**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:**  **Containment performance analysis for the surface repository at Dessel, Belgium** | |
| **Abstract (300-500 words):**  In the framework of the safety case for the category A waste repository at Dessel (Belgium), a systematic analysis of the containment performance was performed, the ultimate objective of which was to confirm the efficacy of the containment strategy concretised in the long-term safety concept. To this end, three goals were pursued:   * to quantify the expected containment performance of the disposal system and its constituting SSCs and safety functions; * to demonstrate that the disposal system and its components display sufficient robustness with respect to reasonably foreseeable perturbations thereof; and * to demonstrate that the graded approach adopted in the containment strategy is commensurate to the evolving radiological hazard associated with the waste.   The expected containment performance was assessed using the phenomenologically expected evolution – which can be reliably described over timeframes of the order of two thousand years – and the long-term safety concept in terms of main roles of SSCs for the containment and protection safety functions. While the containment performance is strongly linked to design requirements and conformity criteria substantiating them, a set of quantitative performance indicators, calculated from qualified best-estimate near field models, was also tested – the most useful ones were found to be the fraction of activity and radiotoxicity decayed and/or present in the main SSC’s as a function of time, and the cumulative radiotoxicity released from the disposal system.  This allowed to get a clear picture of the overall level of containment provided by the disposal system and the relative contributions of SSC’s and safety functions. It was confirmed that the vast majority of initial activity/radiotoxicity is subject to decay inside the disposal system and that releases of radionuclides can essentially be prevented as long as an efficient limitation of water infiltration towards the waste can be ensured by the subsequent components of the multilayer cover. It was further demonstrated that releases can be strongly limited and delayed even as the system degrades, thanks to the continued diversion of most water away from the waste, and chemical retention – to which the waste form is the key contributing component.  Performance indicators were also quantified under perturbed conditions resulting from potential threats posed by predefined plausible events/scenarios (e.g. major earthquakes) that could compromise the disposal system's containment capacity. It was found that complementary and independent SSC’s and/or safety functions are available in all cases. Indeed, no common cause failures could be identified, while conductive sorbing media at the base of the disposal system mitigate enhanced releases from the waste and monoliths (the concrete disposal units containing the waste).  Thus, it was confirmed that the disposal system maintains adequate containment over a span of two thousand years across all plausible evolution scenarios. Cumulative radiotoxic releases over this duration are limited to at most a few percent of the residual radiotoxicity. This reaffirms that the containment strategy outlined in the long-term safety concept ensures a sufficient margin of safety compared to the residual radiological hazard associated with the waste. | |