Numerical modelling of migration tests through a fracture

JAKUB JANKOVEC[1*], MICHAL POLÁK[1], FILIP JANKOVSKÝ[2], MILAN ZUNA[2], JAROSLAV KOTOWSKI[3], MILAN HOKR[4]

[1] PROGEO, s.r.o., Tiché udolí 113, 252 63 Roztoky, CZE
[2] ÚJV Řež, a.s., Hlavní 130, Řež, 250 68 Husinec, CZE
[3] Research Center Řež, Hlavní 130, 250 68 Husinec, CZE
[4] Technical University of Liberec, Studentská 2, 461 17 Liberec, CZE

Radionuclides transport characterisation is one of the fundamental information for repository safety assessment. Since the naturally fractured environment is typically too complex to descibe, it is common to mimic its behavior by means of numerically simulated fracture network. The groundwork for applicable simulation of large-scale structures comes out from comprehension and verification of parameters for basic components such as a single fracture. For this reason, number of numerical simulations were performed to infer hydraulic and transport properties of an artificial single fractures in a granite block on a laboratory scale. Equivalent porous continuum approach using finite difference method was used for the numerical modelling purposes.

Significant contribution to the exact model representation of the flow regime is the precise fracture topography description, derived from the method of the laser scanning. This allows the model resolution up to 100 μm for each of the two granite blocks used in the study and subsequently the identification of the preferential pathways for the contaminant migration.

The focus of the numerical modelling effort were transport experiments, using various types of conservative and reactive compounds. NaCl, KI, $Pb(ClO_4)_2$ and ^3H were chosen as a set of tracers to fully describe the hydraulic and transport properties of the fractured granite environment. Pressure field distribution across the fracture and breakthrough curves at the outlet were used for the fracture parameters calibration and evaluation of the model overall fidelity.

The work described herein was funded by the project of Czech Technology Agency ČR TH02030543