**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:**  Study of Hydrological Conditions at the Geosphere-Biosphere Interface and Development of Alternative Models for Biosphere Assessment – a Regulatory Perspective  Key author:  Shulan Xu  Xu Environmental Consulting AB, Sweden  Email: [shulan@xuec.se](mailto:shulan@xuec.se) | |
| **Abstract (300-500 words):**  In the last ten years, several site-specific post-closure safety assessments in support of geological disposal of spent nuclear fuel and low and intermediate level radioactive waste have been submitted for regulatory review in, for example, Sweden, Finland and France. From a regulatory point of view, as such assessments move towards being more complex, ie, as site understanding develops, a greater emphasis is required to justify the degree of complexity in the assessment models in relation to their robustness and transparency. It is fundamental that the target audience, including regulatory bodies, the general public and decision makers, understand the approach that is used in the safety assessment. Experience from regulatory reviews of earlier safety assessments have shown that independent modelling is an effective way to provide valuable insights and understanding of the methodology and calculations presented by the applicant.  In this paper, we focus on the biosphere component that is a key part of the overall post-closure safety assessment for understanding potential radiological consequences to humans and to the environment. The biosphere model in post-closure safety assessments translates calculated radionuclide releases into expressions of radiological dose or risk that are used to determine compliance with regulatory criteria.  SSM has financed a study that has been performed in five different Swedish catchments, each with a number of streams, designed to investigate how groundwater flow and hyporheic exchange flow interactions vary between and within catchments, as well as how these interactions are controlled by specific hydromorphological and geographical catchment and stream characteristics. The aim of the study is to develop alternative approaches and assessment models that can be used for independent modelling in support of regulatory review.  The study shows that hyporheic exchange flow can reduce the groundwater upwelling area and increase the upwelling velocity in areas closest to the streambed-water interface. The strong convergence of groundwater discharge causes fragmentation forming narrow “hotspots” penetrating through the more spatially extended and intense hyporheic flow zone. In this paper, we describe modelling and tracer tests performed in the study. Further, we use methods based on the findings obtained from the study, to identify biosphere dose objects and to develop stream and lake models for the biosphere assessment as well as analysing the effect of the “hotspots” on the redistribution of releases in the surface environment. These methods are being used in STUK’s independent biosphere modelling activities in support of its on-going review of the post-closure safety assessment associated with the operational licence application for the Olkiluoto spent nuclear fuel repository. | |