A Nuclide Release Behavior due to a Varying Thickness of an EDZ in the Near-field of an HLW Repository

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1. Introduction

In view of a safety and a performance assessment for a repository as well as its design feed back, it seems very important to quantify a nuclide release in and around the near-field a high-level radioactive waste repository (HLW) due to the varying physical and geochemical parameters associated with an HLW. During past years, by utilizing AMBER[1], some nuclide transport models for not only the near- field but also the far-field of a repository with detailed system features have been developed [2-3]. In the current study, for the thickness of an excavated damaged zone (EDZ) around a repository which is one of the principal parameters affecting the performance of a repository, a model has been devised for an HLW with the aid of a general purpose modeling tool, GoldSim[4]. GoldSim has been designed to facilitate the object-oriented modules by which any kind of specific models can be easily addressed in a straightforward manner, analogously like solving jig saw puzzles. Through this study, some probabilistic calculations according to a varying thickness of an EDZ for an assumed case, which are believed to be further extended and applied to other parametric studies, are made and briefly introduced.

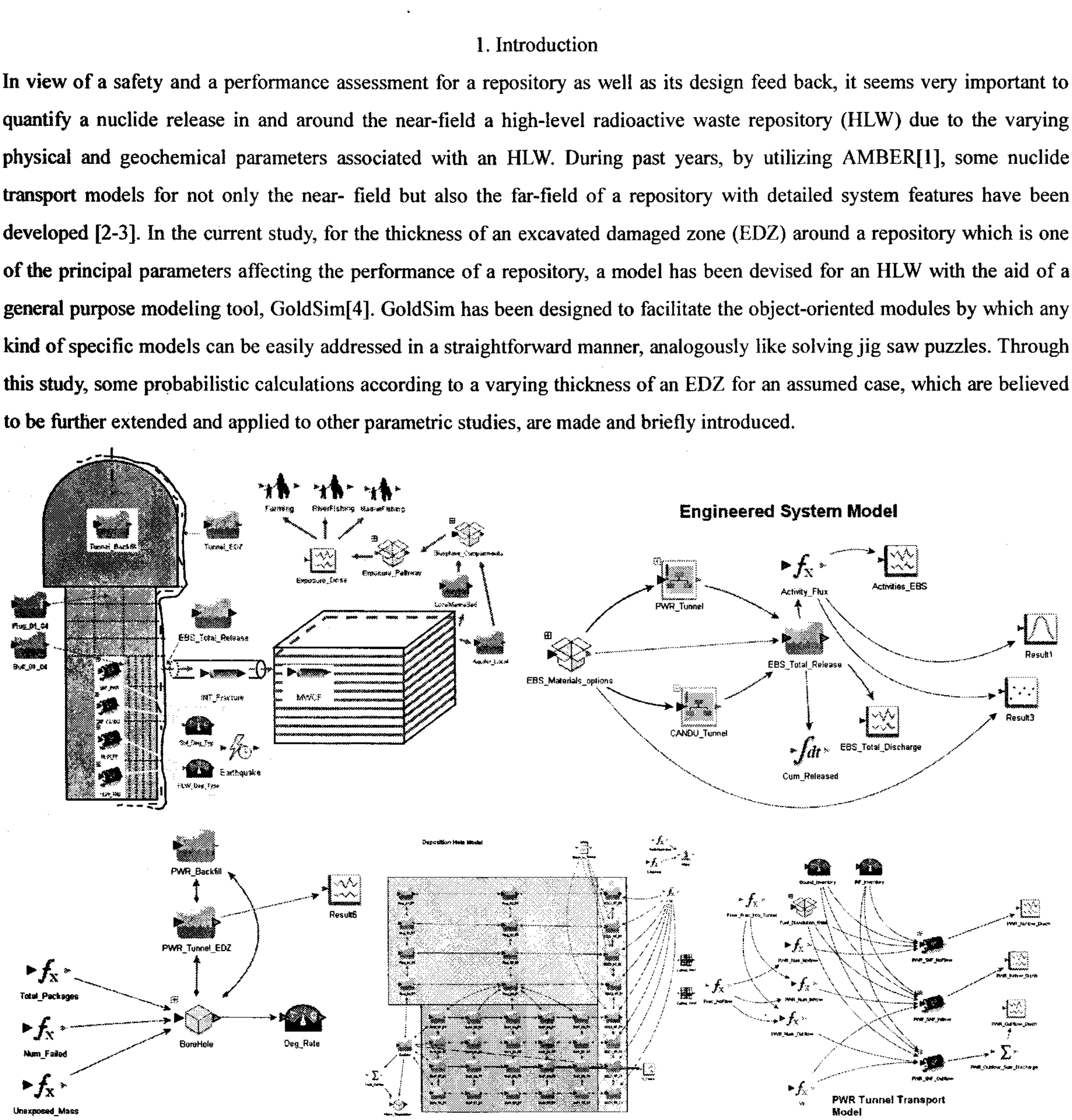

Fig. 1. Concept of a total release from the engineered near-field barrier in the frame of the total system performance assessment system

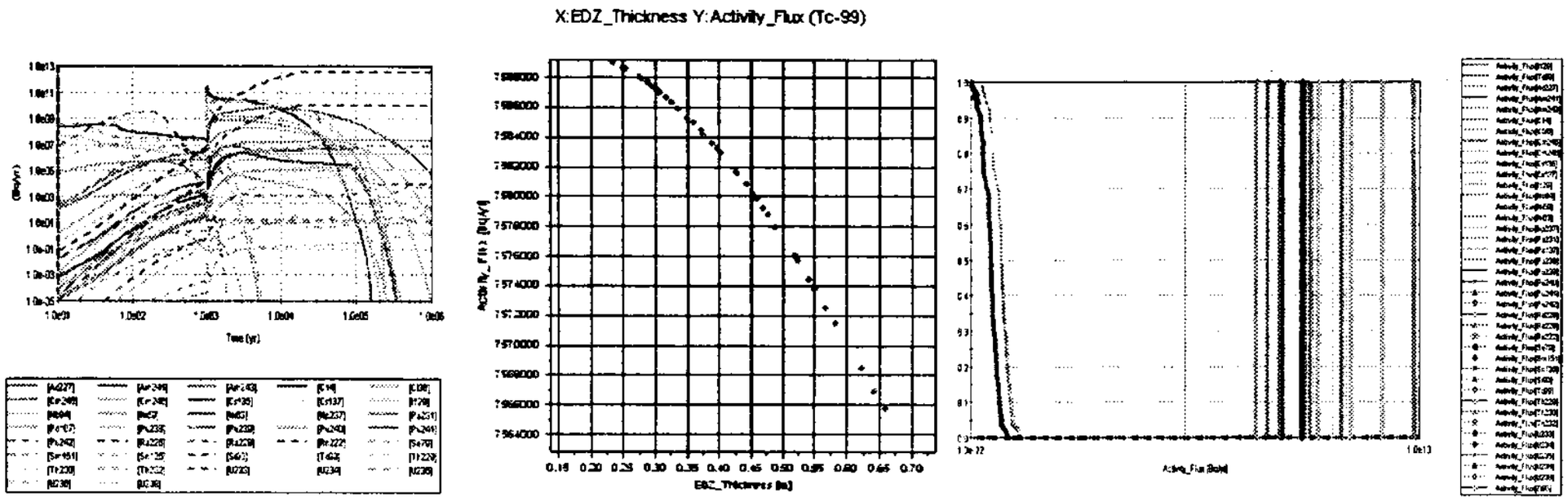

Fig. 2. Some calculated EDZ thickness sensitivity results: (*left*) nuclide fluxes with mean EDZ thickness value (0.3m), (*middle*) scatter plot for Tc-99, (*right*) CCDF for all nuclide fluxes.

2. Illustration and Discussion

For the total release from the near-field of the repository, such near-field barriers as a canister itself and a surrounding buffer and outer part of a tunnel, filled by a backfill material as well as an EDZ (modeled as a cell, *Tunnel_EDZ* as shown upper left in Fig. 1) formed both around the deposition holes and tunnel are modeled as the main components involved in a nuclide release into the far-field of a repository. This complex system can be implemented with GoldSim modules as conceptually depicted in Fig. 1. Breakthrough curves for a bunch of nuclides throughout the near-field pathway with a mean value of the EDZ thickness as well as a sensitivity for varying EDZ thicknesses, which seems somehow sensible for the release flux of ^{99}Tc as implicated by scatter scatter plot and CCDF for all the nuclide fluxes, are also shown in Fig. 2. Although only a simple illustrative case is represented here, GoldSim seems useful and necessary for a further in depth feedback to refined a repository design concept and it would also be helpful to build another appropriate safety assessment tool even though there might be many more things to be developed.

REFERENCES

[1] AMBER 4.4 Reference Guide, Enviros Quantisci, Henley-on-Thames, U.K., 2002.

[2] Youn-Myoung Lee et al., "Nuclide transport calculation in the near- and far-field of a reference HLW repository using AMBER," Proc. Waste Management 2005 (WM'05), Feb. 26~March 4, 2005, Tucson, AZ, U.S.A.

[3] Youn-Myoung Lee et al., "Nuclide release from an HLW repository: development of a compartment model," Annals of Nuclear Energy, 34, 782-791, (2007).

[4] GoldSim Contaminant Transport Module, User's Guide, Version 4, GoldSim Technology Group, 2006.