Proceedings of the 8th International Conference on Environmental Science and Technology
Lemnos Island, Greece, 8 – 10 September 2003
Full paper Vol. A, pp. 973 - 981

STUDY OF ENVIRONMENTAL IMPACT AND NATURAL ATTENTION OF EXPLOSIVES

M. ZAKIKHANI, D. W. HARRELSON, J. C. PENNINGTON, J. M. BRANNON, M. K. CORCORAN, J. CLARK and W. A. SNIFFEN

The U.S. Army Engineer Research and Development Center (ERDC)
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS 39180-6199
E-mail: Mansour.Zakikhani@erdc.usace.army.mil

EXTENDED ABSTRACT

Manufacturing and loading, assembling packaging, and waste disposal of explosives have resulted in contamination of soil and groundwater at several sites in USA. This disposed waste predominantly consisted of 2,4,6-trinitrotoluene (TNT) and 1,3,5-trinitro-1, 3,5-hexahydrotriazine (RDX). Several processes of biotic and abiotic transformation, microbial degradation, and immobilization by chemical reactions between contaminants and organic matter or clays affecting the attenuation of TNT and RDX. The objective of this project has been to demonstrate natural attenuation of explosives at the selected sites. Groundwater monitoring procedures were optimized to generate reliable trends in explosives concentrations over time. Batch and column partitioning studies were used to evaluate the significance of site capacity on ultimate fate and transport of the explosives. Both biomarker and stable isotope techniques were investigated for use as monitoring tools. The groundwater modeling system was used for contaminant plume definition and predictions of future contaminant extent. The field demonstration was conducted at the several sites in USA. The demonstration included groundwater monitoring, modeling, and a cone penetrometry sampling event to characterize site lithology and to obtain sample material for other parts of the study. Results demonstrated declining concentrations of explosives in groundwater over the two-year monitoring period. Contaminant mass declined and the groundwater model predicted a shrinking plume in a 20-year simulation. Biomarkers demonstrated the microbial degradation potential of RDX and TNT in aquifer soils and provided an estimate of degradation rates. Use of stable isotope ratios of nitrogen in TNT extracted from groundwater was a promising indicator of attenuation. Results demonstrated that natural attenuation is a viable option, which should be among the options considered for remediation of explosives contaminated sites. Natural attenuation of contaminants has provided a very cost-effective alternative remediation for the sites.

Key words: Natural attenuation, explosives, numerical modeling, CPT