Influence of natural attenuation and river fluctuations on benzene dispersion in an alluvial aquifer subject to strong interactions with surface water

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Abstract A numerical groundwater flow and transport model, calibrated under transient conditions, was used to simulate benzene attenuation in an alluvial aquifer discharging into the Meuse River, Belgium. The mean benzene degradation rate used in the model was quantified in situ along the groundwater flow path using compound-specific carbon isotope analysis (CSIA). The results of the transient solute transport simulations confirmed that benzene concentrations decreased almost five orders of magnitude within 70 m downgradient of the main source zone, and dropped below the detection limit in the zone adjacent to the river. This was consistent with the absence of benzene in downgradient piezometers located in the vicinity of the river. Interestingly, benzene concentrations were observed to be inversely correlated to river water levels, leading to the hypothesis that benzene dispersion was controlled by natural attenuation and river fluctuations.

Key words groundwater; brownfield; benzene; stable isotope fractionation; natural attenuation