Reactive transport modeling incorporating isotope fractionation as a tool for quantifying natural attenuation of chlorinated hydrocarbons

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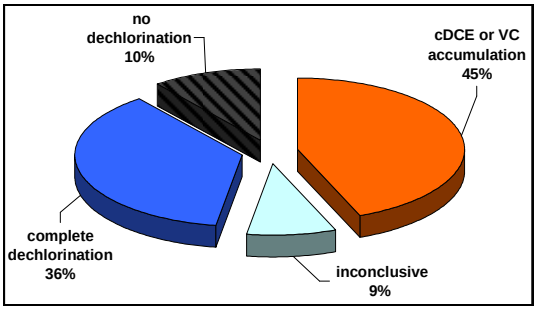
Introduction

Natural attenuation of PCE and TCE;

- in many cases incomplete degradation
- often a poor mass balances
- other mechanisms than reductive dechlorination



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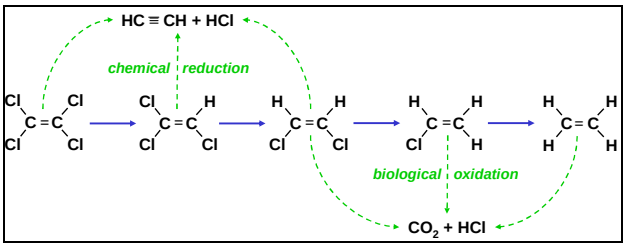
Stable (carbon) isotope analysis

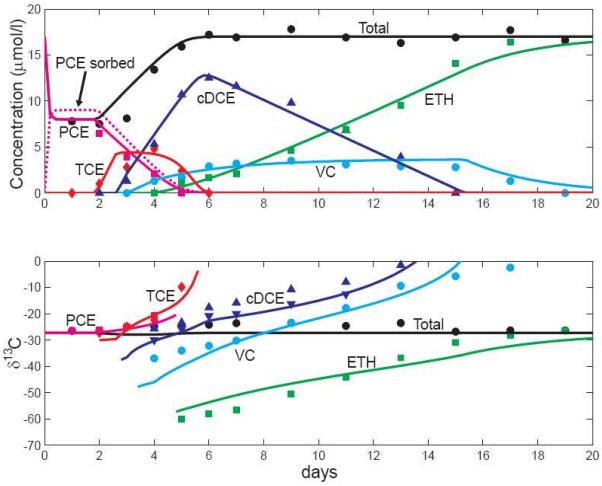
A unique method for providing evidence of destructive NA processes base on preferential degradation of lighter isotopes. Suited for:

- reductive dechlorination (biological)
- anaerobic oxidation (biological)
- abiotic reduction by Fe(II) species

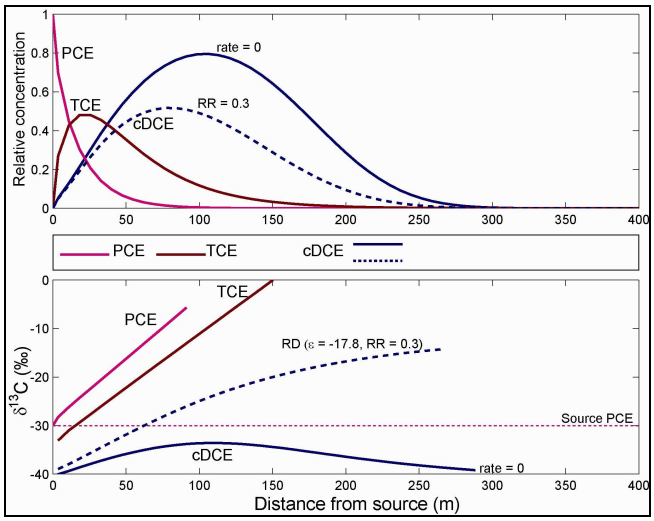


Isotope modeling

Reactive transport model incorporating carbon isotope fractionation developed to allow interpretation of the complex processes.



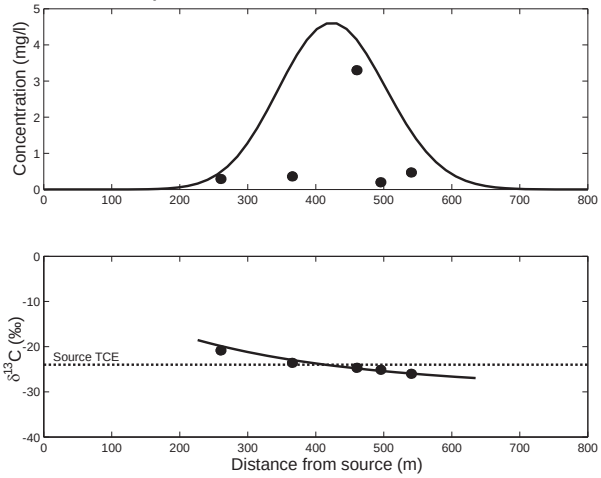
Isotope modeling can be used to demonstrate cDCE stall:



Case

Plume with cDCE. Anaerobic oxidation was forwarded as alternative NA mechanism. Isotope modeling revealed:

- no degradation past cDCE
- source depleted



SKB-project "New NA processes"

- Laboratory experiments to determine fractionation factors abiotic reduction
- Stable isotope analyses and screening for alternative degradation products at six VOCl sites
- Stable carbon isotope modeling

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Vlaamse Instelling voor Technologisch Onderzoek

Tauw

TNO