New Advances in Phytoremediation and Keys to Success on Challenging Sites

Galen O'Toole, John L. Freeman, and Renee Murphym (Intrinsyx Environmental)

Background/Objectives. In 2014, Intrinsyx Environmental collaborated with NASA to introduce endophytic bacteria from Dr. Sharon Doty with hybrid poplar trees to address TCE groundwater contamination at the MEW Superfund site (Doty et al., 2017 ES&T). During the last seven years, the first pilot on the MEW site expanded to a full-scale solution, and there are now more than 30 endophyte-assisted phytoremediation deployments on Superfunds, state-mandated cleanups, and Fortune 500 redevelopment sites across the U.S. Endophyte-enhanced tolerance and appropriate tree selection of unique varieties are newly discovered keys to successful phytoremediation on polluted sites with phytotoxic concentrations of both organic and inorganic constituents.

Approach/Activities. This presentation covers design methodologies and data from full-scale phytoremediation projects currently deployed, as well as lessons learned from utilizing Endophyte-Assisted Phytoremediation System (EAPS) technology. These synergistic bioremediation tools and innovative techniques have been deployed to address several classes of pollutants, including chlorinated VOCs, petroleum hydrocarbons and 1,4-dioxane alone and in mixed wastes. Data will be shared from several active remediation installations where grass, tree and plant species have been inoculated with endophytes that were previously identified and isolated by Dr. Doty at University of Washington.

Results/Lessons Learned. Success with phytoremediation comes from careful site assessment and selection of appropriate tree and microbe varieties. Data and lessons learned will be highlighted from contaminated sites across the U.S. where EAPS is currently installed to treat chlorinated solvents (PCE/TCE/DCE), 1,4-dioxane, and petroleum compounds in soil and groundwater. We have learned many lessons along the way, including additional confirmation that endophytes contribute to phytoremediation success and improved plant establishment, in-planta degradation, and enhanced source-zone depletion rates. Data suggest that selection and application of appropriate endophytes are the key factors in plant establishment on sites with phytotoxic concentrations of petroleum hydrocarbons or chlorinated solvents. Additionally, selecting site-appropriate tree varieties and providing them with consistent care is vital for establishment and long-term success on contaminated sites. EAPS now represents a standalone treatment for mitigating contaminant migration and in situ degradation of soil and groundwater contaminants.