Assimilating hydraulic response data from in-situ bioremediation injection treatment for improved decision-support modelling

Nikolas Benavides Höglund[a], Carlotte Sparrenbom[b] and Rui Hugman[c]

[a]Department of Geology, Lund University, Lund, Sweden, nikolas.hoglund@geol.lu.se; [b]Department of Geology, Lund University, Lund, Sweden, charlotte.sparrenbom@geol.lu.se; [c]INTERA, Perth, Australia, rhugman@intera.com

In-situ remediation through the injection of bioremediation fluids is becoming increasingly common for treating contaminated sites. Contaminants are targeted for treatment either directly at the source zone or through injections that form a permeable reactive barrier to prevent further transport of the contaminants. Commonly, multiple injections are performed in a grid covering an area of strategic importance. These injections, essentially serving as high-frequency inverse pumping tests, present an opportunity to capture rich information regarding the hydraulic response (changes in head during injection) in the aquifer at multiple locations. This information, which is often overlooked, can add valuable insight into the site, improve site characterization, aiding in predictions of future management actions and enhancing future monitoring efforts. However, due to the high pressures during injections, hydraulic fracturing often occurs at the time the injections are made. These events, representing temporary or permanent changes in aquifer properties depending on the treatment strategy, must be considered when assimilating hydraulic response data into a decision-support model to reduce the risk of introducing parametric biases. We have developed four groundwater numerical models for a PCE-contaminated site in Alingsås, Sweden, that was treated with in-situ remediation injections in 2017. Each model, although structurally identical, is calibrated using different parameterization and weighting approaches applied to the hydraulic response data. Preliminary results showed that by employing time-varying parameters at the location and time of injection, the model achieved a better fit with measured data and a lower parameter variance compared to other models. On the other hand, traditionally configured models (i.e., models that do not employ the use of time-varying parameters) show signs of parameter compensation, potentially biasing any predictions based upon their use.