Abstract

The "Bundesamt für Bauwesen und Raumordnung" (BBR) has instructed J.W. Goethe-University Frankfurt am Main to carry out the research project entitled „ Practical application of a risk-based corrective action at petroleum contaminated sites" In order to verify the practical applicability of the theoretic considerations the project has been linked to a running research project of the Umweltbundesamt entitled "Long-term monitoring to investigate the scope and limitation of natural attenuation processes for selected compounds at contaminated sites" (SELMA).Within the frame of this project the ground water at the former military-used location Schäferhof-Süd (Nienburg) has been studied since the year 2000 with respect to the occurrence of petroleum hydrocarbons. With support of the BBR five additional ground water monitoring wells have been installed at this location to measure the degree of contamination and the spacial distribution of the contaminants. Within the course of the current project ground water has been sampled six times from the new and the old monitoring wells and has been investigated with respect to the content of hydrocarbons and their metabolites and for the amount of electron acceptors. Additionally, analytical results from another former military-used location (Wegberg-Wildenrath) have been implemented in the interpretation of data.

The analytical results have shown that at the location Schäferhof-Süd within the 1.5 years of investigation the concentration of hydrocarbons in the ground water increased significantly. Despite the increased concentration at the same time biodegradation occurred as indicated by the formation of metabolites from hydrocarbons. However, the hydrocarbon degradation was superimposed by the much stronger effect of delivering of new hydrocarbons to the ground water. The reason for the increase of hydrocarbon has been identified in the rising ground water table during the time of investigation. As a consequence, residual contamination in the unsaturated zone has been dissolved and added to the ground water. At the other location Wegberg-Wildenrath used for comparison purposes, the residual contamination in the unsaturated zone has been excavated before the natural attenuation measure started. Although at this location the ground water also rised significantly over the last years, a similar

substancial increase of the amount of hydrocarbons in the water at the former center of contamination has not be observed. This allows to conclude that the presence of residual contamination in the unsaturated zone can substancially influence the dynamic of the spacial distribution of contaminants downstream of the plume. Particularly, rising ground water levels can result in a large expansion of the area of contamination in the ground water. When a risk-based corrective action is planed to be applied, one cannot assume necessarily, that the spatial distribution of contamimation remains constant in the future even when it was constant or shrinking back over the last few years.

The results obtained from both study sites have provided valuable information with respect to natural attenuation processes an – as a consequence – for the application of risk-based corrective action strategies with respect to petroleum hydrocarbons at contaminated sites. In the technical protocols applied so far in USA and in other countries for the implementation of MNA, a largely constant dimension of the contaminant distribution downstream from the source is assumed. MNA is supposed to applied only when the plume is shrinking or constant. The current study has shown that this prerequisite is only fullfilled when the ground water remains constant. Increases of the ground water level can be expected to have a significant influence on the distribution of the contaminant plume, particularly in those cases when residual hydrocarbon phase is located in the unsaturated zone.