

## Is it All from Biodegradation? Forensics with Tetrachloroethene $\delta^{13}\text{C}$ Values and Concentrations of Tetrachloroethene Biodegradation Products

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**Background/Objectives.** It is often assumed that any trichloroethene (TCE), cis-dichloroethene (cDCE) and/or vinyl chloride (VC) present at tetrachloroethene (PCE) sites are from biodegradation of that PCE. This is particularly a problem when concentrations of the TCE, cDCE and/or VC are low, because missing a source could lead to an incomplete conceptual site model which in turn can lead to an improper allotment of remediation costs and/or a failed remediation.

**Approach/Activities.** Sets of CSIA data were collected to elucidate forensic issues at sites where PCE impacts to groundwater were the main issue. Plots of  $\delta^{37}\text{Cl}$  vs.  $\delta^{13}\text{C}$  of PCE were used to suggest the separation of the PCE sources. The “lines” were checked against site maps to ensure that all the wells in each group were hydrologically connected but that the two groups were separate. The concentration of PCE biodegradation products was then predicted based upon the Rayleigh Fractionation model. That prediction was compared to the measured concentrations of the products. The results were used to identify TCE that was not produced by the biodegradation of the PCE.

**Results/Lessons Learned.** This technique helped identify a source that was suspected but not confirmed at one site, and identified the remnants of an older PCE spill at a second site. In the first case it helped implicate a third party (there were two other known sources, each on a separate property). The second case is still ongoing.