

Case study: North Sea

Enhanced perforating system generated production in tight, low-perm reservoir

A North Sea customer had perforated four low permeability (1 to 3 mD) at 4,500 metres. Subsequent PL logs showed no contribution from these zones.

Baker Hughes personnel recommended re-perforating the well with the new **DeepConnect™ reservoir-driven shaped charge** and to add the **TerraPERM™ enhanced perforating system**.

DeepConnect is the new series of shaped charges from Baker Hughes specifically designed to perforate reservoir rock. The perforation tunnel geometry and entry hole size are tuned for maximum productivity.

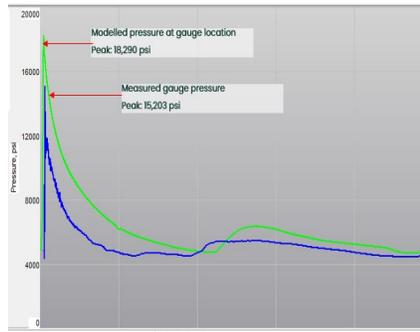
TerraPERM is a propellant based system designed to add additional energy to the perforating event. This additional energy will break through the crushed and compacted rock created by the detonation, improving near wellbore skin and overall conductivity.

The zones were re-perforated through the large bore tubing, Hi speed gauges were run to monitor the response as the gun and propellant detonated. Very good data matches between the original PulsFrac models and the actual data recovered from each job. The PulsFrac model has estimated 80% perforation breakdown and a fracture extension of between 2 and 4 feet.

The client put the well on test immediately. Initial indications were additional production was being realized. Production logs were run two

months after the perforating campaign and confirmed that all four zones were producing hydrocarbons at a significant rate.

The well has been on production for more than six months with no decline in productivity. Further wells are now being evaluated in the field for an application of this technology.



The blue curve is actual gauge data from one of the runs, the green curve is the Baker Hughes' PulsFrac Model pre-job prediction.



DeepConnect reservoir-driven perforating charges deliver increased formation connectivity compared to traditional charges.

Challenges

- No production from previously perforated low permeability zones
- Potential lost oil production
- Client wanted to ensure a clean connection to the reservoir

Results

- Production Logs revealed contribution from all four perforated zones
- Excellent data matches between pre-job PulsFrac models and actual pressure data from the well