

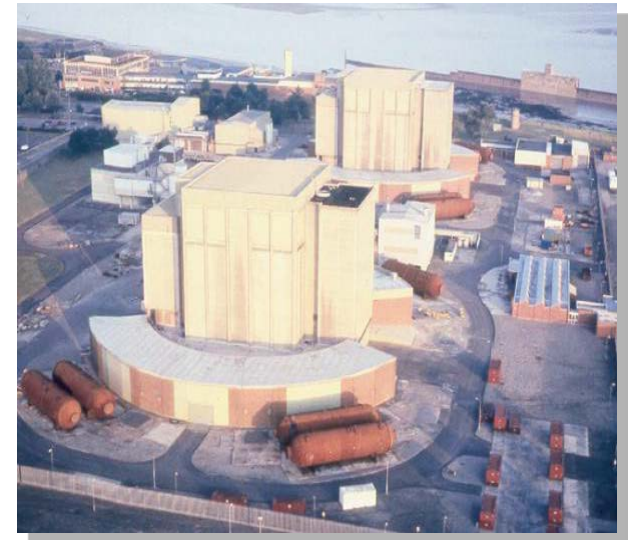
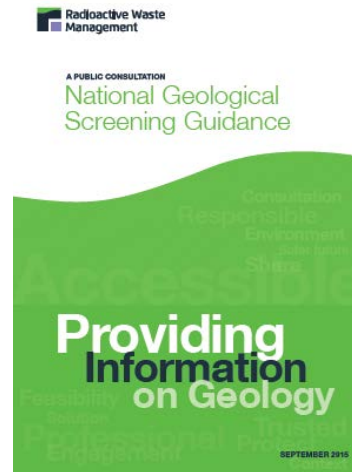
Collaboration on the Thermal Treatment of Waste

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Presented by Anthony Banford

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UK Waste Management and Decommissioning Challenges



- Ongoing successful immobilisation of waste arising from operational plants
- At Sellafield for example:
 - Operational ILW is routinely cemented/grouted
 - High active liquor vitrified – successful operation of High Level Waste Plants, with over 6300 containers produced



- However some legacy wastes provide significant challenges for the established immobilisation technologies

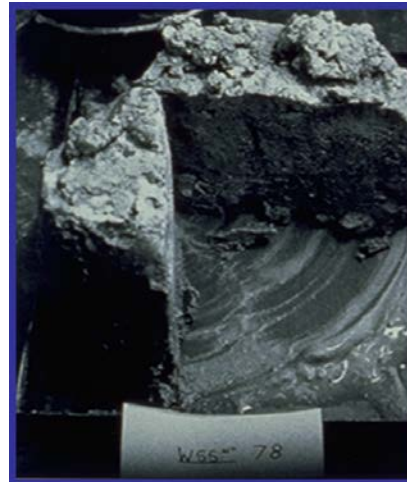
SIXEP Magnox Sludge	1200m ³ Magnesium salts
SIXEP Sand/Clino	1200m ³ Clinoptilolite and sand
Magnox Pond Sludge	1350m ³ Magnesium salts
Plutonium Contaminated Materials	16800m ³ until 2020 - general process waste from alpha plants
Pile Fuel Cladding Silo	~2000 off 3m ³ boxes swarf, metals, sludges
Future decommissioning wastes	81000 off 3m ³ box equivalents concrete, brickwork & metals
Contaminated soils	~1600m ³
Pond solids	~3100m ³ Spent fuel, skips, isotope cartridges & zeolite
Miscellaneous orphans	Various
Pile Fuel storage pond waste	~ 350m ³ Spent fuel pond sludge
Magnox Swarf Storage Silo	~10000m ³ Various ILW forms from sludges to solids

Examples



Silo wastes from historic processing

Sludges from
legacy facilities



Operational PCM

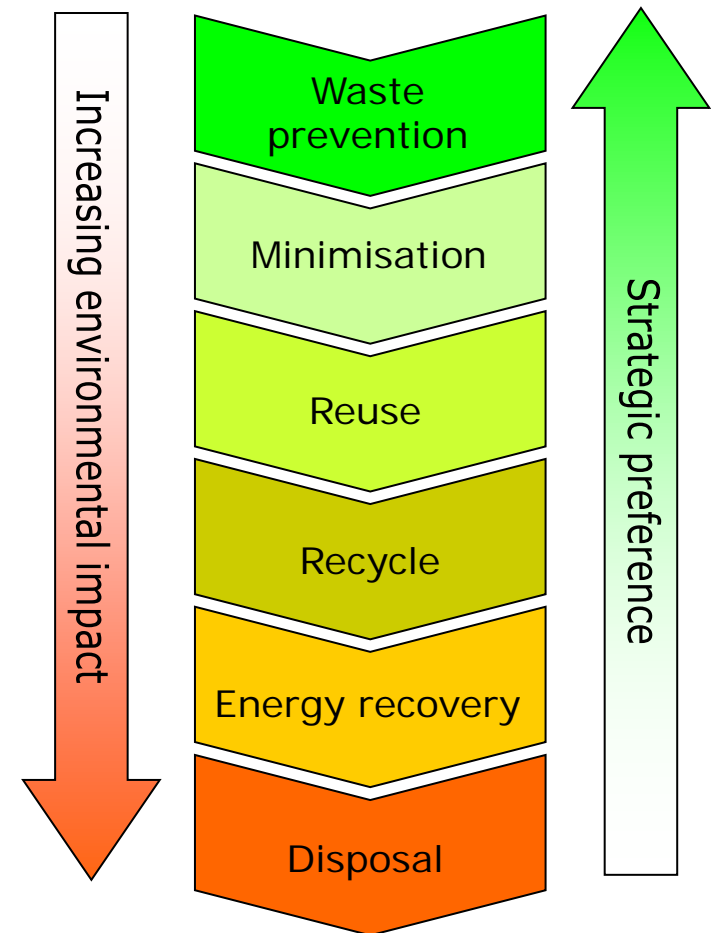
NDA Strategy 2 (2011)



- “We are exploring the possibility of developing alternative waste treatment capabilities to provide a more flexible and cost-effective approach to the management of HAW...”

NDA Integrated Waste Management Strategy 2012

- aims to enhance and diversify the UK's treatment capability for ILW.

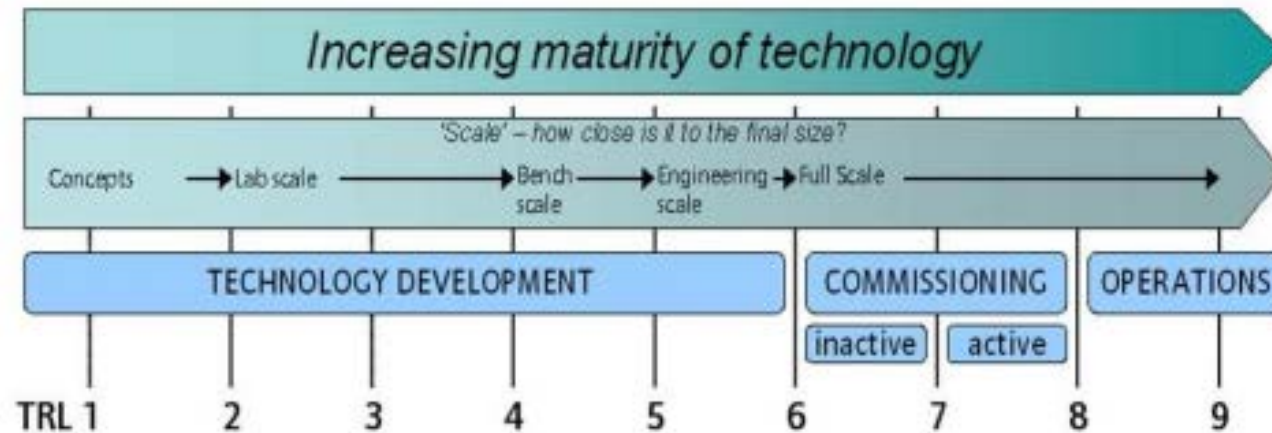
Safer, faster, cheaper, sustainably



- Volume reduction
 - Passivation
 - Off gas
- 
- A photograph of an industrial facility, likely a thermal treatment plant. It features large metal structures, pipes, and a control room with a computer monitor and a red chair. The floor is polished and reflective.
- Robust Product
 - Likely to meet repository requirements
 - Enables very long term above ground storage
 - In UK context –site and repository solution timing
- 
- A photograph showing two large metal drums. The drum on the left is dark green and appears to be made of steel. The drum on the right is silver and appears to be made of aluminum. Both drums have a central vertical pipe or vent.
- Potential reduction in wastes to deep disposal
 - Nature of product may make the case for sub surface disposal/storage of short lived ILW, thus reducing load on repository

- Sellafield Ltd have commissioned several in-active demonstrations aimed at key waste streams using simulants for:
 - Corroded Magnox sludge
 - Sand/Clinoptilolite
 - PCM
 - High metallic fraction wastes
 - Demonstrations on varying selections of the above streams have been provided by:
 - Energy Solutions - Joule Heated Melter Technology
 - Kurion Inc. - Geomelt In Container Vitrification Technology
 - Costain/Tetronics - Plasma Technology
 - Georoc - Hot Isostatic Pressing Technology
 - *All technologies demonstrated feasibility*
-

Technology Readiness Levels



There are many different interpretations of TRLs !

- At Sellafield TRL is employed to determine the level of maturity
- Their TRL calculator calls for “active” development prior to TRL 6
 - TRL 4 - Have laboratory-scale tests on a range of simulants and real wastes been completed?
 - TRL 5 - Have bench-scale tests on a limited range of real wastes (using a prototypical technology element) been completed?
- Increasing TRL to at least 6/7 will cut ultimate time to market/deployment
- *A platform is required to enable “active” demonstration of candidate technologies*

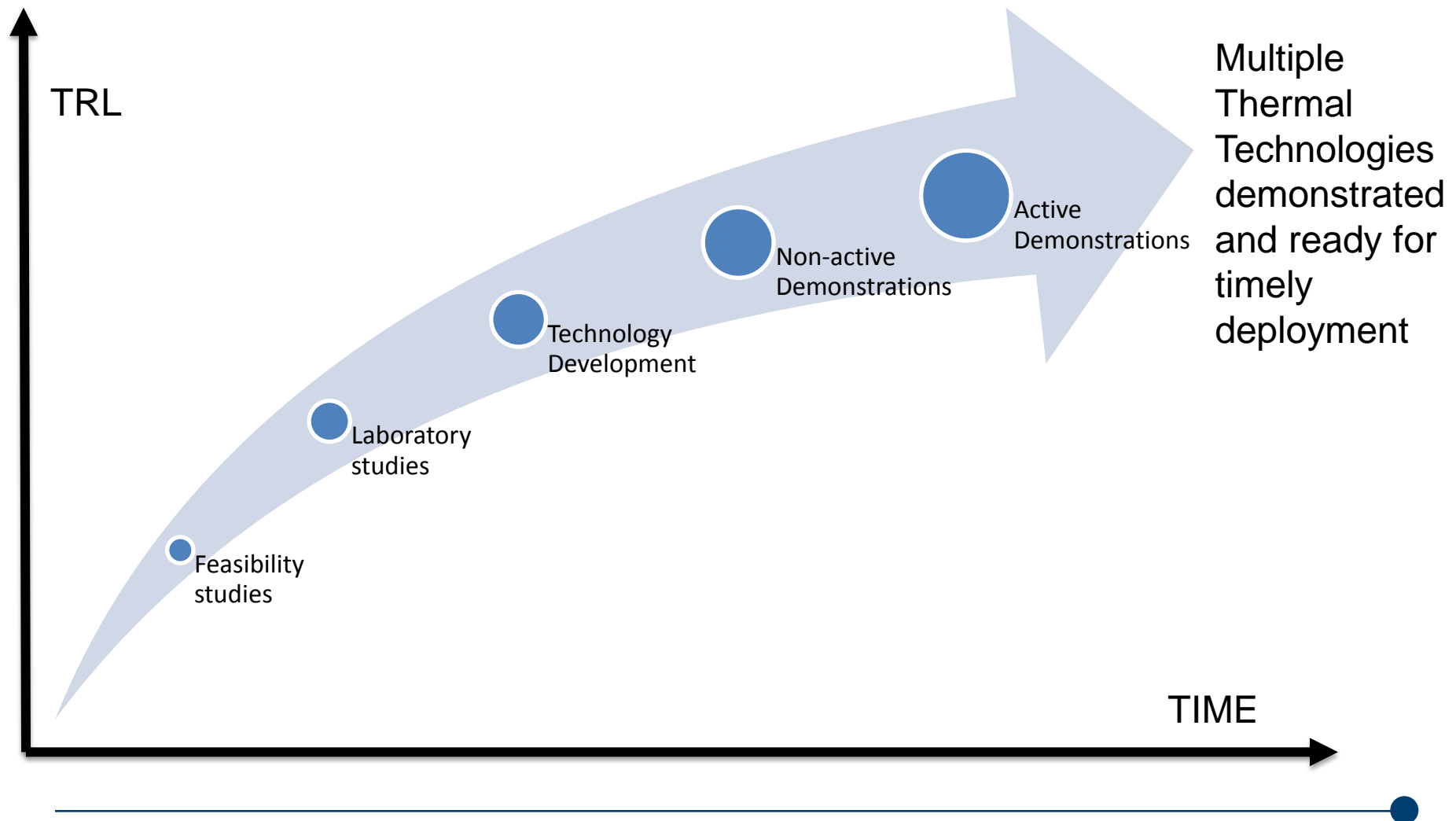
An Integrated Project Team has been initiated -SL/NDA/NNL, but will involve other interested parties

- Drive to carry out “active” trials
 - Simulants doped to provide data on activity balances through process
 - Real waste – initially low active, enhance with shielding
 - Process evaluation
 - Technology maturity demonstration
- Based in NNL’s Central Laboratory – active facility



- Active facility housing multiple candidate technologies with a capability to process active waste feeds.
 - Start with low active and doped simulants
 - Progress to shielded equipment to enable enhanced activity
 - Potential to use existing fumehood/glovebox facilities to carry out R&D on lab scale where appropriate
 - Potential to use phase 3 hot cells to process significant quantities of ILW
- Provision of valuable data on
 - Technology maturity and process evaluation
 - Passivation of reactive metals
 - Volume reduction factors
 - Product quality
 - Off gas behaviour...

Schematically..

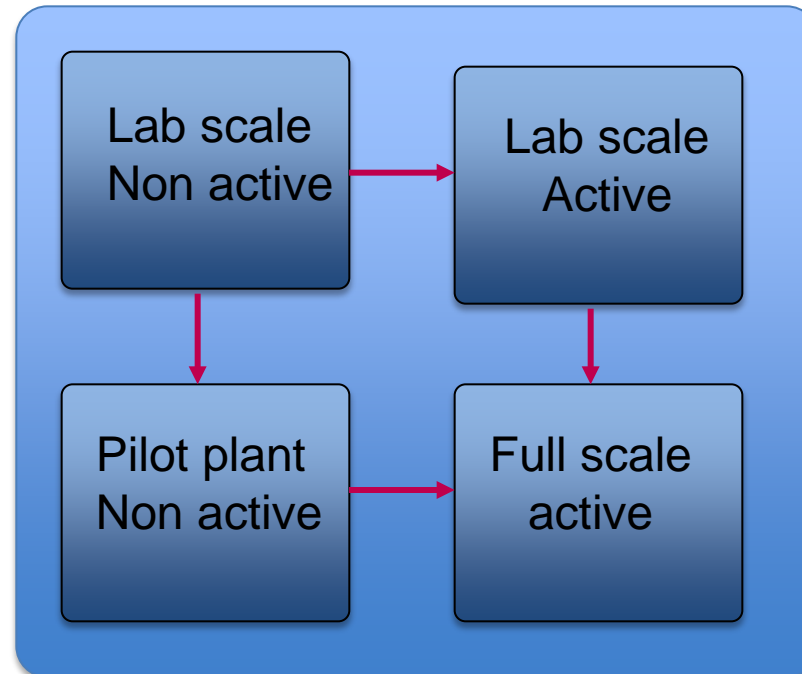


Approach to R&D

Laboratory scale R&D



Full scale vitrification
development facility



Active glove box experiments



Sellafield site



- As a result of an existing programme of work with Kurion Inc, NNL will install Geomelt technology in the rig hall in 2016
- An active melt planned in 2016 to demonstrate:
 - Mass and activity balance between melt and off gas
 - Determine operational characteristics with a view to optimise product and minimise activity lost to off gas
 - Characterisation will be carried out on active product

Rig hall facility will be available for testing a range of technologies



- Thermal treatment has significant potential benefits for waste management and decommissioning
- Active demonstration of is a crucial stage in maturing these technologies
- Establishment of an Integrated Project Team will facilitate collaboration
- EURATOM Horizon 2020 collaborative R&D project would internationalise the benefits to all

Thank you for your attention



Facilities- Central Laboratory



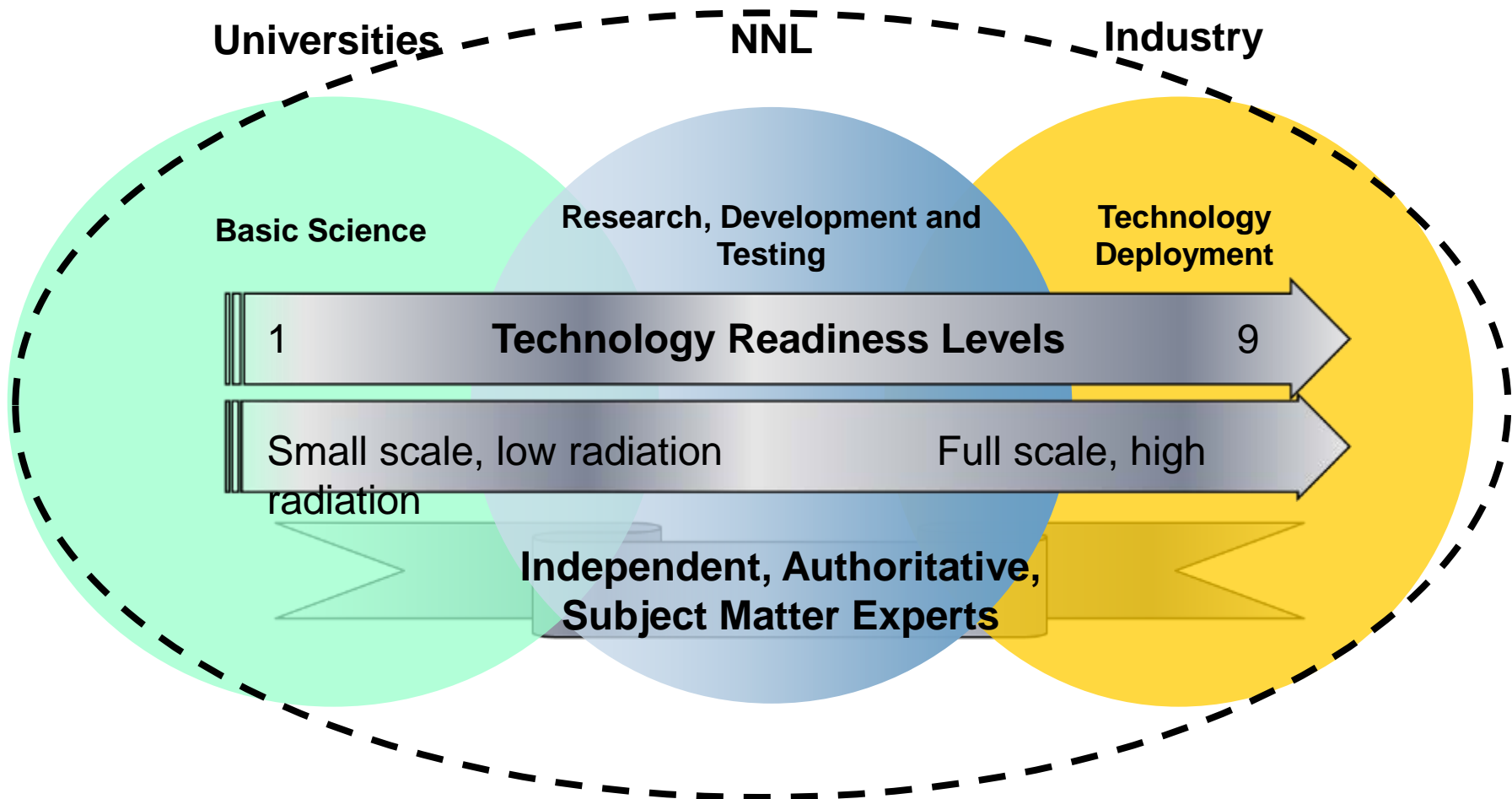
Central Laboratory: An investment of over £250m in world-beating nuclear R&D facilities



- Non active labs
- Active Labs
- High active alpha Labs
- Beta & gamma cells
- Plutonium and MOX facilities
- Solvent extraction glove-boxes
- Graphite labs
- Full scale test facilities



NNL / University / Industry – Greater Integration



Collaborative Research, Development and Demonstration

