

Development Of Assessment Tools For Evaluation Of The Benefits Of DNAPL Source Zone Treatment

Background:

The evaluation, reduction, and management of risk at Department of Defense (DoD) chlorinated solvent contamination sites pose distinct technological challenges. To reduce containment costs and achieve mass reduction within an acceptable time frame, several alternative treatment technologies have been developed. These technologies include air sparging, co-solvent flushing, surfactant flushing, chemical oxidation, and thermal treatment. Despite documented successes in reducing contaminant mass within the source zone, none of these current technologies can be expected to remove all dense non-aqueous phase liquid (DNAPL) contaminants, even under favorable conditions. The residual contamination may lead to continued and persistent contaminant elution. Unfortunately, reliable tools are not currently available to predict or monitor plume development and attenuation or organic mass flux reduction after source zone treatment, or to conduct a cost/benefit analysis of potential treatment technologies.

Objective:

The primary objective of this research is to develop and evaluate a suite of tools that can be utilized by site managers to: (1) predict and monitor plume development following DNAPL source zone treatment and (2) perform cost/benefit analysis during the selection of a source zone remediation technology.

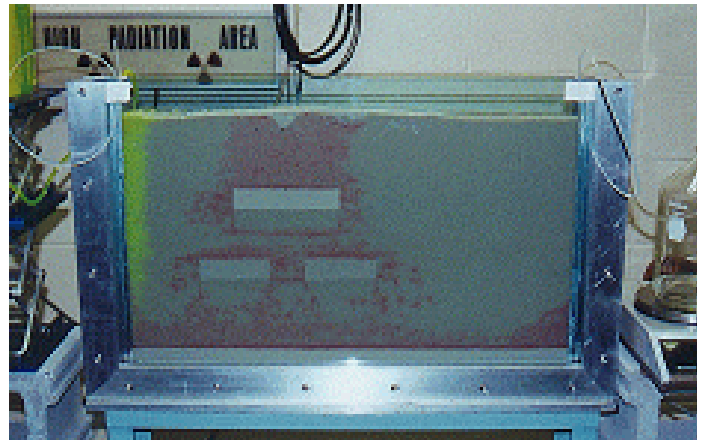
Summary of Process/Technology:

Despite the importance of evaluating alternative site remediation/management options, relatively little research has been conducted to assess the post-treatment distribution, mass transfer, and biotransformation of DNAPLs following in-situ flushing treatments. This research is a multidisciplinary integration of laboratory, field, and modeling studies designed to provide a more comprehensive understanding of the impacts of DNAPL source zone treatment on contaminant mass fluxes, contaminant bioavailability, and future plume development. The effect of DNAPL source zone treatments on dissolved-phase contaminant concentrations in heterogeneous aquifer systems will be quantified under controlled laboratory conditions that are representative of DNAPL field sites. The potential for microbial reductive dechlorination following source zone treatment by surfactant flushing and air sparging will also be evaluated. A multiphase remediation simulator for applications to field-scale source zone mass removal estimation and post-treatment contaminant mass flux predictions in a variety of settings will be refined and validated. Using the bench scale measurements and

numerical simulations, sampling protocols designed to quantify near source zone contaminant mass flux and to estimate the uncertainty in these flux estimates will be developed and evaluated. Finally, cost-benefit analysis “tools” that will provide site managers with an efficient and effective means to compare alternative source zone treatment methods, relative to baseline pump-and-treat plume containment, will be developed.

Benefit:

This project will contribute to the development of reliable methodologies to predict or monitor plume development and attenuation or organic mass flux reduction after source zone treatment under heterogeneous field conditions. Results will provide site managers with tools and protocols designed to assess the effectiveness and cost-benefit potential of DNAPL source zone treatments. Such tools will be of great benefit to DoD site managers engaged in remedial option selection and implementation at DNAPL contaminated sites.



Distribution of DNAPL (dyed red) following release into a 2-D aquifer cell containing discrete permeability lenses.

Accomplishments:

This project began in FY 2002. Accomplishments will be noted upon completion of the project. For information on the project's status, see the [timeline of tasks and deliverables](#).

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