

Coupled THM modelling of Engineered Barriers for Waste Isolation

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ABSTRACT

The ONKALO will be a part of the final nuclear waste repository in Finland. The project consists of tunnels excavated at a depth of approximately 460 m and located at approximately 25 m from each other. The spent fuel will be encapsulated in final disposal canisters made of cast iron. These canisters will be placed in holes drilled at the bottom of the repository tunnels and surrounded with bentonite clay. After placement of the canisters, the tunnel will be backfilled with a mixture of bentonite and crushed rock.

The preliminary analyses of coupled THM processes in ONKALO project have been published by POSIVA OY (POSIVA 2012-47: Thermo-Hydro-Mechanical Modelling of Buffer, Synthesis Report, Toprak et al. 2013). The time required for the buffer to reach full saturation, the maximum temperature reached in buffer, deformations at the buffer-backfill interface and the stress deformation balance in interaction between buffer and backfill also buffer and backfill homogenization were the main interests of the Posiva 2012-47.

In this paper, an additional modelling work on the backfill and pellets material which was not in the above mentioned Posiva report is included. Barcelona Basic Model is used to model the oedometer test for backfill. As the pellets have double porosity, the oedometer test for pellets is modelled by Barcelona Expansive Model taking into account macro and micro porosity.

The effect of rock fracture and also intrinsic permeability of rock is subjected to 2D sensitivity analyses. Effect of air gap over temperature is analyzed. Preliminary results of 3D modelling of deposition tunnel and comparison with results of 2D calculations are also discussed.

Key words: THM modelling, buffer, backfill, pellets, 3D Modelling, Barcelona Expansive Model, BBM

REFERENCES

- [1]  kesson, M., B rgesson, L., Kristensson, O. (2010). *THM modelling of buffer, backfill and other system components*. Updated 2013-12. SKB TR-10-44. Stockholm. Sweden,2013
- [2] Hokmark. Harald. *Hydration of the bentonite buffer in a KBS-3 repository*. Clay Technology AB, Ideon Research Centre, 223 70 Lund, Sweden,2003
- [3] Pintado, X., Rautioaho, E. *Thermo-Hydraulic Modelling of Buffer and Backfill*. Posiva Report 2012-48. Eurajoki. Finland,2013
- [4] Toprak Erdem, Nadia Mokni, Sebastia Olivella, August 2013. POSIVA 2012-47: *Thermo-Hydro-Mechanical Modelling of Buffer*, Synthesis Report, 2013