Optimizing well completion and flowback strategy in a tight sand reservoir

An operator in the Powder River Basin wanted to reassess an aggressive choke strategy that was causing consistently high sand production during the flowback process and impairing the maintenance of fracture connectivity to the wellbore. Simply moderating the choke settings did not solve the problem, and the volume of proppant flowback on some wells was as high as 80,000 lbm. The goal was to improve well performance while eliminating the excessive solids production, which was posing high costs for the required remedial cleanouts, sand disposal, and early equipment replacement due to sand-related erosion.

Integrating the choke strategy, proppant flowback, and productivity criteria

The sand production that the operator was experiencing made the flowback strategy a prime candidate for applying AvantGuard advanced flowback services. AvantGuard services are based on determination and application of the SOE, which incorporates reservoir, completion, and stimulation parameters for maximizing well productivity through preservation of the connection between the wellbore and hydraulic fractures. Operating within the SOE ensures consistency along the progression of plug drillout, well flowback, and production operations to maintain proppant pack stability.

CASE STUDY

Reservoir Testing

Comparison of the original aggressive choke strategy, which is widely used in the basin, the modified choke strategy that the operator had tried without much effect, and the SOE-governed choke strategy determined with AvantGuard services. The SOE methodology balances the forces applied to the proppant to keep it inside the fracture for the entire well startup and subsequent production with rates maximized for the reservoir conditions.
Identifying the root cause of proppant flowback to minimize sand production and improve productivity

SOE analysis performed on Well JV 1, which had produced 80,000 lbm of proppant with the aggressive flowback strategy, indicated that the applied choke in the beginning of the well flowback period was too aggressive for the given reservoir and well completion parameters.

The lower oil production of Well JV 7 is related to higher water cut because the well was drilled at the reservoir boundary. The liquid production performance of Well JV 7 is still in the top quartile.

SOE postoperational analysis of Well JV 1 flowed back with the aggressive choke strategy. High initial flow rates (red oval) were identified as the root cause of the proppant production from the fractures during the time when the stress on proppant was low.

The SOE-derived flowback strategy defined by AvantGuard services was employed for all subsequent project wells. At the beginning of the well flowback period, the flowback rate was kept at a low level until sufficient stress on proppant was developed. After that, the choke size was gradually increased to bring each well to its production target. Implementation of this procedure resulted in less than 30 lbm of total proppant flowback per well with the early production results exceeding expectations.

Implementation of the SOE methodology ensured consistency between the well stimulation and the startup strategy, which maximized productivity. The field’s economics were further improved by significant cost reductions because of the mitigated cleanouts, disposal, and equipment failures.