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Model-based assessment of repository induced effects in the vicinity of repositories for SF/HLW

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Repository induced effects (RIE) play an important role in the assessment of long-term safety of a deep geological repository for Spent Fuel and High-Level Waste (SF/HLW). Three categories of RIE and the associated indicators are assessed in this study. The generation of heat from SF/HLW canisters causes build-up of pore water overpressure in the repository near-field, whereas gas generation from the corrosion of waste and construction materials can lead to gas pressure buildup in the repository structures and surrounding rock. The third effect is related to the development of the Excavation Damaged Zone (EDZ) around the repository; the vertical extent of the EDZ is associated with a reduction of the lengths of radionuclide release paths through unaffected host rock. A generic RIE indicator approach presented in this study, providing a numerical framework for quantitative assessment of: (a) the general relevance of RIE for long-term safety of the repository system and, (b) the potential of the RIE indicators to discriminate between candidate repository sites. For the evaluation of the RIE, three-dimensional (3-D) models of the entire repository system as well as two-dimensional (2-D) representations at the component scale (e.g.; models of a single emplacement room). are developed. Scoping calculations are performed in support of the integration of repository-scale with component-scale analyses and the associated dimensionality reduction (3-D to 2-D) applied to the different models. To assess the RIE, probabilistic assessments can be integrated with the uncertainty of the entire ensemble of input parameters and the propagation to model predictions can be estimated in a reliable and computationally efficient manner. The generic workflow presented in this study is considered as a versatile tool for site-specific assessment of the RIE indicators in future site selection programmes.

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