

## A Verification Study between KAERI's and JAERI's Biosphere Assessment Models

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### 1. Introduction

Korea Atomic Energy Research Institute (KAERI) and Japan Atomic Energy Agency (JAEA) have been used similar conceptual and mathematical models as well as datasets for deriving flux-to-dose conversion factors in order to convert the radionuclide flux from a geosphere to a biosphere, to dose exposure rates for a biosphere assessment for the safety assessment of a radioactive waste repository [1,2]. In this study, not only the conceptual and mathematical models, but the datasets of the biosphere assessments used in the KAERI and JAEA models have been compared and the differences between both models have been analyzed. The following approaches were made to compare the KAERI biosphere models and JAEA biosphere models:

- Comparing the geosphere-biosphere interface for the representative model cases
- Comparing the radionuclide transfer pathways and the human exposure pathways for a conceptual and mathematical model
- Comparing the datasets for a representative model case
- Comparing the results for a case with KAERI-AMBER and JAEA-AMBER
- Comparing the results for a case with KAERI-GoldSim and JAEA-AMBER
- Comparing the significant biosphere parameters identified through a sensitivity analysis

To evaluate the exposure doses to humans, exposure pathways are assumed as shown in Fig. 1., based on which, radionuclides from the geological media were assumed to be further transferred after passing through the geosphere-biosphere interfaces. Flux-to-dose conversion factors (DCFs) for the exposure groups were calculated for the river water, well and local marine water models by GoldSim and AMBER, without considering a sorption or dilution in the aquifer for simplicity. In addition, another river water model with the consideration of both a sorption and dilution in the aquifer was also calculated. Sensitivity analysis and regression analysis were performed to evaluate and understand the relative importance of the parameters. In the sensitivity analysis, DCFs were calculated by a straightforward Monte Carlo method, by sampling all the parameter values from the assumed ranges except for the size of the compartments and dose coefficients. Multiple linear regression analysis was carried out for the result of the MonteCarlo simulation by SAS.

### 2. Result and Discussion

KAERI and JAEA biosphere models were compared with each other and it was shown that almost the same radionuclide transfer and human exposure pathways were described in both biosphere models even though some of the biosphere parameters had different values in the KAERI biosphere dataset and the JAEA biosphere dataset. FDCs were calculated with some biosphere models developed by KAERI and JAEA. Only the FDCs for C-14 and I-129 for the marine fishing exposure groups showed some differences between KAERI-GoldSim and JAEA-AMBER (Fig. 2a). The rest seemed almost the same. Sensitivity analysis for the biosphere models was performed to identify the significant biosphere parameters for I-129 (Fig. 2b). It was concluded that the transfer parameters in the surface environments, human consumption rates and soil to plant transfer factors of the radionuclides to agricultural products have a rather larger influence on the FDCs than any other parameter. It would be necessary and useful to identify the significant biosphere parameters for key radionuclides other than I-129 for making a priority list for future oriental biosphere assessments. From the results of the regression analysis for each biosphere model, it became clear that the transfer parameters in the surface environments such as the groundwater flow and volume of irrigation water, and the human consumption rates, and soil to plant transfer factors of the radionuclides to agricultural products have a larger

influence on the FDCs than any other parameter.

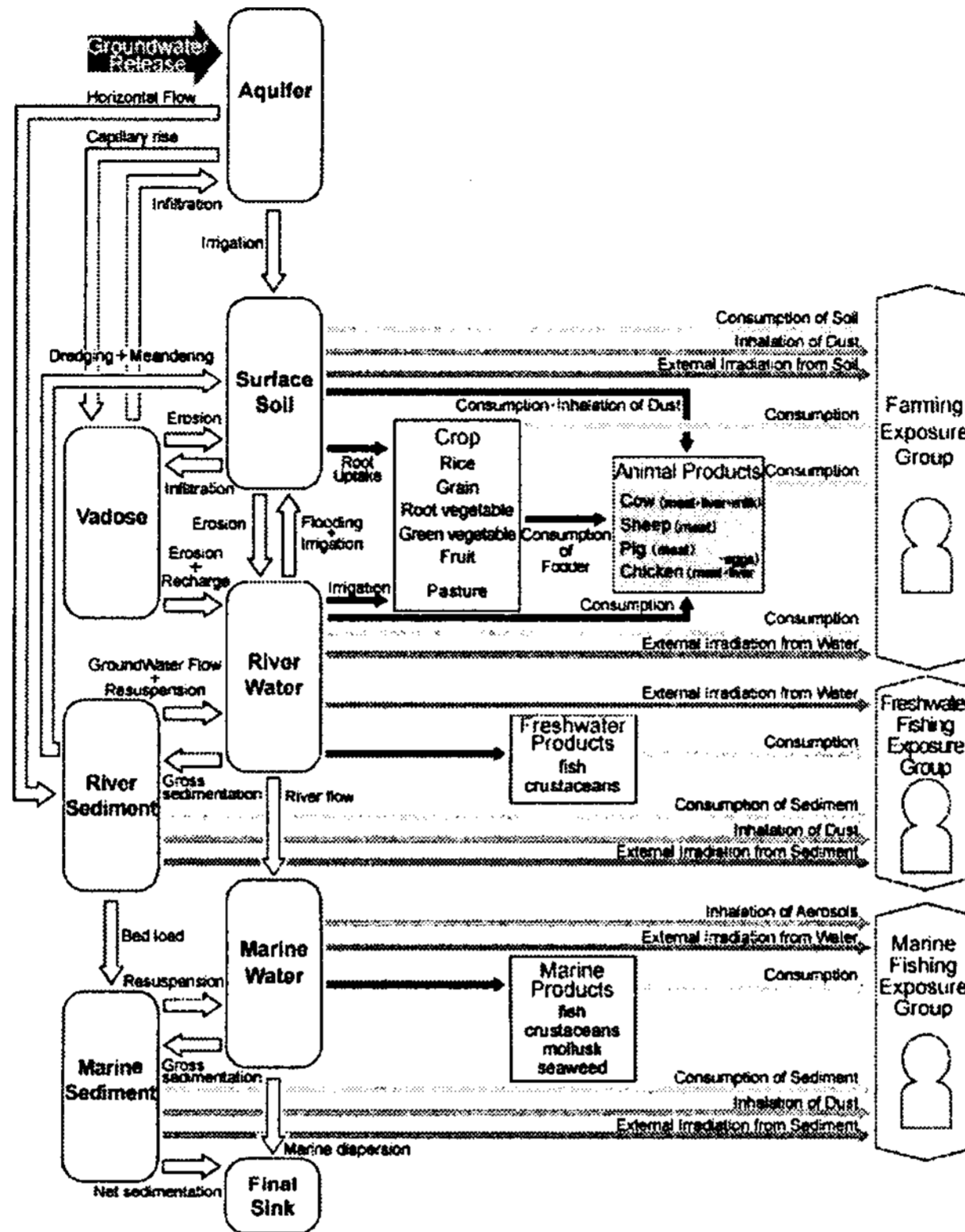


Figure 1 Conceptual model for the radionuclide transfer and human exposure pathways in the KAERI-Well model

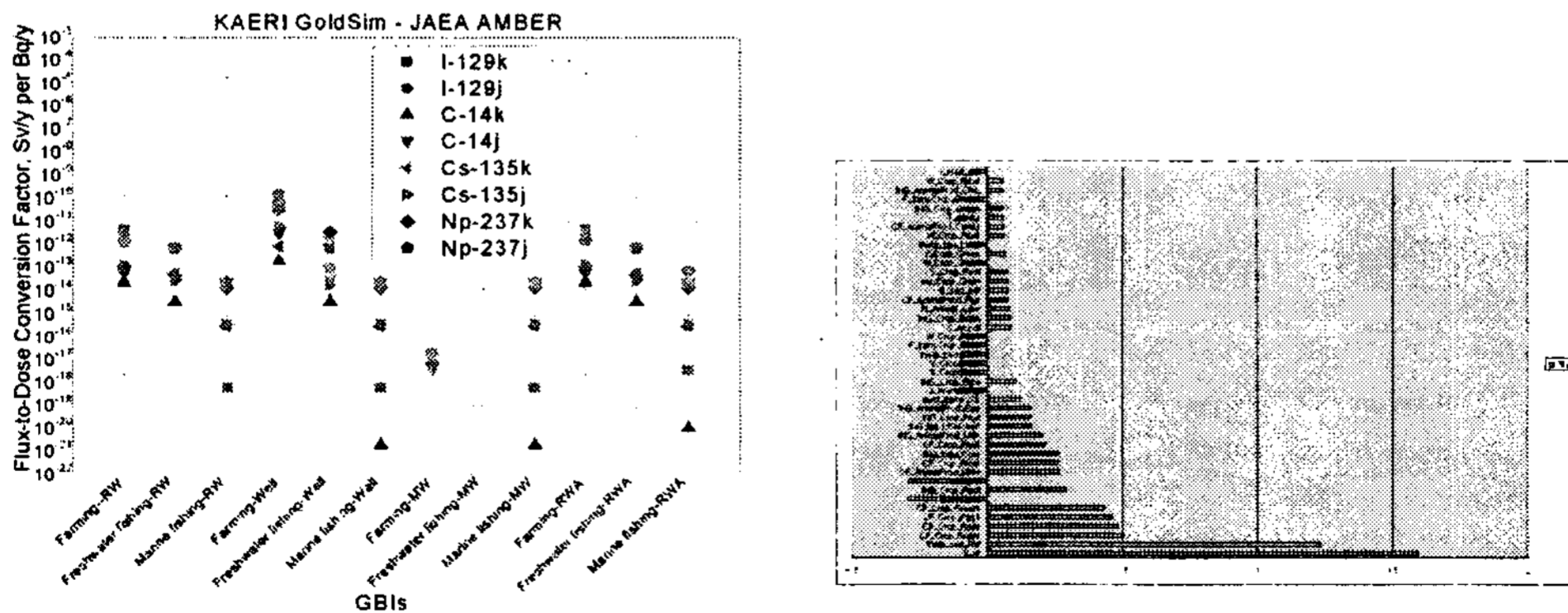


Fig. 2. Some results from the comparison and sensitivity studies

REFERENCES

1. Youn-Myoung Lee and Yongsoo Hwang, "Biosphere Modeling for Dose Assessment of HLW Repository: Development of ACBIO," J. the Korean Radioactive Waste Society (in press).
2. Japan nuclear cycle development institute; Second progress report on research and development for the geological disposal of HLW in Japan, H12: Project to establish the scientific and technical basis for HLW disposal in Japan, JNC TN1410 2000-001(2000).