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Partitioning of Fission Products (Cs, Sr and I) into Salt Phases

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The Waste Isolation Pilot Project (WIPP) is a nuclear waste repository located in SE New Mexico, USA. The repository is hosting TRU waste and future disposal in similar sites may accept waste containing fission products (FPs). Should groundwater intrude such a repository and mobilize FPs, the transport of Cs, Sr and I may be limited by partitioning into salt phases, such as carnallite [$KMgCl_3 \cdot 6H_2O$], langbeinite [$K_2Mg_2(SO_4)_3$], leonite [$K_2Mg(SO4)_2 \cdot 4H_2O$], polyhalite [$K_2Ca_2Mg(SO_4)_4 \cdot 2H_2O$], gypsum [$CaSO_4 \cdot 2H_2O$], and sylvite [KCl]. We report experimentally determined partitioning of non-radioactive isotopes of Cs, Sr and I between salt phases and solution as a function of temperature and concentration of target elements.

Experiments were carried out at temperatures from 28 to 90°C. Saturated solutions were evaporated to induce mineral growth. Concentrations of Cs, Sr and I were added to solution between 100 to 1,000 ppm, except for sylvite experiments, in which concentrations of 1,000 and 5,000 ppm were required. Concentrations (ppm) of major, minor and trace elements were determined by ICP-MS, -AES and IC (SO_4^{2-} and I^-). Concentrations of Cs, Sr and I (ppm) in crystals were determined by electron microprobe analysis (EMPA) and the distribution of these elements in solids imaged by time-of-flight secondary ion mass spectrometry (ToF-SIMS).

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