Environmental Engineering and Management Journal March 2014, Vol.13, No. 3, 583-596
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

COMPARATIVE ASSESSMENT OF LABORATORY AND FIELD-BASED METHODS TO MONITOR NATURAL ATTENUATION PROCESSES IN THE CONTAMINATED GROUNDWATER OF A FORMER COKING PLANT SITE

Anne Berghoff[1,3], Anja Berning[2], Christoph Wortmann[2], Achim Möller[4], Bernd Mahro[1*]

[1]*Bremen University of Applied Sciences, Institute of Applied Biology and Environmental Engineering, Bremen, Germany*
[2]*Wessling Beratende Ingenieure GmbH, Altenberge, Germany*
[3]*TTZ Bremerhaven, Department of Water Energy and Landscape Management, Bremerhaven, Germany*
[4]*NRW Urban GmbH, Dortmund, Germany*

Abstract

The monitored natural attenuation (MNA) of groundwater contamination is in many cases considered to be a cost-effective and appropriate strategy to manage the remediation of contaminated aquifers. A prerequisite for the public acceptance of such NA-remediation approaches is that the efficiency of the presumed NA-processes should be proven. This proof must be based on an extensive hydrogeological and in-situ characterization of the ongoing aquifer processes. Additional investigations of aquifer samples in the laboratory (microcosms) are often questioned because they are not representative.
The aim of this research was therefore to evaluate and compare the microcosm-monitoring of degradation activity directly to results obtained from field investigations at the same site, a former coking plant in Castrop-Rauxel in Germany. The *in-situ* monitoring of the contaminant degradation at this site revealed a clear decrease in the concentration of the major contaminants, benzene and naphthalene along the flow direction of the plume. Furthermore, comparative isotopic analysis of the sulfur pools indicated that sulfate-reducing processes could play a predominant role in this degradation process. However, attempts to prove the microbial degradation of the organic contaminants directly by analysis of the isotopic fractionation of the contaminant carbon failed, especially in the case of benzene and naphthalene. The assumption that a very active microbial population was actually involved in the natural attenuation process of the prevalent contaminants at the site could be shown more convincingly with laboratory microcosm experiments. The two monitoring approaches therefore complemented each other very well and should therefore both be implemented in standard natural attenuation monitoring programs.

Key words: anaerobic microbial degradation, BTEX, coking plant, field measurements, microcosm experiments, natural attenuation, PAH

Received: November, 2011; Revised final: June, 2012; Accepted: June, 2012

[*] Author to whom all correspondence should be addressed: E-mail: bernd.mahro@hs-bremen.de; Phone: +49 421 5905 2305