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“Leaching of U(VI), Am(III) and Sr(II) from simulated tank waste sludges”

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The Hanford tank clean-up operation will involve the pretreatment of the high level waste (HLW) sludge by leaching with 3 M NaOH solution prior to vitrification. In addition, alkaline oxidative leaching is proposed for removal of problematic elements such as Cr from the sludges. The purpose of these procedures is to decrease the volume of HLW by removal of non-radioactive constituents and consequently reduce costs. Current estimates quote \$1 million per canister of vitrified waste.

The effect of acidic, caustic and oxidative leaching on the chemical behavior of U(VI), Am(III) and Sr(II) has therefore been investigated and compared to preliminary sludge leaching tests on plutonium. Simulated sludges were prepared according to the historical processes for reprocessing nuclear spent fuels and radionuclides were incorporated into the simulated sludges under conditions relevant to the tank supernatant solutions (0.1 M Na₂CO₃/0.50 M NaOH/1 M NaNO₃). Spectroscopic techniques including EXAFS and NMR were used to help interpret the leaching behavior whilst the dissolution of the radionuclides was measured using liquid scintillation counting. The effects of both complexants present in the tank supernatant solution (e.g. HEDPA) and radiolysis on the leaching of radionuclides have also been assessed, as has the effect of temperature on the dissolution of Am(III) by oxidative leaching.