Pneumatically Enhanced Amendment Injections for Combined Bioaugmentation and In Situ Chemical Reduction

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Background/Objectives. Chlorinated volatile organic compounds (cVOCs) were historically released into the subsurface at two confidential former dry-cleaning sites, including one in Pennsylvania, and another in Washington State. As a result, perchloroethylene (PCE) and its degradation daughter products (predominantly trichloroethylene [TCE] and cis-dichloroethylene [cis-DCE]) were present in soils and groundwater that required remediation. The Pennsylvania site was underlain by tight soils including clays and silts, which were in turn underlain by mica schist bedrock. The Washington site was underlain by silty sand with gravel which was in turn underlain predominantly by dense silt. The objectives for both sites included reduction of cVOC concentrations to below site-specific cleanup goals.

Approach/Activities. Based on pre-remediation characterization of both sites, a strategy involving the combination of bioaugmentation (ISB) and in situ chemical reduction (ISCR) was chosen for evaluation during a treatability study, and for full-scale injections. For both sites the lithology in the planned treatment zone consisted of tight soils through which conventional injections would have limited effectiveness for the distribution of amendments. Pneumatic enhancement (PE) was selected to optimize the delivery of amendments throughout the treatment zones. Injections were performed at both sites as part of a treatability study to evaluate the performance of both ISB and ISCR, and to optimize delivery for full-scale injections. Full-scale injections were implemented at both sites followed by performance monitoring.

Results/Lessons Learned. Performance monitoring for cVOCs and relevant biogeochemical parameters was performed following the treatability study and full-scale injections at both sites. Based on performance monitoring, cVOCs were effectively being degraded and/or destroyed. Results will be presented along with lessons learned regarding optimization of injections using PE both in exterior areas and within existing structures.