

“The combination of production chemicals and standard completion fluid ensured optimal production of highly emulsifying crude oil.”

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Well Information

Location Offshore Malaysia
Well type..... Deepwater production and injection
Completion type..... Cased and perforated
Water depth 4,285 ft (1,306 m)
Well depth..... 1,067 to 1,524 ft (3,500 to 5,000 m) measured depth (MD)
Hole size 12¼ in.
Maximum bottomhole temperature 140 to 190°F (60 to 88°C)
Maximum inclination 50 to 75°
Brine weight 10.0 to 11.1 lb/gal (1,198 to 1,330 kg/m³) Calcium Chloride

The Situation

Several wells were to be completed in a highly sensitive reservoir. The crude oil from the field was known to emulsify with most fluids, in particular divalent brines. It was essential for both the production rate and the injection rate that the emulsification between the completion fluid and the crude oil was eliminated.

The formation pressure of the wells dictated that these wells needed to be completed with a brine density between 10 and 11.1 lb/gal. The final fluid also needed a sufficiently reduced water activity to suppress hydrates.

The field exhibited a classic case of sodium carboxylate soap emulsion. “Soap” emulsions are alkali-metal salts (Ca, Na, Fe, Mg and K) of organic acids, including fatty carboxylic acid insoluble in oil and water. The term “naphthenic acid” is used to account for all carboxylic acids present in crude oil, including acyclic and aromatic acids. Completions fluids, particularly calcium-base types, exacerbate the issue and lead to very tight emulsions. All other issues such as solubility, compatibility and formation damage were also taken into consideration and tested.

The Solution

Formates were initially considered but testing showed that they also required treatment to prevent emulsification. This, in addition to logistical issues and the natural high pH of formates, called for an alternative solution. Several “off-the-shelf” de-emulsifiers/emulsion preventers typically used in completions were tested but had only a limited success. The M-I SWACO team used an IFE approach which brought together traditional completion fluid technology with Production Chemical Technology.

M-I SWACO Wellbore Productivity and Production Technology groups developed and optimized a de-emulsifier/emulsion preventer that was compatible with both calcium chloride brine and a calcium chloride/MEG hydrate inhibitive blend for this deepwater project.



The Results

The combination of the ordinary completion fluids and production chemicals prevented emulsion between the crude oil and completion brine, and allowed the operator to successfully complete 13 deepwater wells with production meeting or exceeding expectations.

The Details

The completion fluids were initially mixed at the Labuan shore base and loaded out as 11.5-lb/gal spike fluid with 1.3% by volume EB-8769* and 0.03% MB-5075*. The fluid was diluted down with drill water on the rig to required density. Additional EB-8769 and MB-5075 were used after the fluid was diluted down. The spike brine was not treated to the full concentration to ensure the fluid pH was above the minimal level for transportation.

Typical fluid formulations used for the project are given below.

Final Completions Fluid Composition		
Chemical	Function	Concentration
Calcium Chloride	Weight	21–33% by weight
EB-8769	De-emulsifier	1.4–1.8%
MB-5075	Biocide	0.02%

For brine weight under 10.4-lb/gal, extra hydrate suppression is necessary, such as this alternative formulation for a 10.0-lb/gal completion fluid.

Final Completions Fluid Composition		
Chemical	Function	Concentration
Calcium Chloride	Weight	20.5% by weight
MEG	Hydrate Suppression	25%
EB-8769	De-emulsifier	1.4–1.8%
MB-5075	Biocide	0.02%

All brine was filtered through the DE Filter Press as well as 2- and 10-micron filters without any complications or significantly increased use of filters.

Questions? We'll be glad to answer them.

If you'd like to know more about the completion fluid product and how it's performing for our other customers, please call the M-I SWACO office nearest you.

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