RESEARCH CATEGORY: 6.3 Advanced Development

LEAD AGENCY: U.S. Army

LAB: Cold Regions Research and Engineering Laboratory - Hanover, VT

PRINCIPAL INVESTIGATOR: Dr. Charles M. Reynolds, (603) 646-4394

FY 1997 COMPLETED PROJECT

OBJECTIVE: The objective of this project was to develop rhizosphere-based remediation systems to improve bioremediation ability in areas subject to low temperatures. The quantity of soil that requires treatment necessitates using techniques that expose soil to seasonal temperature cycles and extended periods of freezing. The net influence of freezing temperatures on the overall rate and extent of soil biotreatment is not sufficiently known to exploit or manage biotreatment systems in advantageous ways. Enhanced microbial activity in rhizosphere zones is documented for some pesticides. The effort utilized a sampling method developed to address the primary technical risks: the difficulties in getting sufficiently precise data to show treatment effects and in evaluating nutrient competition between the selected plant and soil microbial populations.

BENEFIT: The benefit is savings in cost, time, and liability. Savings are site specific and largely a function of available alternatives, but costs using rhizosphere-enhanced remediation are conservatively estimated to be one-tenth that of currently available alternatives. Results from conducting monitored, documented, and defensible demonstrations of rhizosphere-enhanced biotreatment options could be readily field implemented where appropriate. These low-cost alternatives would be applicable in both northern and temperate regions. Additionally, the methodology and lessons learned will be useful as we extend this type of treatment to other compounds.

ACCOMPLISHMENTS: In FY97, results have documented enhanced populations of contaminant degrading microorganisms and greater degradation in rhizosphere soil in laboratory studies. Research efforts have extended these results to a field research site in Alaska. This may offer a significant mechanism for low-cost soil treatment. We have shown that limitations to bioremediation at remote sites can be overcome by stimulating soil-rhizosphere effects and will be further quantifying and demonstrating this process.

TRANSITION: This effort will transition through: 1) the Environmental Security Technology Certification Program (ESTCP) project, Field Demonstration of Rhizosphere-Enhanced Treatment of Organics-Contaminated Soils on Native American Lands with Application to Northern formerly used defense (FUD) Sites; 2) ongoing reimbursable field projects; and, 3) applied research work units in the Army Environmental Quality Technology Program.