NATIONAL PROGRAMMES UPDATE: Recycle

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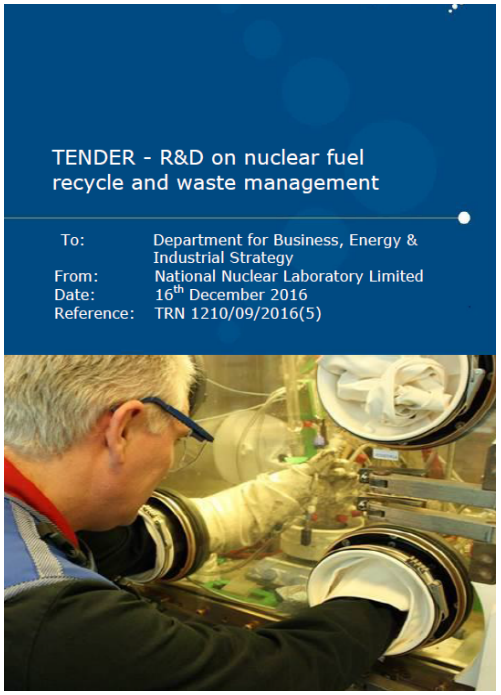
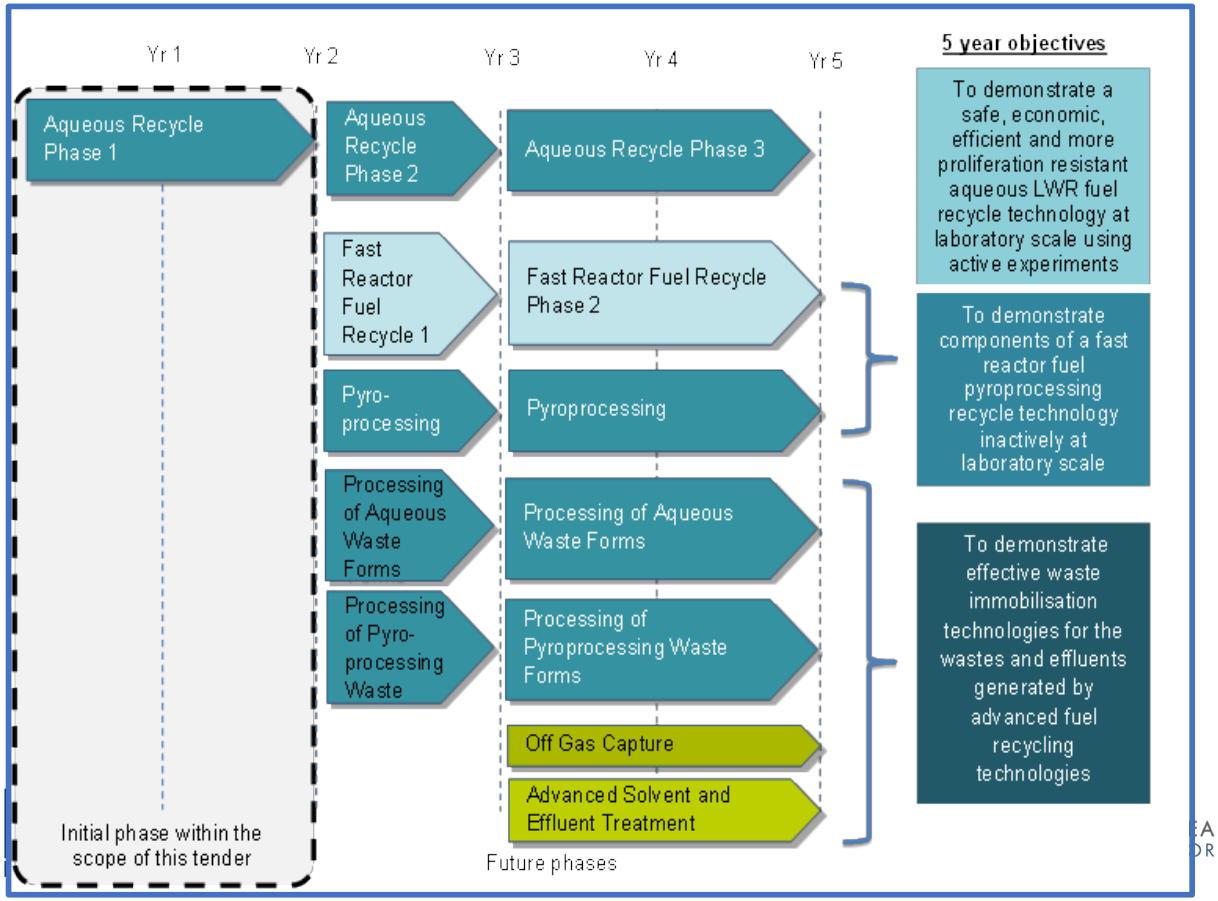
Recap – Nuclear Fuel Recycle & Waste Management

£2M over <2 years to address NIRAB priority recommendations

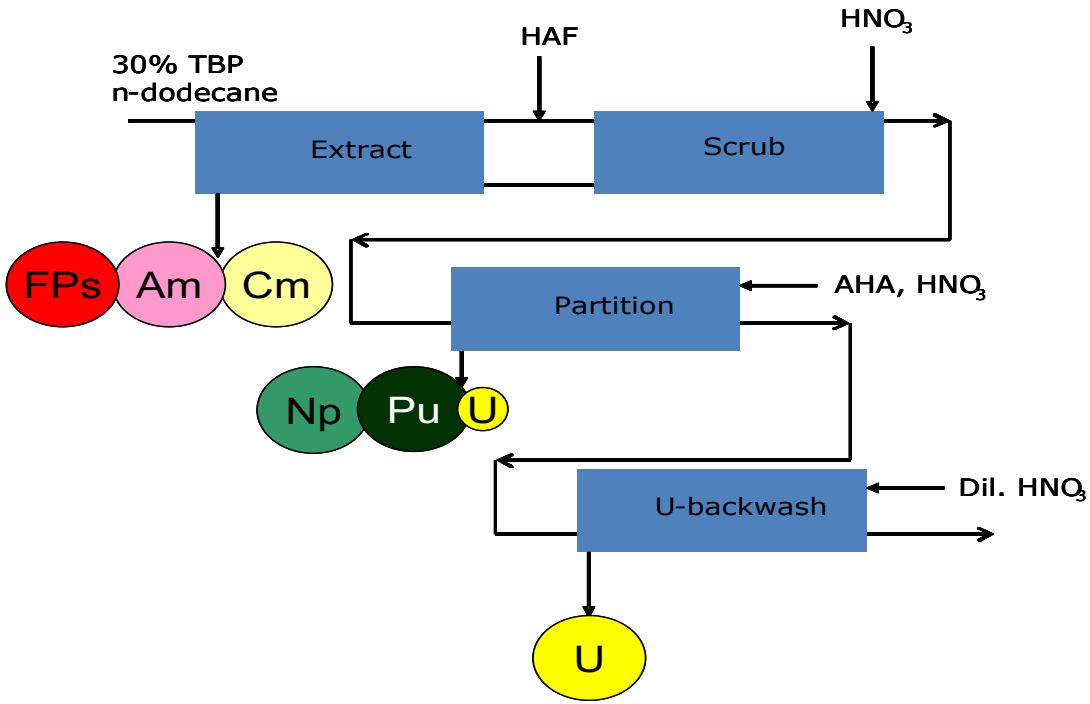




Project Outcomes

- Baseline flowsheets for an advanced aqueous LWR fuel recycling process underpinned by experimental evidence
- "Sim-Plant" tool for fuel recycle plant evaluations applied to waste arisings
- Definition of the "Part 2" programme
- Close collaboration with GENIORS and other national/international projects
- Positive impact on UK skills, knowledge base & reputation in actinide separations & spent fuel recycling R&D

Advanced PUREX process



- Dissolution of MOX fuels
- Single SX cycle
- Mixed (U,Pu) product
- Centrifugal contactors
- Minor actinide partitioning
- Co-conversion of (U,Pu) to oxide product

⇒ Greater flexibility
⇒ More proliferation resistance
⇒ Smaller size
⇒ Less wastes generated
⇒ Reduced costs
⇒ Enhanced process safety

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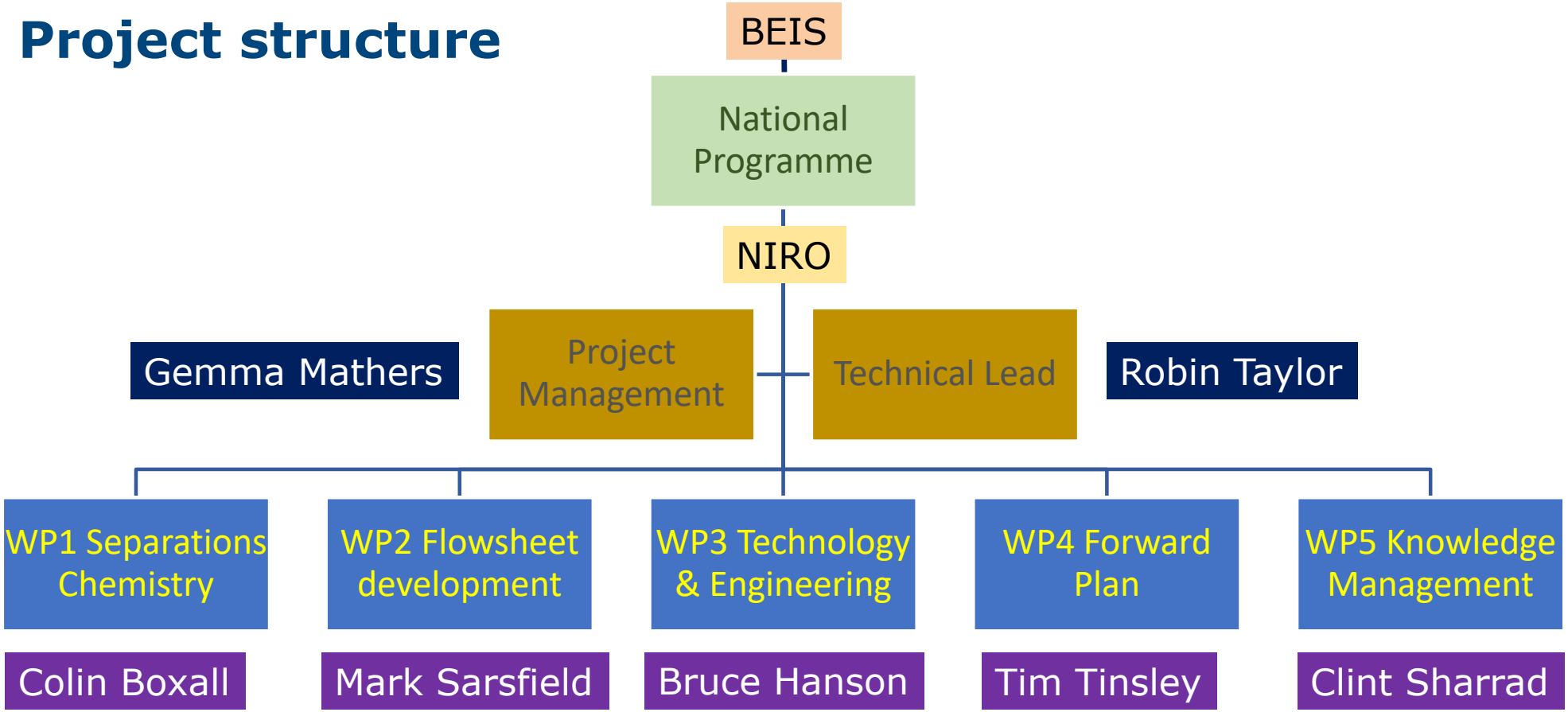
Project structure



Recycle R&D, UK facilities

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PuMA Lab
Plutonium & Minor Actinides

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Engineering scale U-active lab

UTGARD LABORATORY

Lancaster University

U-active applied chemistry lab

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Dalton Cumbria Facilty

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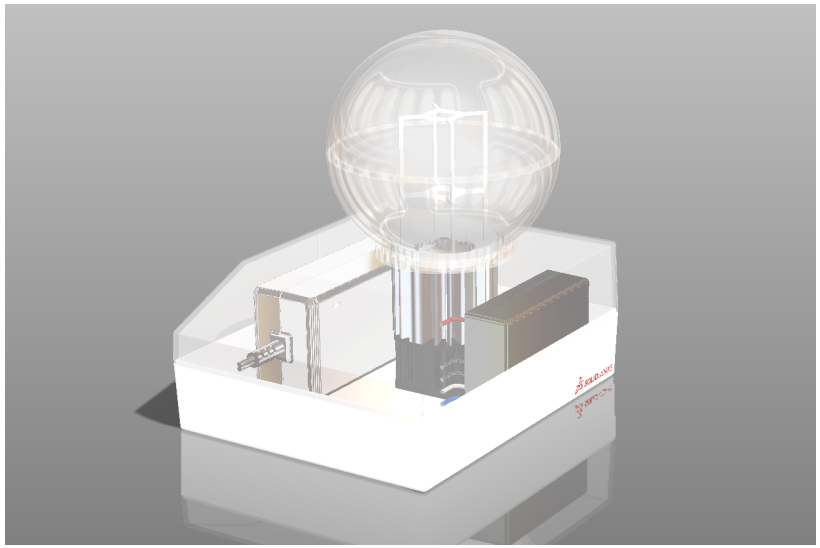
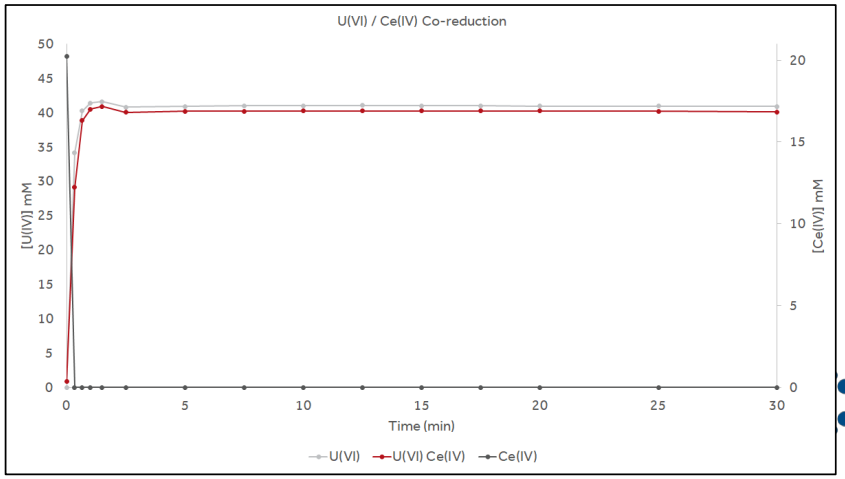
WP1 Highlight: Photochemical reduction

- Key gap is interface between SX & finishing stages
- Need to reduce U(VI) and Pu(IV) to U(IV) and Pu(III) to co-precipitate
- Photochemical reduction – innovative method
- 3D-printable, modular design photo-reactor

- **Rapid conversion of U & Ce**
- **Stable product**





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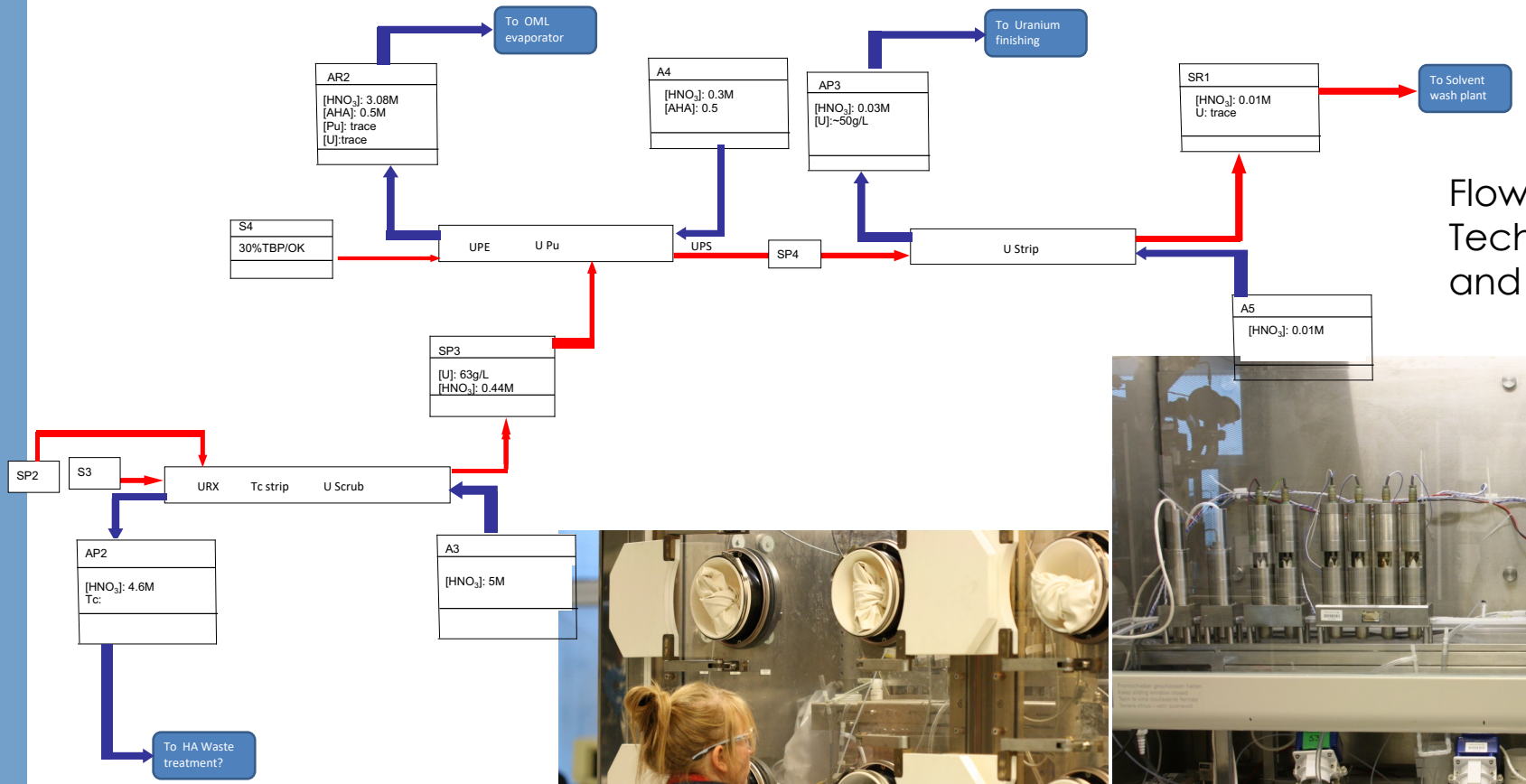
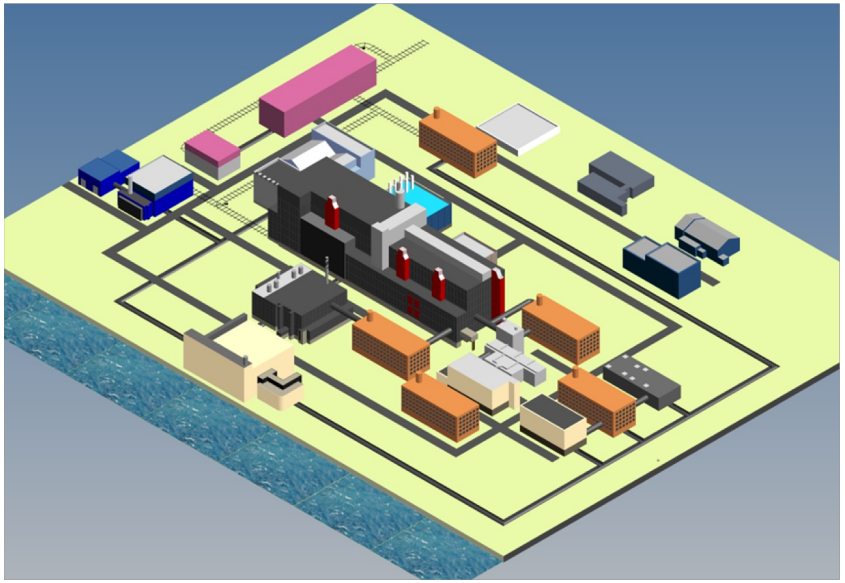
WP2 Highlight: 2nd flowsheet trial completed



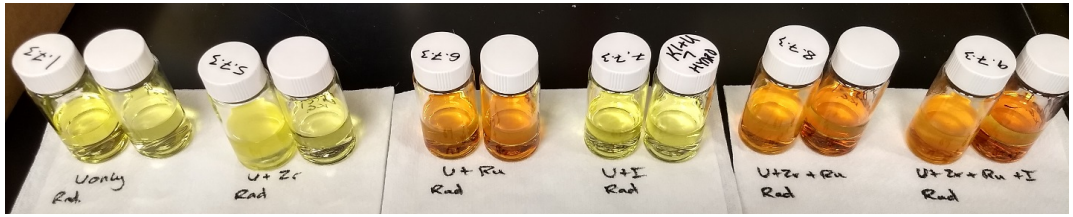
Flowsheet test at NNL
Technetium rejection
and Pu barrier stages

WP 3 Highlights:

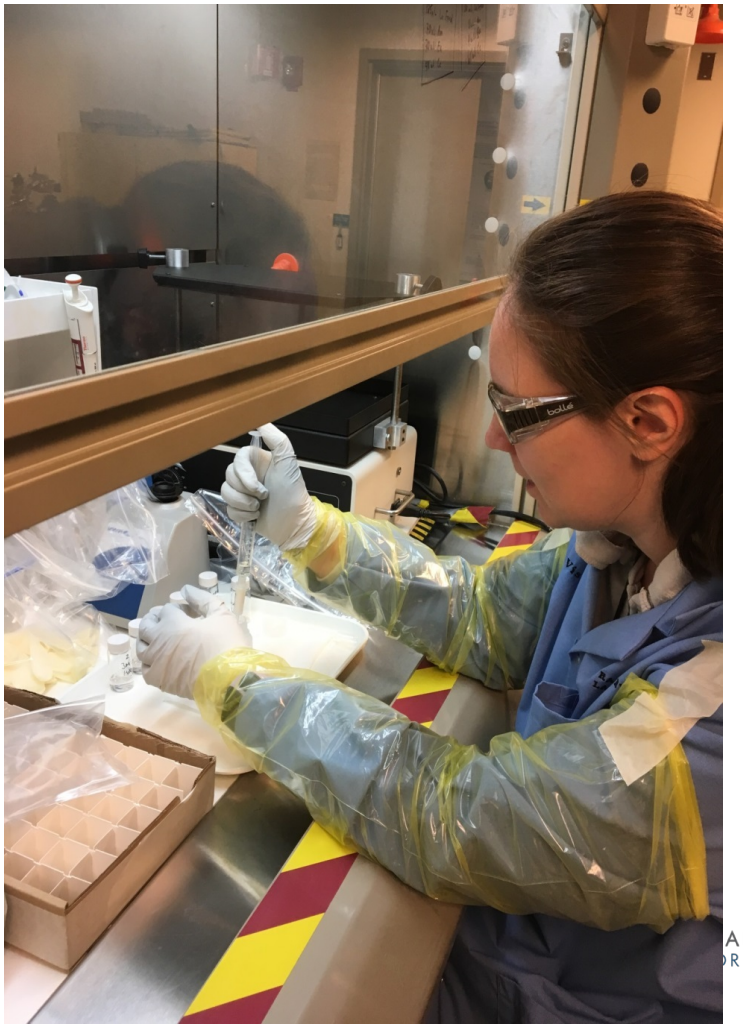
- Centrifugal contactor rig at UoLeeds
- Sim-Plant Development



WP5 Highlight:
Secondment to Idaho National Laboratory



Kathryn George (PDRA, UoM) studied effects of gamma radiation on U, Ru, Zr & I extraction at INL



Summary

- **2 year programme focused on:**
  - Advanced PUREX process that delivers benefits & addresses challenges
  - Reaching TRL 3 in dissolution, SX & U/Pu finishing
  - Including engineering & waste assessment (via "Sim-Plant")
  - Focus on skills & core recycle facilities

- **Progress in last 12 months**
  - New facilities / capabilities at UoLeeds & NNL
  - 2 Advanced PUREX flowsheet trials at NNL – U+Pu co-processing demonstrated
  - Innovative photochemical U(VI) reduction stage (UoLancs)
  - Post-doc seconded to Idaho National Lab

- **International reputation, leverage (GENIORS) & links (NEA, IAEA, INL…)**
- Recommendations for next phase of programme being developed

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