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Retardation of uranium and thorium by a cementitious backfill developed for radioactive waste disposal

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1 **RETARDATION OF URANIUM AND THORIUM BY A CEMENTITIOUS**
2 **BACKFILL DEVELOPED FOR RADIOACTIVE WASTE DISPOSAL**

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15 **Abstract**

16 The solubility of uranium and thorium has been measured under the conditions anticipated in
17 a cementitious, geological disposal facility for low and intermediate level radioactive waste.

18 Similar solubilities were obtained for thorium in all media, comprising NaOH, Ca(OH)₂ and
19 water equilibrated with a cement designed as repository backfill (NRVB, Nirex Reference

20 Vault Backfill). In contrast, the solubility of U(VI) was one order of magnitude higher in

21 NaOH than in the remaining solutions. The presence of cellulose degradation products (CDP)

22 results in a comparable solubility increase for both elements. Extended X-ray Absorption

23 Fine Structure (EXAFS) data suggest that the solubility-limiting phase for uranium

24 corresponds to a becquerelite-type solid whereas thermodynamic modelling predicts a poorly

25 crystalline, hydrated calcium uranate phase. The solubility-limiting phase for thorium was

26 ThO₂ of intermediate crystallinity. No breakthrough of either uranium or thorium was

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