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Effect of the Repository Configuration on Radionuclide Transport with the Multi-compartment Model for the LILW Repository Performance

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Nuclear Environment Technology Institute (KHNP-NETEC) developed the conceptual design of the low and intermediate-level radioactive waste (LILW) repository. Among many engineering challenges, it is of particular importance to find out an optimum arrangement of near-surface disposal vaults in the repository area to minimize the radionuclide flux and concentration at the interface between the geo-sphere and bio-sphere. For this purpose, VR-KHNP (Virtual Repository-Korea Hydro & Nuclear Power) is developed for the radionuclide transport in the near- and the far-fields by formulating the continuities of mass flux and concentration with the multi-compartment model. VR-KHNP evaluates the mass transfer rates from the repository to the far field, and to the bio-sphere. The spatial distribution of radionuclide mass as a function of time can also be calculated. With the code, the radionuclide transport has been calculated and the results have been successfully benchmarked against those from SAGE. Effect of repository configuration in relation to the groundwater flow has been investigated. For some radionuclides such as Ni-63, Tc-99 and Cs-137, it is shown that repository configuration has significant effects on their release rate at the interface between the near field and the far field.