

## Introduction

Over time, the corrosion of metal wastes and the ingress of additional organics can result in a significant build-up of radioactive sludge within a Pile Fuel Storage Pond (PFSP). The understanding of sludge bed settlement, compaction, bed shearing and re-suspension is critical to the successful recovery, separation and encapsulation of sludge. These multiphase flows are difficult to observe experimentally, and a thorough process understanding is best achieved through computational modelling.

## Physical & Computational Methods

MMI developed a settlement model for PFSP sludge, which was based on the Drift Flux framework for multiphase flow. The constitutive relationships for particle size distribution, solids mixture density, settling velocity and mixture viscosity were first calibrated to recent and historical data from sludge samples. A novel approach, using discrete free settling velocities for low concentration solids, was included, augmenting the Vesilind hindered settling curve at higher concentration. This concept of combining Multiple Drift Fluxes to resolve complex multiphase systems is discussed in a paper by Burt and Gibertson (2005) [1].

## Results for the PFSP Corral

The solids settling model was applied in ANSYS-CFX13.0 to calculate the fill settle cycles for a 72 hour campaign of sludge retrieval from the PFSP in question. In this system, a corral bay within the pond was used as the settling basin. Dilute sludge was pumped into the bay for 12 minutes and then allowed to settle for a further 48 minutes, thus allowing a thickened sludge blanket to build up within the corral. The results showed that the best retention efficiency was achieved in the corral with a modified stilling well, designed by MMI, to separate the corral into distinct flocculating and settling zones.

[1] Burt, D.J. & Gilbertson, M.A. "Extended Drift Flux Models for Waste Water Sludges", PSA 2005, Stratford, Sept 2005.



Figure 1: Pile Fuel Storage Pond (PFSP)

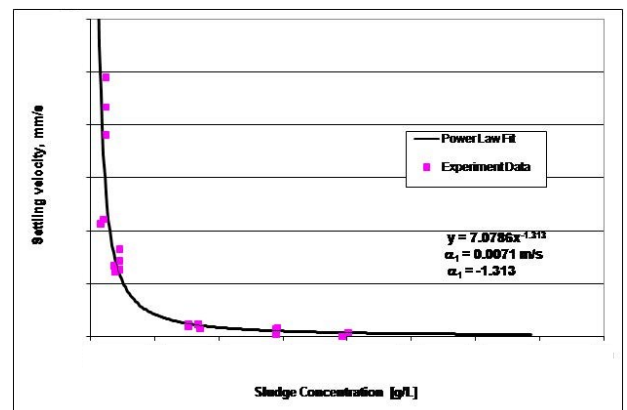


Figure 2: Sludge line settling experiments were used to determine a settling correlation for  $\text{Mg}(\text{OH})_2$  sludges.