The Evolving UK Nuclear Landscape

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The Evolving UK Nuclear Landscape

NATIONAL NUCLEAR LABORATORY

- Single entity post-WWII (AERE/UKAEA)
- Progressive changing focus (defence → civil)
- Privatisation, contractorisation and fragmentation leads to underfunding of the nuclear infrastructure
    - ❑plus closures of facilities and capabilities without consideration of the wider strategic impacts
    - ❑loss of experienced workforce
    - ❑creates barriers to information sharing
- No centralised strategic decision making

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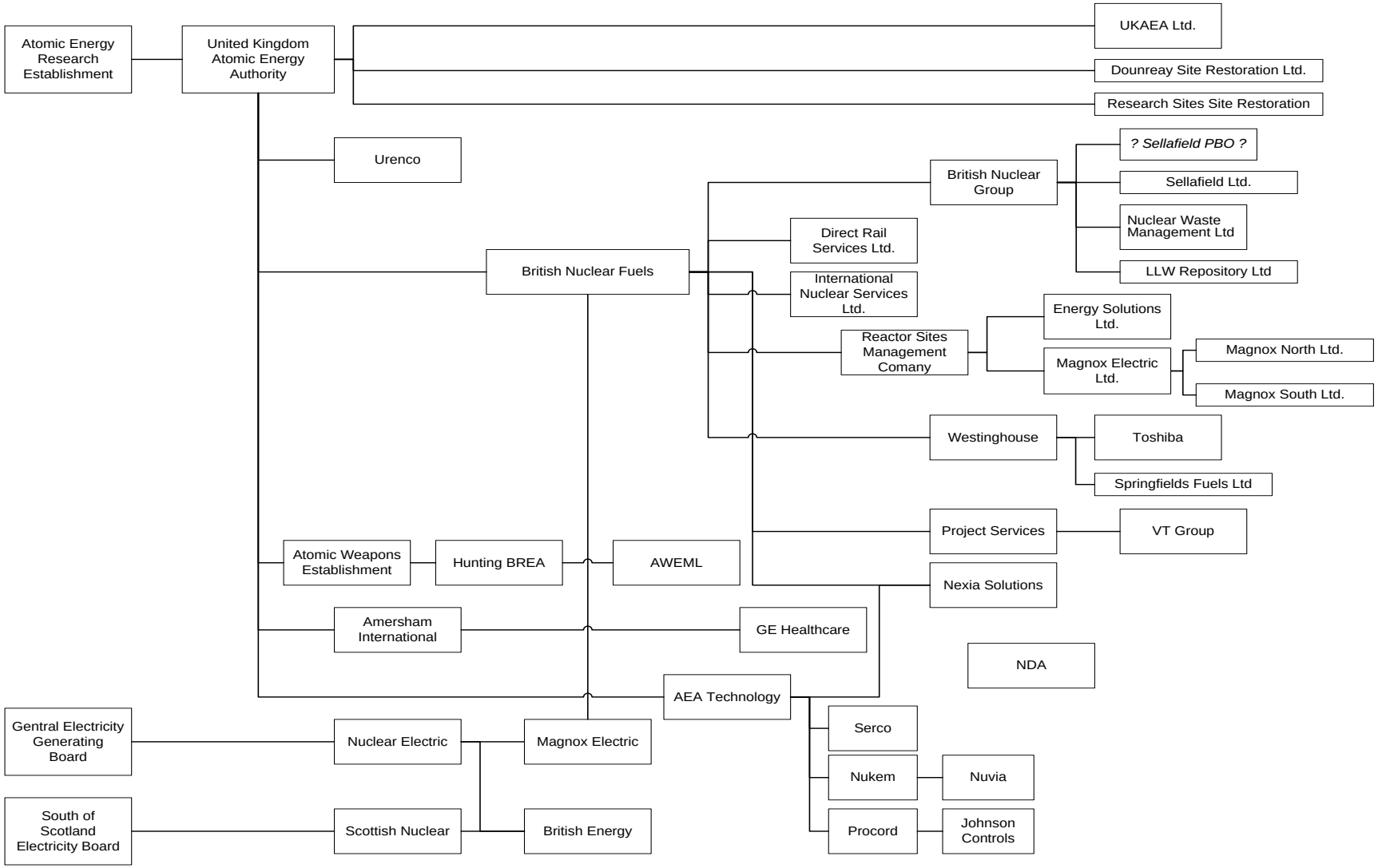

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- Early 21st century focus on decommissioning (formation of Nuclear Decommissioning Authority)

- 2006 UK Government stated its intent to preserve and develop nuclear R&D capabilities as part of a national nuclear laboratory

- July 2008 National Nuclear Laboratory was formally announced by the Secretary of State

- March 2009 Dept of Energy and Climate Change announced a consortium of Serco, Battelle and MoU would act as the managing contractor (as GOCO)

- Initial focus on supporting decommissioning and reactor life extension

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On a comparable timescale a number of external driving forces were developing:

- 2008 Climate Change Act

Commitment on Secretary of State to reduce greenhouse gas emissions by 80% by 2050 (<550ppm = 2^{o}C temperature rise) - original target 60% but data shows we need to be more aggressive, hence 80%

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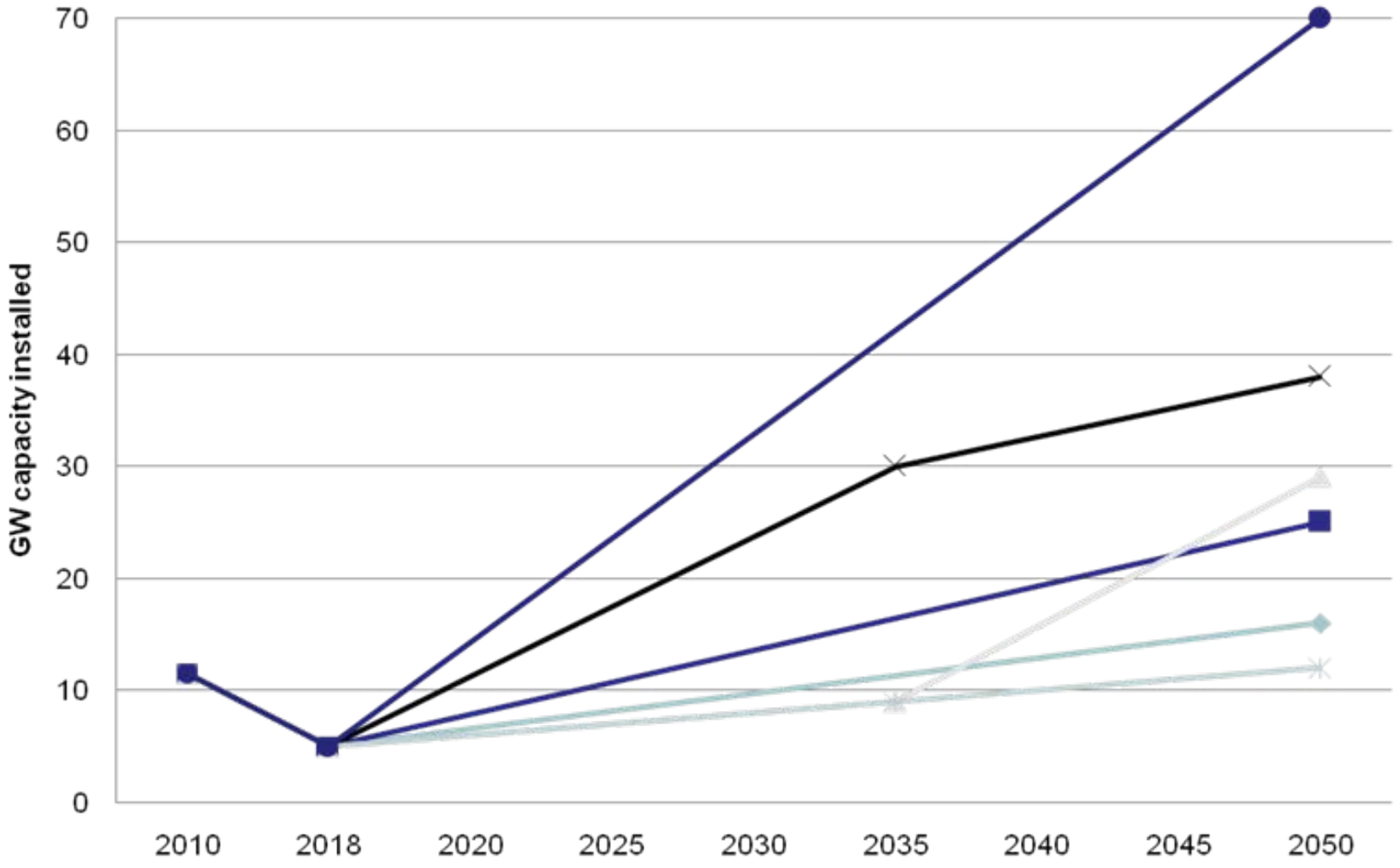

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- Energy supply

Significant energy shortfall likely to appear during mid 2020s due to the progressive closure of Magnox and AGR stations, together with those fossil fuelled stations unable to meet the CO_2 emission levels - and a growing reliance on imported fuels purchased in a volatile market place

- 2011 House of Lords Review

Found a declining nuclear R&D capability and recommended a need for investment to maintain the nuclear knowledge base and facilities to support nuclear training and R&D

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- UK Government response issued in March 2013 - Nuclear Industry Strategy –
- Considers R&D required to keep options open for scenarios of up to 75GW contribution from nuclear energy
- Baseline, open and closed fuel cycle
- Recommendation that programme should start now particularly maintenance of skills
- Closer working between industry and academia
- International collaboration important particularly for future nuclear energy R&D

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Major topic areas of activity:

- Decommissioning and clean up
- Current and new reactor systems (eg SMR, LWR, BWR, FR, GenIV [eg HTR])
- Nuclear materials management (Pu & U)
- Spent Fuel Management
- Geological Disposal
- Safeguards and security

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- Progressive clarification of the future nuclear programme
- Central co-ordination of UK nuclear R&D
- Welcome focus and investment in UK nuclear facilities
- Retention of capability across the fuel cycle
- Recognition of the rapid and successful development of the NNL – moved to Government Owned Government Operated (GOGO) organisation

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Windscale Laboratory

- Built in the 1960's for the inspection of uranium metal (Magnox) fuel
- The Windscale Laboratory has been developed and modified over the decades to provide capability for water reactor and gas reactor fuel and to handle decommissioning wastes across the Sellafield site
- Lack of investment over the last few decades has lead to poor plant status, obsolescence, and configuration control issues
- Refurbishment now underway to assure plant availability to 2035 – but availability and output must be also maintained

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- 60 heavily shielded work stations over 13 hotcells
- 3 separate cask/flask receipt crane halls
- Hotcells typically 11 x 2.5 x 4m internally
- Each hotcell serviced by 0.5 or 1 tonne capacity crane
- Hoist, and some with power manipulators
- Horizontal/vertical posting ports
- Roof of each cell is removable allowing flexible access
- Flexible/adaptable facility

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Central Laboratory

•£300M investment in new facilities for nuclear R&D

• Low active and inactive laboratories

• Uranium-active rig hall

• Plutonium active laboratories

• Highly Active alpha/beta/gamma cells

• Supporting infrastructure to meet the requirements of 300 technologists

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- Highly Active alpha/beta/gamma cells

- These comprise a number of high integrity shielded alpha sealed containment boxes

- Providing a high quality operating environment capable of supporting ‘forensic’ levels of analyse - particularly suited to detailed solution-based radiochemical analysis and analytical studies on plant materials and components/systems whilst operating at full and representative radiation levels

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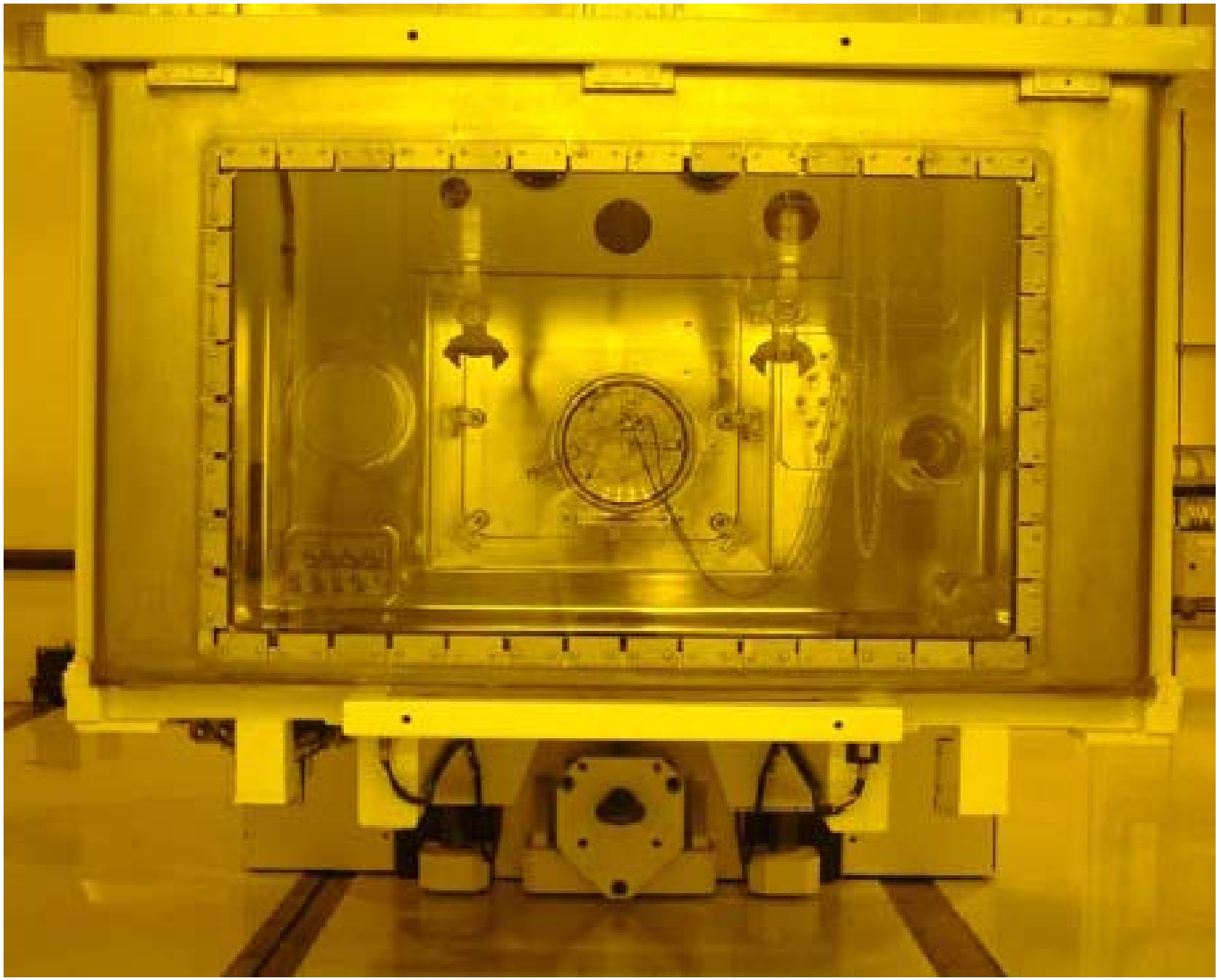

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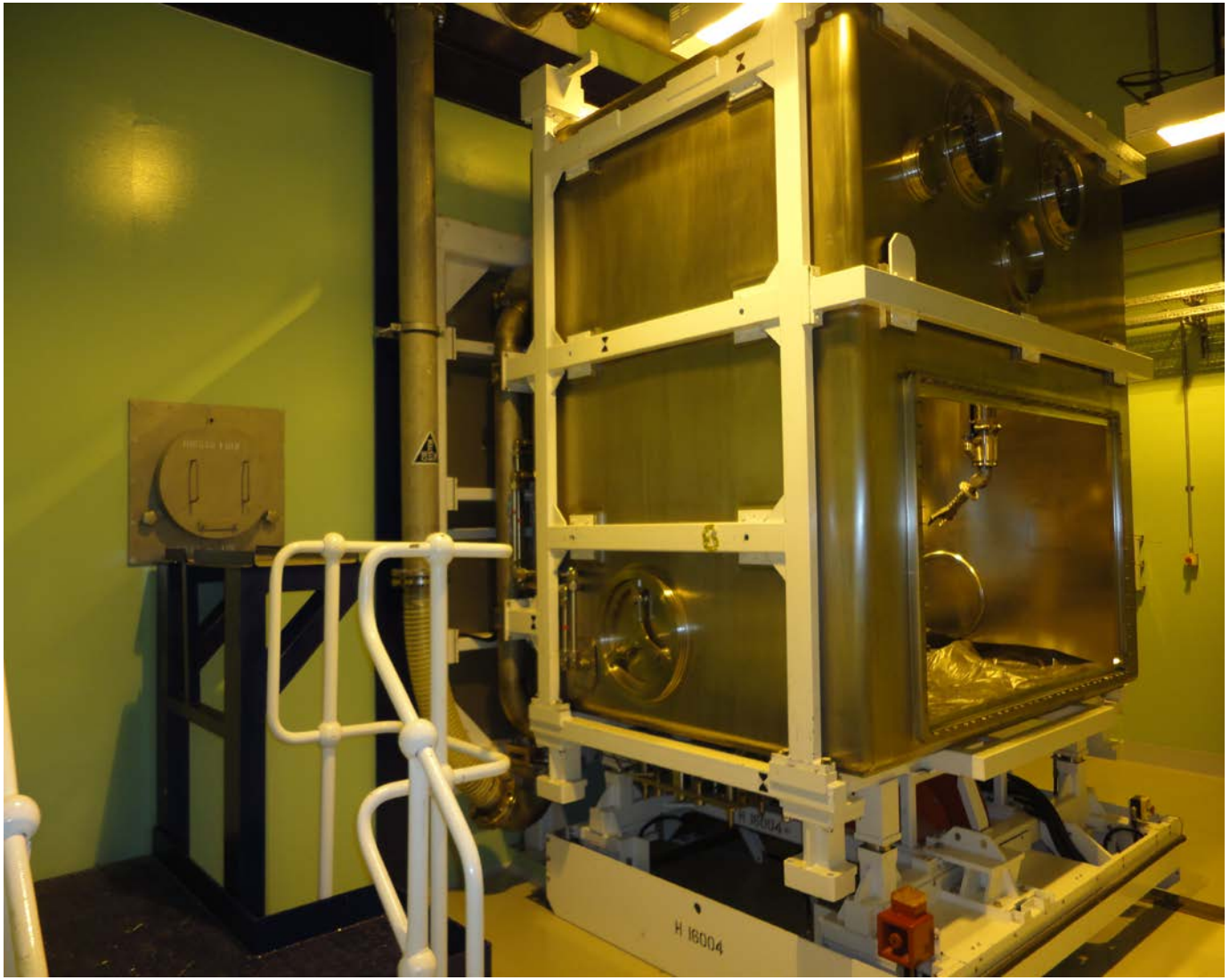

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- NNL is therefore operating a facility rooted in the genesis of the industry, and one that is truly of 21st century
- With regard remote handling facilities they reflect the 50 year ‘journey’
- So what do we learn by looking at the two plants?

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➢ Windscale Laboratory

- Built at a time when funding was not constrained
- Built at a time of expansion of nuclear interests and reactor types
- Had to be flexible – demand not closely defined (roof blocks)
- Limited use of interlocking – documentary/manual controls
- Operational staff needed to be creative as new challenges arose
- Period of self regulation

- Thus has survived because it was able to adapt to ‘today's’ needs – inherently ‘future proofed’

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➢ Central Laboratory

- Higher containment specification (alpha sealed)
- Reduced need for man access (both during commissioning and containment box decontamination)
- Significantly reduced decommissioning costs
- Highly specified mode of operation – limited flexibility
- External regulation

- Operational staff need to be creative as new challenges arise and anticipate how the demand will change with time (>10 years ahead)
- Nuclear Industrial Strategy can help define potential challenges
- Skills maintenance essential in facility operational areas