

N-FLOW™-325 Breaker System Increases Production by 30 Percent in Giant Boscán Heavy Oil Field

BOSCÁN FIELD, VENEZUELA

CHALLENGE

Solve two main issues that decreased production and caused delays in heavy oil wells:

- » Asphaltene precipitation
- » Emulsion blockage tendencies

SOLUTION

WellSET® module and laboratory testing to optimize particle size distribution of bridging agents in BARADRILN® drill-in fluid

- » Rigorous compatibility testing to overcome emulsion block
- » Uniform acid reaction throughout reservoir
- » Helps maximize productivity
- » Pump treatment with drilling rig to save time

RESULTS

- » Provided uniform filter-cake removal within the pay zone
- » Increased field production by 30 percent
- » Saved rig time and avoided HSE incidents

HEAVY OIL PRODUCIBILITY IMPAIRED BY ASPHALTENE PRECIPITATION AND EMULSION BLOCKAGE

The Boscán field, located in the state of Zulia in western Venezuela, is a large field that produces crude oil with 9.5 to 12 API gravity and a viscosity of 130–500 cp, depending on temperature related to reservoir depth. The 175°F (79.4°C) reservoir consists of basal Oligocene sandstones above and upper Eocene sandstones below.

Matching a filter cake breaker to the physical characteristics of this crude called for a special formulation designed to restore permeability in the pay zone while mitigating asphaltene precipitation and preventing emulsion formation. The selected breaker would need to perform well with a wide range of completion types.

**PRODUCTION
INCREASED
30 PERCENT
THROUGHOUT THE FIELD**

BAROID SOLUTION PROTECTS PAY ZONE AND ENHANCES PRODUCTION

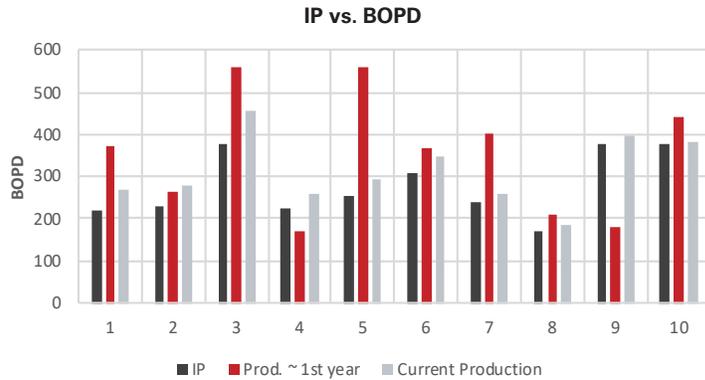
The Baroid team used the WellSET® module, along with rigorous laboratory testing, to optimize the particle size distribution of bridging agents in the BARADRILN® drill-in fluid. This helped prevent fine solids invasion in the 8-1/2-inch reservoir interval.

After reaching the reservoir total depth (TD), the Boscán wells were completed with a variety of completion systems, including gravel-packed slotted liners and standalone screens. Each reservoir was treated with a customized N-FLOW™ 325 delayed-reaction filter cake breaker that could be pumped and distributed evenly throughout the pay zone before converting to acid. The ability to completely remove the filter cake is ultimately dependent on the thickness of filter cake and the surface area/volume of filter cake breaker ratio. The Boscán field is drilled with an overbalance of 1,000+ psi. The delayed-acid generator reacts with water to slowly release an organic acid downhole. The acid dissolves calcium carbonate and polysaccharides in the filter cake, thereby removing mud damage in the downhole interval.



Lab tests using ceramic disks show filter cake accumulation before and after treatment with the N-FLOW™ 325 system. In the Boscán field, 12–14 hours of soaking time are required for the in-situ acid to dissolve the filter cake, based on lab testing and field observations.

The customized N-FLOW™ formulation was designed to minimize risk of emulsion blocking.



Comparison of the increase in oil production value within a year of production after the N-FLOW™ 325 system was applied in the giant heavy oil Boscán field, along with a current measurement over the following 2–3 years.

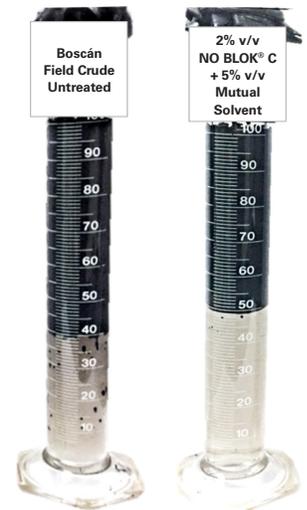
Drilling fluid filtrate, crude oil and brine can all create emulsions when they mix, and this had been a problem in this field. The customized N-FLOW formulation was designed to minimize risk of emulsion blocking. It was mixed with an optimized concentration of NO BLOK® C non-emulsifier, which had been tested extensively in the lab under simulated field conditions.

N-FLOW BREAKER SYSTEM IMPROVES PRODUCTION BY 30 PERCENT

With the use of the N-FLOW system, the reported production rates showed a 30 percent increase throughout the entire field.

The N-FLOW in-situ acid treatment has proven to be non-emulsifying, thermally stable, water-wetting, and devoid of mineral acid. It reliably mitigates acidic sludges and hydrocarbon precipitants to provide uniform filter-cake removal within the pay zone.

Using the N-FLOW breaker system also saved rig time. Because of its delayed reaction and safe handling at the surface, the N-FLOW breaker could be mixed and pumped with the drilling rig, eliminating the need to move in a workover rig for this purpose and avoiding health, safety, and environmental (HSE) incidents.



Oil/completion brine compatibility test after 24 hr of static aging. Without proper proactive treatment, drilling fluid filtrate, crude oil and brine can all create emulsions when they mix.

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