

Thermally Enhanced Attenuation of Substituted Benzenes

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Abstract. Past practices have led to frequent releases of chemicals at petroleum refineries and chemical production facilities. Many of the released compounds have the potential for significant health risks. Petroleum hydrocarbons are attenuated naturally under anaerobic conditions. Recent research has shown that maintaining soil temperatures in the range of 20°C to 30°C dramatically increases rates of anaerobic degradation of petroleum hydrocarbons. The hypothesis of this research is that the same is true for substituted benzenes such as chlorobenzene and nitrobenzene. Substituted benzenes, used for various consumer products, are slow to degrade anaerobically. To evaluate the feasibility of thermal enhancement as a remediation technique for substituted benzenes, anaerobic soil microcosms were constructed using soils from a site that has been used for chemical manufacturing for more than a century. Microcosms have been held at temperatures ranging from 10°C to 30°C, and biogas production has been monitored. Thus far, substituted benzene microcosms have produced less biogas than previous petroleum microcosm studies. This suggests that the kinetics of degrading substituted benzenes are much slower than petroleum hydrocarbons. At the conclusion of the experiment, initial and final contaminant concentrations will be compared to determine the extent of biodegradation rate enhancement at each temperature. In addition, a multilevel sampling device was installed at the field site. The device allows for the determination of water quality, temperature, and resistivity values as a function of depth. Additionally, carbon dioxide fluxes are being determined at the ground surface to evaluate the amount of mineralized contaminants. Results will be used to evaluate the feasibility of thermally enhanced anaerobic degradation as a remedial strategy for substituted benzenes.