Implications of recycling flowback and produced water on microbial community composition and scale formation

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Hydraulic fracturing is a water intensive process to recover oil and gas from tight geologic formations. An average of 15,000 m^3 of water, typically freshwater, is used per well to make the injected hydraulic fracturing fluid (HFF). After fracturing, between 30-80% of the injected volume returns to the surface as flowback and produced water (FPW). The FPW often has high total dissolved solids (10,000 mg/L to >300,000 mg/L) and is a complex mixture of hydrocarbons from the geologic formation, compounds from the HFF and compounds that form as the product of secondary downhole reactions. This water intensive process has led to a variety of concerns ranging from the allocation of freshwater for mixing HFF to the treatment and disposal of the FPW. One proposed means of addressing both is through reuse of FPW in the makeup of new HFF. However, this may pose risks related to the seeding of sulfate and hydrogen sulfide producing bacteria, as well as scale formation, in wells fractured with recycled FPW.In this study, we analyzed the inorganic composition of the FPW and microbial communities of two different wells in the Duvernay Formation of Alberta, Canada over the first 100 days of fracturing. One well used solely freshwater for HFF and the other well used a portion of FPW to make HFF. Using geochemical modeling and 16S rRNA analysis, we observed minimal changes in the inorganic geochemistry; however, the recycling of FPW encouraged the growth of *Halanaerobium*. Ultimately, these results will enhance our understanding of the potential risks related to the recycling of FPW.