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# The DIAMOND University Research Consortium

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## Nuclear Legacy



A little history –

Disposal of waste material and plant decommissioning was probably not top priority in 1940's UK!

Legacy of pile reactors and first fuel reprocessing plant at Sellafield



## Waste Legacy



10 Magnox stations operational by 1966. High demand for military grade Pu and electricity meant:

- Requirement for new reprocessing plant demanding higher throughput
- Increased pressure on storage facilities for spent fuel
- Cladding stored under water in silos
- Outdoor cooling ponds for spent fuel
  - Partial / full corrosion of metals
  - Facility open to the elements
  - Dust, dirt, algae, other 'bio-material'
  - Sludge formation



## A Need for Research?



Nuclear waste comes in many forms

In addition to the legacy waste there are wastes arising from current and likely future reprocessing operations

There is a growing requirement for academic research on many aspects:

- Waste characterisation and minimisation
- Legacy waste plant decommissioning
- New methods and materials for waste immobilisation and encapsulation
- Long term disposal issues and geological impact
- Issues of site termination and societal impact







## **RCUK** Funding



Until 2006 research council funding for nuclear was mainly through responsive mode

2006 RCUK Energy Programme Funded largest single nuclear fission research programme for >30 years

Keeping the Nuclear Option Open (KNOO)

£6.1M over 4 years

Imperial College (Robin Grimes - PI)



Leeds, Open, Cardiff, Sheffield, Manchester, Bristol

## KNOO



Skills gap identified by UK Government in 2003

Retain skills in 4 key areas

43 research projects



- WP1 Fuel, thermal hydraulics and reactor systems
- WP2 Materials performance and monitoring reactor conditions
- WP3 An integrated approach to waste immobilisation and management
- WP4 Safety and performance for a new generation of reactor designs

## DIAMOND



RCUK Energy Programme, call for consortia proposals (2007) in "Nuclear Waste Management and Decommissioning"

Building on the success of KNOO – WP3

#### DIAMOND

Decommissioning, Immobilisation And Management Of Nuclear Wastes For Disposal

Imperial, Leeds, Loughborough, Manchester, Sheffield, UCL

Imperial College London

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Started July 2008

£4.27M over 4 years (9 month extension granted to Mar 2013)

Simon Biggs - Principal Investigator 12 named Co-Investigators 35 individual research projects 28 PhD students 7 postdoctoral research fellows

Total of 50 academics involved as supervisors or cosupervisors

#### Aims

- To carry out internationally leading science and engineering in the field of nuclear waste and decommissioning
- To support research underpinning innovative technologies
- To broaden the UK's research base focusing on nuclear waste
- To develop new links between investigators at universities
- To facilitate new multidisciplinary collaborations to stimulate new solutions
- To train the next generation of scientists and engineers with relevant skills and expertise

## Work Packages



Three work packages:

- WP1: Define processes which control transport of key radioactive contaminants in natural and engineered environments
- WP2: Provide new techniques and technologies in support of legacy waste management, decommissioning and monitoring of site end points
- WP3: Provide innovations in the processing and immobilisation of problematic wastes

Further details at http://www.diamondconsortium.org/



## Training



National Nuclear Laboratory Training Event:

- Sponsored by NDA
- All DIAMOND researchers and academics invited
- Basics of power generation and the nuclear fuel cycle
- Course delivered by NNL
  with guest lectures from
  - Westinghouse
  - NDA



## **DIAMOND** Conference

- Excellent engagement with industry (2009 / 2010 / 2011, delegates ≈100 with half from industry each year)
- All DIAMOND researchers give a poster / oral presentation
- Industry presentations
- Excellent opportunity for networking and recruitment



## Industry Engagement



- Viewed as a key area to achieve many of the goals
- Essential for research to remain relevant
- Industrial steering committee 20 companies represented
- Industrial supervision for every project
- Building links for the future
  - Additional research
  - Additional PhDs, e.g. CASE Awards
  - Consultancy work
- Enhanced PhD / research experience for our researchers
- Essential for the supervisors too

## Other Funding



Nuclear Decommissioning Authority:

- Pledged £500k to support DIAMOND activities
- Funded extra PhDs
- Support for active facility work at NNL
- Sponsorship of training activities

In-kind and cash support from many other companies, including (apologies, too many to mention all):

- Sellafield Ltd
- NNL
- Amec

## **Goals of Industrial Interaction**



Looking to achieve:

- Being a valued partner to industry (engaged with over 20 companies)
- Developing new academic and industrial links nationally and internationally
- Improved technology transfer from other industry sectors
- Innovative approaches to old problems
- Build long term relationships between academia and industry
- Providing highly trained personnel familiar with the industry
- PhD students to consider the industry as a career choice (projected reduction in student numbers – 15.3% reduction in 18 year olds projected between 2010 and 2020)

## **Concluding Remarks**



Research activity in waste disposal:

- Comparatively little RCUK funding pre-KNOO (2006)
- Success of KNOO
- Initiated DIAMOND core group
- RCUK activity now significantly higher
- Generating long term relationships with industry
- Great deal of interest from industry colleagues
- Recruitment of students is a key deliverable