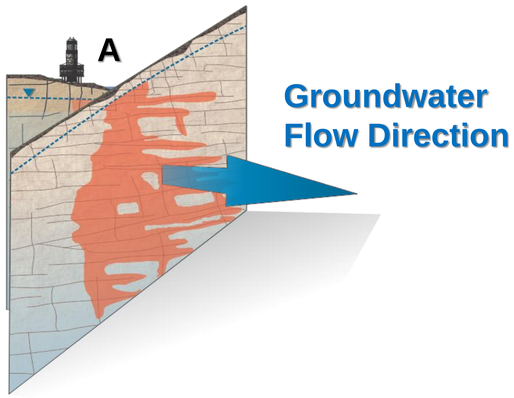
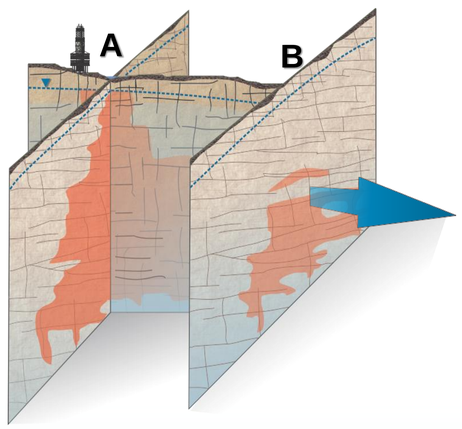
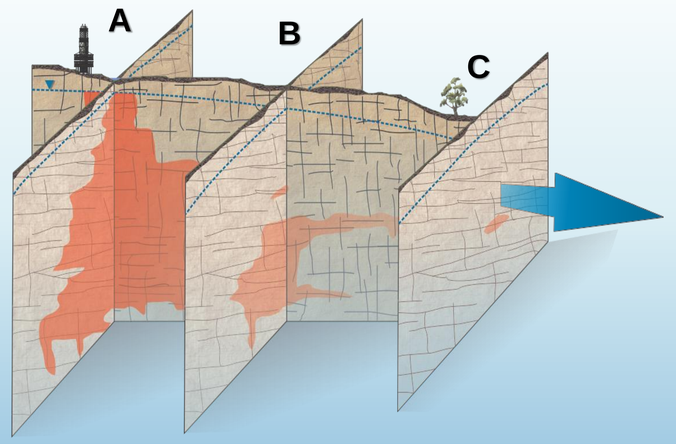
The Northeast Plume

Application of the Transect Approach for Plume Delineation

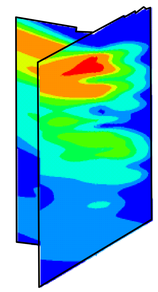
Transect Approach Conceptual Model







Northeast Plume Transect Data

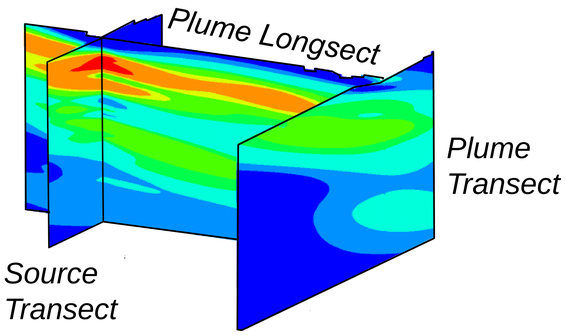


Source Transect

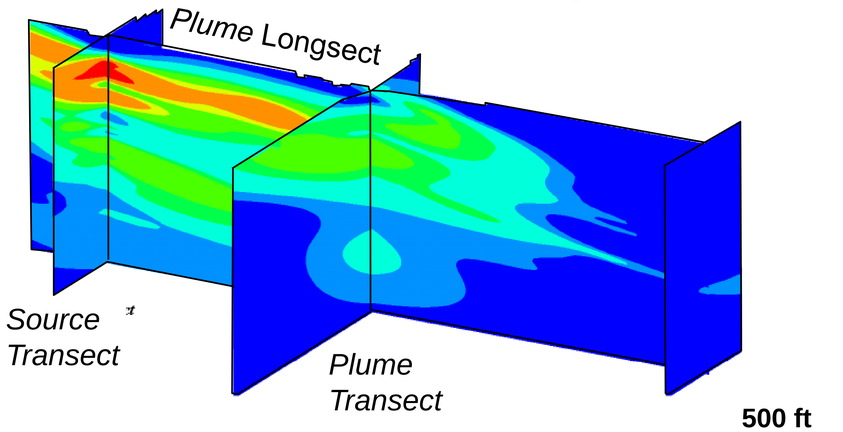
Transects and longsects created from weighted average of rock core concentrations (20ft intervals) and groundwater concentrations. Kriging done in 3-D with 8 degree dip along longsect and 15 degree dip along transects (Anisotropy = 10). The Y axis was oriented to the plume longsect.

Total Equivalent TCE µg/L

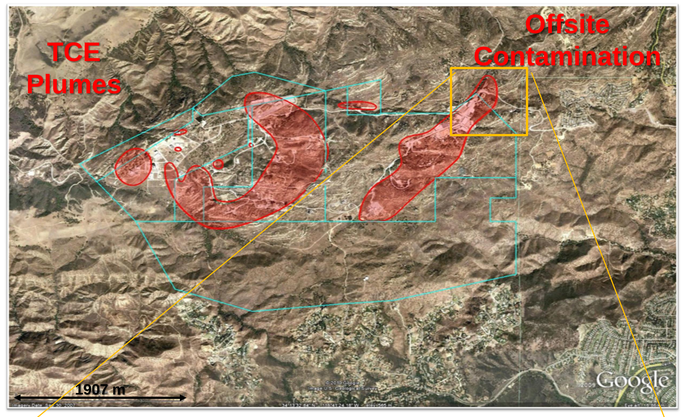
5 10 50 100 500 1000 5000

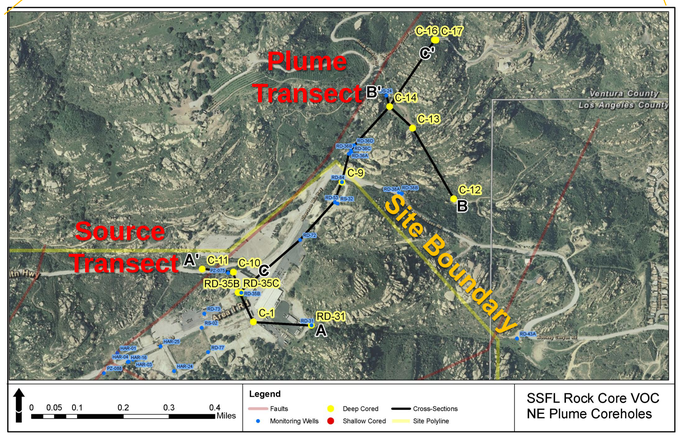


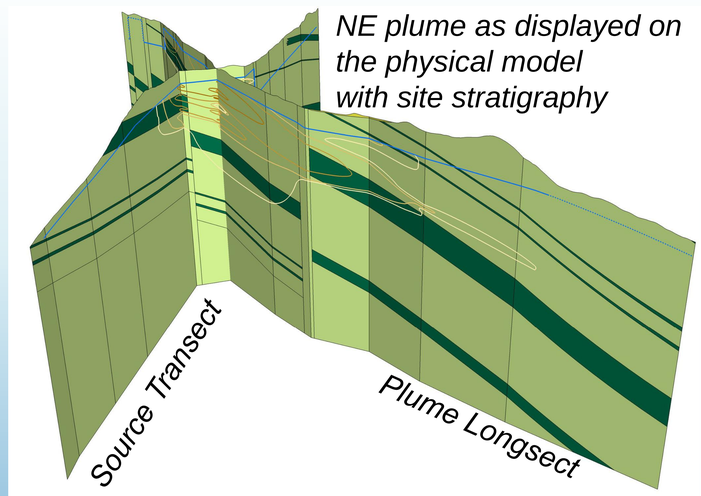
Length of Longsect: 3055ft
Figure is scaled 1:1



Location and geology of Transects and Longsect



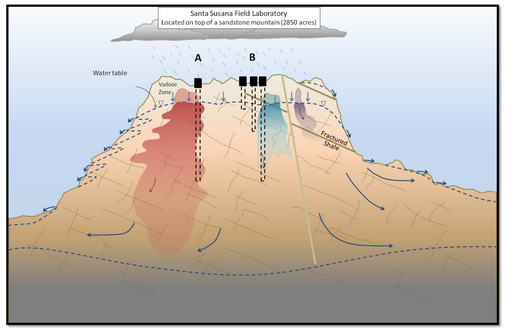




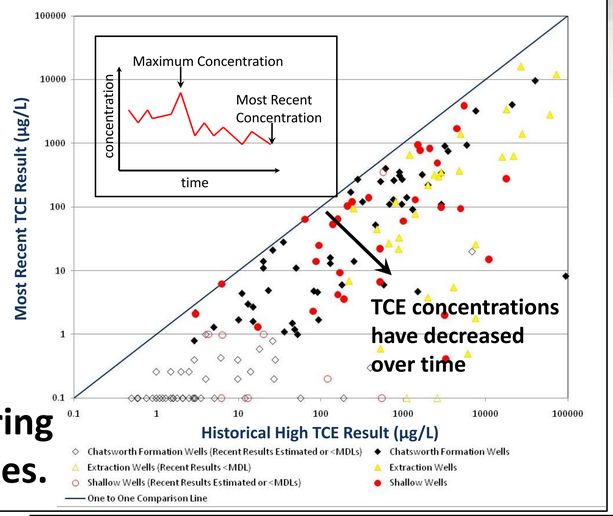
NE plume as displayed on the physical model with site stratigraphy

Poster Prepared by Jonathan Kennel and Kristina Small, G360, June 24th 2011

Evidence for Natural Degradation of Trichloroethene in Chatsworth Formation Groundwater, SSFL

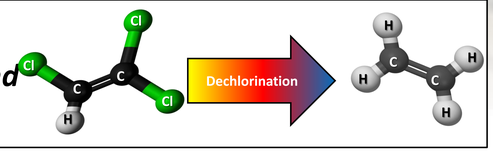


Evidence of TCE degradation products in groundwater samples from conventional monitoring wells prompted 3 groundwater degradation studies.



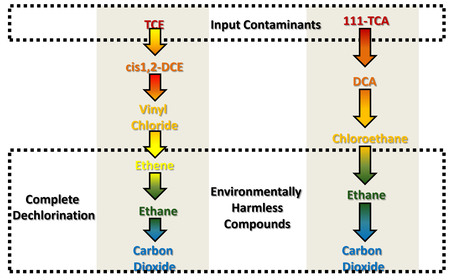
What is degradation?

A compound changes into another compound that may be more or less hazardous.



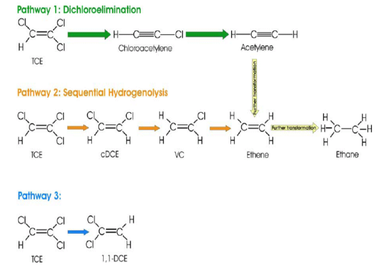
Biotic Pathways

(microbial biodegradation)



Abiotic Pathways

(in the presence of iron-bearing minerals)

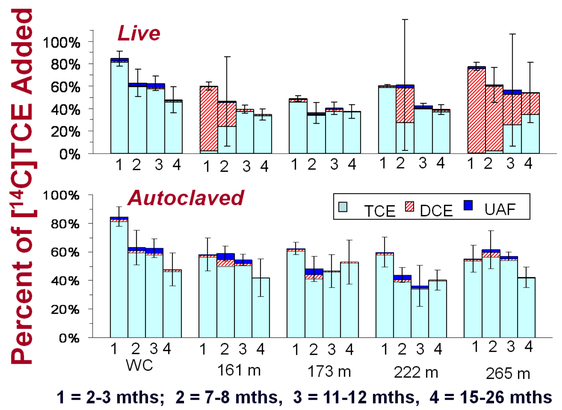


1. Laboratory Microcosm Study

Ramona Darlington, PhD Thesis, Clemson University (2002 – 2008)

Use of carbon-14 labeled TCE, cis-DCE, and VC at field concentrations in live and autoclaved crushed Chatsworth Formation sandstone with monthly monitoring of headspace.

Results from the microcosm study show TCE degrading by both biotic and abiotic pathways.



1 = 2-3 mths; 2 = 7-8 mths, 3 = 11-12 mths, 4 = 15-26 mths

Degradation products were identified in microcosms: *cis*-DCE, VC, ethene, ethane, acetylene and non-soluble residue consisting of formate, glycolate, and acetate

References:

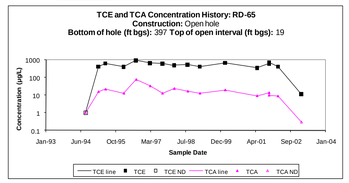
Darlington, R., Lehmicke, L., Andrachek, R. G., Freedman, D. L. 2008 "Biotic and Abiotic Anaerobic Transformations of Trichloroethene and *cis*-1,2 Dichloroethene in Fractured Sandstone." *Environ. Sci. Technol.*

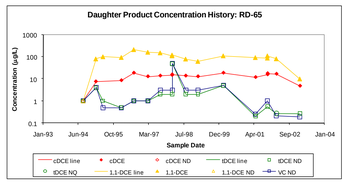
2. Groundwater Field Investigation

Amanda Pierce, MSc Thesis , University of Waterloo (2002 – 2005)

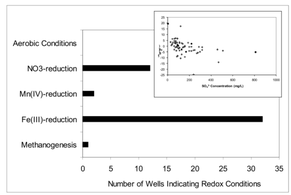
Sampling Methodology:

- ***122 conventional monitoring wells (2003-2004).***
- ***Conventional sampling (dedicated pumps, 3-volume purge)***

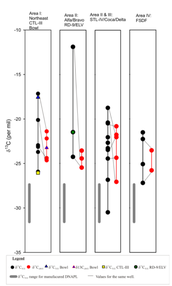




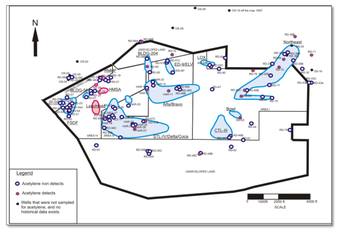
Analysis of groundwater indicates microbial degradation products (cis-DCE, trans-DCE, VC, and ethene)



Reduction/oxidation conditions ideal for microbial reductive dechlorination



Stable isotope analysis confirms degradation.

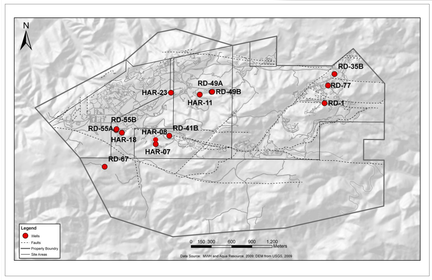


Dissolved acetylene measured in groundwater samples.

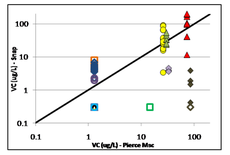
3. Snap Sampler® Field Investigation

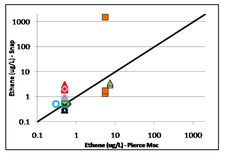
Laura Zimmerman, MASc Thesis, University of Guelph (2008 – 2010)

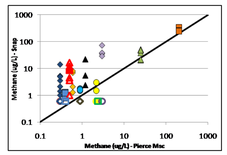
The Snap Sampler® bottles are sealed in-situ to capture volatile compounds indicating dechlorination.



14 monitoring wells chosen for deployment of the Snap Sampler®.







Higher concentrations of dissolved gases in the Snap Samples provide additional evidence of degradation.

Conclusions:

1) Field and lab studies identified biotic and abiotic processes contributing to complete dechlorination of TCE at the SSFL.

2) A general decrease in contaminant concentration with time indicates loss of mass due to degradation processes.

3) Additional studies are in progress to determine the extent of TCE degradation.

Poster Prepared by Amanda Pierce, G360, June 24, 2011