TECHNICAL SPECIFICATION SHEET

MALLET™ - MIDAR®-Augmented Lower-cost Lower-carbon Encapsulation Technique for Magnox Sludge

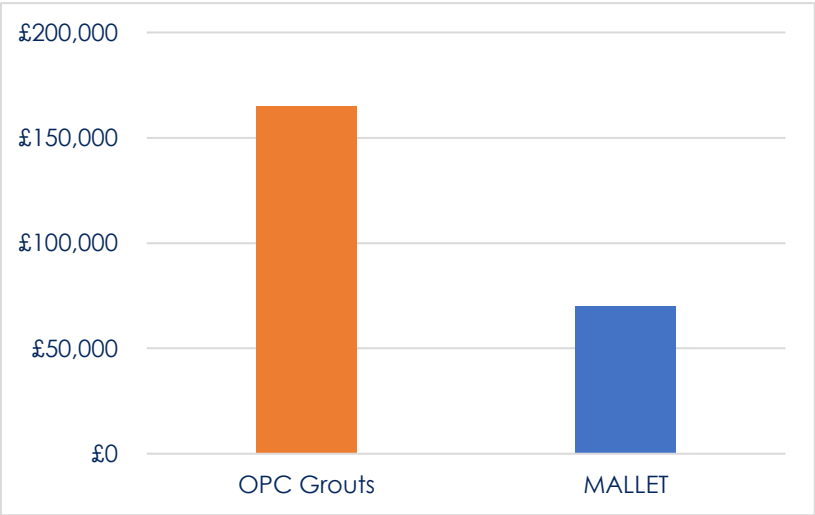
Background

- NUVIA and Lucideon have worked on the development of MALLET™, a novel geopolymer formulation for the encapsulation of radiologically contaminated problematic wastes
- One waste stream that has been a focus of the study is magnesium hydroxide-based sludges that result from the corrosion of Magnox fuel cans and swarf
- Over 5,400m^3 of magnesium hydroxide-based sludges require treatment and disposal (UK Radioactive Waste Inventory, 2019), with 61% of this arising at Sellafield
- The baseline plan is for sludge to be retrieved from legacy plants (ponds and silos) and stored in either 3m^3 boxes or storage vessels awaiting final grouting

Problem

- Baseline encapsulation methods using OPC based grouts are problematic, with high yield stresses causing the grout to be difficult to mix
- Sludge incorporation is only up to 30% of the overall waste form volume, meaning that 70% is grout
- Disposal packages costs are 3.3 times the raw sludge volume. ILW disposal costs are £50,000 per m^3, so each m^3 of magnesium hydroxide sludge costs £165,000 to dispose
- Encapsulation of sludge requires a homogeneous product, which is proving difficult with OPC based grouts

MALLET™ ENCAPSULATION OF MAGNOX SLUDGE COULD REDUCE £95,000 PER M^3 IN DISPOSAL COSTS, SAVING UK TAXPAYERS £513M COMPARED WITH TRADITIONAL OPC ENCAPSULATION

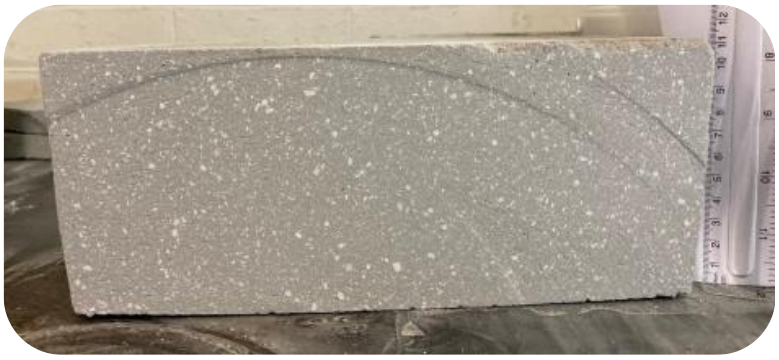


Solution

- NUVIA and Lucideon geopolymer dissolves Magnesium Hydroxide, forming a grey paint-like solution which solidifies
- Sludge incorporation is 70% of the overall waste form volume, meaning that 30% is geopolymer
- Disposal package costs are 1.4 times the raw sludge volume. ILW disposal costs are £50,000 per m^3, so each m^3 of magnesium hydroxide sludge costs £70,000 to dispose
- Disposal Cost Saving per m^3 of sludge is £95,000 (3.3 – 1.4 x £50k)
- Sludge wasteform resembles a breeze block, demonstrating good homogeneous distribution of magnesium hydroxide solids within the matrix

Benefits

- Lower disposal costs
- Lower interim storage costs
- Lower carbon emissions than OPC
- Simple batch process
- Potential to be used in retrofits of existing encapsulation plants
- Potential to be used as a 'pour on' solution for $3m^3$ boxes with sludge



MALLET™ encapsulated Magnesium Hydroxide sludge simulant (70:30 MgOH:MALLET™)