**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:**  **The role of a probabilistic uncertainty and sensitivity analysis in the Safety case for the Loviisa LILW repository 2018** | |
| **Abstract (300-500 words):**  In Finland, the waste producer has the responsibility to manage nuclear wastes produced, including the final disposal. Fortum disposes the low and intermediate level wastes (LILW) produced at the Loviisa nuclear power plant (NPP) in a repository located at the NPP site at a depth of approximately 100 meters. The repository was commissioned in 1998. Having the whole chain from waste production, handling, transportation and disposal of the LILW within a single organisation has proven to be a straightforward and cost-effective way to manage and dispose of the nuclear waste produced.  A safety case for the Loviisa LILW repository in Finland was carried out in 2018 and approved by the regulator in 2019. In the safety case, a probabilistic uncertainty and sensitivity analysis was performed for the whole radionuclide transport modelling chain from the repository near field to the surface environment, including a dose assessment to humans.  The role of the uncertainty was to generate a statistical distribution for relevant results, e.g. release rates into the surface environment or doses to humans, and to analyse the impact of data uncertainties on the results. The aim of the sensitivity analysis is to identify the parameters/parameter uncertainties that have the largest impact on the relevant results, which provides guidance for future research and development activities.  In the probabilistic – or global – sensitivity analysis, the whole parameter space is analysed at the same time, i.e. all possible parameter value combinations are analysed. Several methods are available for performing the actual sensitivity analysis: correlation and regression methods, non-parametric statistical tests, variance-based methods, and graphical methods. In the Safety case for the Loviisa LILW repository a combination of graphical methods, correlation and regression based methods, and variance-based methods were applied.  The general benefits to performing a probabilistic uncertainty and sensitivity analysis for the whole modelling chain at the same time is that all relevant parameter interactions are included, and propagating uncertainties and sensitivities over interfaces between models is not required in fully coupled models. However, analysing the results becomes more complicated due to higher order dependencies and complicated interactions between parameters and results, and the transparency of the analysis generally suffers.  For radioactive waste disposal systems, the model results typically span over several orders of magnitude. Therefore, logarithmic transformations of all the input parameters and the model outputs performed, which increased the usefulness of the sensitivity analysis results.  The maximum dose rate was generally most sensitive to parameters related to the surface environment, while release rates normalised to release constraints set by the regulator were most sensitive to parameters related to transport of nickel (e.g. steel corrosion rates, sorption). | |