Reconsidering ISCO for Treating Low Contaminant Concentrations

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Background/Objectives. In situ chemical oxidation (ISCO) is a demonstrated remediation technology for reducing contaminant source mass and groundwater concentrations but is not commonly considered for sites with low contaminant concentrations, or to attain stringent remedial goals such as drinking water criteria and/or to attain single digit micrograms per liter. Numerous in situ remediation technologies can significantly reduce contaminant groundwater concentrations. However, successfully achieving low remedial goals in a cost-effective manner can be a challenge for all remedial technologies. The 2016 ESTCP report titled "Development of an Expanded, High-Reliability Cost and Performance Database for In-Situ Remediation Technologies" presented that only 21% of 710 monitoring wells and 7% of 235 sites evaluated achieved typical Maximum Contaminant Level (MCL) criteria of 5 micrograms per liter. Monitored natural attenuation (MNA), often required for a long and unpredictable period of time, is assumed to be a component for nearly all remediation sites. However, many sites have remediation schedules driven by regulatory requirements, property transfer, and/or development.

Approach/Activities. Rapid reaction time without generation of regulated treatment byproducts are advantages of applying ISCO to low contaminant concentrations. The presentation will share experiences of performing ISCO at four sites with low remedial goals for chlorinated ethenes and/or 1,4-dioxane. Pre-ISCO treatment contaminant concentrations at three of the sites were less than 20 mg/L. One site received ISCO as a polishing step following successful enhanced biodegradation. Oxidants applied at the four sites include permanganate, activated sodium persulfate, and hydrogen peroxide (modified Fenton's reagent).

Results/Lessons Learned. In general, ISCO injections resulted in lowering contaminant concentrations at all four sites facilitating attainment of stringent remedial goals, with reductions ranging from 50 to 80% in individual performance monitoring wells following injections in target treatment area(s). Both sustained reductions as well as concentration rebound trends were observed, and multiple ISCO applications were required at some of the sites. Oxidant selection and dosage, ISCO performance, oxidant residual, and lessons learned from applying ISCO for successful attainment of low concentration criteria will be discussed in the presentation.