



Contribution ID: 53

Type: Oral Presentation

(Scholarship application) Thermal Treatment of Magnox Sludge Intermediate Level Nuclear Waste through Vitrification

Tuesday, 31 October 2017 11:30 (15 minutes)

Vitrification of sludge waste arising from legacy nuclear activities such as Magnox reprocessing is a promising alternative to the current baseline plan of cementation with superior long-term durability, improved waste loadings and significant volume reduction. Glass products were produced from oxidized and metallic uranium and magnesium, representative of the extremes found with the First Generation Magnox Storage Ponds, in simple 3 or 4 component systems.

Magnesium aluminosilicate (MAS) and magnesium borosilicate (MBS) glasses were analytically characterised by X-ray diffraction, scanning electron microscopy, differential thermal analysis, X-ray absorption spectroscopy and inductively coupled plasma optical emission spectrometry. Accelerated dissolution testing was performed at 90 °C for 28 days with periodic sampling of the leachate solution.

Surrogate materials neodymium and the rare-earth alloy mischmetal were used alongside uranium and subject to the same testing regime to determine the effectiveness and validity of using such substitute materials in scientific studies of uranium bearing glass.

Summary

Thermal treatment of problematic radioactive sludge waste in durable glass wasteforms.

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Session Classification: Glass Wasteforms

Track Classification: National and international collaborative waste management programs