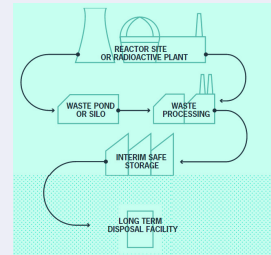


Decommissioning, Immobilisation and Storage Solutions for Nuclear Waste Inventories (DISTINCTIVE)

PI: Prof Mike Fairweather, University of Leeds

Overview

- In 2013, the Government detailed clear milestones for “nuclear waste management & decommissioning” as part of the “Nuclear Industrial Strategy”.
- DISTINCTIVE was formed following a call from EPSRC for a collaborative research programme to address this legacy challenge.
- The aim is to build a strong and vibrant R&D community focused on the medium- and long- term needs of the UK industry in this area.
- DISTINCTIVE has brought together over 50 academics from a diverse array of backgrounds and experience in the nuclear field. This is essential due to the size and complexity of the current UK waste inventory; a range of skills and knowledge spanning a range of science and engineering disciplines are imperative.
- The programme will train 10 Post-Doctoral Research Associates and 21 PhD Researchers with high levels of skills of direct relevance to issues in nuclear waste and decommissioning. The consortium hopes to achieve a flow of trained experts into Academia and Industry, and therefore address the current skills gap.



Research Themes

AGR, Magnox & Exotic Spent Fuels

Leads: Scott (University of Bristol); Evans (Loughborough University)

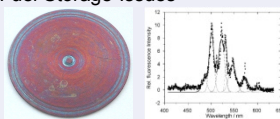
Aim: To provide technical underpinning to the options for the management of the UK's AGR, Magnox and Exotic Spent Fuels.

Objectives.

- To understand the evolution of Magnox & exotic SNF during recovery from aqueous storage, drying and repackaging.
- To develop spectroscopic methods for improved determination of SNF dissolution and corrosion rates in water.
- To determine the optimum drying conditions for AGR fuels and the subsequent surface reactivity and alteration of unclad UO₂ in dry storage.
- To determine the consequences of radiation damage in SNF, cladding and other wasteforms for safe long term storage.
- To determine suitable waste management options for spent carbide fuels.

Work Packages

Wet Fuel Storage Issues



Transitions to Dry Fuel Storage



Long-term Storage Effects and Exotic Fuels

PuO₂ & Fuels Residues

Leads: Boxall (Lancaster University); Kaltoyannis (UCL)

Aim: To provide technical underpinning to the options for the UK's civil Plutonium inventory

Objectives.

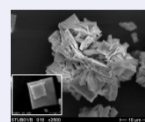
- To understand how the structure and properties of PuO₂ change with time in the presence of H₂O.
- To understand the roles these processes play in gaseous product evolution from PuO₂ in storage.
- To understand radiation induced amorphisation and dissolution kinetics of Pu wasteforms.
- To develop novel, fast neutron based radiometric methods for the quantification, isotopic composition assessment and remote imaging of Pu bearing materials.

Work Packages

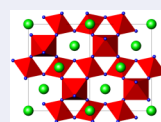
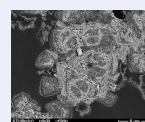
- The Behaviour of PuO₂ during Interim Storage
- The Behaviour of Pu Bearing Wasteforms & Encapsulants
- Methods for the Characterisation of Stored Pu, PCM & Pu Contaminated Facilities



Waste



characterization



Encapsulation

Structural Integrity

Lead: Lunn (University of Strathclyde)

Aim: To develop reliable systems for infrastructure characterisation, restoration and preservation, that minimise current, and future, radiation exposure to the workforce whilst providing economically viable technological solutions.

Objectives.

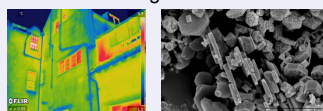
- To develop in-situ ground barriers that could act as a 'second skin' surrounding on-site structures, such as silos and ponds, for prevention of subsurface radionuclide migration.
- To develop smart solutions for remote crack detection, infrastructure health prediction and building preservation that can be retrofitted to existing sites.
- To develop autonomous systems with increased functionality and to coordinate them through a CAD-based real-time management system, to facilitate planning and execution of decommissioning works.

Work Packages

Physical Ground Barriers for In Situ Contaminant



Remote Crack Detection, Infrastructure Health Prediction & Building Preservation



Development of Autonomous Systems for Decommissioning



Legacy Ponds & Silo Wastes

Leads: Hriljac (University of Birmingham); Lee (Imperial College)

Aim: To develop innovative technical approaches to clean up UK legacy wastes.

Objectives.

- To understand durability of heterogeneous ILW glass/ceramic wasteforms from LP&S wastestreams.
- To develop improved ways to remove radionuclides (RNs) from solution, both novel inorganic ion exchange solids and tailored binding superparamagnetic nanoparticles, to treat complex and variable effluents.
- To develop new micro- and ultra-filtration methods for use with sludges.
- To provide three-dimensional modelling and simulation for sludge disturbance, mobilisation and transport, with supportive experimental studies, and manipulation planning for removing corroding nuclear materials.
- To develop a better understanding of gas hold-up in sludges.
- To develop improved techniques for remote monitoring of sludges and heterogeneous wastes.

Work Packages: Wasteform Durability
Effluent Treatment and Analysis
Pond and Silo Sludges



Engagement & Impact

Public & Media

Proposed Activities

- Summer School
 - Day 1: Vision setting talks, Skills Workshop 1
 - Day 2: Skills Workshop 2, Skills Workshop 3, dinner speaker
 - Day 3: Public engagement focus; form outreach groups; close.
- Work package Drop in events
- Radio documentary

Lead: Hyatt (University of Sheffield)

<http://distinctiveconsortium.org>

Policy Makers

Objectives:

- Raise profile of project in government departments and Westminster
- Promote research outcomes and impacts
- Provide opportunity for consortium researchers to engage policy makers

Proposed Activities

- Event at Royal Academy of Engineering
 - Distinctive sponsored lecture and panel, dinner
- Showcase event at Westminster
 - Posters and demonstrations on research outcomes (Royal Society style)

Industry

•Key industry partners:

National Nuclear Laboratory
Nuclear Decommissioning Authority
Sellafield Ltd

•Formation of International Advisory Group

•Industry Roadshows to develop further collaborations

