



Evaluation of excavation-induced changes in rock permeability

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Abstract

The nature of the changes in permeability around an underground opening induced by blast-damage or stress-relief is an important factor in the design of nuclear waste repositories in rocks such as granite or basalt. Changes in stress and corresponding changes in rock mass hydraulic conductivity are analyzed for a circular shaft using simplifying assumptions regarding fracture geometry and initial stress state. Stress distributions around the shaft are calculated using closed-form solutions and are related to changes in hydraulic conductivity using a form of the cubic law for flow through fractured media. The analysis predicts that hydraulic conductivity may be increased, close to the wall of the opening, by two to three orders of magnitude over the far-field value solely in response to stress relief. The zone in which hydraulic conductivity is increased by at least one order of magnitude over the far-field value is limited to within one to two radii from the opening. Blasting may result in large increases in hydraulic conductivity immediately adjacent to an opening but blast damage may be limited to within 0.3 m of the opening using controlled blasting techniques with low perimeter charge weights.

