Innovations in Groundwater Remediation

Innovative research conducted by a University of Florida (UF) faculty team offers an efficient and less costly approach to remediating contaminated groundwater.

The traditional pump-and-treat method involves flushing with water to dissolve and extract pollutants. Because contaminants do not dissolve readily in water, this procedure requires using large quantities of water over several decades.

Mike Annable of the UF environmental engineering department taking groundwater samples to evaluate remediation efficiency at the Sages site.

The UF approach is based on injecting mixtures of water, alcohols (co-solvents) and/or detergents (surfactants) into contaminated areas. These additives dissolve nearly 1,000 to 10,000 times more of the contaminant, thereby drastically reducing the clean-up time. The flushing agents dissolve the pollutants, which are then 'flushed' out for disposal or treatment above ground.

The relatively-high cost of water-only remediation leads many companies to stall restoration, accepting less expensive legal fees incurred from delaying clean-up efforts. The UF groundwater remediation method could make site restoration more economically feasible.

An example of the new method's efficiency was demonstrated in a pilot study at the Sage's Dry Cleaner site in Jacksonville, FL. The estimated total cost of the Jacksonville demonstration for PCE source-zone removal was $440,000.

Researchers predict at least a 50% reduction in the initial amount of ethanol needed if ethanol is recovered and reused. Based on the success of this project, the Florida Dry Cleaning Program is considering this innovative technology for full-scale application at the Sage's site, and testing at other PCE-contaminated locations.

STUDY SITES

These new techniques offer several advantages. The following field tests confirm the same:

- **Hill Air Force Base, Utah**
  The first field-scale demonstration of in-situ flushing using two separate techniques was conducted in 1995 and 1996. The first technique used an ethanol-pentanol mixture while the second one used a surfactant (Brij 97) and alcohol (pentanol mixture). Both techniques were used to remove jet fuel/ BTEX (benzene, ethylbenzene, toulene, xylene), pesticides, and volatile and semi-volatile organic compounds (VOCs and SVOCs). Hill Air Force Base was also the venue for the first field-scale demonstration of partitioning tracer test for nonaqueous phase liquid (NAPL) source zone delineation.

- **Borden Canadian Forces Base, Borden, Ontario, Canada**
  This base was witness to the first field test of partitioning tracers measuring a known volume of dense nonaqueous phase liquid (DNAPL). The tracer predicted the perchloroethylene (PCE) volume within 2 percent and ethanol flushing removed 85 percent of the targeted DNAPL.

- **Sage's Dry Cleaners, Jacksonville, Florida**
  This was the venue of the first commercial pilot demonstration of DNAPL removal (specifically PCE) using in-site flushing with ethanol. DNAPLs are common occurrences in dry cleaning activities.

- **Dover Air Force Base, Delaware**
  A known volume of PCE was introduced, which emulates sparse DNAPL distributions found at actual sites. The PCE was removed using in-situ flushing with ethanol. This constituted the first demonstration of ethanol recovery and reuse.

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Sage's Dry Cleaners in Jacksonville, Florida


Free phase PCE collected during in-situ flushing conducted at the Sage's site

OTHER WEB SITES

EPA Hazardous Waste Clean-Up Information
http://www.clu-in.org/

Remediation Technologies Development Forum
http://www.rtdf.org/

Ground Water Remediation Technologies Analysis Center
http://www.gwrtac.org/

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http://www.nttc.edu/env/dod_serdp.html