

Potential for induced seismicity from canisters emplacement of a deep geological repository

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The geological storage of high-level radioactive waste has been evaluated to be the safest disposal option in the long term by a number of nations, among them Switzerland. The challenge of understanding and predicting the behavior of the stored waste and the rock mass for the next hundreds of thousands of years involves also seismological aspects. With this work, we present preliminary results on the assessment of thermoelastic stress and pressure changes induced by the canisters emplacement in a repository embedded in a low-permeability argillaceous rock formation, focusing on their effects on the stability of a nearby fault. Recent field scale experiment at the Mont Terri Underground laboratory (performed with an electric heater mocking the heater from waste decay) showed that the heat produced by the nuclear waste is affecting the rock mass not only by means of increase in temperature, but also by a strong fluid pressurization. We numerically investigate the thermal pressurization effects by coupling two numerical solvers, where an iterative scheme is applied to determine the mechanical stress state after calculating pressure and temperature field. Elastoplastic behavior is evaluated on a localized plane of failure by means of ubiquitous joint elements. Preliminary results show that the heat load can induce shear failure and potential seismicity for a certain combination of fault distances and stress regimes, possibly posing design constrains on the maximum allowable temperature increase generated by the radioactive decay of the material contained in the canisters.

Keywords: Induced seismicity, thermoporoelasticity, argillaceous material, deep disposal, fault reactivation

Snapshots at 400 years

