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USGS Maryland-Delaware-District of Columbia Water Science Center

Seminar Series

Wednesday, May 20, 2015 11:00 a.m.

Fate and Remediation of Chlorinated Benzenes and Benzene in a Wetland

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Anaerobic and aerobic biodegradation processes that can be advantageous for contaminant remediation can co-occur in areas of groundwater-surface water interactions, such as wetlands. Bioremediation is being evaluated to address high concentrations (greater than 80 milligrams/liter) of chlorobenzenes and benzene in a freshwater wetland at a Delaware Superfund site. *In situ* microcosms incubated 25-55 cm below the wetland surface showed that that both aerobic and anaerobic biodegradation can occur in the wetland and that bioaugmentation with WBC-2, a dechlorinating culture developed for degradation of chlorinated ethanes and ethenes, could enhance degradation.

Analysis of *in situ* microcosm samples for functional and taxonomic genes involved in biodegradation of benzene and chlorinated solvents showed that bioaugmentation with WBC-2 resulted in one to five orders of magnitude higher quantities of both anaerobic and aerobic targeted microbial populations than observed in the unamended or biostimulated microcosms. ^{13}C-labelled testing verified that anaerobic and aerobic degradation of monochorobenzene is possible in the wetland sediments. In flow-through laboratory bioreactors seeded with WBC-2 compared to those seeded with the native microbial community, degradation efficiencies were similar for tri- and di-chlorobenzenes in both sets of reactors under anaerobic conditions, but degradation rates for monochlorobenzene and benzene increased under aerobic conditions in the native microbial community.

Additional experiments are underway to evaluate bioremediation approach that uses a reactive barrier on the wetland surface composed of a sorbent matrix (granular activated carbon) coated with biofilms of both WBC-2 and a native aerobic culture enriched from the wetland sediment, allowing simultaneous anaerobic and aerobic biodegradation.

Dr. Michelle Lorah is a Research Hydrologist and has been with the U.S. Geological Survey in the Maryland Water Sciences Center since 1985, where she directs the Fate and Bioremediation Team. She has a Ph.D. in Environmental Chemistry through the Marine-Estuarine-Environmental Sciences Program at the University of Maryland, a M.S. in Environmental Science from the University of Virginia, and a B.S. in Geosciences from Penn State University. Her research focuses on bioremediation of organic contaminants in complex hydrogeologic environments, including wetlands and fractured rock. Learn more about Dr. Michelle Lorah at: https://profile.usgs.gov/mmlorah

This presentation will also be available remotely via Webex: https://usgs.webex.com/

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