

3 - Outstanding Abstract Award: The Impacts of the Biocide Glutaraldehyde on Community Structures and Degradation Potential in Streams Impacted by Hydraulic Fracturing

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Disclosures

M. Campa: None. **S.M. Techtmann:** None. **C. Gibson:** None. **M.L. Patterson:** None. **A. Garcia de Matos Amaral:** None. **R. Lamendella:** None. **T.C. Hazen:** None.

Abstract

Hydraulic fracturing (HF) involves injecting chemicals, sand, and water into shale formations to create fractures and release hydrocarbons. Large volumes of the hyper-saline fluids used return to the surface as waste. Potential spills of this wastewater raise concerns about the environmental impact these fluids may impose. Biocides are one of the main chemicals of concern used in HF fluids. Biocides are added to prevent biocorrosion of equipment and gas souring. To understand the effect of biocides on the environmental microbial community after a HF surface spill, microcosms were inoculated using stream water impacted and not impacted by Marcellus shale HF operations. Microcosms were incubated aerobically at ambient temperature for 56 days using glutaraldehyde (GA), the most commonly used biocide in HF operations. The microbial community adaptation to biocide was monitored every two weeks using next-generation 16S rRNA amplicon sequencing, and abiotic and biotic GA degradation was measured every week using Liquid Chromatography- coupled with Exactive Quadrupole-Orbitrap Mass Spectrometry. 16S rRNA amplicon sequencing showed three methanotrophic taxa enriched in the HF impacted sites after the addition of GA. These taxa were the genera *Beijerinckia*, *Methylobacterium*, and *Methylosinus*. Over time, HF impacted sites kept a higher Simpson alpha diversity than the HF not-impacted sites. Presumably, HF-impacted sites have more organisms capable of tolerating the biocides. The difference of alpha diversity between HF-impacted and HF-not-impacted sites suggests there is a long lasting effect in the microbial population after a HF spill. Furthermore, HF impacted experienced a smaller log reduction of bacterial 16S rRNA gene copy number, that can be attributed to less bacteria dying off. HF not impacted sites show more "enrichment" afterwards, but this could be due to the new carbon sources provided by dead microbes. In 56 days there was not a statistically significant abiotic degradation of GA. However, overtime HF not impacted sites, experienced more biotic degradation of GA as compared to the HF impacted sites. Showing there is a decrease in degradation potential after GA exposure, even though more members of the microbial community are able to tolerate the biocide. These findings show there are lasting effects in microbial community structure and degradation potential in streams impacted by HF operations.