To what extent can isotopes help substantiate natural attenuation of chlorinated ethenes?

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Chlorinated ethenes are common groundwater contaminants which biodegradation into non-toxic end-products is difficult, contrary to petroleum hydrocarbons. As natural attenuation by biodegradation is a cost-effective environmental friendly remediation approach, evaluating a chlorinated ethenes plume degree of attenuation by biodegradation is essential. Yet, the degree to which this process is involved in concentration decrease in the field is not always straightforward as concentration can also decrease due to dilution or sorption.

In the past ten years, isotopic methods have gained interest as they are mainly affected by biodegradation and would thus allow quantifying the extent of biodegradation regardless of any dilution process. Numerous studies demonstrated this method potential to evaluate the extent of biodegradation based on laboratory-scale studies, but few were dedicated to evaluate the degree to which isotopes could help substantiate natural attenuation of chlorinated ethenes at the field scale.

Our work hence aims at exploring the latter based on data acquired in 2006 in a site located in Denmark which is contaminated with PCE and its end-products TCE, cDCE, and VC. Previous work on this site has enabled to demonstrate that PCE and TCE were undergoing reductive dechlorination while cDCE would be at least partially degraded through reductive dechlorination[1]. However, the magnitude of the contaminants attenuation by biodegradation was not evaluated. Based on simple modeling including previous isotope data, the fate of the chlorinated ethenes plume will be investigated. The results will be compared with the data acquired from a new sampling campaign planned in 2014.

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