



LESSONS LEARNED FACT SHEET

Assessing the Long-term Performance and Impacts of ISCO and ISBR Remediation Technologies

Introduction: This fact sheet summarizes the results of a recent ESTCP project designed to conduct a long-term assessment of the performance of fracturing-enhanced in-situ bioremediation (ISBR) at a site contaminated by trichloroethene (TCE), 1,4-dioxane (dioxane), and chromium. The project was conducted at Air Force Plant 44, which is part of the Tucson International Airport Area federal Superfund site located in Tucson, AZ. The site comprises several primary source zones and a large, several kilometer long, groundwater contaminant plume that resides in the regional aquifer. The remedial action and performance monitoring were conducted by the Air Force contractor. Performance monitoring data were obtained for a period of greater than three years after completion of ISBR. The project focused on treating the interface between the vadose zone and saturated zone. This interface region, which consists of primarily lower-permeability (clay) media, has been identified as a primary location for remaining contaminant. Slow release of contaminant from this domain is considered a primary cause of the observed delayed attainment of cleanup objectives.

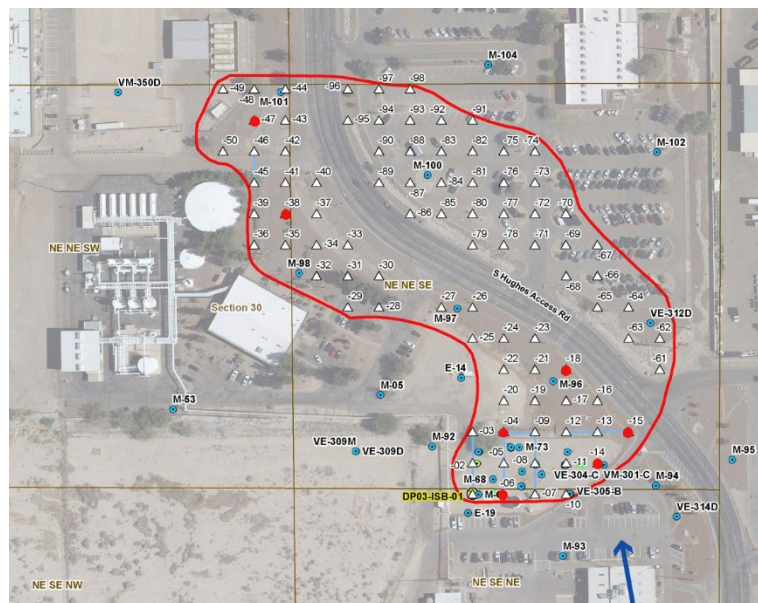
Key Result 1: ISBR employing enhanced reductive dechlorination (ERD) was effective. TCE, chromium, and dioxane concentrations at site DP003 were reduced by 94, 83, and 36%, respectively. The observation of cis-1,2-dichloroethene, vinyl chloride, ethene, and ethane in groundwater samples after ISBR implementation (but not before) supports that reductive dechlorination of TCE was initiated in the treatment zone.

Key Result 2: ISBR employing enhanced aerobic cometabolism (EAC) was effective. Dioxane and TCE concentrations at site DP003 were reduced by 92 and 60%, respectively. The concentrations of chromium remained essentially unchanged over the course of the EAC-ISBR treatment, which indicates that the generation of aerobic conditions had no measurable impact on chromium levels in groundwater.

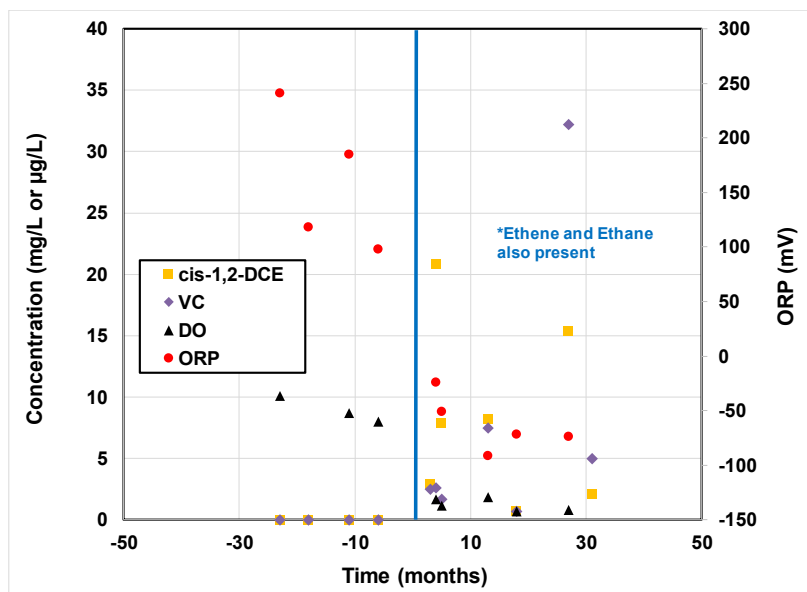
Key Result 3: The performance results are consistent with other field tests. A meta-analysis was recently reported of enhanced anaerobic bioremediation projects conducted for sites wherein the original contaminants of concern (COC) were either tetrachloroethene or TCE. The median concentration reduction was 90% for 34 sites for which the performance-monitoring period was at least three years. The %-reductions observed for the present study are consistent with the meta-data.

Key Result 4: The longer-term performance assessment provided more robust assessment. Concentrations of the COCs measured after >3 years of monitoring were approximately 50% lower than the values measured after three months for a majority of the sampling points. This

demonstrates the advantage of conducting longer-term performance assessments.



Map of the treatment system for ISBR implementation at the DP03 source zone. The white triangles represent the wells used for hydrofracturing-enhanced injection of amendments. The pictured region is approximately 300 by 300 meters.



Concentrations before and after implementation of ERD-ISBR at site DP03. DCE= dichloroethene, VC=vinyl chloride, DO=dissolved oxygen, ORP=oxidation-reduction potential.

FOR MORE INFORMATION

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