COUPLED THM MODELLING OF ENGINEERED BARRIERS FOR THE FINAL DISPOSAL OF SPENT NUCLEAR FUEL ISOLATION

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Abstract: This paper describes the thermo-hydro-mechanical (THM) simulation of engineered barrier systems (EBS) for the final disposal of nuclear spent fuel in Finland. To represent the mechanical behavior of the bentonite barriers (MX80 and Friedland Clay) Barcelona Basic Model, BBM (Alonso et al., 1990), has been considered. The parameters of the mechanical and hydraulic model have been determined from the back-calculation of laboratory tests such as infiltration-swelling and oedometer. The Barcelona Expansive Model (Gens and Alonso, 1992) has been used to reproduce the mechanical response of pellets (pillow pellets between rock and buffer, rod pellets between rock and backfill and granules between buffer and backfill). In addition to expansive model parameters, a set of hydraulic laws considering the double structure phenomena is necessary to perform THM analysis. This paper also describes the effect of macro porosity variations on the intrinsic permeability changes. The evolution of gap closure and the presence of a fracture intersecting the disposal were analyzed. The simulations were performed in 2D axi-symmetrical geometries. Full 3D simulations were carried out in order to check the effect of the third dimension. The time required for the barriers to reach full saturation, the maximum temperature, deformations and displacements at the buffer– backfill interface and the homogenization of components both locally and globally are the main interests for repository design.

KEY WORDS: BBM, BExM, macro and micro-porosity, KBS-3V design, coupled THM calculations, pellets, bentonite