ITRC TECHNOLOGY STATUS REPORT

POST-IMPLEMENTATION

In Situ Bioremediation of Chlorinated Ethene: DNAPL Source Zones
BioDNAPL Team
June 2010
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TECHNOLOGY STATUS

Status of the Technology

In situ bioremediation (ISB) of dense, nonaqueous-phase liquid (DNAPL) source zones involves in situ degradation mechanisms in DNAPL source zone remediation efforts. The primary mechanism for this engineered in situ application is reductive dechlorination (destruction) of DNAPL in an anaerobic environment. This application often involves biostimulation (stimulation of the microbial activity in the saturated zone by the addition of an electron donor) and possibly bioaugmentation (the addition of selected microorganism to the treatment zone). Reductive dechlorination occurs with chlorinated ethene only in the dissolved phase and has been a known mechanism for over a decade. Its application to DNAPL source removal progressed primarily with the realization that, by increasing the concentration gradient at the DNAPL-water interface, the rate of DNAPL dissolution can be increased.

New information is continually emerging on methods to stimulate the organisms, materials used as electron donors, distribution/injection methods, source characterization tools, and methods; however, the reaction mechanisms and concept of reductive dechlorination at the DNAPL/water interface remains valid.

Evolution of the Technology

During the two years since ITRC implementation began, the BioDNAPL Team Leader has observed that this source destruction technology has been used as a common practice when site conditions accommodate ISB of DNAPL, potential exposure suggests source removal and source removal can be measured. ISB of DNAPL may require long treatment periods, and the effect of source removal may not be measured in the plume for months or years. However, the increased use of mass flux estimates in the analysis of site remediation are encouraging increased use of ISB of DNAPL at source zones to reduce mass flux as an interim remedial objective.

Since June 2008, team members have described the use and usefulness of the guidance through presentations and training to the following:

- New Jersey Department of Environmental Protection

- Colorado Department of Public Health and Environment
- U.S. Army Corps of Engineers, Kansas City
- U.S. Army Corps of Engineers, Concord, Massachusetts
- Langan Engineering
- Battelle, short course, 2009 and 2010
- Strategic Environmental Research and Development Program poster, 2008 and 2009
- Association for Environmental Health & Sciences poster, 2010
- National Ground Water Association short course
- American Institute of Professional Geologists short course
- Air Force Center for Engineering and the Environment article in newsletter for fall and winter, 2008
- Air Force Center for Engineering and the Environment, 2009
- Battelle, 2008 and 2009
- Battelle platform presentation, 2009
- American Academy of Civil Engineers, 2010
- Central Valley Regional Water Quality Control Board, 2010

Feedback during these events provided reinforcement for the increased use of ISB to reduce the mass of DNAPL in the subsurface.

There have been 1374 participants in the Internet-based training sessions, including 350 state employees, 50 Environmental Protection Agency, 29 Department of Defense, 15 Department of Energy, 2 from other federal agencies, 647 consultants, 40 site owners, 19 technology vendors, and 113 from academia. The technical feedback from these courses was positive and encouraging.

ITRC GUIDANCE STATUS

Condition of the Guidance

The guidance document *In Situ Bioremediation of Chlorinated Ethene: DNAPL Source Zones* continues to be valid and useful. A follow-up proposal has been prepared to update the *Introduction to Characterizing Sites Contaminated with DNAPL* (2003) document with information pertaining to DNAPL site characterization tools and to the level of a technical/regulatory guidance document.

Recommendation

The guidance is still valid, should remain on the ITRC site, and should continue to be promoted.