Using Molecular Techniques to Characterize Sites Undergoing ISCR: A Site Comparison Study

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Background/Objectives. Due to the success of in situ chemical reduction (ISCR), novel in situ products and methods are becoming more common for ISCR implementation, and the treatment options are continuing to evolve. Furthermore, the potential to utilize ISCR in conjunction with bioremediation techniques allows for targeted, site-specific approaches, resulting in more efficient contaminant attenuation. In this study, multiple chlorinated solvent-impacted sites were analyzed. Careful characterization of each site using common molecular biological tools led to tailored ISCR treatments. By reviewing the chemistry involved at each site before and during the treatments, this study aims to aid in future treatment selection, as well as distinguishing contaminant transformation pathways.

Approach/Activities. Different chlorinated solvent-impacted sites located across North America are analyzed in this study. Various ISCR-based treatment approaches were tested by using in situ microcosms (ISMs) and critically examining the impacts on contaminant concentration and geochemistry. Compound specific isotope analysis (CSIA) was employed to confirm the degradation of target compounds and quantitative polymerase chain reaction (qPCR) was performed to identify and quantitate the microbial communities present. The combination of these analyses provided an in-depth look into the subsurface environment before and after the introduction of different amendments. Subsequent pilot tests at three of the sites have been implemented based on the results of the ISM studies.

Results/Lessons Learned. This comparison study of different sites further confirms that there is no “one-size-fits-all” approach to remediation and that efficacy is a direct result of scientific understanding. Extended studies incorporated new remediation products and methods, and evaluate their impact on long-term remediation efforts. Future work includes the implementation of full-scale treatments and continued monitoring of pilot studies.