a fluid's resistance to flow and its value determines important hydraulic engineering properties, such as pump pressures, solids settlement rates and flow through porous media. In brines, the viscosity is a function of the dissolved salt type, salt concentration and temperature. Up until now the industry has lacked precise data on how viscosity varies with brine density and environmental conditions.

Fortunately, an MSc student from Robert Gordon University in Aberdeen has just finished mapping the viscosity of sodium, potassium and cesium formate brines as a function of brine density and temperature. The tests were conducted on a broad range of formate brines, from dilute to saturated solutions, over a temperature range of 10°C to 70°C. Around 450 viscosity measurements were taken in total, including readings for blends of cesium formate and potassium formate brine.

The research was conducted at Cabot Specialty Fluids's laboratory in Aberdeen using a falling-ball viscometer. This simple instrument measures Newtonian fluid



**Sodium formate brine viscosity as a function of brine density and temperature**

viscosity using the time taken for a spherical ball to fall between two points on a graduated cylinder holding a test fluid.

The results of this extensive study will be incorporated into the Formate Technical Manual, which can be downloaded at [www.formatebrines.com/manual](http://www.formatebrines.com/manual). This new chapter includes mathematical models that accurately predict the viscosity of single-salt and blended formate brines.



**Omofe-Okoro Omohowho from Robert Gordon University measuring the time it takes for the ball to fall through the fluid column**

## Wordsmith competition

This puzzle is all about quantity. The more words the better. Listed in the box are nine letters. The aim is to generate as many English words as possible, but always using the letter in the middle and never using the same letter twice. All words must be four letters or more, entered in the latest edition of the Concise Oxford or Merriam Webster dictionaries, singular and without hyphens. Verbs must be regular and not conjugated (see is ok, but not seen), adjectives stay in their basic form (best, but not better) and adverbs ending in 'ly' are disallowed.

The five participants with the greatest numbers of accepted words win a Kodak PlaySport HD

video camera each. In the event of more than five entrants reaching the top score, winners' names will be drawn at random. Good luck!

|   |   |   |
|---|---|---|
| C | S | F |
| O | R | M |
| A | T | E |

Please send your entry to: [formatematters@cabot-corp.com](mailto:formatematters@cabot-corp.com) or fax (44) 1224 870089 by 18 March 2011.

Congratulations to all those who solved the spot the difference competition in the previous issue of Formate Matters. The lucky winners are: Curtis Huff of BJ Services Company, Dave Henson of Halliburton, John Smith of Greenrock Energy Ltd., Robin Davies, Drilling Consultant and Haitham Al-Attar of Nile Delta Exploration.

For the correct answers to the previous competition, or for the complete rules for this puzzle, please email [formatematters@cabot-corp.com](mailto:formatematters@cabot-corp.com).



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**AND FINALLY...**

**“Satisfaction does not come with achievement, but with effort. Full effort is full victory.”**

Mahatma Gandhi (1869 – 1948)