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Modeling Fe0 permeable reactive barriers for groundwater remediation

Luca Carniato (1), Gerrit Schoups (1), Piet Seuntjens (2,3,4), and Leen Bastiaens (2)

(1) Department of Water Resources, Delft University of Technology, PO Box 5048, 2600 GA Delft, The Netherlands, (2) Flemish Institute for Technological Research (VITO), Boeretang 200, 2400 Mol, Belgium, (3) University of Ghent, Coupure Links 653, B-9000 Ghent, Belgium, (4) University of Antwerp, Groenenborgerlaan, 2000 Antwerp, Belgium

Remediation of groundwater pollution has traditionally been achieved by energy-intensive and drastic methods such as pump and treat (P&T) systems. Recently, more economically viable and less invasive methods such as permeable reactive barriers have been used to clean up a wide variety of groundwater pollutants (volatile organic compounds, VOCl). Permeable reactive barriers are installed in the subsurface and the naturally present hydraulic gradient makes the groundwater flow through the barrier where the contaminants are removed by different removal processes (biodegradation, sorption, precipitation, chemical destruction).
Effective application of these techniques requires a solid understanding of the site-specific hydrogeological and biochemical conditions, as well as a predictive assessment of long-term remediation efficiency. For example, secondary mineral precipitation has been shown to reduce reactivity and efficiency of permeable reactive barriers and the interactions between biological and chemical processes may also influence the long-term efficiency of such systems.
In this study a multi-component transport model based on PHAST USGS has been developed to simulate the removal processes in the barrier and to make quantitative predictions about the long-term efficiency of the system. In particular the modelling approach will be presented together with the model application in lab-scale experiments and in field.