The effect of seawater intrusion on strontium mobility at nuclear sites

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Introduction

Many nuclear facilities are located near shorelines, which will lead to the intrusion of seawater into subsurface enviroments. Seawater intrusion can raise concerns regarding the potential (re)mobilisation of radionuclides because of change in groundwater salinity. Batch experiments were conducted to investigate the effect of these processes on Sr mobility in groundwater below a nulcear power plant (NPP).

Results and Discussion

A core rock sample was collected from Kori NPP site in South Korea, and the < 2-mm fraction samples were used for batch experiments. To simulate seawater intrusion, various ratios of mixing groundwater (GW) to seawater (SW) were adopted. The amount of Sr sorbed was driven by ion exchange competition between Sr and Na present in solution. The removal efficiency of Sr by the solid material as an exchangeable phase was reduced by increasing the mixing ratio of seawater to groundwater. However, in solution with more than 70 % seawater, Sr removal from solution also increased because of strontianite, $SrCO_3$(s) precipitation.

Table 1. Percent Sr removal as a function of different mixed solutions at constant pH 8.0 with ratio of solid to solution (0.5g/10mL).

Mixing ratio GW : SW [%]	Ionic strength [M]	Sr removal [%]
100 : 0	0.01	39.5
70 : 30	0.24	8.18
50 : 50	0.39	8.11
30 : 70	0.54	13.7
0 : 100	0.77	15.0

The degree of salinization in groundwater chemistry is important to predict radioactive Sr mobility in case of severe nuclear accidents, during which Sr can be released to the subsurface environment.