Influence of a backfill on a Nuclide Release from a HLW Repository

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It is very important to quantify a nuclide release in the near-field of a repository where groundwater bearing fractures are available for carrying the nuclides released from initially damaged canisters or due to whatever reason after a disposal in view of a safety assessment of a repository as well as its design feed back.[1] A detailed modeling, quite similar to the one studied in Swedish KBS3 SR97[2], but with a more in depth approach, for a nuclide transport through the near-field with newly introduced repository system features for a compartment modeling such as the excavation disturbed zone (EDZ), buffer thickness, and tunnel crowns, all of which are expected to control a nuclide release from the near-field of a repository has been developed under the name of ACGEO[3-7]. ACGEO has been developed as an AMBER case template based on a compartment modeling method by accounting for the physical geometry and repository materials that could influence a nuclide transport by utilizing a general-purpose compartment modeling code, AMBER[8]. After a leakage from a canister, nuclides will spread out through the buffer material surrounding the canister before migrating farther into the flowing groundwater in the fractures possibly embedded at various locations of the host rock medium through which a preferential nuclide transfer into the far-field probably takes place. To exclusively investigate the influence of a backfill on a nuclide release from the leakage point Q1, from among all the other possible sensitive release points shown in Fig.1, nuclide releases for 4 arbitrarily chosen nuclides both from the near-field as well as the far-field of a repository through leakage point Q1 are calculated in this study. All the other backfill except for around this area is assumed to remain unchanged while the buffer material around leakage point Q1 almost loses its functionality to retard a nuclide transport by accounting for its variation in thickness from 0.5m to 2×10^{-6}m. As found through previous studies, Q1 is regarded as the most critical pathway with a fracture intersecting deposition hole and that is the reason why it is solely investigated for an outlet for farther far-field nuclide release.

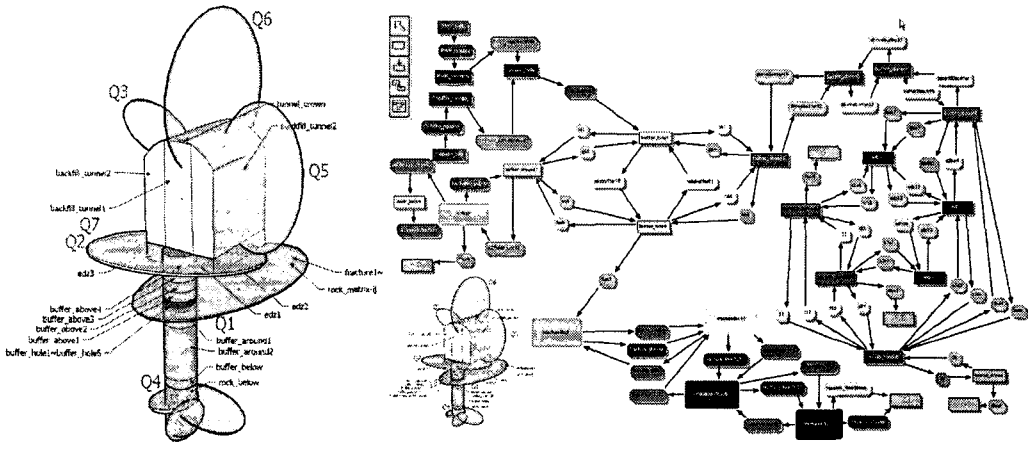
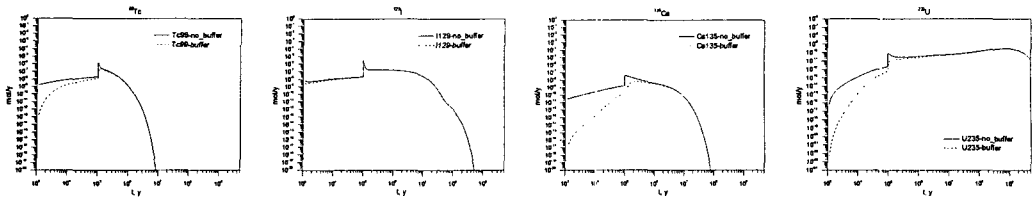
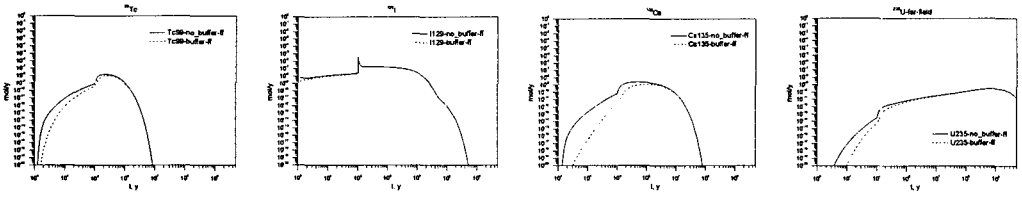


Fig. 1. Modeling domain and compartment modeling scheme.



(a)



(b)

Fig. 2. Nuclide release from (a) the near-field (Q1); and (b) from the far-field for 4 chosen nuclides.

Fig. 2 shows the nuclide releases from the Q1 release exits of the near-field and the far-field of a repository. For the far-field release it is assumed that the nuclides are all transferred to the fracture from the Q1 exit where a canister hole–fracture interface exists. The canister hole area is assumed to abruptly grow at 10^5 years for all the calculations. In each figure, nuclide release rates both from the near- and far-field for two cases, one of which (solid line) represents the case of no consideration of a buffer material (imagine actually very *thin* buffer) and the other of which (dashed line) shows the normal case with a consideration of a full buffer material thickness (of 50cm) are compared. Except for ^{129}I, which has a very low sorption coefficient in a buffer material and also a long half-life (1.6×10^7y), does not show a great difference in the nuclide release rate, the other 3 chosen nuclides show a noticeable change of the nuclide release rate between the two cases especially at an earlier time.

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