Mitigating Production Degradation Due to Frac Hits in Unconventional Reservoirs

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Dr. Junjing Zhang, Staff Completion Engineer in the Global Wells organization at ConocoPhillips, will speak on Thursday, September 16, 2021.

The topic is “Mitigating Production Degradation Due to Frac Hits in Unconventional Reservoirs.”

Abstract

In unconventional reservoirs, a "frac hit" is the infill-to-parent well communication during hydraulic fracturing. In most shale plays, production from the parent-infill well system drops below original forecasts due to production degradation after fracture hits from offset wells. Fracturing treatments in infill wells often are handicapped by asymmetrical fracture growth and interactions with depleted parent wells. These events result in excessive impairment in parent wells and unbalanced stimulation of infill wells. This study reviews current methods to mitigate the negative outcomes of frac hits and evaluates the effectiveness of these methods. Major challenges and opportunities of each method are also pointed out in this study.

The mitigation methods discussed in this lecture include (1) applying far-field diverter during fracturing in the infill wells, (2) reinjecting water into the parent wells and (3) refracturing parent wells. Key design considerations are presented in detail, such as lab tests devised to optimize far-field diverter blends for bridging fractures, fracturing treatment data analysis to find the optimum fluid volume for parent well reinjection, and comparison of different near-wellbore diversion methods in parent well refracturing. A total of 565 fracture "hit events" at 41 impacted parent wells are statistically analyzed and compared to evaluate the abovementioned mitigation methods. Long-term well performance of several hundred impacted wells are statistically compared to area-specific type curves.

Based on the comprehensive analysis, pumping far-field diverters during infill fracturing, reinjecting water into the parent wells and refracturing parent wells, are field-proven approaches to protect parent wells from fracture hits and also to improve infill well stimulation efficiency. With low operational costs, pumping far-field diverters results in a P50 EUR increment by 6%, with a 20% failure rate in the parent well protection. Water reinjection in the parent wells shows successful parent well protection, but the impact on the long-term well performance is negligible. Re-stimulation of properly selected parent wells with near wellbore diverters indicates a P50 EUR increment by 35%. Selection of parent well protection methods needs to be fit-for-purpose and is fundamentally dictated by the operational experience and specific economic models applicable to the area.

Biography

Junjing Zhang (ZJ) is a Staff Completion Engineer in the Global Wells organization at ConocoPhillips. He supports completion and hydraulic fracturing across ConocoPhillips assets in Lower 48, Alaska, China, Canada and Australia. Zhang is the recipient of the ConocoPhillips Outstanding Early Career Technologist Award. He has 14 years of research and industry experience and has authored 15 journal publications. Zhang is a 2020-2021 SPE Distinguished Lecturer, and has received 6 SPE awards, including the 1st place award for the SPE International Student Paper Contest (PhD group) and the SPE International Cedric K. Ferguson Medal. He served as program committee member and session chair for the SPE Hydraulic Fracturing Technology Conference and Exhibition during 2017-2020. Zhang is a licensed Professional Engineer in the State of Texas, U.S.A. He holds a MS degree from University of Petroleum (Beijing) and a PhD degree from Texas A&M University, both in petroleum engineering.