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PURE Clean Perforations System Doubles Productivity in Offshore Wells

Dynamic underbalance perforating maximizes reservoir connectivity, perforates 79 ft of net pay offshore Malaysia

CHALLENGE

Maximize oil productivity of four producing zones offshore east Malaysia.

SOLUTION

Use the PURE* clean perforations system to achieve maximum reservoir connectivity.

RESULTS

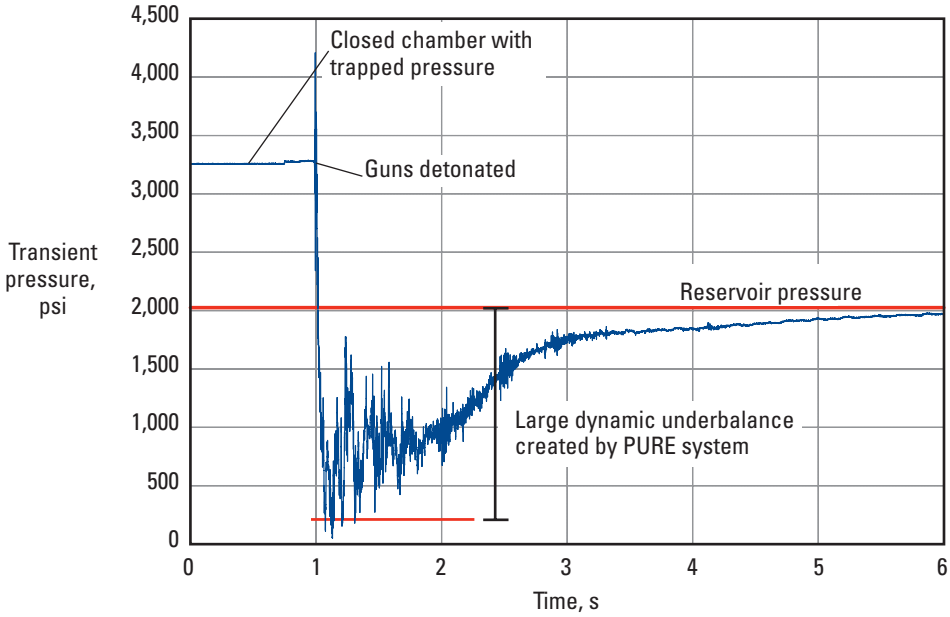
Perforated 79 ft [24 m] of net pay, which then produced at a steady-state rate of 2,200 bbl/d, almost double the rate expected based on wells in the field that had been perforated conventionally.

Increase productivity from a field with wells showing rapid production declines

An operator sought to extend the economic producing life of one of its offshore Malaysia fields by maximizing the oil productivity of four independent producing zones. Production from three offset wells had exhibited high decline rates and high sandface completion skin factors.

Ensure maximum productivity from each zone

Schlumberger proposed using the PURE system. Unlike conventional perforating, which relies on a large static pressure differential between the wellbore and the formation to remove perforation debris and crushed-zone damage, the PURE system fully exploits the transient underbalance that occurs immediately after perforating. It creates a large dynamic underbalance and absorbs perforation debris into the gun chambers, minimizing skin and leaving an obstruction-free path for flow from the reservoir to the wellbore.



The PURE system delivered clean perforations, as demonstrated by analyzing the pressure transient data acquired at a 1-ms rate by the fast gauge.

PURE system software was used to specify the unique perforating system based on full consideration of the completion geometry, reservoir fluids, and formation characteristics. The effects of non-Darcy flow, partial completion, and oriented perforations were all considered. The geomechanics study proved sand control would not be required provided the perforations were oriented.

SPAN* Schlumberger perforating analysis was used to select the most suitable gun configuration, shot density, and charges. High shot density was included in the design to ensure optimum hydrocarbon production from each of the independent producing zones.

In a single shoot-and-pull trip, the four zones were perforated using a gun system and PowerJet Omega* deep-penetrating perforating shaped charges with 135° phasing. The IRDV* intelligent remote dual valve was used to create a closed chamber and trap pressure in the sump of the well. After perforating, fluid flowed into the gun chamber, creating a dynamic underbalance.

Produce at double expected rate

After the four independent producing zones—a total net interval of 79 ft [24 m]—were perforated, the well was put into production. During a test, the well flowed 2,200 bbl/d, double what would have been expected based on the performance of offset wells that had been perforated conventionally.

The production payback period was reduced to just 7 days, and the total incremental value was USD 2.1 million per month.

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