**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:**  **Semi-probabilistic radiological consequence analysis** | |
| **Abstract (300-500 words):**  Analysis of radiological consequences of the normal evolution scenario and various disruptive events after the closure of a radioactive waste repository is an essential part of its long-term safety assessment. PURAM has conducted such analysis for the low- and intermediate level waste geological repository at Bátaapáti, SW Hungary (National Radioactive Waste Repository, NRWR). In accordance with international practice, relevant disruptive events were selected based on FEP-analysis. Consequences of the derived alternative evolution scenarios were evaluated mainly on deterministic basis. Nevertheless, in order to decrease conservatism, some of them were assessed using a semi-probabilistic approach. This approach was also applied for certain considerations of the normal evolution scenario. Two examples are presented below.  According to the normal evolution scenario, long after the closure of the repository, the contaminated groundwater will reach the near-surface zones, where it can be extracted from a well at a farm. However, it is unlikely that the well will be located exactly in the centre of the potential contamination, and the water production itself will also contribute to the decrease of the contamination level due to dilution in the well.  In the post-closure safety analysis, the expected value of the contamination in the well was assessed based on a **geometric (spatial) probability**. A series of dedicated hydrogeological model runs (~ 75) comprised the evaluation of water production from the well with an assumed yield and distance away from the highest concentration in the groundwater. These analyses proved that the concentrations in the well are about two orders of magnitude lower than the maximum concentration in the shallow groundwater, resulting lower effective dose to the representative person in the normal evolution scenario of the subsequent safety assessment model calculations.  One of the evaluated alternative scenarios was the early failure of the engineered barrier system (EBS) due to a disruptive event, when a fracture had formed through the underground disposal vault and contamination released to the geosphere. A **temporal semi-probabilistic approach** was used to assess radiological consequences of this seismic disturbance (earthquake). Although the Bátaapáti site is located in a seismically low-risk area, previous seismic hazard studies and evaluation for load-bearing capacity of the reinforced concrete structures suggested that a high magnitude earthquake with a frequency of about 1 in 1 000 000 years may result in cracking of the already degraded concrete disposal vault. Applying a semi-probabilistic approach, such a seismic event occurring with a probability of 1% at 10,000 years after the closure of the repository can be considered as a realistic alternative scenario. In the post-closure safety model, the inventory was calculated for this time and the contamination was released directly into the biosphere, neglecting previous results from the hydrogeological model on the EBS and geosphere. It was concluded that such a seismic event will increase the effective dose to the representative person by about 2 orders of magnitude compared to the normal evolution scenario, but this still does not exceed the specified dose constraint of 0.1 mSv/year. | |