

Complementary hydrogeological characterization to update the groundwater monitoring program at a remediated hydrocarbon site in an unconfined aquifer



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ABSTRACT

A complementary hydrogeological characterization work was performed on a remediated hydrocarbon site that has had a groundwater monitoring program in place for more than a decade. The work included: (1) the installation of a monitoring well network outside of the former source zone, (2) the drawing of a hydraulic head map, (3) the estimation of aquifer recharge using the GLUE (*Generalized Likelihood Uncertainty Estimation*) model, (4) the surface water-groundwater interaction via flow rates measurements in a creek, (5) the evaluation of the horizontal hydraulic conductivity (K_h) of the fractured/porous bedrock aquifer by slug tests, (6) the estimation of the vertical hydraulic conductivity (K_v) using packer tests interpreted with the KGS model, (7) the analysis of hydrocarbons and polycyclic aromatic hydrocarbons (PAHs) in groundwater, (8) the modeling of the groundwater flow using Feflow, (9) the delineation of the capture zone at two municipal wells located close to the site under various pumping scenarios (actual and historical) and K_v ratio and, (10) the use of isotope forensics of PAHs in groundwater to evaluate the origin of a contamination detected above the tolerance limit outside of the original source zone.

Groundwater flow modeling shows that less than 1% of the water composition in one of the municipal wells would come from water that could have flowed through the area with detected PAHs. However, the dilution factor would be approximately 100-fold and the likely PAH concentrations at this well would be near or below the detection limit of the analytical method. The isotopic characterization of PAHs detected in groundwater confirmed the same origin as the former source zone that was remediated.