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Title

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Author(s) name(s) and affiliations

F. CLARET[1], A. DAUZERES[2], D. JACQUES[3], P. SELLIN[4]
[1]*BRGM, France, f.claret@brgm.fr*
[2]*IRSN, France, a.dauzeres@irsn.fr*
[3]*SCK CEN, Belgium, diederik.jacques@sckcen.be*
[4]*SKB, Sweden, patrick.sellin@sk.se*

Abstract

Components of a so-called “multiple-barrier system” between the waste matrix and the biosphere include a combination of waste containers (e.g. metal canisters, concrete), engineered barriers such as bentonite or cementitious materials and natural barriers such as salt formation, clayey, volcanic or granitic rocks. The engineered Barrier System (EBS) is a crucial component for containment and isolation in a radioactive waste disposal system. The number, types and assigned safety functions of the various engineered barriers depend on the chosen repository concept, the waste form, the radionuclides inventory in the waste, the selected host rock, the hydrogeological and geochemical settings of the repository site among others. EBS properties will evolve with time in response to the thermo, hydro, mechanical, radiological and chemical gradients and interactions between the various constituents of the barriers and the host rock. Therefore, assessing how these properties evolve over long time frames is highly relevant for evaluating the performance of a repository design and safety function evaluations in a safety case. For this purpose, mechanistic numerical models are increasingly used. Such models provides an excellent way for integrating in a coherent framework scientific understanding of coupled processes and their consequences on different properties of the materials in the engineered barrier system. Their development and validation are supported by R&D actions at European level. For example, the aim of the HORIZON 2020 project BEACON (Bentonite mechanical evolution) is to develop, test and validate numerical models against experimental results in order to predict the evolution of the hydromechanical properties of bentonite during the saturation process. Also in relation to the coupling with mechanics, WP16 MAGIC (chemo Mechanical AGIng of Cementitious materials) of the EURAD Joint Programming Initiative focuses on multi-scale chemo-mechanical modelling of cementitious-based materials that evolve under chemical perturbation (including bacterial impact). Integration of chemical evolution in models of varying complexity (from complex description to its abstraction) is a major issue tackled in the WP2 ACED (Assessment of Chemical Evolution of ILW and HLW Disposal cells) of EURAD. WP4 DONUT (Development and improvement of numerical methods and tools for modelling coupled processes) of EURAD aims at developing and improving numerical models and tools to integrate more complexity and coupling between processes. The combined progress of those projects at a pan-European level will definitively improve our understanding of and our capabilities for assessing the long-term evolution of engineered barrier systems and will encourage collaboration between scientific communities.