STEP energy services

POST-PRODUCTION STIMULATION SOLUTIONS

SINGLE SHOT IOR™ USING LPG

Proprietary Post-Production Treatment for Declining Wells

How many stages of your wellbore are contributing to your production today? Where do you think the water used in your original stimulation has gone? How can I get more from my existing wells? These are questions that many operators ask themselves, and without definitive answers, and with decreasing production rates, they seek to find solutions for their declining wells.

Single Shot IOR™ is a patent-pending, post-production stimulation technique that uses liquid petroleum gasses (LPG) and proprietary chemistry to mobilize hydrocarbons in shale or tight sand, oil bearing reservoirs.

The Challenges – Post-Production

Many wells in shale and tight sand reservoirs experience a rapid decline of the initial production rates. Factors that contribute to the decline include:

- Depletion of reservoir energy in the near wellbore region.
- Long horizontal wells are completed in multiple stages and not all stages contribute to their full potential.
- Large volumes of water injected into the wells during the original stimulation program may adversely affect oil relative permeability.
- Conventional improved recovery methods such as waterflood or CO_2 flood, are not feasible due to low permeability.

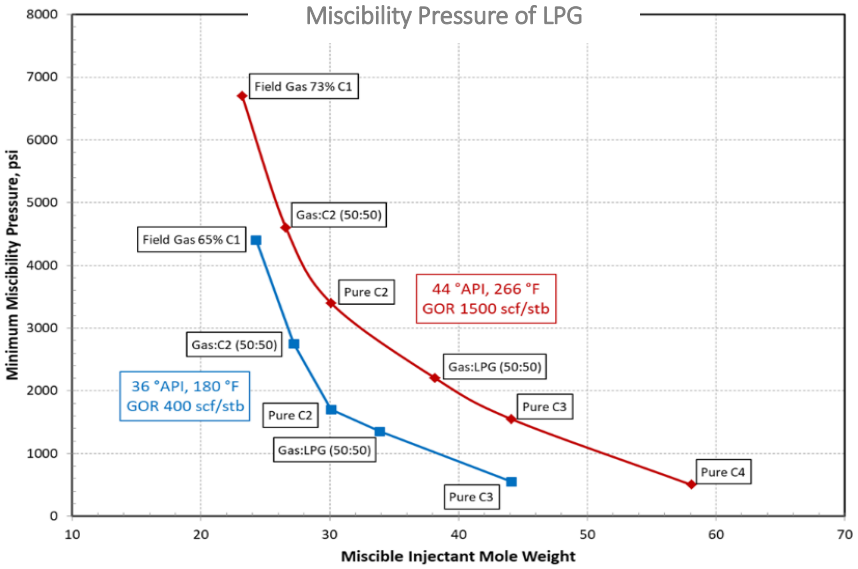
The Technology

The Single Shot IOR™ system is designed to combat post-production challenges and access unproduced pay that has been left behind by completion efforts. Single Shot IOR™ will:

1. Mobilize incremental oil by introducing a miscible fluid (LPG) to the well's stimulated rock volume (SRV) where it swells the residual oil, reduces its viscosity, and mobilizes it toward the wellbore.
2. Access and stimulate non-contributing zones, increasing SRV through the use of diverters.
3. Utilize LPG treating fluid to deliver proprietary chemistry, restoring relative permeability and enhancing oil mobility.

Mobilizing Residual Oil: During the Single Shot IOR™ treatment, the LPG solvent is pumped into the fracture system. The injected LPG, miscible with residual oil, causes the oil to swell, reduces its viscosity and increases its mobility, resulting in a very rapid – virtually instantaneous – response in oil production rate from the well post-stimulation.

The use of heavier LPG such as propane, butane and liquid condensate improves the efficacy of the miscibility process. The LPG is miscible at much lower reservoir pressures than ethane or methane, and is miscible through the entire pumping and production pressure cycle.



The pressure increase associated with the Single Shot IOR™ treatment, coupled with the energy associated with the post-treatment expansion of the LPGs as reservoir pressure drops, provides energy to drive incremental oil to the wellbore.

Increasing SRV: We know SRV deteriorates over time. What we don't know is how much deterioration is due to blockage in or near the wellbore, or deterioration of the fracture system itself. By using proprietary chemistry, Single Shot IOR™ can increase the SRV which exposes more of the formation to LPG and allows access to the fracture system that has either closed down over time or never contributed to the production of the reservoir.

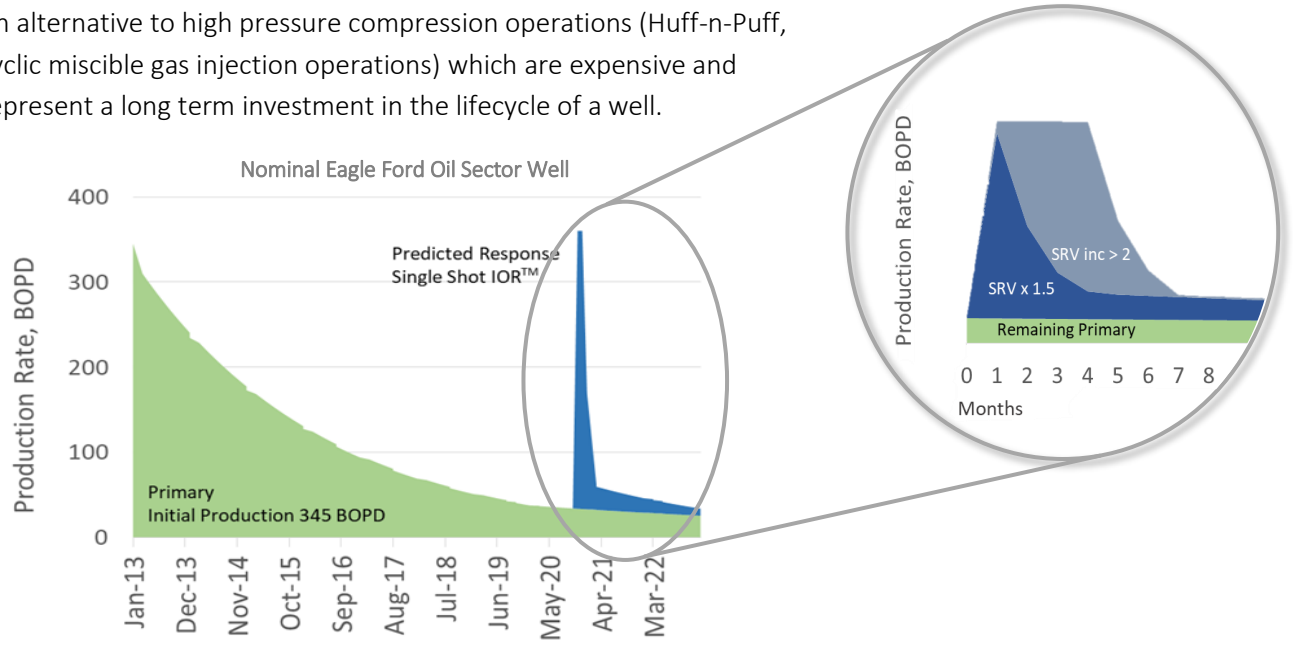
How does the injected solvent increase SRV in non-producing or low-producing zones?

- The chemical system and solvent displaces water and debris from the long horizontal wellbore.
- Diverters direct LPG and chemicals to poorly / non-contributing zones.
- The solvent mobilizes bound water restoring oil relative permeability.
- Improved oil mobility through miscibility also applies in new zones.
- Transmissibility in previously induced but unpropped fractures is enhanced due to spalling with the relatively high-rate/high-pressure stimulation.

Restore Relative Permeability: Certain reservoir rocks may absorb water pumped as part of the initial fracturing treatment. This water may impact oil relative permeability and/or block oil flow. In such cases the LPG will alter matrix wettability and/or mobilize bound water, thereby increasing oil production from the affected rock.

The Benefits

- Improve post-production recovery with a single pumping treatment of LPG into the hydrocarbon bearing reservoir.
- Stimulate existing SRV with LPG solvent to swell and mobilize oil.
- Increase the SRV in the near wellbore region using diversion, volume, rate, and pressure.
- Restore permeability damaged by water during fracturing.
- An alternative to high pressure compression operations (Huff-n-Puff, cyclic miscible gas injection operations) which are expensive and represent a long term investment in the lifecycle of a well.



Predicted response for Single Shot IOR™

- *Rate should be close to its original IP*
- *Total IOR in the range of 20K to 45K bbls depending on the SRV increase achieved*