Demonstrating Contaminant Biodegradation in Conjunction with Colloidal Activated Carbon Remediation Technologies

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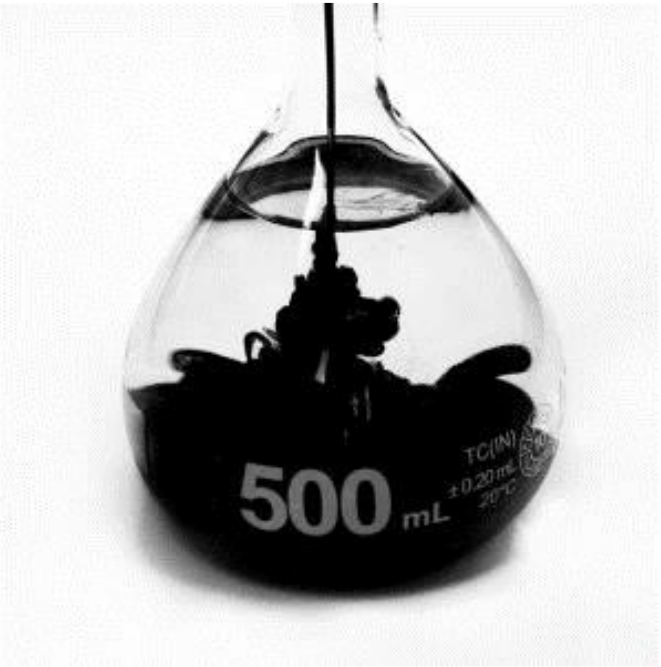
Colloidal Activated Carbon

PLUME STOP
Liquid Activated Carbon

- Colloidal
  - 1 nm to 1 µm
  - Particles Dispersed in Medium
- Activated Carbon
  - Allows Sorption
- Commonly Used with Electron Donor



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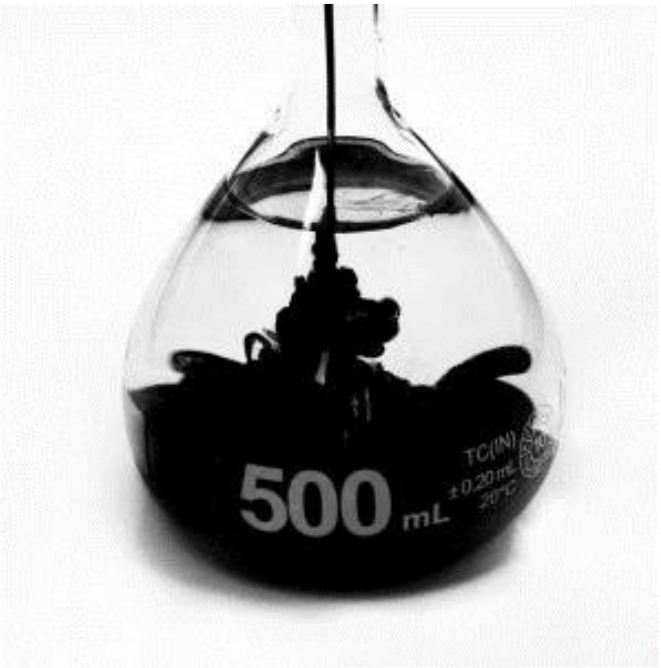
Colloidal Activated Carbon

PLUME STOP®
Liquid Activated Carbon

- PlumeStop®
  - Stabilized Form of CAC
  - Distributes Widely in Subsurface
  - Rapidly Reduces Dissolved Phase Contaminant Concentrations
  - Promotes Biodegradation



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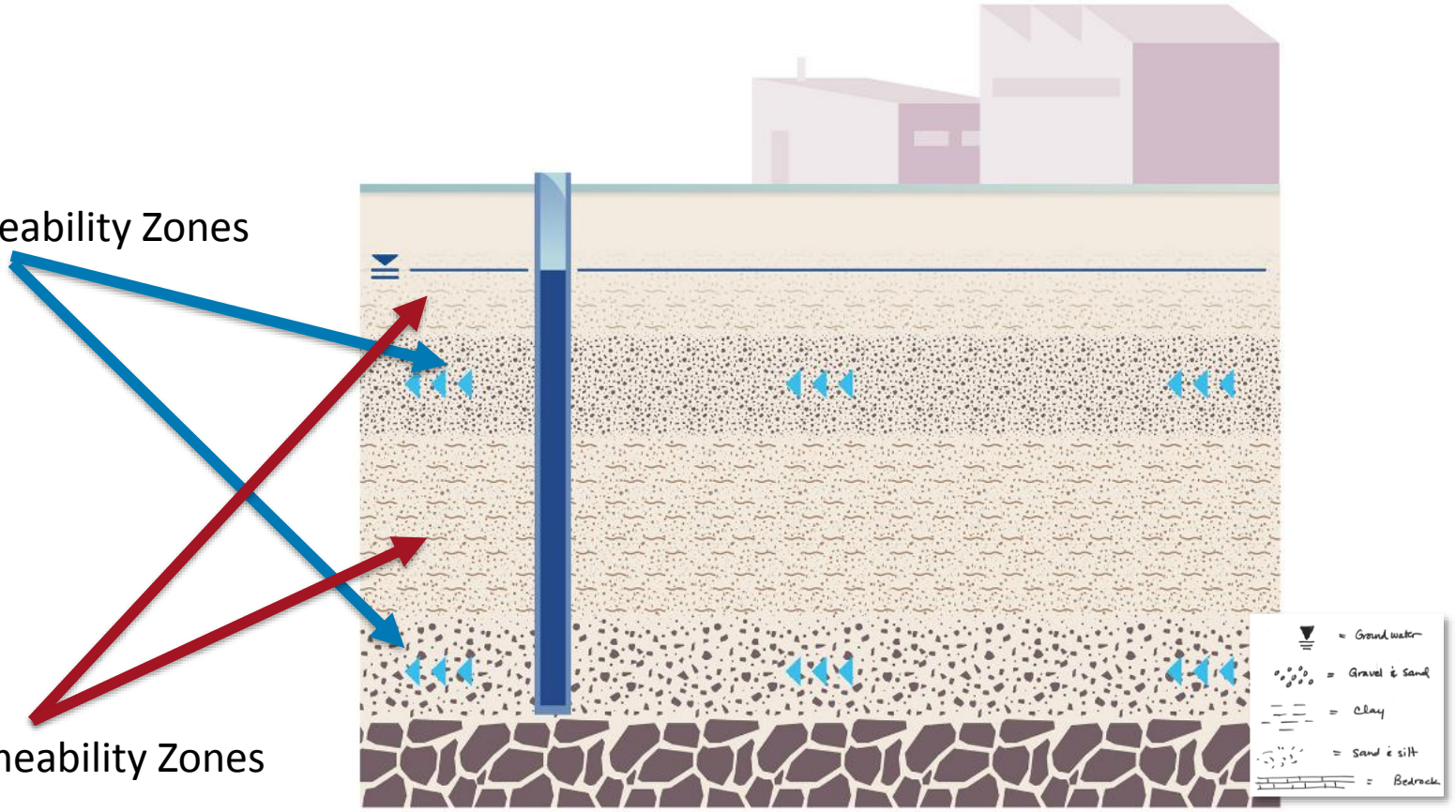
Colloidal Activated Carbon

Higher Permeability Zones



Lower Permeability Zones

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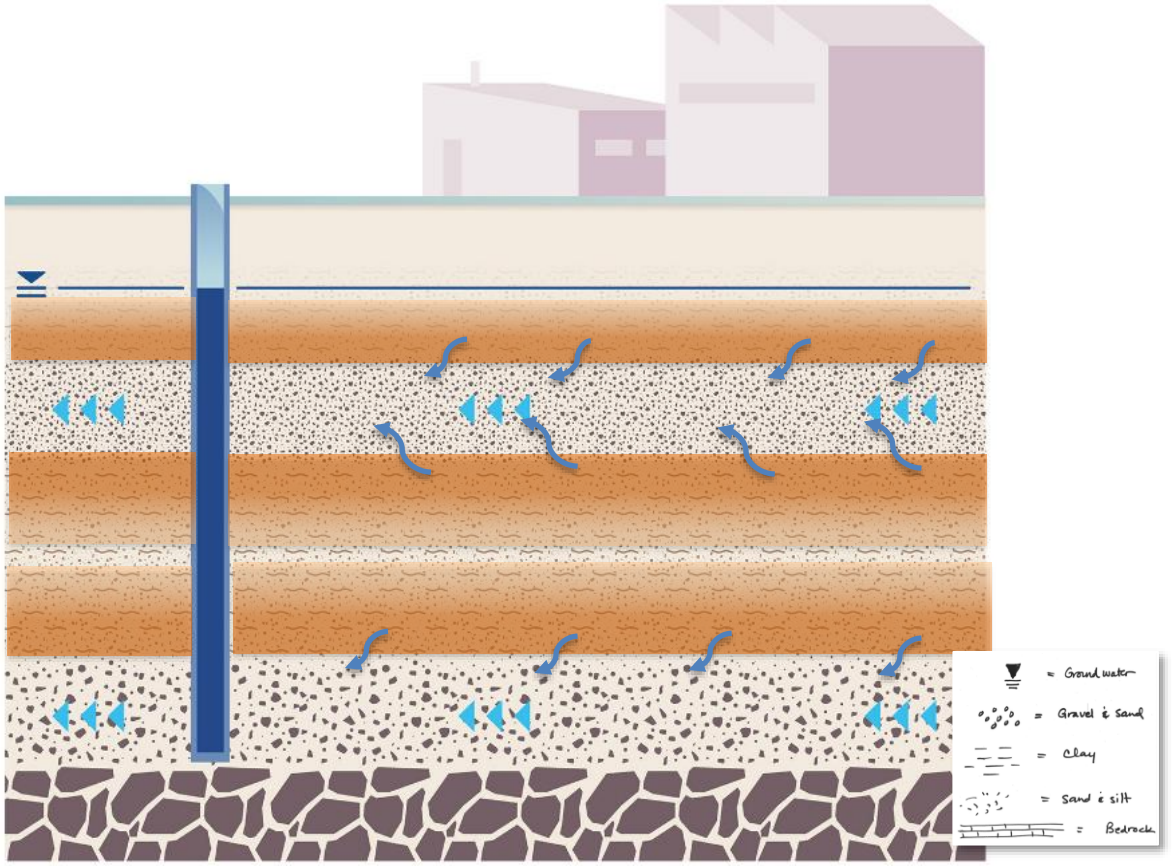

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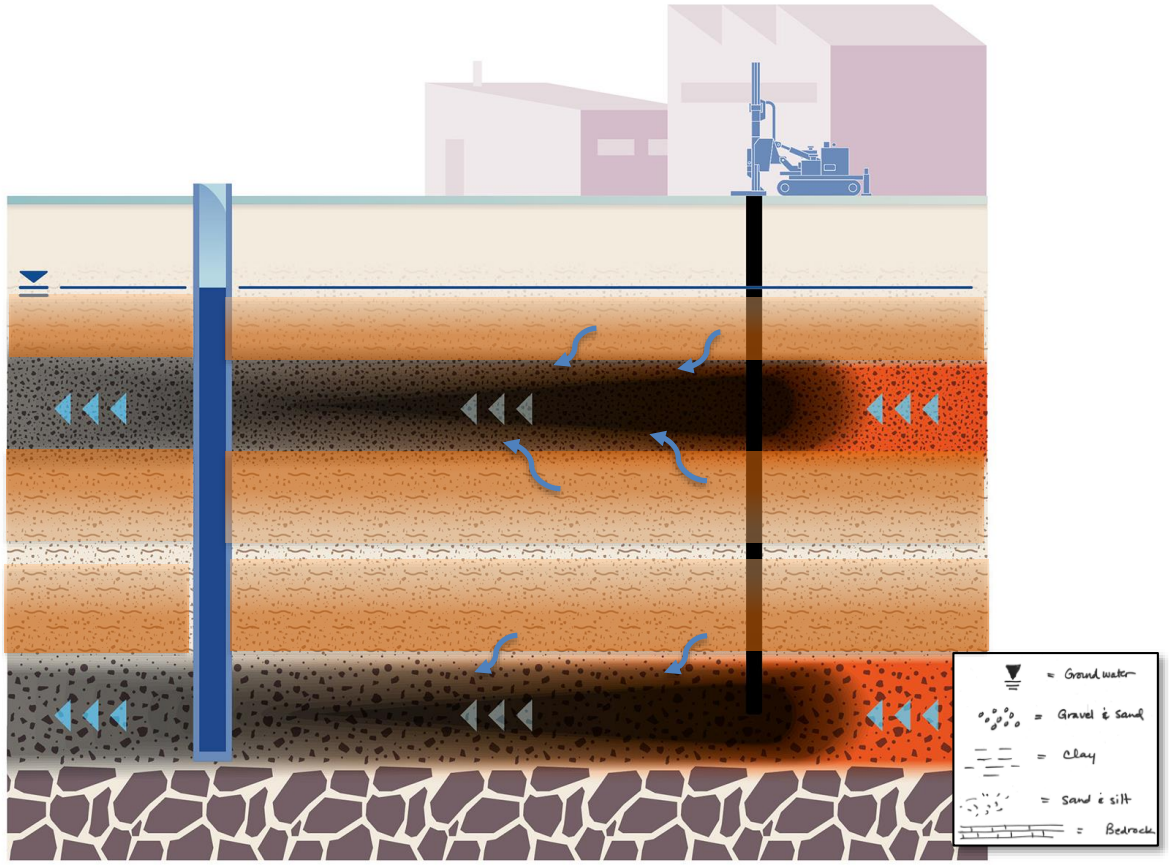
Colloidal Activated Carbon



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Research Objectives

Questions

- Are Sorbed Compounds Bioavailable?
- Evidence of Biodegradation?
- Do Bench Studies Translate to Field?

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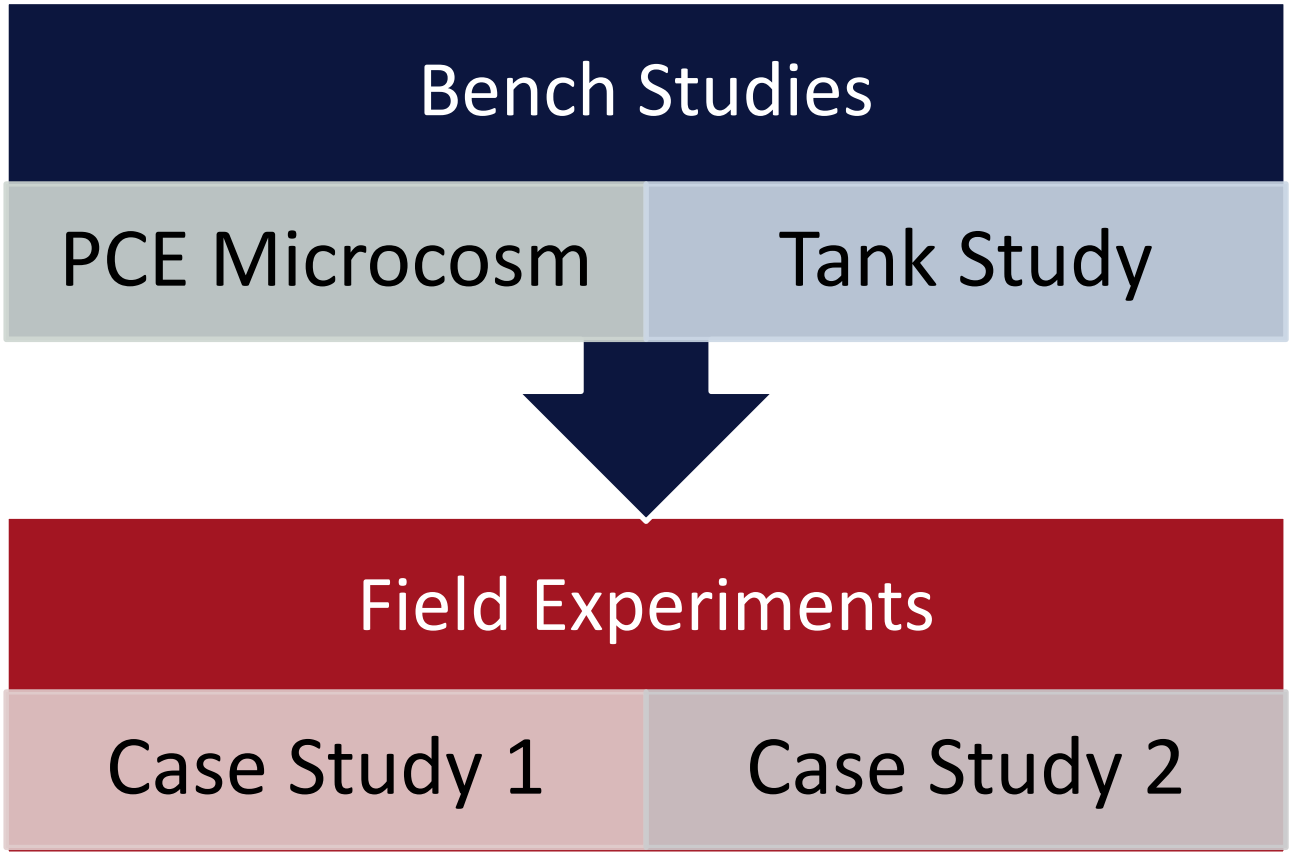
Materials and Methods



Bench Studies

Test 1: PCE Microcosm study

- Monitor degradation based on contaminant mass

Test 2: Simulated back diffusion tank study

- MBTs
- Lines of evidence

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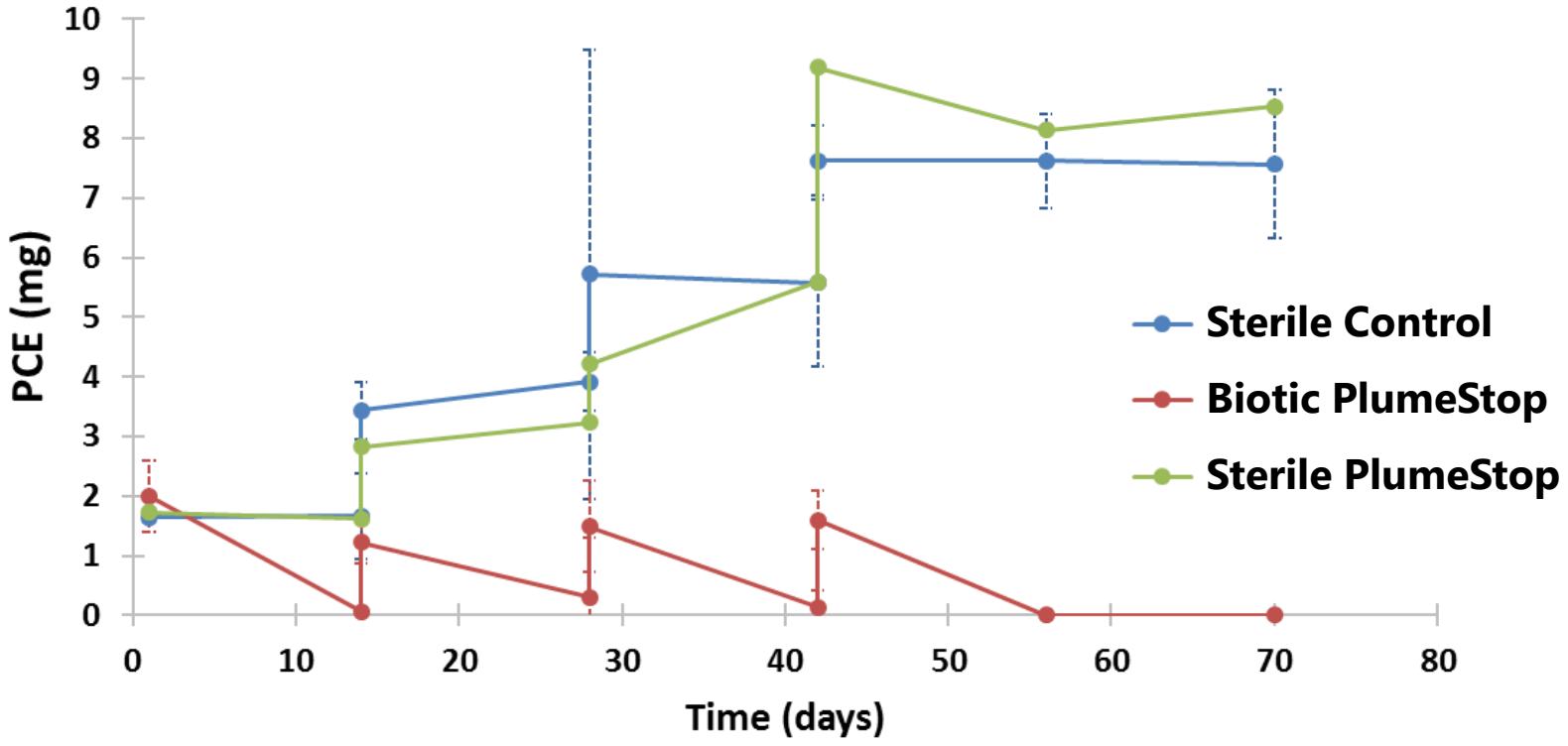
PCE Microcosm Study



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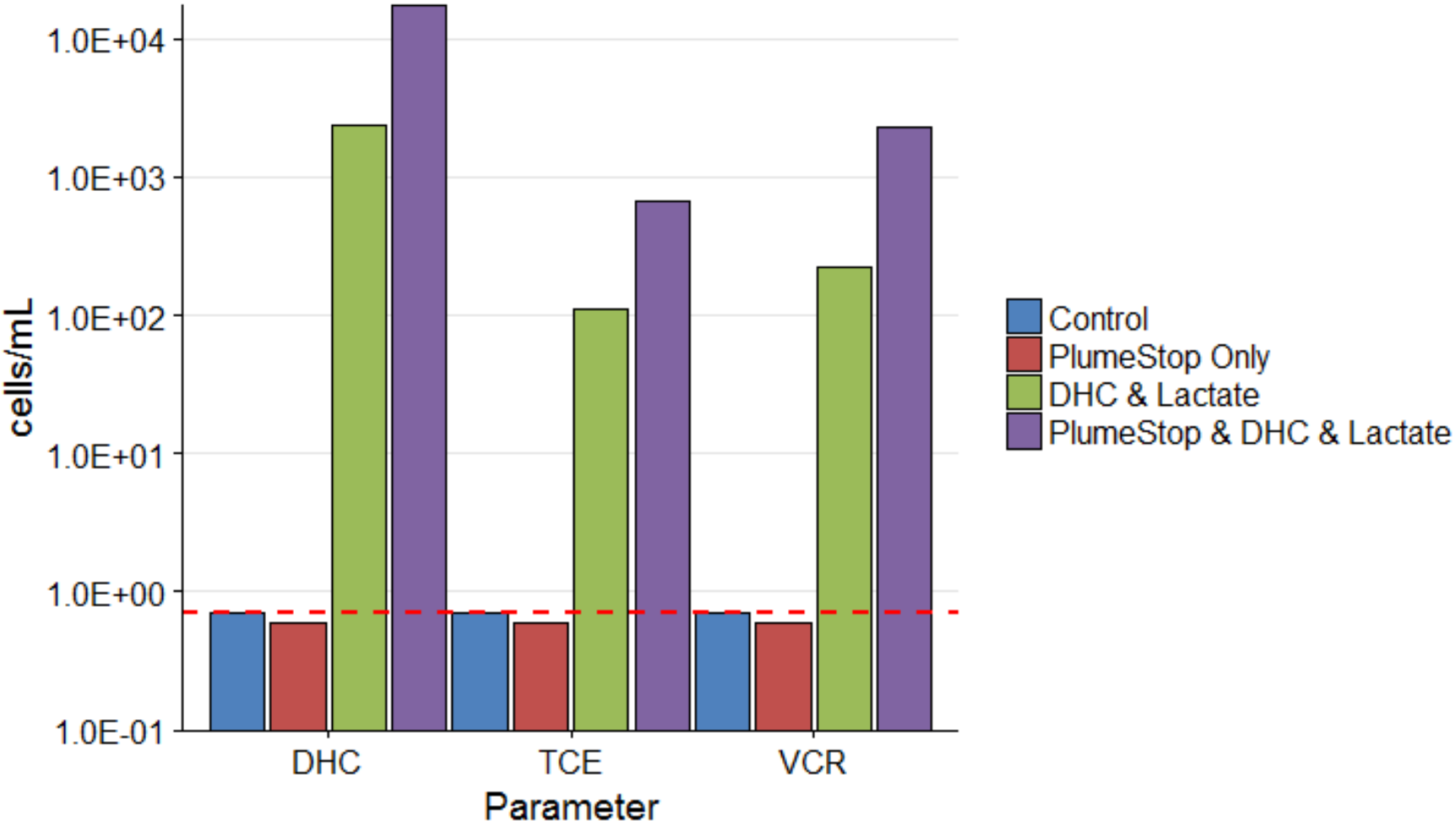
Simulated Back Diffusion Tank Study



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Field Studies

Former Dry Cleaner in CA

Former Manufacturing Plant

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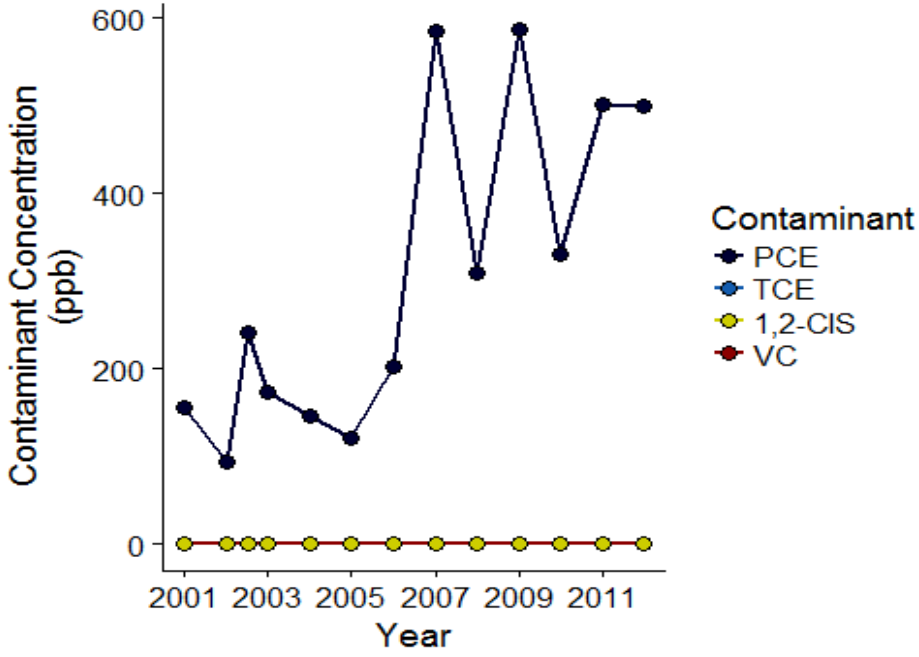
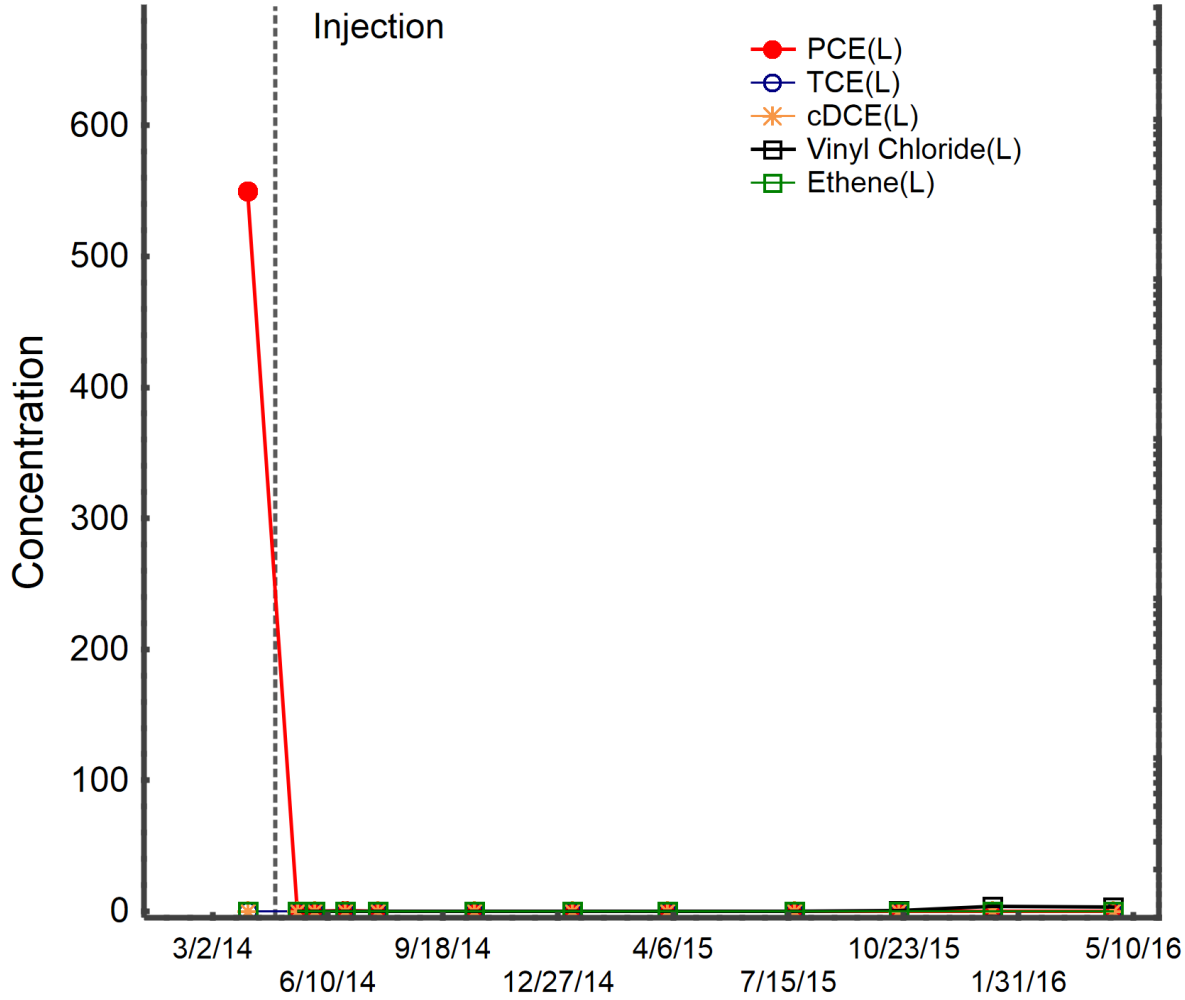
Case Study 1 - Introduction

- No Daughter Products (since 2001)
- No Detected Dehalogenating Bacteria
- No Attenuation
- Sandy Aquifer
  - 10 m/yr GW Flow



Contaminant Concentrations



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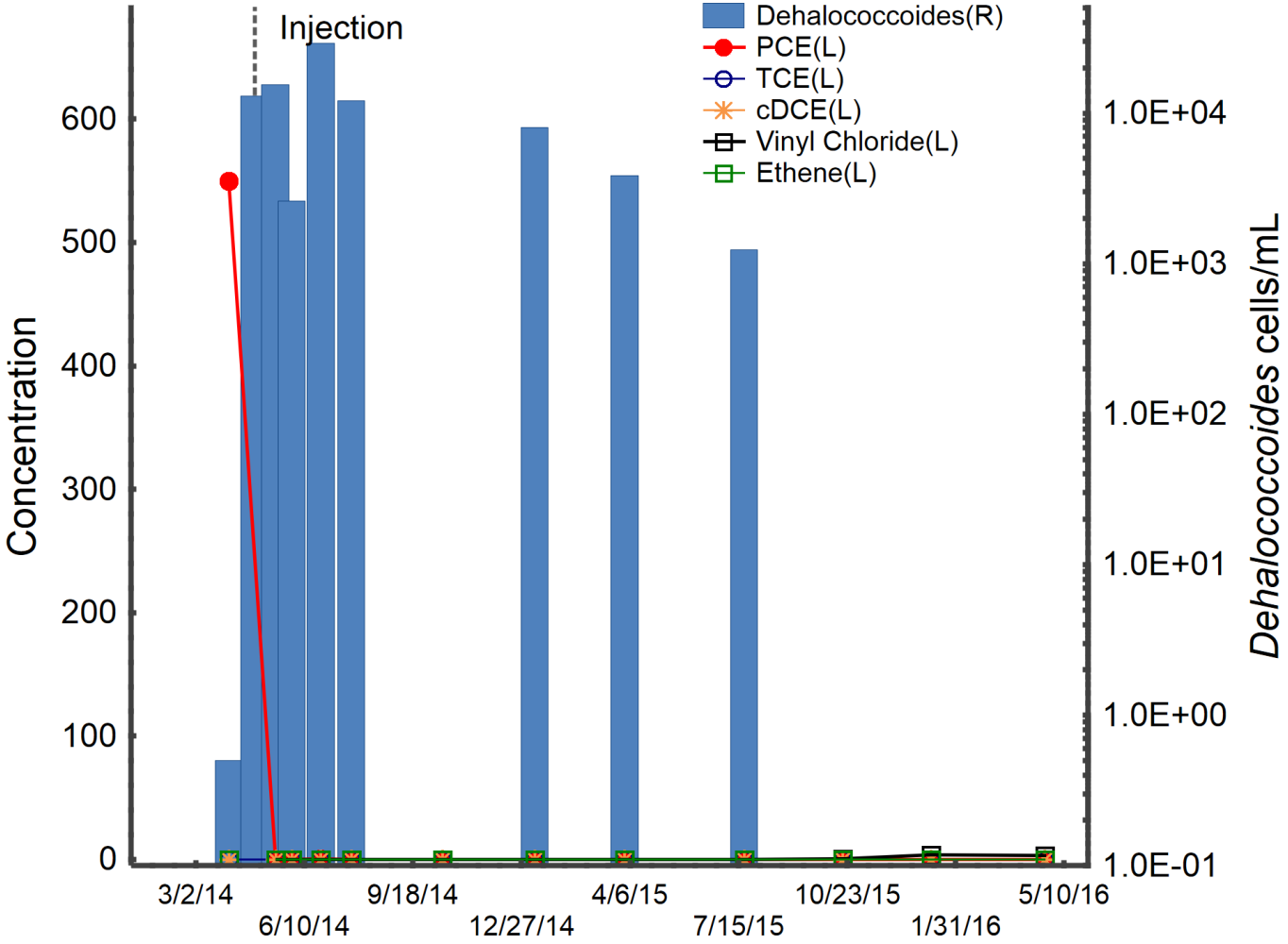
Dehalococcoides



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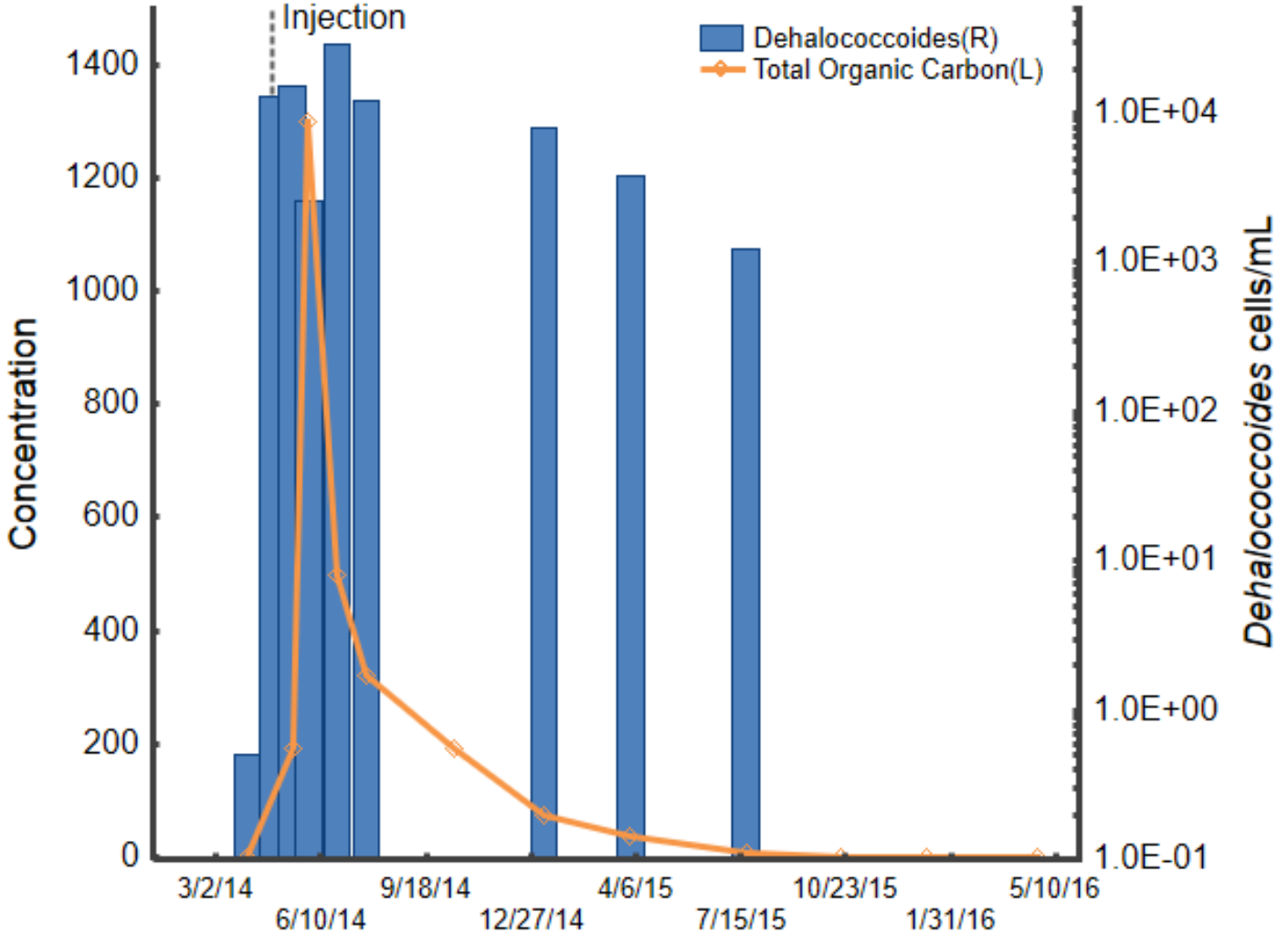
Electron Donor Concentration



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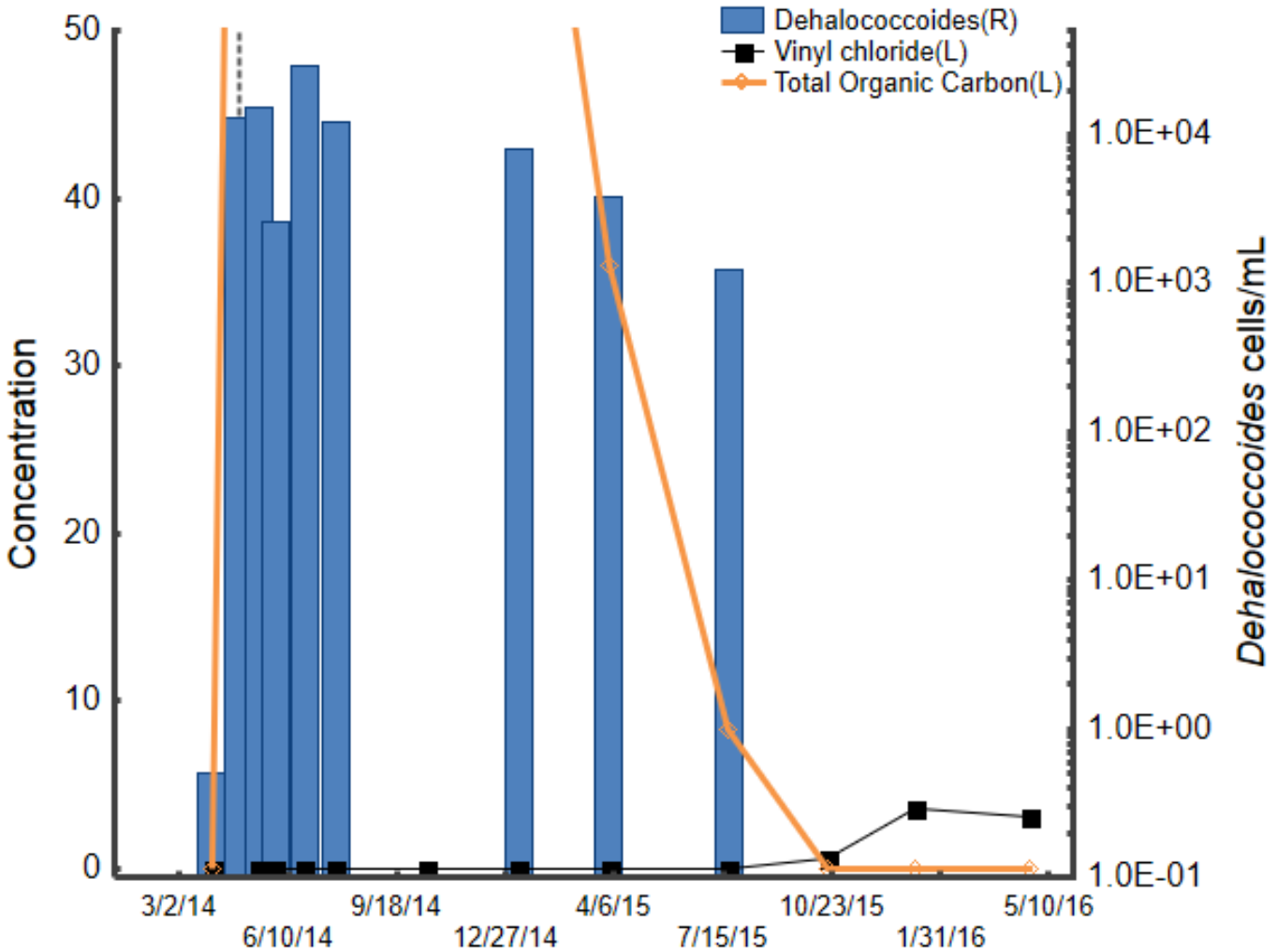
Daughter Products



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Case Study 1 - Conclusions

- Effective Adsorption and Biodegradation
  - *Dehalococcoides* is an Obligate Halorespiring Microbe
  - *Dehalococcoides* Decreased when e^- Donor was Consumed
  - Daughter Products Detected after Low Concentration of *Dehalococcoides*
- Microbial Monitoring Critical after PlumeStop®
  - Daughter Products Not Detected during Biodegradation
  - Daughters Only Detected after Biodegradation Slowed

Case Study 2 - Introduction

- Former Manufacturing Facility (began in 1950s)
- Degreaser
- Coastal Plain Sediments
- Groundwater Flow of ~9 m/yr

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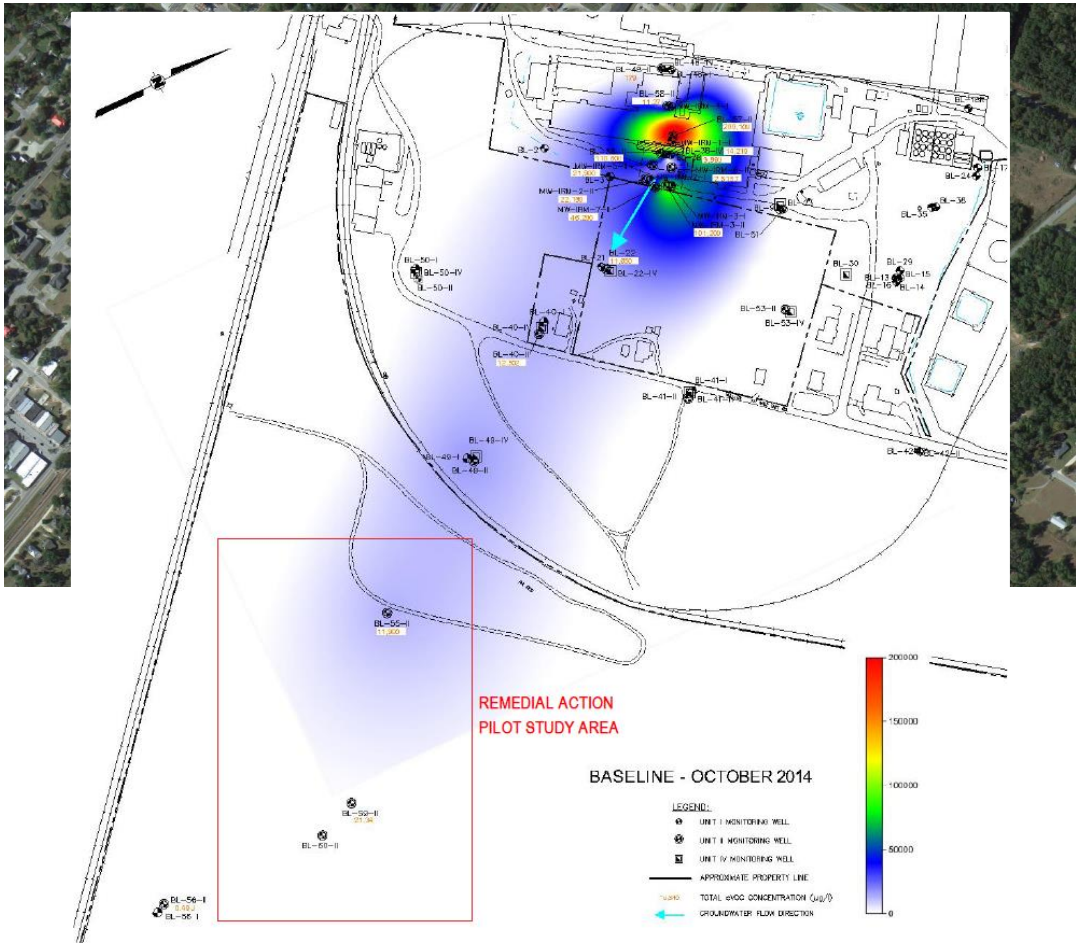

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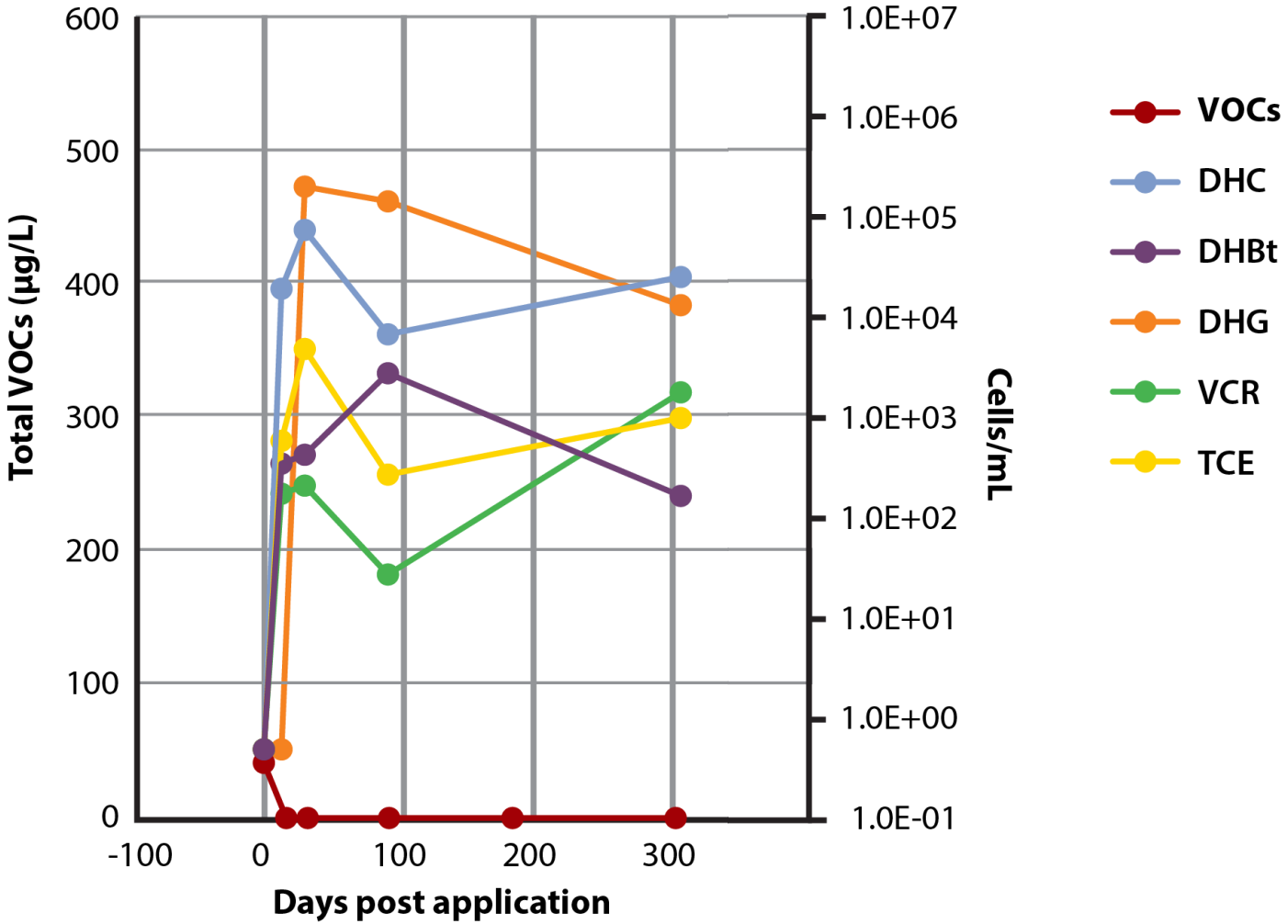
Case Study 2 - Results



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Overall

- PlumeStop® Injection Led to Decreased aqueous COCs
- Biodegradation Occurs with Contaminant Sorbed to CAC
- Multiple lines of evidence
  - Geochemistry/Electron Donor
  - qPCR when Using CACs

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Questions???

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