

Refracturing with BroadBand Sequence Service Increases Oil Production 212% for Slavneft

WellWatcher Stim service verifies fluid entry points to distribute treatments throughout the multistage openhole completion, Russia

CHALLENGE

Deliver sustained production improvement after a refracturing treatment.

SOLUTION

- Design a BroadBand Sequence* fracturing service with engineered diversion pills.
- Verify fluid distribution during the treatment using the WellWatcher Stim* stimulation monitoring service.

RESULTS

- Increased oil production by 212% over the prestimulation level.
- Sustained the higher oil production for 4 months.

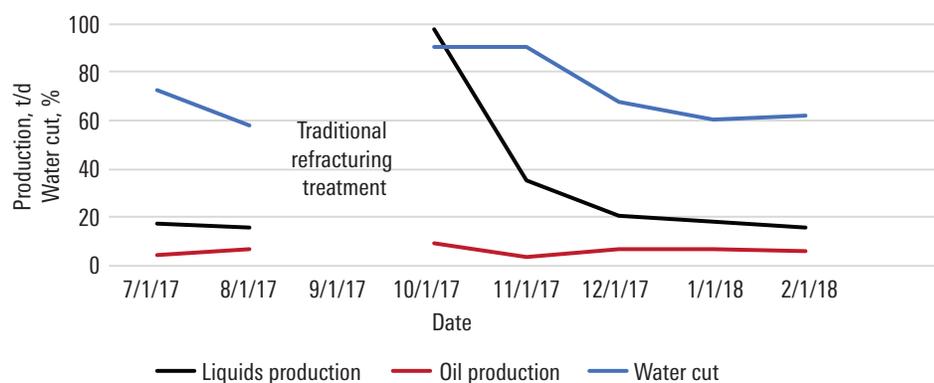


Openhole multistage completions limit refracturing options

Operators have developed more than 1,300 horizontal multistage wells to produce conventional oil reservoirs in Russia. The wells were initially completed with an average of five to seven openhole ball-activated frac ports separated by swell packers every few hundred feet. This design results in large openhole volumes between frac ports, poor port isolation, uncertainty in fracture initiation point, and no options to isolate ports in case of water breakthrough. As a result, operators struggle to achieve or maintain economical oil production from these wells; production often declines much more rapidly than expected.

Many operators rely on refracturing treatments to restore production, but the resulting improvements are marginal at best. The traditional restimulation practice is blind fracturing: A designed volume of fluid and proppant is bullheaded into the well. Because of the initial completion strategy, the fluid and proppant are most likely to enter the well at the point of highest permeability—which is usually the most depleted part of the formation. Recently a more aggressive near-screenout fracturing technique has been attempted to introduce some diversion, but the wells still experience minimal production improvement with rapid declines to prestimulation levels.

For example, Slavneft asked a local Russian service provider to refracture Well 1, which is 3,700 m deep with six ports and a perforated liner, using the traditional practice. Water production increased by 55% and oil production by about 40%, but both fell back to prestimulation levels within 4 months.



Production in Well 1 experienced the production increase and rapid decline that are typical after the traditional bullheaded refracturing treatments in the area.

To achieve more sustained production improvements, Slavneft asked for a restimulation option with thorough fluid distribution across the wellbore and verification of fluid entry points. The operator discarded the real-time monitoring option of distributed temperature sensing as uneconomical and eliminated posttreatment production logging because it was not a real-time option.

Diversion pills distribute fluid and monitoring verifies entry points

Schlumberger recommended a Broadband Sequence service with diversion pills engineered specifically for conventional reservoirs and the WellWatcher Stim service to verify fluid distribution throughout the wellbore.

CASE STUDY: Refracturing with BroadBand Sequence service increases oil production 212% for Slavneft, Russia

The BroadBand Sequence service sequentially isolates fractures at the wellbore to ensure each stage is fractured and can contribute to the well's full potential. At the end of each fracture stage, engineers pump an engineered pill comprising degradable particles and fibers that temporarily block subsequent fluids from reentering the same fracture or perforation cluster, diverting the fluid to higher-stress or lower-permeability regions to distribute the stimulation treatment throughout the wellbore.

The WellWatcher Stim service monitors powerful, high-frequency pulses during a stimulation treatment to confirm downhole events—such as diversion and fluid entry points—in nearly real time. This enables immediate corrective measures, such as repeating a treatment, to ensure each stage contributes to production.

Stage treatment delivers sustained oil production increase

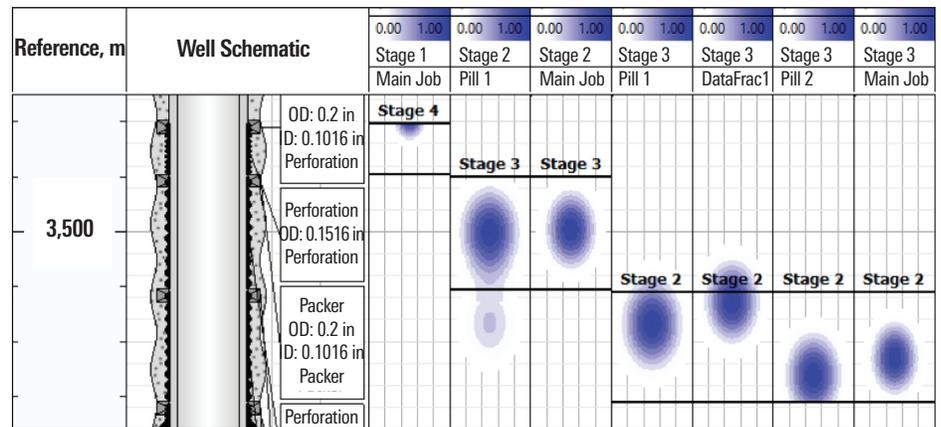
Well 2 is 3,700 m with three frac port stages (stages 4, 3, and 2) and a perforated liner (stage 1), each isolated with swellable packers.

The first BroadBand Sequence service treatment entered the heel of the wellbore at stage 4, as verified by the WellWatcher Stim service. At the end of the treatment, an engineered composite pill was pumped to temporarily block that stage and divert the fluid to another zone. WellWatcher Stim service verified the new fluid entry point in stage 3.

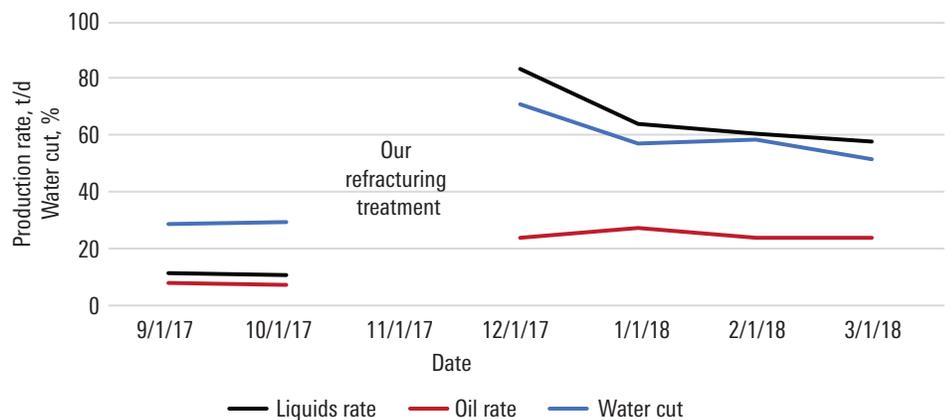
At the end of the second treatment, another pill was launched to divert the fluid again. WellWatcher Stim service verified a new fluid entry point—but still too close to stage 3. Engineers launched a second pill, and this time WellWatcher Stim service verified the fluid entry point deeper in stage 2, making a more uniform stimulation distribution. The operator decided not to stimulate stage 1.

On startup, Well 2 oil production increased by 212% and water production by 137% as compared with prestimulation values. The well sustained the oil production increase for more than 4 months as water cut declined.

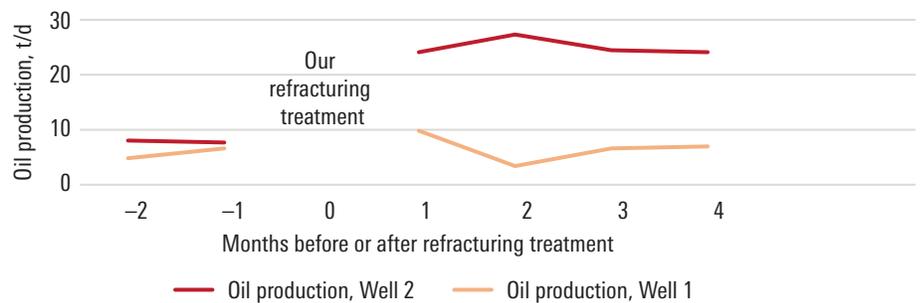
Slavneft has adopted the BroadBand Sequence and WellWatcher Stim services as the standard for its restimulation campaign.



During a BroadBand Sequence service in Well 2, the WellWatcher Stim service verified new fluid entry points after each engineered diversion pill was pumped.



After the BroadBand Sequence service, Well 2 oil production increased 212% and continued at the higher level for at least four months.



The Well 2 oil production increase after the BroadBand Sequence service was significantly higher compared with the Well 1 production increase after the traditional bullheading treatment.

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