

# KB-1®

## Case Study

### Client:

URS Corporation  
Denver, Colorado

### Site Location:

Spill Site 7 (SS7)  
FE Warren AFB  
Cheyenne, Wyoming

### Project Duration:

Full-scale  
bioaugmentation 2007/  
ongoing monitoring

### Services Provided:

- Biotreatability Testing
- KB-1® Bioaugmentation
- Gene-Trac®  
*Dehalococcoides* testing

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## KB-1® Bioaugmentation Using Hydraulic Fracturing at a Low Permeability TCE Site

### Project Highlights

- Effective bioremediation remedy implemented in a low permeability unit
- TCE MCLs reached in half the expected time-frame
- Remedy-In-Place designation by Wyoming DEQ and EPA within 2 years
- Project won Assoc. of Consulting and Engineering Companies, Engineering Excellence Award for Colorado with submission “Empowering Nature, Delivering Results”

### Problem Definition

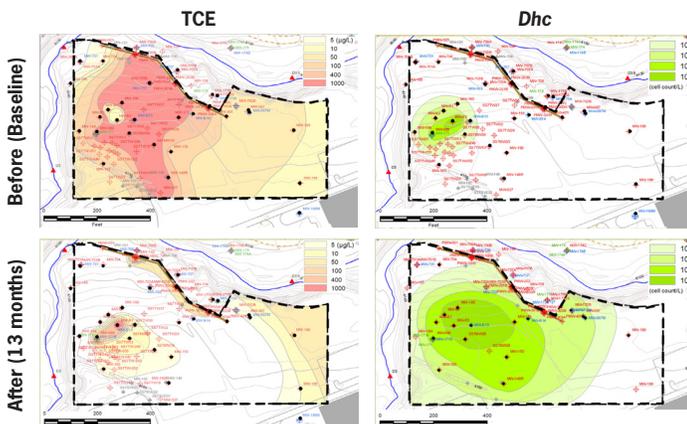
Widespread trichloroethene (TCE) contamination at Spill Site 7 (SS7) was present from releases at a liquid oxygen facility that operated from 1960-66. Site geologic units are low permeability including interbedded clays. Gene-Trac® testing indicated that dechlorinating *Dehalococcoides* (*Dhc*) microorganisms were not widely distributed.

### Solution

Results from a bench-scale biotreatability study demonstrated that biostimulation and KB-1® bioaugmentation (to add *Dhc*) were required to promote complete conversion of TCE to ethene. A pilot test indicated hydraulic fracturing could be used to deliver electron donor into the low permeability geologic materials, followed by pneumatic injections to disperse KB-1® into fractured zones. Following successful completion of the pilot test, injection of 310 liters of KB-1® was conducted into 39 injection locations accessing 165 fractures.

### Notable Results

Accelerated degradation of TCE to ethene was observed after KB-1® bioaugmentation. cDCE and vinyl chloride concentrations increased initially and subsequently decreased followed by corresponding increases in ethene. *Dhc* were detected at locations as far as 70 feet from injection locations indicating effective *Dhc* growth and spread in a low permeability unit. Site closure schedule has been expedited by 10 years based on the rapid biodegradation rates achieved.



LEFT: Before full-scale bioremediation TCE plume exceeded 1,000 µg/L (top left-red) over large areas of SS7; 13 months after biostimulation (3 months after KB-1® bioaugmentation) large areas of SS7 (bottom left-white) were below MCLs (5 µg/L) for TCE. Gene-Trac® testing indicated *Dhc* concentrations increased up to 10<sup>8</sup> *Dhc* per liter and *Dhc* spread over much of the site (lower right-green) indicating the establishment of a robust dechlorinating microbial population after addition of KB-1®. Note baseline *Dhc* (top right) was result of KB-1® pilot test performed prior to full scale implementation. Courtesy of URS Corp.