## 4.64.P07

# Radionuclide release models for contaminated concrete

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Concrete materials in nuclear installations may become activated or contaminated by various radionuclides through different mechanisms. Consequently, decommissioning and dismantling of the facilities produces considerable quantities of concrete materials, which are at least potentially contaminated with radionuclides and which must be managed safely and cost-effectively. Safety and environmental impact of decommissioning/disposal options (e.g. direct reuse of building structures, reuse of recycled building materials, disposal of rubble in landfills) depend inter alia on potential releases of the radioactive contaminants into groundwaters and/or surface waters.

In this paper we present results of a research project funded by the German Federal Ministry of Education and Research (BMBF Grant-No. 02S7900) that aims to improve the knowledge concerning the release behaviour of radionuclides from contaminated concrete, the radiological assessment of recycling and/or reuse of contaminated building materials from nuclear installations and the optimisation of the disposal process (i.e. selection of cost-effective and reasonable disposal options). One of the key issues in this project is the development of source terms for the mobilisation of relevant radionuclides (e.g. $^{60}$Co, $^{63}$Ni, $^{90}$Sr, $^{137}$Cs, $^{129}$I as well as U, Pu, Am and other actinide elements) from contaminated concrete materials.

The behaviour of radionuclides in contaminated concrete materials depends on the nature and chemical behaviour of the contaminant, the source/pathway of the contamination, and the physical, chemical, and mineralogical properties of the concrete material itself. The assessment and modelling of the radionuclide release from concrete or other cement-based materials thus take especially into account the solid speciation and the chemical behaviour (e.g. aqueous speciation, solubility) of the individual radioactive contaminants as well as the chemical environment and the hydraulic regime within the concrete, which may depend on the disposal option. Other important factors that are considered are mechanical and chemical degradation processes (e.g. micro-cracking, carbonation, sulphate attack, and chloride ingress) and their influence on contaminant mobilisation from concrete materials. Model calculations are used to illustrate the evolution of the source term over time and the potential release processes such as desorption-diffusion, leaching and dissolution of discrete solid phases.

## 4.64.P08

# Sorption ability of $^{152}$Eu and $^{241}$Am in geological materials

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### Introduction

Rare earth elements are very useful as an analogue of actinide elements in geological environment. Based on physical and chemical characteristics of Eu and Am and previous research result [1], we assumed that Eu and Am might show very similar sorption ability in geological environments, and performed a batch experiment using four kinds of rocks. In this paper, we report and discuss its preliminary result.

### Samples and Experimental Method

We performed the batch experiment using $^{152}$Eu and $^{241}$Am as radiotracers in granitoids, meta-basalt, and tuff. The radiotracer solution tubes were shaken continuously for a given interval using a linear reciprocating shaker. Specific activity ratio($A/A_0$) of the tracer solutions with contact times was measured(Fig. 1). After the activity measurement, the radiotracer solution was transferred to the original centrifuge tube and was reshakened.

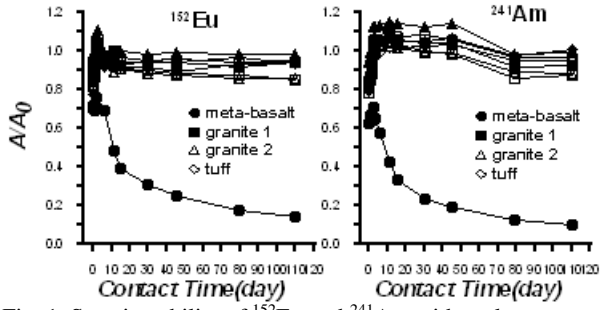


Fig. 1. Sorption ability of $^{152}$Eu and $^{241}$Am with rock types

### Results and Discussions

In Figure 1, we can observe that the sorption trend of $^{152}$Eu and $^{241}$Am with time is very similiar, which suggests that Eu is a useful analogue of Am in geological environments. Especially, $^{152}$Eu and $^{241}$Am in basaltic powder (solid circle) were sorbed more compared with other rock powders. This suggests a strong sorption abilty of some basaltic composition against $^{152}$Eu and $^{241}$Am.

### Reference

[1] Johansson, B. and Rosengren, A. (1975) *Phys. Rev. B* **11**, 1367-1372.