Title: Reusing Produced Water: Implications of Clean Brine Use in Completions

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Abstract:

Clean brines derived from produced waters provide an important source of water for stimulations in nearly all shale plays. Though produced waters are treated for organics and iron through separations and oxidation, the brines produced are extremely saline containing a wide range of dissolved elements. The majority of the ions are Na^+ and Cl^- with significant quantities of divalent cations (Mg, Ca, Sr, and Ba) with the concentrations varying due to the shale play. Though this high salinity is closer in ionic strength in the natural system, it is an issue with regards to corrosion of steel in the wellbore where the salinity enhances the corrosion that would already occur due to the oxidative nature of the stimulation fluid. In Marcellus, Ba^{2+} is high in solution while in the Permian Basin Sr^{2+} dominates (both are 100's of ppm). These divalent cations are problematic when SO_4^{2-} is present in the systems derived either from additive breakdown (ex. Persulfate degradation) and/or the oxidation of pyrite native to the rock. The oxidation of the pyrite in the rocks, regardless if corrosion inhibitors and iron control agents are used, also result in the precipitation of Fe(III)-(hydr)oxides in the stimulated rock volume. Stimulations using clean brines are necessary and can significantly reduce the environmental impact of stimulations by lowering the burden on freshwater sources. But proper use of these brines requires a strong understanding of how these fluids will impact overall rock and fracture permeability along with corrosion in the wellbore. If a low cost method for removing divalent critical materials such as Ba and Sr can developed, not only will a problematic issue with regards to mineral scaling be averted, but a new potential revenue stream can be developed.