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Applying Enhanced Cyclic Diversion Process in Granite Wash Open Annulus Horizontal Completion

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Abstract

This paper describes methods to alter the flow path in the open annulus section of a horizontal Granite Wash stimulation completion. The challenge was to complete a 1,600-ft open annulus section using standard plug and perf (P&P) stimulation methods. The objective was to isolate and initiate individual fractures at each stage in an open annulus environment.

Altering the flow of proppant and fluid in the open annulus and near wellbore (NWB) involved multiple products, and procedures. This included cyclic application of the following:

- Pump rates and intra stage shut-ins.
- Fluid types and viscosity-alteration (friction reducer and crosslinker).
- Proppant slurry and clean fluid sweep stages.
- Solid diverters.
- Chemical surface modification agents (SMAs) and resin-coated proppant (RCP).

The objectives were to cycle the bottomhole treating pressure (BHTP) and alter the flow path in the wellbore, annulus, NWB, and far field, while maintaining annulus and casing integrity.

A cyclic but continuous bottomhole pressure (BHP) increase was observed throughout the four stimulation stages pumped in the open annulus section. The surface pressure characteristic signature changed after each shut-in. Perforation operations in the open annulus sections above a completed stage did not indicate proppant inflow through the new perforations. The drill out of plugs in the open annulus section circulated trace amounts of untreated proppant. Initial flow back operations showed minimal proppant flowing to surface. Strong production results indicate contribution from 40% of the lateral section that had no annular isolation. Normalized production is compared to adjacent offset.

Our use of an enhanced cyclic diversion process (ECDP) was a success. Instead of using a single product or process; we used a cyclic combination of solid diverters, proppant coatings, prop/sweep stages, and shut-ins to deliver a variable BHTP and altered flow paths.