**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:**  **Geosphere model calibration in safety assessment based on detailed site-specific data** | |
| **Abstract (300-500 words):**  PURAM operates the National Radioactive Waste Repository (NRWR), which is an underground facility for final disposal of low and intermediate level radioactive waste (LILW) and located at Bátaapáti, SW Hungary. Surface-based and subsurface exploration of the site, and the construction of the repository itself generated a large amount of data and information from different sources, which were used to improve site understanding and safety assessment of the facility.  A key element of the confidence in the safety assessment is reliability of the models, representing the fate and transport of contaminants in the geosphere, after the closure. This is particularly important in a fractured rock environment where spatial variability and uncertainty of the data is relatively high, and it is not trivial how to set up a conceptual transport model.  Crystalline rocks, such as the host rock of the NRWR, are characterised by hydraulic processes mainly linked to hydraulically active fractures, while transport processes are strongly influenced by the so called “background” fracture set. Within the hydraulically active fractures, contaminant migration occurs primarily by advection as a function of the hydraulic gradient. However, other processes also occur that cause retardation of the contaminants. These are basically sorption on the fracture surface and fills, and matrix diffusion in the general sense, which includes all diffusive interactions between the hydraulically active and inactive regions.  An improved safety model of the contaminant transport in the geosphere was compiled based on a multi-step hydraulic modelling approach. The main consideration was to use detailed site-specific data with the least uncertainty. In the first step, a site-scale hydraulic DFN (FracMan) model was built based on known fracture statistics (fracture intensity, orientation, length, transmissivity). An equivalent porous continuum model (FEFLOW) was also set up to simulate hydraulic and transport processes, based on other field data as hydraulic potentials, groundwater flow rates, porosity. Based on the results of these two hydraulic models, a piston flow type transport model was built in GoldSim environment.  Downward groundwater movement (infiltration) in the fracture system above the geological repository was represented by an appropriately parameterized pipe element in the GoldSim model. Effect of the background fracture system on the transport was taken into account by using a zone of matrix diffusion around this pipe element. Depth of the matrix diffusion was chosen to minimize the difference between the measured and calculated C-14 groundwater age data at the repository level, representing the undisturbed conditions. This calibrated pipe model was then used to describe also the contaminant transport out of the repository, and served as a basis for the long-term post-closure safety assessment.  The use of C-14 groundwater ages as the main parameter for model calibration is of particular importance, because earlier safety assessments of the Bátaapáti site has also identified that radiocarbon is one of the major contributors of the post-closure effective dose, caused by the radioactive waste disposal in the NRWR. | |