**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: Hierarchical safety function system to derive design criteria** | |
| **Abstract (300-500 words):**  One of the major challenges faced by all nuclear waste disposal programs is to derive safety functions and safety function criteria for design elements which ensure that the overall safety of the system is reached and maintained for the whole assessment timeframe.  A new hierarchical system of safety function-based approach is presented which is based on the following main underlying assumptions: 1) with proper site selection and design the required safety can be achieved originally, 2) those processes and events must be considered which may result in the system failing to work as planned. The system, as presented here, was developed primarily for high-level radioactive waste disposal systems utilizing the geological disposal concept, but with minor alterations it may be applied to different disposal concepts.  The system presented here is made up of five levels: 1) At the highest level there are three ultimate goals defined for all disposal systems: a) to safeguard the biosphere (to establish an initially adequate system), b) to ensure the long-term stability of the disposal system (to maintain the proper performance for long time periods), and c) to enhance reliability of proper performance of the system by ensuring understandability and predictability. 2) At the next level there are specific goals under each of these, such as the limitation of contaminant fluxes leaving the repository, maintaining stable hydraulic conditions, or selecting sites which may be properly explored, and their evolution well predicted. 3) The third level represents in our nomenclature the safety functions which may be very specifically defined for each component of the disposal system or for specific processes. Since these represent functions or conditions to be achieved, their wording generally contains phrases such as limiting, maximizing, minimizing, maintaining, selecting, or avoiding. The current system contains some 30 safety functions. 4) The safety functions are closely related to the safety criteria which should be defined by mathematical equalities and inequalities. 5) The lowest level of the system contains the numerical criterion values for each material property, environmental condition, and parameter value representative for processes and events which may influence the system and its long-term evolution.  During site investigation, design, and operation, all of these must be regularly reviewed and updated based on new information, current understanding, and design. In a real-world application, this system may be further enhanced by providing proper definition and description for each of its elements and their potential relations, similar to a FEP-database. It is also acknowledged that the same level of safety may be achieved by different combinations of the criterion values, and selecting from these alternatives may be dependent on non‑technical aspects. | |