

# Surging and Gravel Packing Technique Improves Packing and Well Performance

Case study: Novel sand control method used in offshore formation achieves sand-free production rates up to 5,000 bbl/d

## Challenge

Remove perforation damage and control sand production in cased hole gravel-pack completions in unconsolidated offshore formation.

## Solution

Combine surging and perforation packing processes to improve connectivity to the reservoir.

## Results

Reduced drawdown across the sandface and achieved sand-free oil production rates up to 5,000 bbl/d.

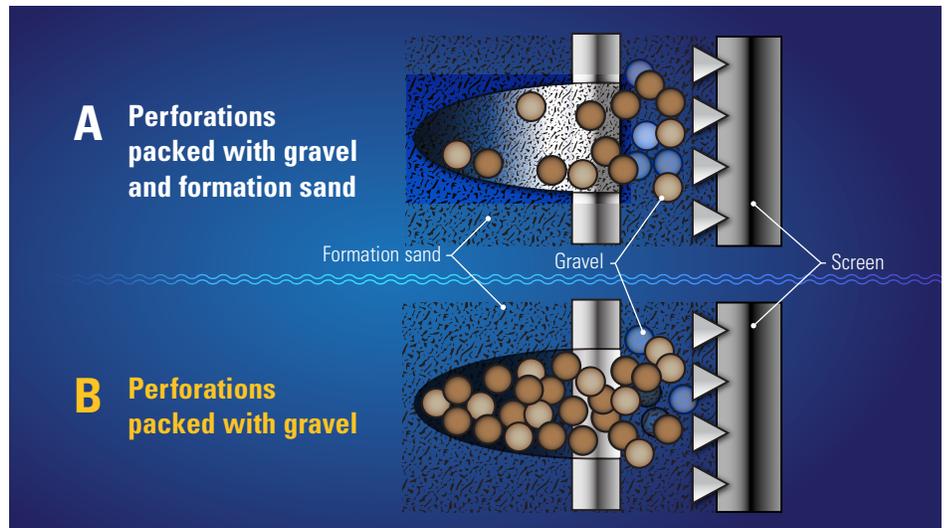
## Choking effect in perforation tunnels reduces productivity

The most common solution for mitigating sand production in cased holes is gravel packing. The success of a gravel-pack job depends on effectively packing the perforation tunnels, which act as conduits between the reservoir and the wellbore. Any damage in the perforation tunnels inhibits the uniform placement of gravel behind the casing during the completion phase and results in increased skin and reduced productivity. Perforations may be damaged by debris created by perforating, by sand grains pulverized when a zone is compacted or crushed, by reservoir sand migration, and by various drilling- and completions-related activities.

An operator had several wells in an unconsolidated, highly permeable formation requiring sand control. Ensuring maximum well production after installation of the sandface completions was a major concern.

## Perforations are surged and prepacked

Schlumberger proposed a novel system approach for surging the perforations and prepacking them with high-permeability gravel to improve connectivity to the reservoir. This system would remove drilling and perforation damage after perforation while negating the risks of sanding in the guns.



*In an unconsolidated formation, filling the perforations with gravel is the key to obtaining high productivity from a well. Panel A shows how a perforation only partially packed with gravel will fill with formation sand. Panel B shows how one completely packed will prevent sand from entering the perforation and clogging the perforation tunnel.*

# Case study: Novel sand control method used in offshore formation achieves sand-free production rates up to 5,000 bbl/d

For this system, an atmospheric chamber is run into the well with the gun assembly. To remove the risk of sanding in the gun string, the atmospheric chamber is activated with the guns clear of the zone after perforating in an overbalanced condition. The perforated interval is then exposed to a short, sharp pressure drop, creating a differential pressure and an underbalanced state across the perforations. This drop in pressure draws a controlled volume of fluid into the wellbore, breaking down a hemispherical region at the entrance of each perforation and pulling perforation debris and mud from the invaded zone into the crushed region. The initial drop in pressure is followed by a controlled flow into the chamber that pulls the loose sand and debris from the collapsed region through the casing cement tunnel into the wellbore. The dynamic pressure drop created by this downhole surge allows uniform cleanup of the perforations over the entire interval.

During the perforation prepacking process, gravel slugs are pumped in a nondamaging carrier fluid. This fluid is a viscoelastic surfactant, which—because of its viscosity and gravel suspension capability—ensures that the gravel enters and packs the perforations efficiently. The gravel slugs are separated with alternating stages of acid and spacer to further improve the cleanup and perforation packing efficiency.

Four multizone wells underwent the perforating and gravel-packing operation, all under slightly different conditions and with slightly different variations in sequencing of the surging and perforating.

## **Surging and perforation prepacking improve skin factor and well performance**

The results clearly showed that dynamically surging the perforations, immediately followed by prepacking, greatly improved the packing efficiency of the perforations. This combining of the two processes—a departure from the standard operation in which the two are handled independently—greatly increased the packing efficiency in the perforation tunnels, reduced skin, improved reservoir connectivity, and enhanced well performance. Perforation packing factors improved from 10 lbm to 40 lbm of gravel per foot of perforation. Sand-free production was achieved, with a reduced drawdown across the sandface. Production reached rates as high as 5,000 bbl/d.

The Transcend\* family of openhole sand management services includes screens and injection and inflow control devices, AquaPac\* integrated water packing technologies, OptiPac\* Alternate Path† gravel-pack systems, and IntelliPac\* measurements in real time.

[www.slb.com/sandcontrol](http://www.slb.com/sandcontrol)

**Schlumberger**