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Modelling long-term Accumulation of Radionuclides in the Soil-Plant-System originating from continuous Groundwater Contamination – a Sensitivity Analysis

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This study was conducted as part of the risk assessment of Swedish final deposits of nuclear fuel waste. The overall objective is to elucidate the possible long-term (i.e. 10.000 y) accumulation of radionuclides after an eventual continuous groundwater contamination. The specific objectives are to assess: i)What proportion of the contamination will accumulate in the soil-plant-system? ii) Where in the soil-plant-system will it accumulate? iii) Which ecosystem characteristics and radionuclides properties are important for the accumulation? and iv) Under which circumstances do losses occur? For these purposes, we developed the trace element model Tracey. Tracey includes two plant uptake approaches; (i) passive uptake driven by water uptake and (ii) active uptake driven by growth. The model is linked to the sensitivity analysis toolbox Eikos (Ekström, 2005) for Monte Carlo simulations (see Gärdenäs et al. 2008a). Tracey was applied on two ecosystems with contrasting hydrology, a *Pinus-Picea* forest found in recharge areas and an *Alnus Glutinosa* forest found in discharge areas. The sensitivity of the radionuclide accumulation to various radionuclide properties and ecosystem characteristics (e.g. allocation pattern of radionuclide and soil bulk density) was assessed. We found that in the *Pinus-Picea* forest type accumulated 20-25 % of the contamination, predominately in the soil, while in the *Alnus* forest type accumulated 20-90 % of the contamination. The plant uptake approach, rooting depth and adsorption capacity and their interactions were the most important explaining factors for the

amount accumulated and the distribution of the radionuclides in the ecosystem.