



MICROBIAL SUBSURFACE REPOPULATION FOLLOWING IN SITU STAR REMEDIATION

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ABSTRACT

STAR (Self-sustaining Treatment for Active Remediation) is an emerging remediation technology that employs a self-sustaining smouldering reaction to destroy nonaqueous phase liquids (NAPLs) in the subsurface. The reaction front travels at rates of 0.5 to 5 m per day and subjects the soil to temperatures between 400°C and 1200°C (Pironi et al. 2011; Switzer et al. 2009). Consequently, not only does STAR cause an in situ destruction of NAPL, but it dries and sterilizes the soil through which it passes (Pape et al. 2015). Microbial recolonization of these sterile treated zones is important to the overall remediation of the site, since soils require microbial populations to cycle nutrients and provide a supportive base for above ground ecosystems (Nwaishi et al. 2016; Tisdall and Oades 2012). However, the smouldering process also acts to remove organics and nutrients, and lowers the cation exchange capacity of the soil. This creates a difficult environment for microbial repopulation to occur in. Indeed, it has been shown in a microcosm study that microbial recovery following thermal treatment at temperatures above 500 °C is up to three orders of magnitude lower than in soils which received thermal treatment at temperatures below 500 °C (Pape et al. 2015). Nevertheless, it is hypothesized that in situ post-STAR microbial repopulation will show more success, as organics and nutrients will be supplied to the treated zone by the influent groundwater.

In this study, the microbial repopulation of an in situ STAR treatment zone is investigated at a field site in New Jersey called Pitt Consol. Final results will include analysis of bacteria and archaea population magnitude and diversity within soil cores taken from the treatment zone before and at regular intervals over six months following STAR treatment, allowing time for groundwater to re-infiltrate the treatment zone and for microbial populations to potentially reestablish. Samples from outside the treatment zones will also be analyzed to provide background data. Further, long term column experiments are looking into the effect of biostimulating the post-STAR treatment zone to enhance recovery time. Microbial abundance and diversity data from both the field observations and biostimulation experiments are expected to be compiled by late spring.

Keywords: Smouldering, Remediation, Biotransport, Recolonization, Subsurface

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