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

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| **Abstract Number: 7** | **poster P7.1.1\_Peake** |
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| **Abstract Title:**  **IGSC GeneSiS Safety Function/Concept Catalogue** | |
| **Abstract (300-500 words):**  The Integration Group for the Safety Case (IGSC) has identified multiple topics related to safety case development as part of the TARGES (Transfer and Return of Gained Experiences on Safety Cases for Disposal Facilities) effort. It is common for countries that have spent nuclear fuel and high-level waste needing disposal in a deep geologic repository, but have not yet selected a site, to develop generic safety cases and assessments to gain modeling/analysis experience. The overall goal of the Generic to Site-Specific Safety Cases (GeneSiS) project is to provide support during the development of generic safety cases and transition to site specific safety cases.  Internationally, different host rocks are being considered. One of GeneSiS’s goals is to develop a catalogue of safety concepts, which cover natural and engineered barriers along with the functions they are intended to perform as part of the overall functions of containing and isolating the waste from the accessible environment.  Our approach is to consider the components of a geological repository and how the natural and engineered barriers work together in three host rock systems. The host rocks being considered are crystalline rocks, salt, and clays. The engineered barrier systems (EBS) include the wasteform, container, buffer, backfill, plugs and seals. Emplacing waste in a deep, stable geologic formation inherently provides isolation of the waste. Different safety concepts rely on different combinations of natural and engineered barriers to contain the waste. The poster will summarize the safety concepts applicable to the three host rocks.  Crystalline  For crystalline rocks, the primary barrier for containment is the EBS. The KBS-3 canister concept with a copper shell and iron insert is a well-known example of a container specifically designed for crystalline rocks (and designed to complement the crystalline host rock qualities of DGR sites identified in the Fennoscandian Shield). Radionuclide releases are also limited by the buffer as another mechanism to retard radionuclide movement. The host rock, backfill, plugs and seals will provide further containment functions.  Salt  For a salt host rock, the primary barrier for containment is the salt itself, which has very low unconnected porosity, low water content, and near zero permeability to fluid flow. Salt experiences visco-plastic deformation: over time, excavations will creep close. Additionally, the disturbed rock zone and any crushed salt backfill will reconsolidate, restoring the original properties of the salt. Salt disposal concepts rely on the waste package to contain the waste only as long as may be required for retrievability of the waste (e.g., a few hundred years). Shaft seals and drift seals are important components of the engineered barrier system, as these are relied upon to seal the repository until the processes of creep and reconsolidation have closed the openings in the salt.  Clay  Clay (argillaceous) host rocks range from plastic, soft, poorly indurated clays to brittle, hard mudstones and shales. The low-permeability and self-sealing behaviour of plastic clays allow them to provide a strong contribution to containment by favouring diffusive transport and sorption of radionuclides but can also introduce potential for gas pressurisation for some inventories. In these environments, the container and buffer provide water-tight containment while the engineered damaged zone is still recovering, and sealing and backfilling systems limit water ingress, prevent accessways providing fast pathways, and may play a role in limiting gas pressurisation.  Hard mudstones and shales may include areas of fracturing and sandstone/salt interbeds, which can provide advective pathways, while saline environments may limit the choice of EBS materials. Concepts in these environments may require longer containment in the EBS, specific materials, and may draw on overlying layers and properties of the broader geological environment for additional containment. | |