

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

Application of thermally enhanced vapor extraction at Lawrence Berkeley National Laboratory

### Permalink

<https://escholarship.org/uc/item/5rs2n9sf>

### Authors

Javandel, Iraj  
Freifeld, Barry

### Publication Date

2002-11-02

**Project Type:** Groundwater Remediation  
**Date:** October 11, 2002  
**Document Type:** Abstract  
**Functional Area:** Regulatory Compliance/Interaction  
**Operation Office:** Oakland

## Application of Thermally Enhanced Vapor Extraction at Lawrence Berkeley National Laboratory

Iraj Javandel and Barry Freifeld

### ABSTRACT

A plume of contaminated groundwater was found near the site of the first Berkeley Lab cyclotron. Detailed investigations have identified the source area and determined the vertical and lateral extent of the contamination. The total mass of dissolved chlorinated hydrocarbons, the main contaminants in the plume, was estimated to be about 7 kilograms. The source area is located within heterogeneous geologic materials consisting of both volcanic and sedimentary rocks. The hydraulic conductivity of these materials varies between  $10^{-5}$  and  $10^{-9}$  m/s. A combination of soil heating and vapor extraction techniques was used in a pilot test to remove the chlorinated hydrocarbons from very low permeability geologic materials of the source area. Resistive heating raised soil temperature to a maximum of 200 degrees Celsius. Three heaters, each of approximately 5.3 kilowatts capacity, were placed in three wells at 20 to 40 ft. depth. Heater wells were drilled 6 ft. apart, at the apexes of an equilateral triangle. Both liquid and vapor were extracted from a well at the center of the triangle. Two instrumented wells were installed within 2 ft. of one of the heaters. Temperatures were measured along the heater well casings, the extraction well and at various depths in the instrumented wells. In addition, soil gas probes and lysimeters were installed at various depths in the instrument wells. Soil vapor and soil water from all sampling points were collected and tested periodically. Flow rate and chemical composition of soil gas samples collected at the top of the extraction well were measured. The total mass of perchloroethene, trichloroethene and carbon tetrachloride removed through vapor extraction exceeded 500 kilograms during the 14-month long pilot test.

#### **Lessons Learned:**

- Thermally enhanced vapor extraction is an excellent technique to remove dispersed non-aqueous phase liquids from very low permeability heterogeneous geologic materials.
- Some of the chemicals volatilized may diffuse and condense in areas that were previously clean.

## **Contact Information**

Iraj Javandel

Phone: 510-486-6106

E-mail: [ijavandel@lbl.gov](mailto:ijavandel@lbl.gov)