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# Field-Scale Evaluation of Biosparging to Mitigate Long-Term Dissolution and Mass Discharge of Contaminants from Coal Tar and Creosote

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**Background/Objectives.** Aerobic biooxidation of dissolved-phase petroleum hydrocarbons (including tar and creosote-related compounds) occurs naturally or via engineered applications when suitable microbial populations and geochemical conditions are present in the aquifer. During aerobic biooxidation, microorganisms utilize hydrocarbons as electron donors in the presence of oxygen as the primary electron acceptor. Although aerobic treatment mechanisms are limited by the low solubility of oxygen in groundwater and the rapid consumption of oxygen by competing scavengers, aerobic biooxidation is thermodynamically favored and can be cost-effectively implemented using biosparging. Biosparging is a proven, effective remediation technology for dissolved hydrocarbons typically observed in groundwater at coal tar and creosote sites. However, the ability to effectively remove hydrocarbon contaminants from coal tar and creosote and mitigate the dissolution risk to groundwater using biosparging is uncertain.

**Approach/Activities.** Engineered applications of biosparging were implemented at a former manufactured gas plant (MGP) site in Florida and a former wood-treating site in Montana. At the Florida site, water-gas tar DNAPL is a source of dissolved-phase VOCs and polycyclic aromatic hydrocarbons (PAHs) to groundwater migrating offsite. Following a 9-month biosparge pilot study at the site boundary to enhance aerobic biooxidation of VOCs and PAHs, the biosparge system was expanded in 2016 to decrease offsite mass flux, and achieve treatment criteria offsite. A portion of the biosparge system is positioned within the DNAPL tar source area to promote contaminant weathering and further reduce the time that the tar is a source to groundwater.

At the Montana site, creosote DNAPL is primarily a source of dissolved pentachlorophenol (PCP) and PAHs to groundwater. A 10-month biosparge pilot study was completed in 2016 in a portion of the creosote source area to evaluate the ability of biosparging to reduce the mass of PCP and PAHs in soil (DNAPL) and groundwater. The pilot study included baseline and post treatment collection and analysis of soil and groundwater samples to estimate the effective removal of PCP and PAHs from the creosote and mitigate mass discharge of PCP and PAHs to groundwater.

**Results/Lessons Learned.** At the Florida site, biosparging decreased the concentrations of VOCs and PAHs in groundwater to the target criteria and resulted in clean groundwater migration offsite. In addition, the mass fraction of VOCs and PAHs in the coal tar DNAPL decreased in areas influenced by biosparging. At the Montana site, decreasing trends in soil concentrations of PCP and some PAHs indicated biosparging changed the composition of the creosote. The results from the pilot studies and chemical composition analysis of the DNAPLs at both sites were used to model the enhanced depletion of contaminants from the DNAPLs and evaluate the feasibility of achieving remedial objectives in the DNAPL source areas with biosparging.