Application of Complementary Indicators for the Performance Assessment of Disposal Facility in Korea

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1. Introduction

In order to assess the safety of disposal system for radioactive waste in terms of dose to human, the simulation of biosphere is required to illustrate exposure pathways. However, due to the altering properties of biosphere over times, the approach related to ecosystem has a relatively high uncertainty in long-term safety assessment. Therefore, the robustness of the safety assessment of a repository should be reinforced by the introduction of complementary indicators alongside primary safety indicators (dose and risk).

This work discussed the practical use of complementary indicators (radiotoxicity flux and radiotoxicity concentration in natural water) with the safety assessment for the rock-cavern type low- and intermediate-level waste (LILW) disposal facility of Korea.

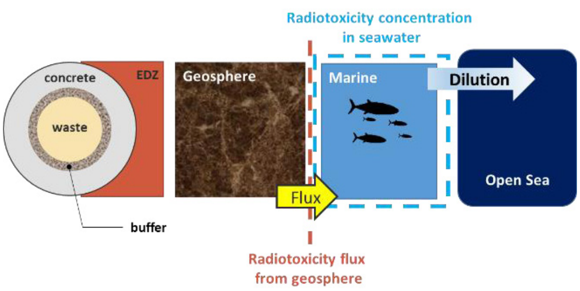

Fig. 1. Conceptual illustration of radiotoxicity flux and concentration in natural water.

2. Methods

2.1 Concentration measurement of natural radionuclides in groundwater and seawater

The concentrations of ^{40}K, $^{226,228}Ra$, ^{232}Th, and $^{234,235,238}U$ in groundwater samples taken from three sites in Gyeongju were assayed by mass spectrometry. In seawater collected near the shoreline, only ^{40}K content was measured. Based on our measurements, the reference levels for complementary indicators has been derived by dose conversion factors [1] and equations given in the previous study [2].

2.2 Modeling

The Goldsim model has been developed for the calculation of radioactive flux from the geosphere and the radiotoxicity concentration in seawater from the rock-cavern type LILW repository. The model consists of engineered barrier, geosphere, and biosphere based on the conceptual design of silo-type disposal system. Details on the modeling are presented in elsewhere [3].

3. Results and Discussions

The natural radiotoxicity in groundwater varied between 1.18 × 10^{-4} Sv/m^3 and 1.00 × 10^{-3} Sv/m^3

depending on the sampling sites. The ^{40}K radiotoxicity in seawater was 6.95 × 10^{-5} Sv/m^3. These measurements were utilized for the determination of yardstick for the complementary indicators related to radiotoxicity flux and radiotoxicity concentration. The safety of disposal system was assessed by comparing simulation results from our model with reference values determined by the natural system.

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