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Evidence for in situ degradation of mono-and polyaromatic hydrocarbons in alluvial sediments based on microcosm experiments with 13C-labeled contaminants

B. Morasch (1), P. Höhener (2), and D. Hunkeler (1)

(1) Center for Hydrogeology, University of Neuchâtel, Switzerland (Barbara.Morasch@unine.ch), (2) Laboratoire de Chimie et Environnement, Université de Provence, France

This study focuses on the evaluation of the intrinsic bacterial degradation potential of mono- and polyaromatic hydrocarbons at the site of a former cokery located in direct proximity to a river. In this particular case it is terms of risk assessment imperative to investigate whether or not biodegradation is sufficiently rapid to prevent dissolved contaminants from reaching the river. Degradation of mono- and polyaromatic hydrocarbons was followed in microcosms using alluvial sediments from the site and under conditions resembling natural conditions. Benzene, naphthalene, or acenaphthene were added to the sediments as 13C-labeled substrates. All three substances were major contaminants at the field site and belong to the 16 priority PAHs designated by the United States Environmental Protection Agency and to the 33 priority substances recently defined in the EU Water Framework Directive. The new approach, based on the addition of 13C-labeled contaminants, follows the subsequent generation of 13C-CO2 during biodegradation using gas chromatography isotope-ratio mass spectrometry (GC-IRMS). Hence it conveys compound-specific information on mineralization and 13C was found to be an ideal marker to test the fate of one particular contaminant out in the presence of other unknown organic substances of the sediment material. Due to the high sensitivity and reproducibility of 13C/12C stable isotope analysis, the approach was suitable to give evidence for the intrinsic biodegradation of benzene, naphthalene, and acenaphthene under oxic and also under anoxic conditions. The semi-quantitative method can be used to screen for biodegradation of any slowly

degrading, strongly sorbing compound in long-term experiments.