

## Long-term natural attenuation of crude oil in the subsurface

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**Abstract** The time frame for natural attenuation of crude oil contamination in the subsurface has been studied for the last 27 years at a spill site located near Bemidji, Minnesota, USA. Data from the groundwater contaminant plume show that dissolved benzene concentrations adjacent to the oil decreased by 50% between 1993 and 2007. To assess how this decrease is related to benzene concentrations in the crude oil, samples of oil were bailed from floating oil in five wells and analysed for volatile components. Compared to reference oil collected from the pipeline in 1984, benzene concentrations in the well located farthest downgradient in the oil have decreased an average of 50%. Benzene and ethylbenzene depletion are linearly correlated with oil saturation in the pore space suggesting that dissolution is the primary removal mechanism and biodegradation within the oil body is insignificant.

**Key words** petroleum; benzene; methanogenic; biodegradation