



Compound Specific Isotope Analysis

Supporting Monitored Natural Attenuation

**Microseeps
Is the first
commercial
laboratory in
North America
to provide
CSIA.**

Compound Specific Isotope Analysis (CSIA) is an evolving technique which generates isotopic characterization of individual compounds. The isotopic data can be used to more definitively characterize processes in groundwater which degrade contaminants of concern such as BTEX, MTBE and CVOC's.

The study of isotopes in groundwater plumes of fuel oxygenates like MTBE has provided unequivocal proof of its degradation, revealed the mechanism of its degradation and provided an in-situ measurement of the rate of degradation.



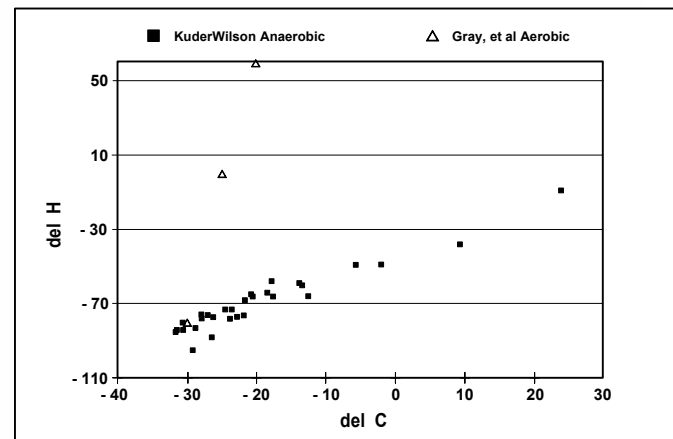
Nature has provided internal evidence in the form of the isotopic ratio. Biodegradation causes a progressive alteration in the isotopic ratio so CSIA can be used to quantitatively assess how much and at what rate remediation has occurred in field samples.

Mike O'Seeps spots nature's clue.

The data that is generated by CSIA can be used to:

- unambiguously determine that biodegradation is occurring
- identify the mechanisms of degradation
- determine the rate and extent of degradation in some contaminants of concern

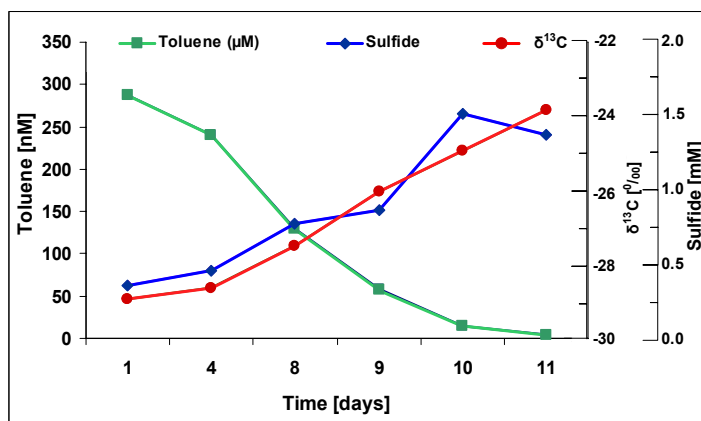
Many processes which affect contaminants in groundwater such as dilution, sorption and volatilization have either very small or no isotopic effects, however processes like biodegradation and abiotic degradation are associated with significant isotopic effects.



This figure illustrates the study of isotopes in groundwater plumes of MTBE.

CSIA is performed using an Isotope Ratio Mass Spectrometer, instrumentation formally similar to that for SW846-8260. Isotopic studies such as are possible with CSIA can be a powerful tool in evaluating the progress of in-situ degradation.

Microseeps will first offer analysis of stable carbon isotopes in groundwater samples for MTBE and TBA, followed by chlorinated solvents and then hydrocarbons. Next, will be stable hydrogen isotopes on the same suite of analytes. Finally, we will develop our systems' capability for stable carbon and hydrogen isotopes on vapor samples, either indoor air from summa canisters or soil gas in a variety of sample containers.



This figure (from Schmidt, et al., 2004) illustrates the anaerobic degradation of toluene under sulfate reducing conditions. Notice that as the concentration of toluene remaining in solution decreases, the measure of its isotopic composition, $\delta^{13}\text{C}$, increases.

