

Case study: Offshore Myanmar

Conversion of used SBM to DELTA-TEQ enables deepwater drilling at 25% lower fluid costs, reduces CO₂ emissions

Immediately after completing an extensive drilling campaign in shallow water, the customer decided to drill a deepwater well at a water depth of 1,054 m (3,458 ft) and reuse the same synthetic-based mud (SBM) system.

The step change to deepwater drilling raised concerns about the quality of the used SBM system. The fluid contained a significant volume of reactive formation solids that sequentially built up in the previous drilling operation. The cold subsea temperature of 7°C (45°F) increased the plastic viscosity and gel strength of the fluid, which lowered the pumping efficiency into the hole, extended drilling times, and required higher fluid dilution rates. Leakoff tests (LOTs) also indicated a narrow drilling window of less than 1.0 ppg between the formation and the fluid.

The customer asked Baker Hughes to deliver a fluid alternative that met these requirements to drill the well to target depth (TD) and deliver a hole size suitable for optimal data logging and well testing. Baker Hughes recommended converting the used SBM system to the DELTA-TEQ™ low-impact drilling fluid system, a nonaqueous fluid formulation engineered to extend drilling in narrow windows.

Designing the optimal fluid solution

The Baker Hughes Drilling and Completions Fluid (DCF) team embarked on pre-job fluid design work in the laboratory to develop the optimal strategy for converting the

used SBM to the DELTA-TEQ system. The team conducted the fluid conversion at the Baker Hughes Liquid Mud Plant and used additional testing methods at the rig site to ensure adherence to the conversion guidelines developed in the lab. The team also provided the operator with continual updates on the progress of the fluid design work, both in the lab and at the rig prior to startup.

Reliably delivering all drilling objectives

With the lab testing providing the proper conversion strategy, Baker Hughes delivered the DELTA-TEQ fluid system to the rig with the required rheological properties. Specifically, the fluid maintained the desired viscosity at both the subsea temperature of 7°C (45°F) and downhole temperature of 49°C (120°F).

LOT results for the 17½ in. section of the deepwater well indicated a maximum fluid density of 10.94 ppg to avoid fluid losses into the formation. The density of the DELTA-TEQ system for this section (10.0 ppg) confirmed a narrow drilling window. However, the system maintained an equivalent circulating density (ECD) of between 10.3 and 10.5 ppg, with circulating temperatures between 21 and 46°C (70 and 115°F), to successfully deliver the section.

Baker Hughes took a similar approach for the 12¼-in. section but using a higher density (11.0 ppg) DELTA-TEQ system. Drilling successfully proceeded with a maximum recorded ECD of 11.5 ppg and circulating temperatures of 25 to 43°C (77 to 109°F).

Challenges

- Drill, log, and core a deepwater well in a highly reactive formation with a narrow drilling window (less than 1.0 ppg)
- Avoid risks of deploying used mud with high content of reactive formation solids from previous wells
- Deploy fluid system with a flat rheology profile and on a rig with inadequate surface solids control system

Results

- Successfully drilled all well sections with zero fluid-related concerns
- Saved five days of drilling time under plan, lowering carbon emissions by 16%
- Conducted wireline logging for seven days with no barite settlement or fluid gelation
- Maintained ECD within less than 0.5 ppg of ESD
- Reduced drilling and completion fluid costs by 25% compared to budget

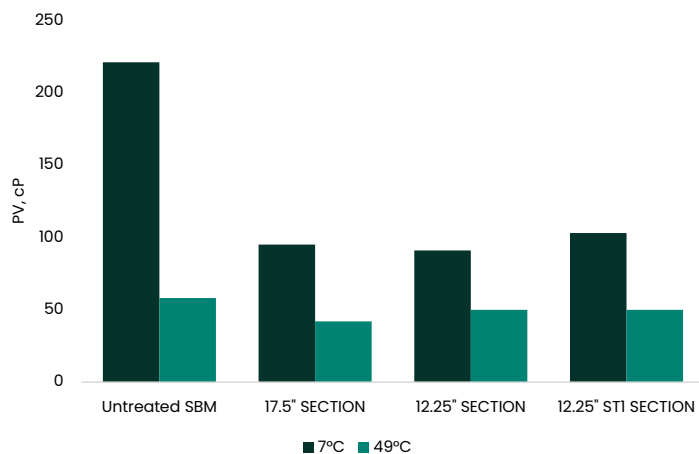
The DELTA-TEQ system remained stable while drilling each section, while maintaining excellent hole cleaning and no drilling fluid-related issues. The system helped provide a clean, stable wellbore that afforded an extended, seven-day wireline logging operation, with no evidence of barite settlement

or fluid gelation. The fluid system also remained stable while drilling a short sidetrack to successfully perform a coring operation.

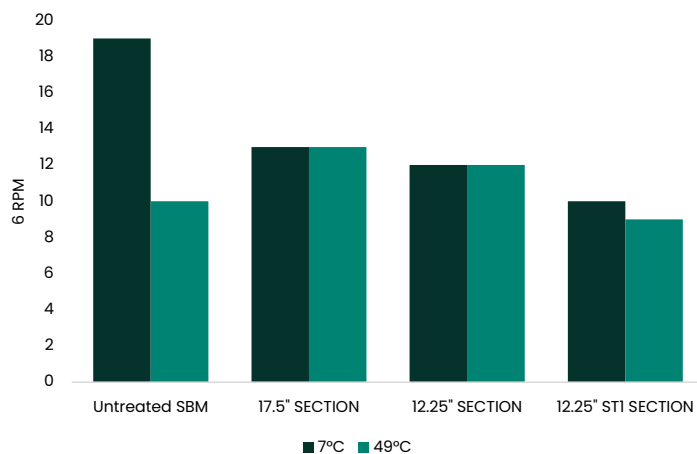
The DELTA-TEQ system successfully met the customer's drilling objectives on the way to TD, while reducing the

cost of drilling and completion fluids by 25% compared to the original fluids budget. Moreover, DELTA-TEQ system helped to shorten drilling time by five days vs plan, avoiding 16% of carbon emissions at the rig site.

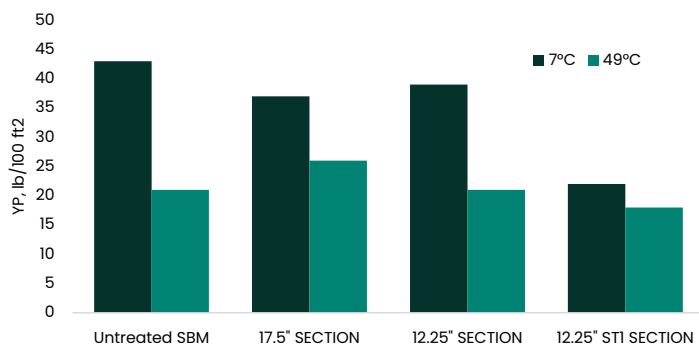
Plastic Viscosity (PV) at 7°C and 49°C



6 RPM reading at 7°C and 49°C



Yield Point (YP) at 7°C and 49°C



All three charts: DELTA-TEQ system helped reduce viscosity and gel strength vs untreated SBM at lower temperatures during deepwater drilling.