

## **Toxic Inhibition of Acetoclastic Methanogenesis near Hydrocarbon Sources**

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### **ABSTRACT**

Results from a series of studies of methanogenic processes in hydrocarbon-contaminated aquifers indicate that acetoclastic methanogenesis is inhibited near non-aqueous sources. At a crude-oil-contaminated site, numbers of acetoclasts found close to crude oil were one hundred times fewer than those of hydrogen- and formate-utilizing methanogens. Laboratory toxicity assays using crude oil-contaminated acetate, hydrogen, and formate solutions showed that acetate utilizers were inhibited by the crude oil. At a methanogenic, creosote-contaminated site, concentrations of volatile acid intermediates are very high near the source, which is consistent with inhibition of acetoclasts. In toxicity assays with aqueous creosote extract, acetate utilizers were completely inhibited over the range of tested concentrations whereas formate and hydrogen utilizers were only mildly affected. The results from these two sites suggest that elevated volatile acid concentrations at a site are related to the degree of toxic inhibition. A comparison of acetate and dissolved organic carbon in the crude-oil and creosote sites to a survey of these parameters in methanogenic rice-paddy sediments shows that the magnitude of the observed build-up of volatile acids is proportional to the degree of toxic inhibition of acetoclastic methanogenesis.