**Integration Group for the Safety Case (IGSC) Symposium 2024***MOVING TOWARDS THE CONSTRUCTION OF A SAFE DGR – GETTING REAL*

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| **Abstract Title:**  **A systematic approach to scenario development for long-term safety assessments for a high-level waste (HLW) repository concept in German crystalline rock**  Correspondence: Andree Lommerzheim (andree.lommerzheim@bge.de) | |
| **Abstract (300-500 words):**  It is international consensus that the safety assessment of a repository be based on a comprehensive description of the repository system by means of a FEP catalogue and a prognosis of potential future system evolutions. In Germany, corresponding methodologies for safety assessments in salt and clay formations have been developed in R&D projects. Taking into account the safety strategy, expected and alternative scenarios for potential future evolutions have been derived systematically and transparently from FEP catalogues. In the current project, a suitable methodology will be developed for a generic HLW repository in crystalline rock. Therefore, geological models as well as safety and verification concepts for the designed repository have been prepared and evaluated. As a result, a modified KBS-3 concept, which was adapted to the German waste types and amounts and to the national regulations, was selected for further investigations. In this concept, the canisters in combination with a surrounding buffer are the major barriers. Although the basics of the methodology for scenario development could be transferred from the concepts for sedimentary rock, rock-type and safety concept-specific adaptions were necessary. The corresponding FEP catalogue includes 31 features and 53 events/processes.  Scenario development is based on the identification of key barriers („initial barriers“), processes impairing the barrier function („initial FEP“), and processes that are linked to “radionuclide mobilisation and transport”. The radionuclide processes will only occur if a canister fails. Experience from industrial production show that when large numbers of components are produced (ca. 16,000 canisters in Germany), production failures can neither be completely excluded nor completely detected. Therefore, a small number of canisters with undetected failures has been assumed for the expected system evolution. The radiological consequences of these canister failures will be analysed by probabilistic numerical evaluations. In this context, water inflow and groundwater hydrochemistry also have a significant impact on the functionality of the barrier system and on radionuclide transport.  In fractured crystalline rocks, groundwater flow paths are difficult to predict, as they can potentially occur anywhere. At worst, they bypass the geotechnical barriers. Therefore, the nearfield surrounding the key barriers is important for the evaluation of their function and of radionuclide transport-related processes. Hence, the barriers and their surrounding components have been compiled in “initial-groups” as starting points for scenario development. During repository system evolution, the “initial groups” will be impacted by a spectrum of thermal, mechanical, hydraulic, and chemical processes. Their intensity can be derived from the interaction with other FEP (casual chains). For the description of the expected scenarios, likely characteristics of components and the probable intensity of the processes have been assumed. The initial groups are key elements for the expected scenarios and will be combined with the geological and climatic evolutions at the site. For the description of alternative scenarios, less probable properties of components and intensities of processes will be considered.  The proposed systematic and transparent approach to scenario development will increase transparency of the expected repository evolution and thus support the communication between implementer and authorities and/or other stakeholders. | |