

Collaborative Research Programme in Decommissioning, Immobilisation and Storage Solutions for Nuclear Waste Inventories (DISTINCTIVE): Overview

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Background

- EP/L014041/1, started 10th February 2014 to 9th February 2018, although no-cost extension likely
- £4.91M EPSRC → total £6.13M, plus £2.23M from industry = £8.36M
- World-class University network:

Imperial College
London



UNIVERSITY OF
BIRMINGHAM



- Key project partners:



Objectives

- Carry out internationally leading science and engineering research in area of decommissioning and nuclear waste management
- Support research that provides routes to innovative technology developments that can be applied to decommissioning and nuclear waste management
- Foster and develop new multi-disciplinary research partnerships between academic and industry researchers
- Train next generation of UK researchers, equipping them with skills and experiences relevant to nuclear waste management and decommissioning issues
- Provide focal point for government, industry and academics through which current and future R&D issues associated with nuclear waste and decommissioning can be discussed
- Provide route for public understanding of underlying research and development needs, opportunities and solutions to nuclear waste and decommissioning

Industrial Engagement

Project Building:

- Strong support from NNL, NDA and Sellafield Ltd. (strategic guidance, challenge definition, academic/industrial bridge, people/facilities)
- Engaged during consortium building (challenges at workshop, >60 proposal reviews, ranking and advice, projects revised as result)

Project Delivery:

- Industry partners want to be engaged in delivery:
 - One or more industry supervisors/advisors for each project
 - Further development of scope will be required in some areas
 - Scholarship/in-kind industry support greater than would typically be offered
- Industry looking for partnership in delivery:
 - Embedding of 2 PDRAs in joint industry-academic team
 - Several other projects planning secondments to active labs or plant
 - Accelerated development of subject matter experts
- Consortium intends to be inclusive in industry engagement – other industrial partners are being encouraged to give input and support

Key Issues

National Importance:

- In line with Government's Nuclear Industrial Strategy (2013), NDA Strategy (2011) and current EPSRC strategy (joined up approach to nuclear R&D across government, industry and academia; benefit to economy and security of supply; establish UK industry as global leader in decommissioning and waste management)

National/International Links:

- Members of consortium already have extensive links (direct research partnerships, members of international research consortia)
- Invite key international players to participate in consortium meetings (offer advice, membership international advisory group)

Technical Programme:

- Can't cover all areas of interest, but research primarily at TRL 1-3 with some higher risk projects
- Active work key focus
- Modelling underpinning safety cases key feature of many projects

Research Plan: Technical Work Packages/Themes

- AGR, Magnox and Exotic Spent Fuels (Lead: Tom Scott/**Nick Evans**):
 - Wet fuel storage issues
 - Transitions to dry fuel storage
 - Long-term storage effects and exotic fuels
- PuO₂ & Fuel Residues (Lead: Colin Boxall/**Nik Kaltsoyannis**):
 - Behaviour of PuO₂ during interim storage
 - Behaviour of Pu bearing wasteforms and encapsulants
 - Methods for characterisation of stored Pu, Pu-contaminated materials/facilities
- Legacy Ponds and Silo Wastes (Lead: **Joe Hriljac**/Bill Lee):
 - Wasteform durability
 - Effluent treatment and analysis
 - Pond and silo sludges
- Structural Integrity (Lead: **Rebecca Lunn**):
 - Physical ground barriers for in-situ contaminant containment
 - Remote crack detection, infrastructure health prediction, building preservation
 - Development and real-time management of autonomous systems for decommissioning

Research Plan: Technical Work Packages/Themes

Theme 1 AGR, Magnox and Exotic Spent Fuels

Nick Evans	Loughborough	PDRA	Use of TRLFS of investigate dissolution rates
Tom Scott	Bristol	PDRA	An investigation of wasteform evolution during wet-recovery and drying of SNF
Tom Scott	Bristol	PhD	UO ₂ surface reactivity and alteration – a fundamental study of photocatalytic and structural effects related to long term storage of SNF
Bruce Hanson	Leeds	PhD	Determination of optimum drying conditions for AGR fuels
Bill Lee	Imperial	PhD	Options for exotic carbide fuels
Enrique Jimenez-Melero	Manchester	PhD	Grain boundary damage mechanisms in strained AGR cladding under irradiation
Paola Lettieri	UCL	PhD	A life cycle approach as a decision tool for nuclear waste management and decommissioning of existing and future plants

Theme 2 PuO₂ and Fuel Residues

Mark Read	Birmingham	PhD	Computational modelling of PuO ₂ ageing and fuel residues
Colin Boxall	Lancaster	PDRA	Understanding the interfacial interactions of plutonium dioxide with water
Simon Pimblott	Manchester	PDRA	Understanding the interfacial interactions of plutonium dioxide with water
Nik Kaltsoyannis	UCL	PDRA	Modelling the surface chemistry of PuO ₂ at the molecular level
Neil Hyatt	Sheffield	PhD	Current glass-ceramic formulations for Pu disposition
Neil Hyatt	Sheffield	PDRA	Ceramic materials for actinide disposition
Claire Corkhill	Sheffield	PhD	Understanding actinide sorption and binding to cement materials for radioactive waste management
Malcolm Joyce	Lancaster	PhD	The non-destructive assessment of isotopic composition for in-situ characterisation of aging and criticality risk in plutonium storage
Malcolm Joyce	Lancaster	PhD	In-situ characterisation of heavily-contaminated plutonium finishing environments

Research Plan: Technical Work Packages/Themes

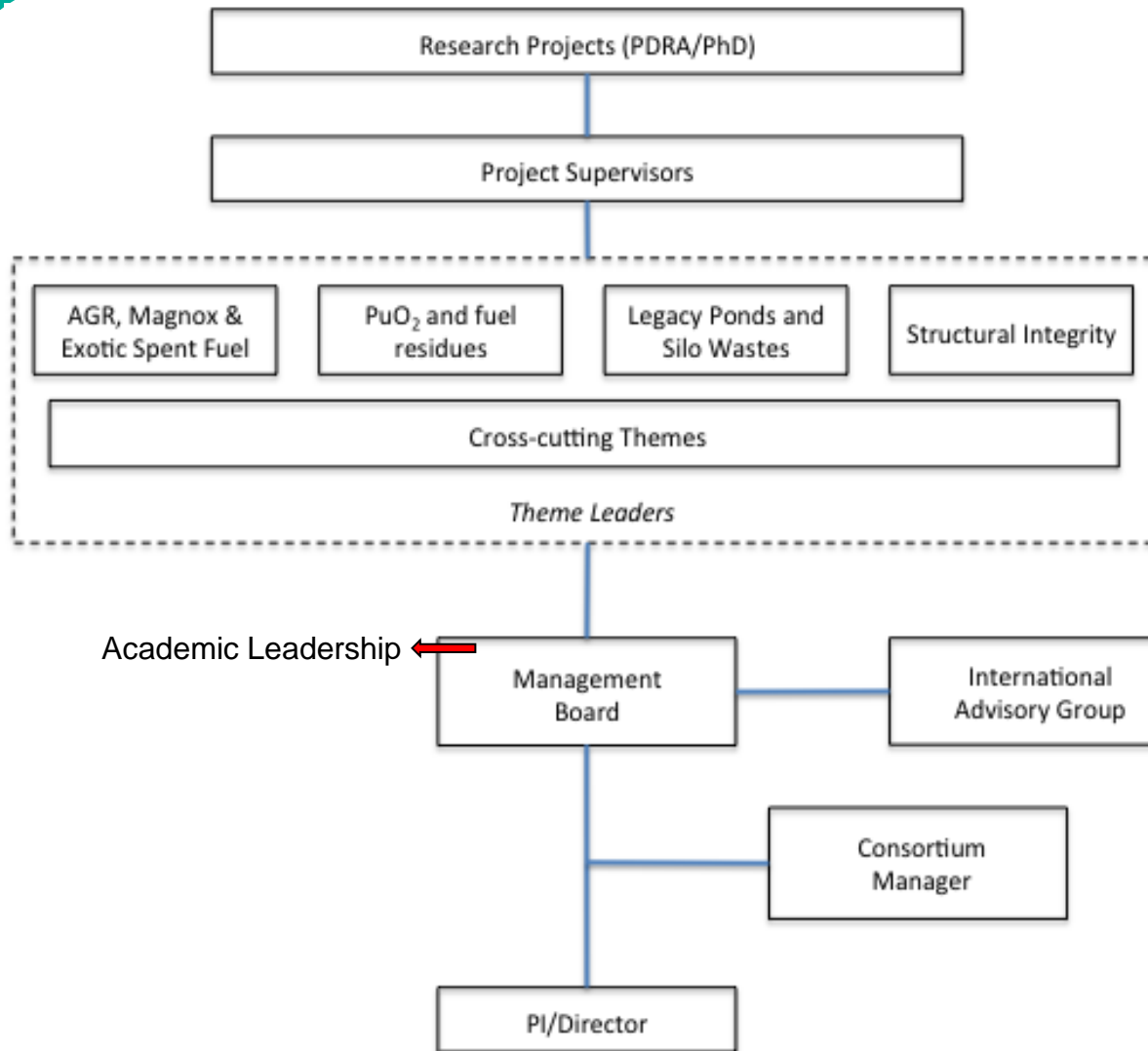
Theme 3 Legacy Ponds and Silo Wastes			
Joe Hriljac	Birmingham	PDRA	Novel ion exchange materials
John Day	Bristol	PhD	Development of Raman spectroscopy techniques for the remote analysis of nuclear wastes in storage
Bill Lee	Imperial	PDRA	Durability of heterogeneous ILW glass/ceramic wasteforms from Complex wastestreams
Mary Ryan	Imperial	PhD	Magnetic nanoparticles for waste separation or sequestration
Andy Kerridge	Lancaster	PhD	Computational simulations of storage pond sludge disturbance
David Harbottle, Tim Hunter	Leeds	PhD	Gas hold-up in sludges
Mike Fairweather	Leeds	PDRA	Measurement and modelling of sludge mobilisation and transport
Tim Hunter, David Harbottle	Leeds	PhD	Characterisation of flocculated waste suspensions with acoustic backscatter
Nick Evans	Loughborough	PhD	One step extraction and quantification of radionuclides using superparamagnetic bead and nanopore technologies
Richard Holdich	Loughborough	PhD	Enhanced shear micro- and ultra-filtration without recycle pumping

Theme 4 Structural Integrity			
Grainne El Mountassir	Strathclyde	PDRA	In-situ ground contaminant containment (physical barrier)
Andrea Hamilton	Strathclyde	PhD	Crack sealing and water transport
Andrea Hamilton	Strathclyde	PhD	Nano-cracking of cement phases: reactivity and dissolution
Barry Lennox	Manchester	PhD	Autonomous systems for nuclear decommissioning in extreme radiation environments
Rustam Stolkin	Birmingham	PhD	Production of real-time segmented as-built CAD models for the planning and execution of remote and human intervention tasks

Research Plan: Cross-Cutting Activities

- Active Research Projects (Lead: Simon Pimblott):
 - Use of active research facilities at NNL and elsewhere
 - Two major projects already planned, others indicated potential need for active facilities
 - Simon to act as champion to promote use of active facilities and to ensure that consortium receives appropriate advice and support
- Impact, Outreach and Public Engagement (Lead: Neil Hyatt) **Matthew Cotton presenting:**
 - Proposal identifies three groups of non-academic beneficiaries: Site licence companies and supply chain; Government, regulators and implementation authorities; Society and stakeholder groups
 - Impact in 4 key domains: Knowledge; People; Economy; Society
 - 5 critical enablers at core of impact strategy: Building and maintaining relationships and networks; Communication and dissemination; Public, media and government engagement; Knowledge transfer and commercialisation; Training and development

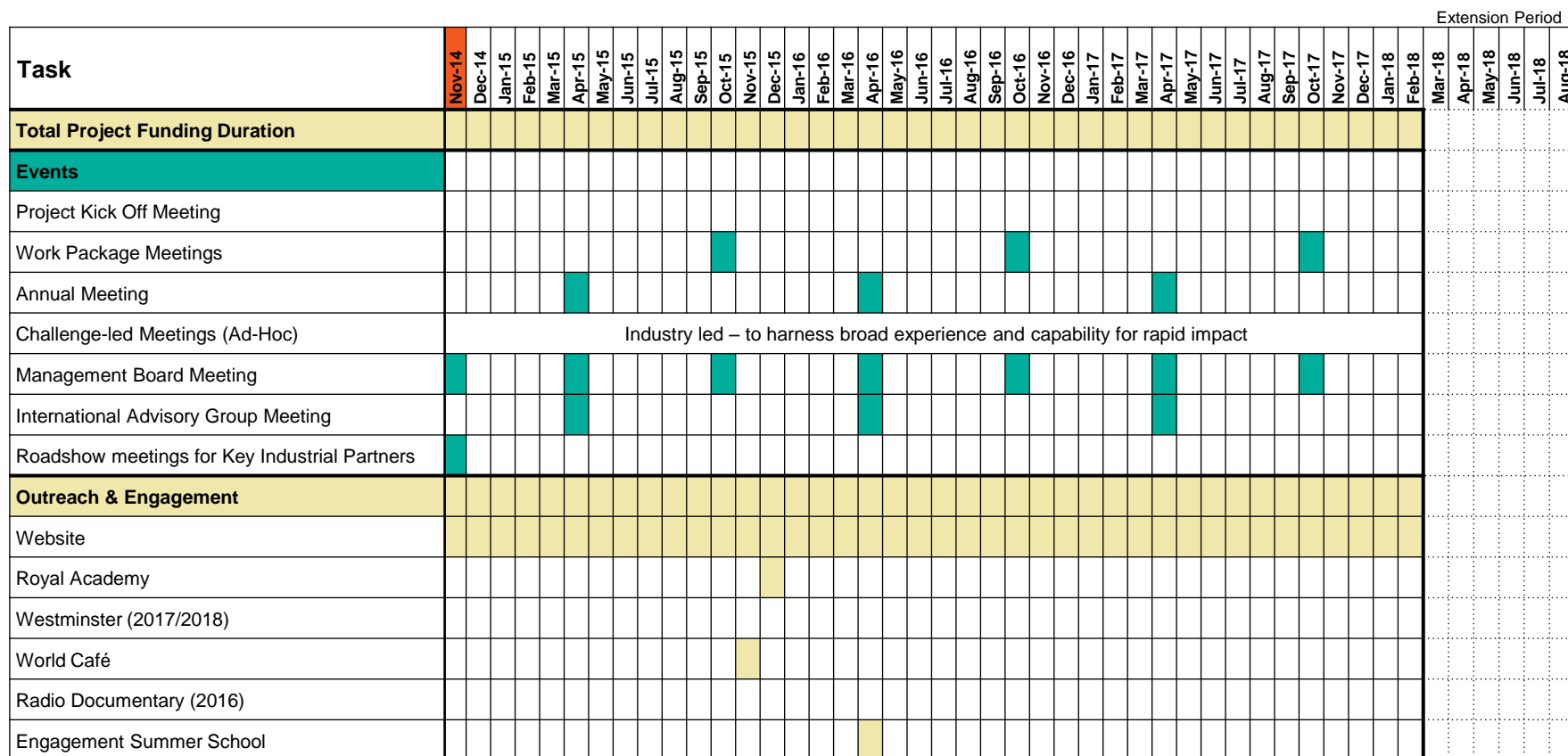
Management



Members to date: AMEC, Arup, ATKINS Global, Costain, Doosan Babcock, Environment Agency, Escubed, MMI Engineering, MoD, NDA, NNL, Nuclear Technologies, Nuvia, PNNL, Sellafield Ltd, SRNL, US DoE

Timeline

Gantt Chart for DISTINCTIVE: Decommissioning, Immobilisation and Storage Solutions for Nuclear Waste Inventories



1ST ANNUAL MEETING



DISTINCTIVE

Decommissioning, Immobilisation and **ST**orage solutions for
NuClear was**Te** **In**VEntories

15TH – 16TH
APRIL 2015

FOR MORE INFORMATION,
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VISIT OUR WEBSITE:
www.distinctiveconsortium.org

MILLENNIUM
GALLERY,
SHEFFIELD, UK

SAVE THE DATE



Summary

- Excellent team of researchers:
 - Significant track-record of success in supporting relevant R&D in nuclear area
- Builds from earlier EPSRC consortia KNOO (Keeping the Nuclear Option Open) and DIAMOND (Decommissioning, Immobilisation and Management of Nuclear Wastes for Disposal):
 - Learning from these consortia input into this new activity
 - Success of earlier consortia gives confidence for this new activity:
 - Supply of researchers into industry
 - Technical developments for deployment
 - General awareness of industry needs
- Expands earlier groupings:
 - Wider coverage
 - Stronger team
 - Larger international profile