Stress Shadows:
How and Why They Affect Hydraulic Fracturing in Unconventional Shale Plays

2016-17 SPE Distinguished Lecturer Series Abstract and Bio

Much is now made about "Stress Shadows" and its impact on hydraulic fracturing - particularly in the long, multi-stage horizontal laterals commonly used in Unconventionals. Unfortunately, there is no standard definition of Stress Shadows and, as a result, there is much confusion over what it is and isn't, and, most importantly, why it can potentially have a significant impact on hydraulic fracturing operations. The goal of this presentation will be to address this confusion and more fully explain Stress Shadows.

The creation of hydraulic fracture width during a stimulation generates a change in the stress field that, while often mistakenly considered to solely be an increase in the minimum horizontal stress Shmin, changes all three principal stresses as well as tip shear stresses. These stress changes are the Stress Shadows. As hydraulic fracture propagation is often dominated by the stress field, Stress Shadows from a previous hydraulic fracture may change the propagation path for subsequent hydraulic fractures or, as often seen in cluster fracturing, propagation may be prevented completely.

The presence of natural weakness planes can also affect, and be affected by, Stress Shadows. At a hydraulic fracture tip, shear stresses are generated that offer the potential to shear and open closed weak planes – and if these can be opened to flow, it then becomes possible to stimulate them. Equally important, behind the hydraulic fracture tip the principal stresses are increased due to Stress Shadows, which tends to close weakness planes making them more difficult to stimulate.

This presentation is 30 to 90 minutes as suitable for the audience and time available.

Biography

Dr. Neal Nagel is currently Chief Engineer for OilField Geomechanics and has nearly 30 years of industry experience. He is a well-known expert in the geomechanics of Unconventionals and has given many invited SPE, AAPG, HGS, SEG, and SPWLA presentations. Nagel has also authored or coauthored more than 50 technical papers, with 20+ related to Unconventionals, including a keynote presentation at the 2014 SPE HFTC. He is a past SPE Distinguished Lecturer, was chief editor of the 2010 SPE Monograph on Solids Injection, has served on the SPE Drilling and Completions Committee, and also been a local SPE section officer.

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