Natural Attenuation of Explosives in Soil and Water Systems at DoD Sites

Cleanup
CU-1043

RESEARCH CATEGORY: 6.2 Applied Research

LEAD AGENCY: U.S. Army

LAB: Waterways Experiment Station - Vicksburg, MS

PRINCIPAL INVESTIGATOR: Dr. Judith C. Pennington, (601) 634-2802

FY 1998 COMPLETED PROJECT

OBJECTIVE: Natural attenuation may be an attractive alternative to more expensive remediation technologies at sites that meet well-defined selection criteria, acceptable risk levels, and that satisfy specific regulatory concerns. However, a significant unanswered question associated with natural attenuation is what processes are relevant and require monitoring to assure that attenuation is effective. Application of existing biomarker and stable isotope technology to in-situ monitoring for natural attenuation of explosives holds the greatest promise for addressing this question. Specific objectives of this project are to (a) identify partner(s) for investigating potential biomarkers, (b) initiate development of mesocosms, and (c) develop an approach for the application of stable isotopes to natural attenuation monitoring.

BENEFIT: Development of effective biomarkers for monitoring natural attenuation will permit application of this technology to sites meeting appropriate selection criteria. Cost of pump-and-treat remediation is approximately $300 per ton, while natural attenuation cost is estimated to be $30 per ton. In addition to the significant cost-saving potential, this project will provide support for and become an integral part of an ESTCP-funded effort for demonstrating natural attenuation of explosives.

ACCOMPLISHMENTS: In FY98, results of studies to verify earlier FY97 result indicate that as extractable TNT concentrations decrease over time in soil mesocosms, the stable isotope ratios of carbon and nitrogen remain unchanged. The sampling protocol has been finalized and implemented with the ten sampling rounds at Joliet Army Ammunition Plant (JAAP) and will be followed at Crane Naval Surface Warfare Center and in an extended sampling program at Louisiana Army Ammunitions Plant (LAAP). Site specific rate and capacity parameters for explosives determined in LAAP groundwater were incorporated into the existing modeling codes. These parameters were used in the modeling of groundwater at JAAP as well as at LAAP. Results for JAAP are included in the draft completion report submitted to the Industrial Operations Command, Rock Island, IL. Three tests have been developed to assess microbial degradation potential of TNT and RDX contaminated sites. These include a mineralization radioassay, lipid biomarker analyses and nucleic acid biomarker analyses. These tests have been integrated into the draft A Protocol for Evaluation and Implementation of Natural Attenuation at Explosives-Contaminated Sites. A complete description of site geology based upon well and CPT data has been completed for LAAP and JAAP.

TRANSITION: This project will transition widely to Department of Defense (DoD) sites contaminated with explosives. The development of effective biomarkers for monitoring natural attenuation will permit application of this technology to sites meeting appropriate selection criteria. Furthermore, appropriate selection criteria will lead to enhanced acceptance of remediation technologies with regulatory agencies and other users concerned with the ultimate safety and environmental effects of explosives.