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Modeling Groundwater-Surface Water Interaction and Contaminant Transport of Chlorinated Solvent Contaminated Site

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Chlorinated-solvent form one of the largest groups of environmental chemicals. Their use and misuse in industry have lead to a large entry of these chemicals into the environment, resulting in widespread dissemination and oftentimes environmental contamination. Chlorinated solvent contamination of groundwater resources has been widely reported. For instance, there has been much interest in the assessment of these contaminant levels and their evolutions with time in the groundwater body below the Vilvoorde–Machelen industrial area (Belgium). The long industrial history of the area has lead to complex patterns of pollution from multiple sources and the site has been polluted to the extent that individual plumes are not definable any more.

Understanding of groundwater/surface water interaction is a critical component for determining the fate of contaminant both in streams and ground water due to the fact that groundwater and surface water are in continuous dynamic interaction in the hydrologic cycle. The interaction has practical consequences in the quantity and quality of water in either system in the sense that depletion and/or contamination of one of the system will eventually affect the other one. The transition zone between a stream and its adjacent aquifer referred to as the hyporheic zone plays a critical role in governing contaminant exchange and transformation during water exchange between the two water bodies. The hyporheic zone of Zenne River (the main receptor) is further complicated due to the fact that the river banks are artificially trained with sheet piles along its reach extending some 12 m below the surface.

This study demonstrates the use of MODFLOW, a widely used modular three-dimensional block-centred finite difference, saturated flow model for simulating the flow and direction of movement of groundwater through aquifer and stream-aquifer interaction and the use of transport model RT3D, a three-dimensional multi-species reactive transport model capable of incorporating multiple chemical and biological reactions to model the movement and chemical alteration of chlorinated solvents as they move with groundwater through the subsurface and reach to the surface water of the Zenne River .

Keywords: MODFLOW, RT3D, Chlorinated-solvent; groundwater/surface water interaction

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