



Transformative Science and Engineering for Nuclear Decommissioning

# TRANSCEND: Collaborative Research Programme in Transformative Science and Engineering for Nuclear Decommissioning

## Overview and Progress

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Transformative Science and Engineering for Nuclear Decommissioning

## Acknowledgements

The TRANSCEND University Consortium gratefully acknowledges funding from the EPSRC as part of the UK Research and Innovation Energy Programme

The Energy Programme is a UK Research and Innovation initiative led by EPSRC and contributed to by BBSRC, ESRC, NERC and STFC

Code: EP/S01019X/1

**EPSRC**

Engineering and Physical Sciences  
Research Council

We also gratefully acknowledge funding from our key project partners:





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## Background

- Project started 1<sup>st</sup> October 2018 to 30<sup>th</sup> September 2022, although 12 month extension applied for due to Covid-19 impact and delays in accessing active facilities
- £4.59M EPSRC → total £5.73M, plus £3.70M from industry = £9.43M
- World-class University network:

Imperial College  
London

Lancaster  
University

QUEEN'S  
UNIVERSITY  
BELFAST

UNIVERSITY OF  
BIRMINGHAM

University of  
BRISTOL

UNIVERSITY OF LEEDS

MANCHESTER  
1824  
The University of Manchester

The  
University  
Of  
Sheffield.

UNIVERSITY OF  
Southampton

University of  
Strathclyde  
Glasgow

UNIVERSITY OF  
SURREY

- Key project partners:





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## Research Areas

### Technical Themes

Integrated Waste Management (Leads: Claire Corkhill / Joe Hriljac):

- New Materials and Methods for Decontamination of Effluent / Modelling and Experiments for Understanding Pond and Silo Sludge / Behaviour / Wasteform Science

- Focus on areas relevant to hazard reduction and decommissioning

Site Decommissioning and Remediation (Leads: Becky Lunn / Luc Vandeperre):

- Colloidal-Silica Grout / Electrokinetic Ground Remediation / Non-Invasive Monitoring of Soil Contamination, Structural Degradation, Assessment and Repair
- Focus on new technologies for monitoring, remediation and containment to minimise volumes of waste for disposal

Spent Fuels (Leads: David Read / Tom Scott):

- Properties and Reactivity of Bulk Corrosion Products / Pressing Fuel Barrier Corrosion / In-Situ Identification of Nuclear Fuel Materials and Surface Corrosion Products / Prediction of Long-Term SNF Behaviour
- Focus on improved understanding and identification of properties of corrosion products and fuel barrier corrosion issues

Nuclear Materials (Leads: Colin Boxall / Nik Kaltsoyannis):

- Surface Chemistry of  $\text{PuO}_2$  under Conditions Relevant to Interim Storage / Plutonium Immobilisation in Advanced Ceramic Wasteforms
- Focus on option development: interim storage, and incorporation of Pu into wasteforms for disposition

### Cross-Cutting Activities

Facilities (Lead Neil Hyatt):

- Includes EPSRC / NDA / RWM funds for active work

Impact (Leads Jo Renshaw / Ross Springell and Impact Committee):

- Relationships and Networks
- Communication and Dissemination
- Public, Media and Government Engagement
- Training and Development
- Knowledge Transfer and Commercialisation
- Includes Flexi-funds



## Transformative Science and Engineering for Nuclear Decommissioning

# Progress

- Kick-off, Leadership Team and Management Board meetings held 2018
- Industry Roadshows 2018 / 2019
- Leadership Team, Management Board, International Advisory Group, Annual and Theme meetings held 2019
- 2020 Annual Meeting had to be cancelled, although Leadership Team and Management Board meetings held by videoconference, International Advisory Group meeting being arranged for late September / early October
- Theme meetings October / November 2020 most likely by videoconference
- Annual meeting in Harrogate hopefully end March 2021
- TRANSCEND session at Waste Management 2020, 8<sup>th</sup>-12<sup>th</sup> March 2020, Phoenix Convention Center with 7 papers
- Newsletter launched 05 / 2020
- Challenge-led meetings to focus on specific challenges within sector to be organised



### UKRI-EPSRC "TRANSCEND" Collaborative Research Programme

Session 107 Wednesday 11th March 13:25 - 17:00 Room 106C

TRANSCEND is a multi-disciplinary collaboration of 11 universities and eight key industry partners from across the UK's civil nuclear sector. Our world-class research programme focuses on the area of nuclear decommissioning and waste

#### Session Structure:

• The TRANSCEND University Consortium: An Overview (20106)  
Prof. Michael Fairweather - University of Leeds

• Progress on TRANSCEND Theme 1: Integrated Waste Management (20194)  
Prof. Joe Briggs - University of Birmingham

• Theme 2: Site Decommissioning, Deconstruction and Remediation (20329)  
Prof. Rebecca Lunn - University of Strathclyde

• The TRANSCEND consortium - Addressing challenges in the Management of Spent Nuclear Fuel (20276)  
Prof. Tom Scott - University of Bristol

• The TRANSCEND University Consortium Theme 4: Nuclear Materials (20431)  
Prof. Colin Boxall - Lancaster University

• Industry overview of TRANSCEND (20271)  
Prof. Anthony Banford - National Nuclear Laboratory

• Development of Acoustic Backscatter for In Situ monitoring of Nuclear Waste Sludges During Transfer (20117)  
Dr. Timothy Hunter - University of Leeds

More information about the programme can be found on our website: [transcendconsortium.org](http://transcendconsortium.org) or by contacting Dr. Les S Tovey: [L.Tovey@leeds.ac.uk](mailto:L.Tovey@leeds.ac.uk)

Please join us for a social networking session in Room 106C immediately after the session and take the opportunity to meet the team, discuss the TRANSCEND programme and to explore opportunities for collaboration.

We are grateful to Longenecker & Associates for their generous sponsorship of this event.

#### Other TRANSCEND-associated presentations

Oxidation Disintegration Process at High Temperatures  
Poster - Monday - Session 032a  
Julio Vazquez - University of Leeds

In Situ Studies of  $UO_2$  Oxidation and Phase Transition into  $U_3O_8$   
Poster - Monday - Session 032a  
Jasek Wasik - University of Bristol

Drying Wet Stored and Corroded Magnox Fuel for Interim Dry Storage  
Poster - Monday - Session 32a  
Oral - Wednesday - Session 093  
Matt Jackson - University of Leeds

Investigating Uranium Corrosion in Magnesium-containing Sludge using X-Ray Tomography  
Oral - Wednesday - Session 105  
Harris Paraskevoulakos - University of Bristol

Amphiphilic Block Copolymers for Flocculation and Hydrophobization of Legacy Waste Suspensions in Flotation Driven Dewatering Operations  
Poster - Monday - Session 032b  
Oral - Thursday - Session 140  
Alex Lockwood - University of Leeds



Website – [transcendconsortium.org](http://transcendconsortium.org) / Twitter – @Transcend\_epsrsc



# Project Details / Recruitment

Project No.	Theme	WP	Project title	University	Lead Investigator	PDRA/PhD	Funding	Researcher
Theme 1 IWM - Integrated Waste Management								
1.1.1	1	1	New Materials and Methods for Decontamination of Effluent	Birmingham	Joe Hriljac	PDRA	EPSRC	
1.1.2	1	1	Nanotechnology for effluent treatment and radionuclide assay	Imperial	Luc Vandeperre	PDRA	EPSRC	
1.1.3	1	1	Scoping studies of new ion exchange materials	Birmingham	Joe Hriljac	PhD	SL	
1.1.4	1	1	In situ ion exchange studies of zeolites	Birmingham	Joe Hriljac	PhD	Birmingham	
1.2.1	1	2	Particle-laden flow characterisation and prediction	Leeds	Mike Fairweather	PDRA	EPSRC	
1.2.2	1	2	Radiation Induced CHanges in Effluents/Sludges (RICHES)	Manchester	Fred Currell	PDRA	EPSRC	
1.2.3	1	2	Simulation of behavioural modification effects in suspension waste pipe flows	Leeds	Mike Fairweather	PhD	Leeds	
1.2.4	1	2	Advanced characterisation of waste pipe flows with polymeric behavioural modifiers	Leeds	Tim Hunter	PhD	Leeds	
1.2.5	1	2	Modelling nanoscale radiation physics/chemistry processes in sludges	Manchester	Fred Currell	PhD	Manchester	
1.3.1	1	3	Durability of magnesium silicate cements	Imperial	Luc Vandeperre	PhD	Imperial	
1.3.2	1	3	Radiation effects on wasteforms	Manchester	Laura Leay	PhD	Manchester	
1.3.3	1	3	Conditioning and encapsulation of mercury contaminated wastes	Sheffield	Neil Hyatt	PhD	Sheffield	
1.3.4	1	3	Novel approaches to encapsulation of low level waste	Strathclyde	Joanna Renshaw	PhD	0.5 LLWR / 0.5 Strath	
1.3.5	1	3	Characterisation of thermal treatment products	Sheffield	Claire Corkhill	PhD	NDA	
1.3.6	1	3	Process monitoring of thermal treatment of nuclear wastes	Sheffield Hallam	Paul Bingham	PhD	NDA	
1.3.7	1	3	Understanding glass melt chemistry in thermal treatment of nuclear waste	Sheffield	Russell Hand	PhD	SL	
Theme 2 SDR - Site Decommissioning and Remediation								
2.1.1	2	1	Inhibiting Radionuclide Migration during Deconstruction and Decommissioning using Colloidal Silica	Strathclyde	Rebecca Lunn	PDRA	EPSRC	
2.2.1	2	2	Electrokinetic ground remediation, and combination with colloidal silica grouting for minimisation...	Southampton	Andy Cundy	PDRA	EPSRC	
2.2.2	2	2	Electrokinetic remediation application to soils, concretes and other site and process wastes	Southampton	Andy Cundy	PhD	Southampton	
2.3.1	2	3	In-situ groundwater monitoring to improve identification of ground/soil contamination volumes...	Lancaster	Malcolm Joyce	PhD	SL	
2.3.2	2	3	Predicting Gamma Dose Rates from Buried Pipelines based on Limited Information	Surrey	Caroline Shenton-T	PhD	NDA	
2.3.3	2	3	Muon Tomography for Monitoring Civil Nuclear Assets	Strathclyde	Marcus Perry	PhD	Strathclyde/Cavendish	
2.3.4	2	3	Field deployment of biomineral technologies for treatment and repair of concrete nuclear infrastructure	Strathclyde	Rebecca Lunn	PhD	Cavendish Nuclear	
Theme 3 SF - Spent Fuels								
3.1.1	3	1	Assessing the properties and release behaviour of products arising from metallic and exotic fuel co	Bristol	Tom Scott	PDRA	EPSRC	
3.1.2	3	1	An investigation of corrosion and leaching of carbide fuels in a Geological Disposal Facility setting	Bristol	Tom Scott	PhD	RWM	
3.1.3	3	1	MOX SIMFUEL - development of simulants	Lancaster	Colin Boxall	PhD	RWM	
3.2.1	3	2	Characterisation of perforated AGR fuel and its behaviour during drying	Leeds	Bruce Hanson	PhD	NDA	
3.2.2	3	2	Development of micromechanical testing methods for spent AGR cladding	Bristol	Mohammed Mostafa	PhD	SL	
3.3.1	3	3	In-situ Identification of Surface Corrosion Products on Spent Nuclear Fuels	Surrey	David Read	PDRA	EPSRC	
3.3.2	3	3	Predicting the Corrosion of Spent Nuclear Fuels	Surrey	David Read	PhD	Surrey	
3.4.1	3	4	Building the foundations of a predictive tool for spent fuel behaviour	Bristol	Ross Springell	PDRA	EPSRC	
3.4.2	3	4	Building the foundations of a predictive tool for spent fuel behaviour	Bristol	Ross Springell	PhD	Bristol	
Theme 4 NM - Nuclear Materials								
4.1.1	4	1	The Surface Chemistry of Plutonium Dioxide under Conditions Relevant to Interim Storage	Lancaster	Colin Boxall	PDRA	EPSRC	
4.1.2	4	1	Atomistic simulation of Am incorporation into PuO <sub>2</sub>	Lancaster	Sam Murphy	PhD	Lancaster	
4.1.3	4	1	Quantum chemical modelling of PuO2 surface chemistry	Manchester	Nik Kaltsoyannis	PDRA	EPSRC	
4.1.4	4	1	Gas generation from the radiolysis of water on uranium oxides and ThO2	Manchester	Fred Currell	PhD	SL	
4.1.5	4	1	Computational Modelling of PuO2: Ageing and Storage Phenomena	Birmingham	Mark Read	PhD	NDA	
4.1.6	4	1	The Recombination of Hydrogen and Oxygen on Metal Oxide Surfaces	Lancaster	Colin Boxall	PhD	NDA	
4.2.1	4	2	Underpinning plutonium immobilization in advanced ceramic wasteforms	Sheffield	Neil Hyatt	PDRA	EPSRC	
4.2.2	4	2	Disposability of wasteforms for plutonium immobilisation and efficacy of surrogates	Sheffield	Claire Corkhill	PDRA	RWM	



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## Progress

- Many researchers impacted by Covid-19-related laboratory closures, but numerical modelling work proceeding largely as planned
- Proposals for EPSRC / NDA / RWM funds for active work submitted, 6 out of 7 approved, open call for proposals, webinar on facilities held on 10<sup>th</sup> June
- Start of PDRA industry placements delayed
- Public Engagement Summer School delayed, potentially move online
- Technical progress available on Gateway to Research:  
<https://gtr.ukri.org/projects?ref=EP%2FS01019X%2F1>
- Researcher secondments to BEIS completed (Laura Leay – advisor on radioactive waste policy in Nuclear Decommissioning and Radioactive Waste team / David Read – risk-based disposability with team working on aspects of Nuclear Sector Deal)
- Third secondment advertised on project to enhance UK's arrangements for managing radioactive wastes in emergencies
- Public outreach activity underway, game being developed as route to providing public understanding of research and development needs, opportunities and solutions. At play testing stage
- Five animated videos on project commissioned, Jim Al-Khalili to do voiceovers
- Science festival promotion delayed

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Royal Society of Chemistry,  
Industry-Academia  
Collaboration Award 2020,  
Awarded to The  
DISTINCTIVE Consortium



Thank you for  
your attention  
Any questions?

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