



Modeling of ^{90}Sr migration in clays with respect to soil adsorption properties using HP1

Моделиране на миграцията на ^{90}Sr в глинни при отчитане на адсорбционните свойства на средата чрез код HP1

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Абстракт. Миграцията на ^{90}Sr в глините на Брусарската свита в района на гр. Козлодуй е оценена чрез моделиране на водо- и масопеноса във вертикална посока с помощта на компютърния код HP1. Адсорбционните свойства на средата са представени с процеса на образуване на комплексни съединения на стронция с феро-оксидите от глините. Резултатите са сравнени с друг модел, при който задържащите свойства на средата са дадени с коефициента на разпределение K_d .

Ключови думи: моделиране, адсорбционни свойства, геохимични реакции.

Modelling of radionuclide transport is always concerned as a key issue of the evaluation of safety of a low and intermediate level radioactive waste (LILW) repository. In Bulgaria, due to the operation of Kozloduy Nuclear Power Plant a building of such facility is forthcoming. The classical assessment of this transport is made with convection-diffusion equation (CDE), which terms describe mathematically the flow and solute transport into the soils (Jury, Horton, 2004). In that case the adsorption-desorption behaviour of soils (property of soils to retard for a given time a given chemical including radionuclides) is examined with the so-called retardation factor, in which formulas the main term is an experimental coefficient known as distribution or partitioning coefficient, K_d . The main problem is that it is highly sensitive (in orders of value) to the chemical conditions (mainly variations of pH, redox potential and CO_2). Therefore this approach contains inherent limitations to describe contaminant migration when the geochemical conditions are not constant.

From the other hand, in the recent year a new approach is developed so-called reactive transport modelling implemented in coupled numerical codes (Steeffel et al., 2005) They integrate two main modules: a mathematical apparatus for the governing equations of the

water flow part including variable saturated medium (usually modified) and a mathematical apparatus for describing the chemical and geochemical reactions. The advantage of these codes and resp. from the reactive transport modelling is that the contaminant partitioning between the solute and solid (mineral) phases is described with equilibrium and kinetic type chemical reactions with the option that these reactions could be function of the geochemical conditions, *i.e.* pH, and redox potential.

The study deals with reactive transport modelling of hypothetical vertical ^{90}Sr migration into the clays of Brusarci Formation in the region of Kozloduy. The flow and chemical modelling were performed with coupled numerical code HP1. The adsorption properties of the clays were implemented in the code by surface complexation reactions between the strontium and clay ferro-oxides. The used methodology is similar to that one published by Jacques et al. (2008). The results were compared with another model performed with computer code HYDRUS 1-D in which the adsorption properties of the medium were evaluated with the relevant for the strontium distribution coefficient, K_d . One of the future tasks includes extension and evaluation of the model with respect to variable pH of the radionuclide flux.

References

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