



PAH release from tar-oil contaminated silty soil material in response to forced environmental gradients: Implications for contaminant transport

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Laboratory test are often required to assess the contaminant release potential at contaminated sites. In this context, it is crucial to realise experimental conditions, which allow drawing conclusions on the processes governing the concentrations observed in the field. We conducted column experiments with varying boundary conditions to identify governing release processes and to evaluate the influence of environmental parameters on PAH outflow. Subsequently, the results were compared to groundwater concentrations monitored at the field site. The columns were filled with tar oil contaminated silt from a former tar-processing site and subjected to saturated flow conditions. The column outflow was monitored in response to forced variations in flow velocity, residence time, ionic-strength and temperature.

As no effects of flow interrupts were observed and concentrations were near to solubility predictions, it was concluded that PAH release is controlled by equilibrium dissolution according to Raoult's Law at moderate ionic strength. Lowering the ionic strength by feeding a pulse of ultrapure water, however, resulted in a marked increase in PAH export concentration. We attribute this to the effect of particle-facilitated release of the PAHs. The effect of low ionic strength was larger during fast flow, hinting on a shear stress driven carrier release. An increase of temperature by 10°C resulted in increases of PAH outflow concentrations from 6% to 160%. Downstream groundwater concentrations correlated well with column outflow data with comparable ionic strength background and temperatures. Thus, it was possible to identify the governing PAH release processes under different conditions and to explain the concentrations observed in the field.