Enhanced Reductive Dechlorination after In Situ Chemical Oxidation: Moving Past the Myth to Design Effective Combined Treatment Remedies

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Background/Objectives. In situ chemical oxidation (ISCO) and enhanced reductive dechlorination (ERD) are mature remediation technologies with more than two decades of demonstrated remediation success. A combined remedy strategy that includes both technologies can improve treatment performance, increase efficiency, and reduce clean-up time and cost. However, common misconceptions that adjusting the reductive-oxidation conditions in a contaminated plume is a significant challenge and that ISCO so radically alters native bacteria communities that anaerobic bioremediation is prohibitively difficult following an ISCO treatment persist among remediation practitioners. This presentation will feature observations from the bench and from field injections to dispel these myths and support increased usage of combined remedies featuring ISCO and bioremediation in sequence.

Approach/Activities. Field- and bench-scale experience of the authors will highlight lines of evidence of increasing biodegradation after ISCO with and without biostimulation. A variety of examples will present lines of evidence for increased intrinsic biodegradation after application of potassium permanganate, activated sodium persulfate, or catalyzed hydrogen peroxide. Two case studies will detail ERD performed nearly immediately after ISCO injections and the rapid establishment of reductive dechlorination environment to accelerate achievement of project objectives. At one project ERD was performed into 150 injection wells less than one month after ISCO utilizing catalyzed hydrogen peroxide. At the second site, ERD injections were performed only 4 days after catalyzed hydrogen peroxide was performed at the same injection points.

Results/Lessons Learned. ISCO can achieve rapid mass removal; ERD is a long-lasting treatment process with resistance to rebound and offers cost advantages compared to other remediation technologies. Combined approaches and treatment-train applications can benefit overall remediation timeframe and cost-effectiveness. Remedial design needs to identify complimentary components and overcome inhibiting factors. For designing a combined remedy featuring ISCO with enhanced bioremediation and/or monitored natural attenuation, the presentation will review oxidant selection, oxidant persistence, reaction products, change in pH, and the potential increased demand for bioremediation amendments as a result of ISCO.