

US EPA ARCHIVE DOCUMENT



# Bioremediation Feasible Following Physical-Chemical Treatment at Chloroethene-Contaminated Sites?

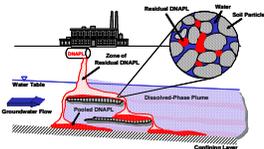
## Overview

### Environmental Issue

Chloroethenes (e.g., PCE and TCE) are

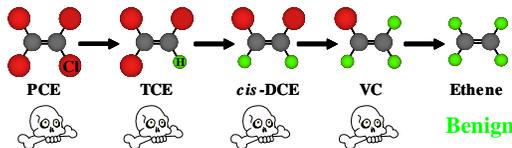
- Toxic and potentially carcinogenic
- Ubiquitous groundwater contaminants
- Form dense nonaqueous phase liquids (DNAPLs) that contaminate drinking water sources for decades

Current physical-chemical treatment technologies are insufficient → Concentrations often above regulatory goals for treatment



## Bioremediation Basics

• Some microbes like to “eat” or “breathe” certain toxic compounds, transforming them into benign products



• Scientists have “fished” to identify microbes that can transform harmful compounds, and bioremediation takes advantage of these natural, biological transformations



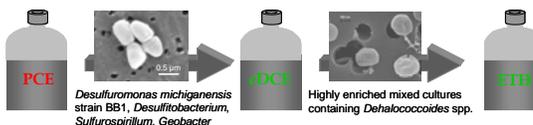
• Engineers, microbiologists, and site managers work together to provide proper conditions and/or add more microbes so that the microorganisms can “bioremediate” contaminated soil and groundwater

## Research Objective

Determine the feasibility of using bioremediation as a polishing step following surfactant flushing

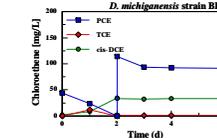
## Methods

- Pure and mixed culture batch experiments
- Evaluate microbial activity in the presence of DNAPL
- Evaluate microbial activity in the presence of Tween 80, a biodegradable, food-grade surfactant commonly employed in surfactant flushing



## Research Highlights

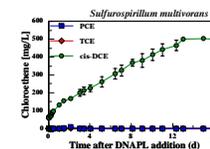
### Dechlorination at High PCE Concentrations



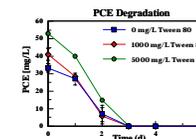
Dechlorination ceased or was severely hindered at high PCE concentrations for all four pure cultures tested

### Dechlorination in the Presence of DNAPL

Sustained dechlorination in the presence of DNAPL observed, even with organisms that cannot tolerate high PCE concentrations



### Surfactant Effect on Dechlorination



Dechlorination proceeds normally in the presence of Tween 80 for most microbes tested, although complete conversion to (benign) ethene has not been observed → Further research needed

## Impact

This research shows that a combination of technologies, bioremediation and surfactant flushing, holds great promise to reduce contaminant concentrations to acceptable levels, allowing a reduction in both remediation costs and time

## Acknowledgements

- Dr. Frank Löffler, Dr. Kurt Pennell, and Eric Suchomel
- For more information visit the Löffler Lab at [www.ce.gatech.edu/research/loefflerlab](http://www.ce.gatech.edu/research/loefflerlab)

## Promising Field Observations

- Surfactant flushing, a physical-chemical treatment, was performed, but PCE levels were still above regulatory limits
- Post-treatment monitoring showed PCE transformation
- Did the surfactant treatment stimulate native microbial activity responsible for PCE transformation?



Han Road Site  
Okemos, Michigan

## Scientific Approach

### Promising Solution

Bioremediation can be used as a “polishing” step to reduce contaminant concentrations to acceptable levels following physical-chemical treatment (e.g., surfactant flushing)