DESIGN AND INSTALLATION OF AN INNOVATIVE ENHANCED BIOREMEDIATION PILOT TEST IN A TIDAL WETLAND

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An innovative, enhanced bioremediation pilot test was designed and installed in a seep area at the ground-water/surface-water interface within the tidal wetland along West Branch Canal Creek at Aberdeen Proving Ground, Maryland, to treat a mixture of dissolved chlorinated methanes, ethenes, and ethanes. The new treatment method, a bioreactive mat, consists of a permeable, organic-based bioaugmented matrix placed horizontally on the seep surface to provide a zone of enhanced degradation for the upward-flowing ground water before the contaminants reach the surface water. This approach to treatment was initiated due to the unique challenges and constraints at the site for implementing more traditional ground-water treatment methods to contaminated ground water discharging to wetlands.

The design approach aimed to maximize contaminant degradation while achieving geotechnical, hydraulic, and geochemical compatibility with the sensitive freshwater, tidal wetland environment. First-order degradation rates were estimated by circulating increasing concentrations of site contaminant mixtures through continuous, up-flow columns comprised of a commercially available compost, peat, and sand matrix (with and without zero-valent iron). Columns were bioaugmented with a mixed anaerobic consortium developed by the U.S. Geological Survey (USGS) from nearby wetland sediment and biostimulated with lactate. The tolerable thickness of the bioreactive mat at this site was determined based on sediment strength, bearing capacity, and estimated settlement over time.

The bioreactive mat was comprised of two primary reactive zones— a lower zone (nearest the sediment) designed to enhance abiotic degradation of chlorinated methanes, and an upper zone designed to enhance biodegradation of the remaining chlorinated methanes, ethanes, and ethenes. The lower zone was comprised of zero-valent iron filings and an organic matrix consisting of commercially-available compost, peat, and sand. The upper zone was comprised of a compost, peat, and sand matrix and was bioagumented with WBC-2, an anaerobic consortium developed by the USGS and propagated *in vitro* to larger quantities and applied in the field by SiREM Laboratory. Chitorem™ was mixed into both zones as a long-term electron donor and buffering agent.

Pilot-test monitoring is being conducted for one year and is ongoing. Preliminary results indicate that the bioreactive matrix was able to achieve and sustain strongly methanogenic conditions. Dechlorinating activity was verified in the laboratory from samples collected from within the bioreactive mat after deployment and after the winter months. Contaminant profiles from the base of the bioreactive mat to land surface show an overall decline in contaminant mass and the transient accumulation of daughter products, indicating that biodegradation is occurring within the two zones.

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