SANITARY LANDFILL OPTIMIZATION TEST FOR REMEDIATION OF CHLORINATED SOLVENTS

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ABSTRACT: Leachate from a sanitary landfill at the Department of Energy's Savannah River Site in South Carolina has contaminated groundwater with chlorinated solvents, predominantly trichloroethylene (TCE), vinyl chloride (VC), and chlorobenzene (CB). In situ bioremediation was selected from over 50 remediation strategies to be the most cost effective while minimizing environmental impact. An optimization test was performed to determine operating parameters required for aerobic biodegradation of the contaminants of concern.

Two sites (1 and 2) were chosen for the optimization test; each site consisted of three injection wells, one central vapor extraction well, and several multilevel vadose and saturated zone piezometers. Site 1, dominated by leachate from the most recently filled side of the landfill, appeared to be carbon limited and was contaminated mostly with TCE, while Site 2, located near the oldest part of the landfill, was oxygen limited and contained VC and CB. The injection campaigns were air alone, air + nitrous oxide (N_2O), air + N_2O + triethylphosphate (TEP), and air + N_2O + TEP + methane. A second test was inducted using helium tracer to distinguish diffusion from biodegradation of contaminants and oxygen levels. The helium served as an internal standard for degradation of methane and for the TCE at Site 1. Air sparging/soil vapor extraction alone resulted in reduction of contaminant levels at both sites to near detection limits over a period of approximately 4 weeks. The system was then shut down for 5 weeks, and contaminants rebounded to values closer to the pretest levels. The above injection campaigns were then the injection of air and nutrients only, while at Site 1, methane was required to achieve removal of contaminants to below detect levels. These findings are a consequence of the significant differences in site characteristics and contaminant makeup at the two test locations. Site 2 contains significant concentrations of CB which when degraded aerobically will serve as an inducer/energy substrate for the biodegradation of VC. Site 1 contains no energy/inducer organic substrate and the injected methane stimulated the biodegradation of TCE.

At both sites air stripping of contaminants by the injection process was insignificant. Instead, contaminant removal was due to biological degradation, as it correlated with increase in chloride ion and in microbial counts, and the ratio of helium to biologically depleted substrate. The wide range of contaminants degraded in test plots with distinct site characteristics demonstrates the flexibility

of in-situ aerobic bioremediation as a promising treatment technology for sanitary landfills.