

Re-fracturing and re-entry

Improve economics of existing wellbores

Production from unconventional horizontal wells tends to decline significantly within the first two years of production. Once a well becomes uneconomic to produce, operators have a number of options, including drilling new wells and re-fracturing. With the combination of rapid production declines and the need to maximize the net present value of reserves in each drilled well, re-fracturing or re-entering existing wells can be a viable option for operators.

With more fluid and proppant volumes being pumped and stages stimulated than ever before, many older wells using conservative completion programs have the potential to regain profitability after being re-fractured or re-entered.

Packers Plus StackFRAC® Slimhole system provides an effective re-fracturing solution by installing an entirely new liner inside the existing completion system of the wellbore. Using field-proven dual-element mechanical RockSEAL® packers provides a permanent isolation solution to specifically target bypassed or damaged sections along the wellbore and maximize reservoir coverage.

WHY RE-COMPLETE?

Re-completion of existing producing wells is an option for increasing production over drilling new wells. Existing wells are re-completed for three main reasons:

1. Initial stimulation was inadequate (e.g., small fluid volume, low proppant concentration, overflushed, damaging fluids, etc.)
2. To restore lost fracture conductivity or poor connection to the wellbore
3. Access new (previously bypassed) reservoir rock (e.g., closer fracture spacing)

In a well with multiple transverse fractures, production can be affected by inadequate near-wellbore conductivity. Re-completing the well and introducing more fractures can help increase the number of wellbore to fracture intersections, improving reservoir drainage^{1,2}.

RE-COMPLETION SOLUTIONS

Temporary isolation

Ball sealers and chemical/particulate diverters are commonly used temporary isolation solutions in the industry. They provide a low cost option to operators to increase production from existing wells.

Ball sealers are solid spheres pumped downhole to block existing perforations. They are operationally easy to use, but it is difficult to be certain if each cluster is adequately stimulated. Data has indicated that most of the stimulation treatment tends to go towards one or two dominant clusters, leaving the majority of clusters undertreated. If the fracturing pumping operation is temporarily halted, then much of the ball sealer diversion effect is also lost³.

¹ Gee, C., MacDonald, D., Hlidek, B. "Slimhole Refracturing Case Studies and Experience Utilizing Mechanical Isolation for Effective Refracture Treatments" SPE 180236-MS (2016) <https://doi.org/10.2118/180236-MS>

² Shah, S. N., Vincent, M. C., Rodriguez, R. X., & Palisch, T. T. "Fracture Orientation And Proppant Selection For Optimizing Production In Horizontal Wells" SPE 128612-MS (2010) [doi:10.2118/128612-MS](https://doi.org/10.2118/128612-MS)

³ French, S., Rodgerson, J., Feik, C. "Re-fracturing Horizontal Shale Wells: Case History of a Woodford Shale Pilot Project" SPE 168607-MS (2014) <https://doi.org/10.2118/168607-MS>

Non-degradable ball sealers can also be difficult to retrieve and interfere with subsequent operations.

Chemical diverters include viscous or particulate materials that are pumped between refrac stages, or used as plugs to divert fluids to another entry point in the wellbore. Fluid leak-off using diverters can be a challenge during treatment and cleanup. During stimulation, leak-off can alter the treatment design by reducing pump rates, increasing proppant concentration and overflushing proppant. If cleanup operations are inadequate, the chemical diversion additives can also cause formation damage and reduce near-wellbore conductivity, and may be a problem in dry gas wells. Although numerous examples in literature demonstrate successful results using chemical diversion, it is overall difficult to determine the success of treatments and demonstrate consistent results.

Coiled Tubing Isolation

Coiled tubing tools provide mechanical isolation during treatment and can be rapidly deployed without the use of a rig. The tools can be used in combination with closeable sleeves to re-complete existing wellbores and also avoid damaged zones, while leaving a full inside diameter after stimulation. Some major disadvantages include: (i) a high cost (ii) limited reach for longer laterals (iii) limited tool durability (iv) limited pump rate due to the smaller inside diameter of the coil, which can limit the effectiveness of the re-completion effort (v) high risk of coil getting stuck in the hole.

Permanent Mechanical Isolation

By installing a new liner inside an existing completion, permanent mechanical isolation can be achieved. The new liner can be cemented inside the existing completion, installed as an expandable liner, or a slimhole system with mechanical isolation packers. With permanent mechanical isolation, specific zones in the wellbore can be re-completed, and areas of poor wellbore integrity, non-productive zones or water producing zones can also be bypassed.

WHITE PAPER

Both cemented and expandable liners require perforations and mechanical plug setting similar to a new completion. It can, however, be difficult to cement a liner inside an existing completion. Cementing the annulus between the old and new liner also blocks off old perforations that may still be contributing to production. Similarly, scales and fines production can impact the expansion of an expandable liner.



(a)



(b)



(c)

Solutions for installing new liner inside existing casing: (a) cementing the liner (b) expandable liner (c) StackFRAC Slimhole liner

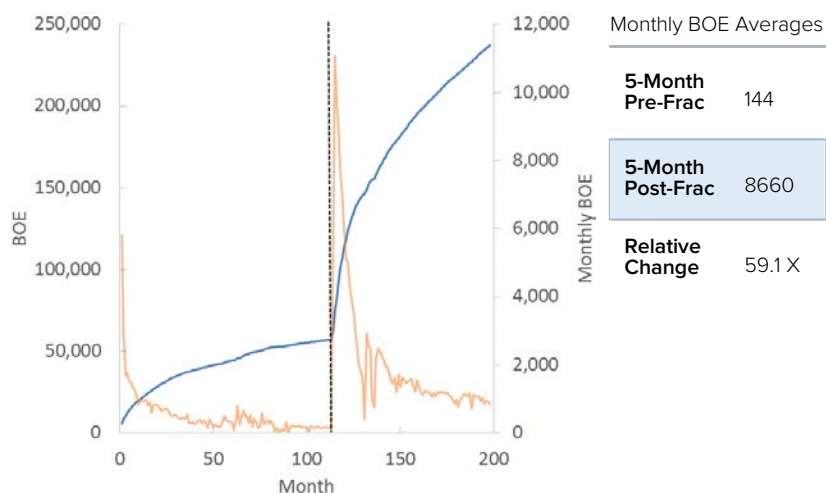
The Packers Plus StackFRAC Slimhole system uses a liner with ball-activated FracPORT™ sleeves and RockSEAL® packers to stimulate the existing wellbore. Using a continuous pumping operation to pump incrementally larger balls from surface to isolate zones for stimulation saves on time and cost. RockSEAL packers provide mechanical isolation inside the existing wellbore to permanently isolate new, existing and undesirable zones.

CASE STUDIES

Accessing Existing and Bypassed Pay in a Cased Hole Horizontal

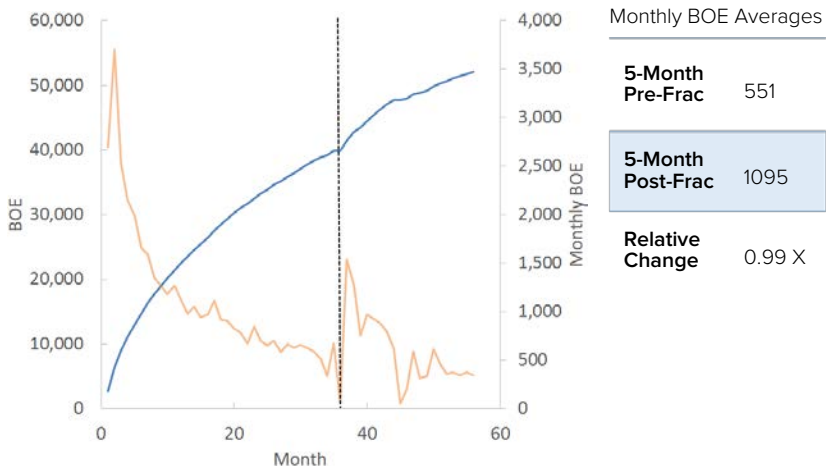
An operator successfully re-fractured a 10-year old, 4.5-in cased hole horizontal well in the Glauconite formation in Alberta using a 4-stage StackFRAC Slimhole system in a 2.875-in. liner.

To stimulate the entire lateral, three new sets of perforation clusters were shot in addition to the two existing clusters from the original completion a third of the way into the 900 m (2,953 ft) lateral. Re-fracturing the well resulted in a relative increase of 6000% in the 5-month average production post-treatment.



Re-fracturing an Open Hole Well

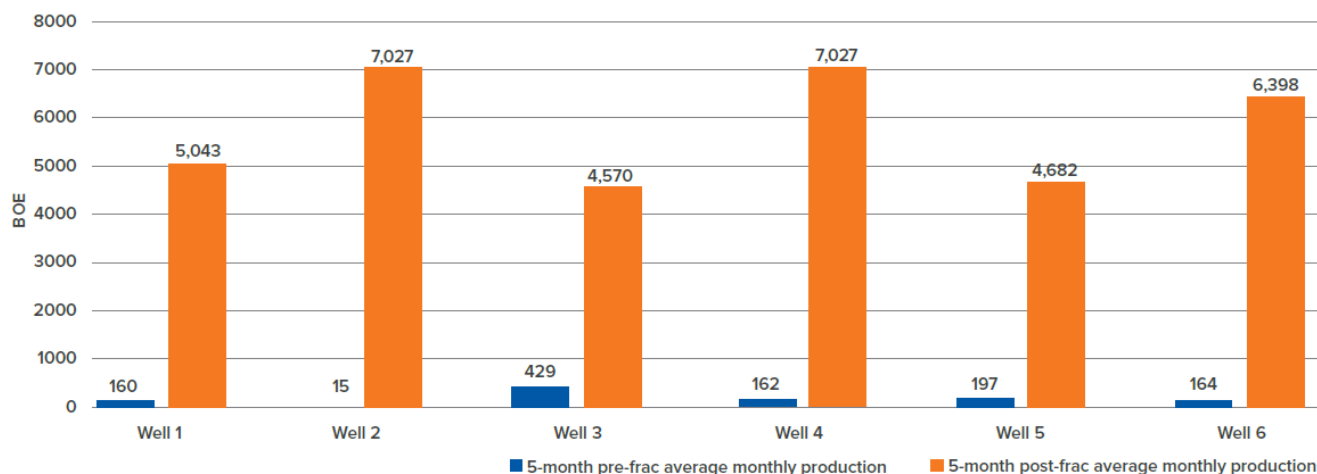
An operator working in the Cardium formation experiencing reservoir depletion due to low bottom hole pressure re-fractured all 11-stages of an existing open hole well with a StackFRAC Slimhole system and experienced a 99% increase in the 5-month average production after stimulation.



A total of 1,795 m³ of fluid was pumped and 213 tons of proppant placed during the treatment. During the last few stages, average pump rates were increased to 10 m³/min.

Re-entry into Vertical Wells

With many older vertical wells in the Cleveland formation that came on production between 1970 and 2000 reaching flat decline rates, operators in the area looked to re-entry as a cost-effective method to boost production. One operator targeted six of these wells between 2005 and 2008 by re-entering and drilling horizontal sidetrack laterals.



Lateral lengths up to 2,200 ft were stimulated, with up to 320,000 lbs of proppant pumped in a single well. Relative increases ranging from factors of 10 to 468 were observed between the 5-month pre-frac and post-frac average production rates.

CONCLUSION

Re-fracturing or re-entry provides operators with a means to increase production and profitability from existing wells, and reduce expenses compared to drilling a new well.

The StackFRAC Slimhole system uses an entirely new liner to enable select bypassed, damaged or existing zones to be permanently isolated for stimulation using mechanically activated RockSEAL packers. Using RockSEAL packers and FracPORT sleeves with customized port sizes ensures that the designed treatment rates can be executed for each selected zone.

FURTHER RESOURCES

Packers Plus is a completion technology company dedicated to providing high quality solutions that work the first time. To this end, Packers Plus offers systems for a variety of applications, including cemented liner, open hole, and high pressure and high temperature applications.

Packers Plus' knowledgeable and experienced specialists have been dedicated to providing customized solutions for clients around the world over 15 years.

Explore more solutions, case studies, and news at packersplus.com.