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Characterisation of an aquifer contaminated with chlorinated solvents by using stable carbon isotope analysis

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Release of chlorinated hydrocarbons into the environment is a significant problem, not only from an environmental hazard and cleanup point of view, but also in terms of liability assessment. Unfortunately, source apportionment and determination of spill migration is not always straightforward, since hydrocarbon releases often occur from multiple sources. Furthermore, hydrocarbons in the soil are subjected to degradation processes and also transport can be very complex. Due to the recent developments in compound-specific stable isotope analysis (CSIA) a lot of new and unique data have become available, which have been shown to have a great potential for source apportionment and assessment of microbial degradation. Still, less is known about the benefits and pitfalls of the application of CSIA to characterize more complicated contaminations. Therefore, the usage of CSIA was studied to distinguish the impact of multiple sources on an aquifer and to evaluate the presence of degradation processes.

Soil investigations carried out at and around the contaminated site (near Antwerp, Belgium), indicated the presence of soil and groundwater pollution with chlorinated solvents (mainly tetrachloroethylene, PCE), caused by two distinct sources. Compound-specific stable carbon isotope analysis was used to allocate both sources and to monitor microbial degradation. Microcosms experiments were performed to determine isotopic fractionation factors of PCE and TCE under anaerobic conditions. These isotopic fractionation factors will be used to quantitatively asses in-situ biodegradation.