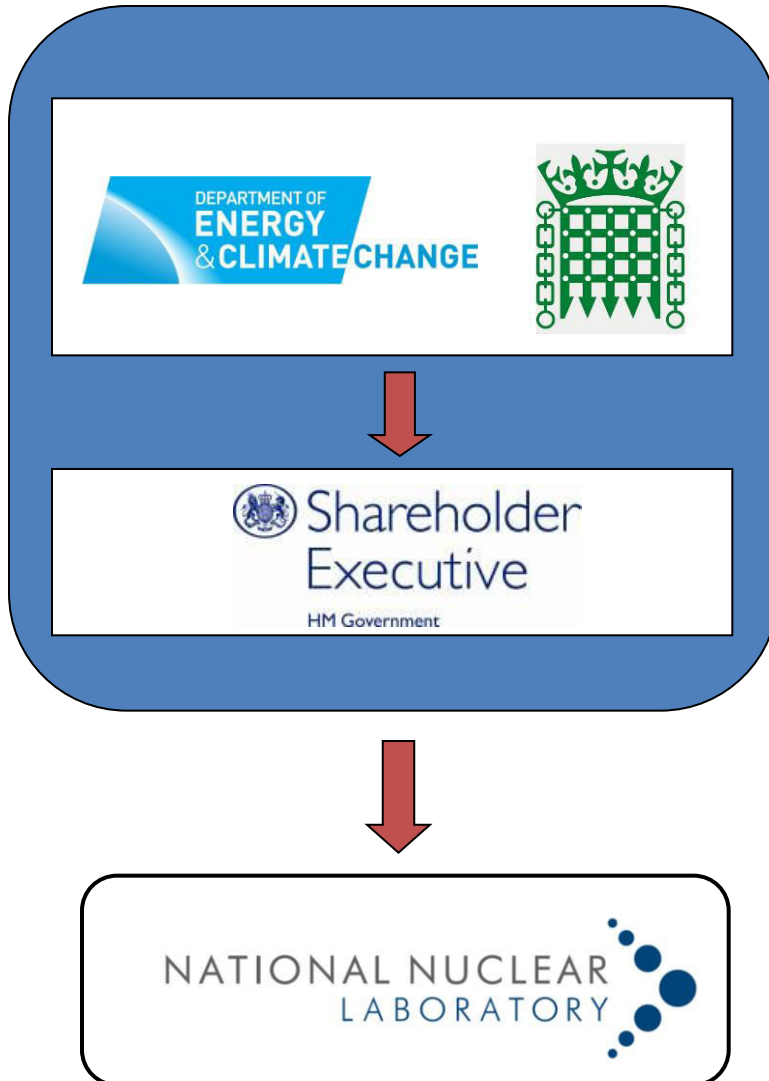




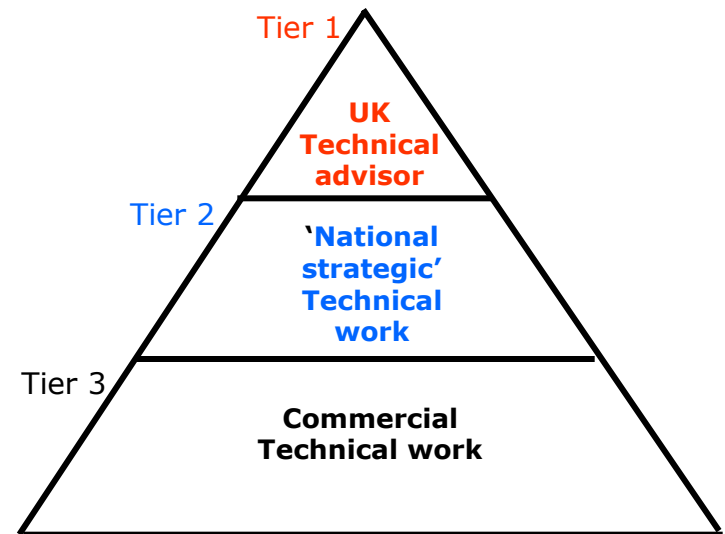
# Plant Life Extension in Central Europe – relevant UK experience

**Peter Handley**

# NNL Ownership



- National Laboratory for both UK Government and Industry
- Support to national R&D programmes
- Host and lead NIRO



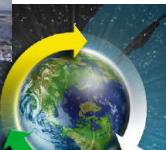
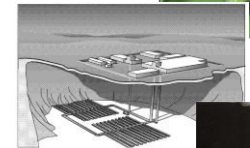
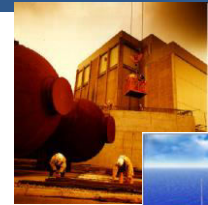
# NNL – Facts & Figures

- Around 800 staff
  - Over 60% of whom have science or engineering degrees / PhDs
- Key customers
  - Sellafield Ltd, EdF Energy, NDA, Magnox, MoD, Westinghouse, UK Government, Regulators
- Annual turnover of around £86M
- Profit of around £9.5M – re-invested in R&D and Capital schemes
- Operating as a commercial business
  - No direct funding grant from HMG

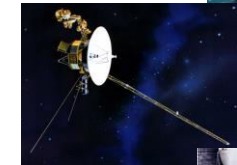


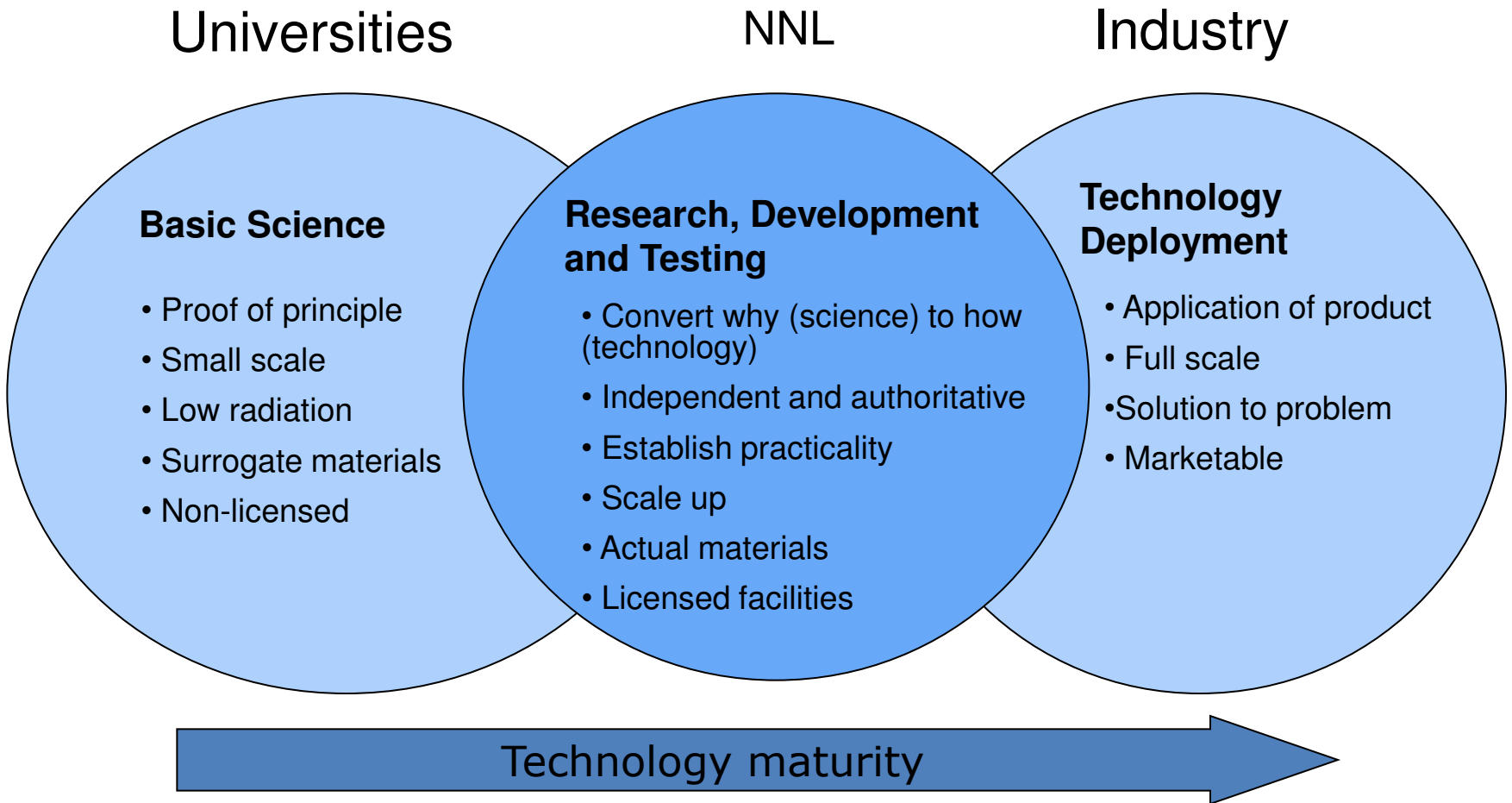
# NNL supports *all* nuclear programmes

- Continued operation of existing reactors & fuel cycle facilities (fuel fabrication, reprocessing)
- Legacy waste management / decommissioning
- New nuclear build
- Geological disposal
- Plutonium stockpile disposition
- Naval propulsion support
- Advanced reactor & fuel cycles
- Space propulsion systems
- Security, non-proliferation & safeguards



Global Nuclear Energy  
Partnership





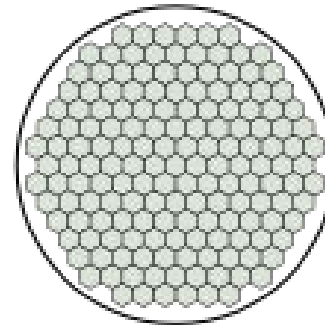
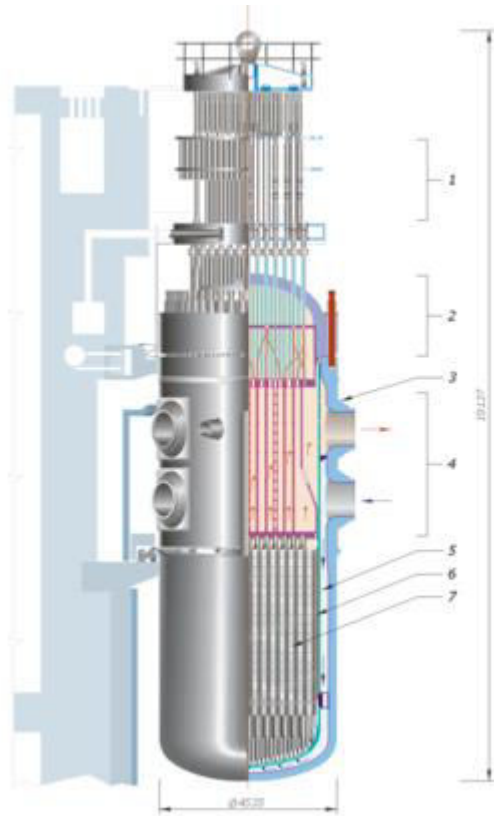


# Plant Life Extension – a case study

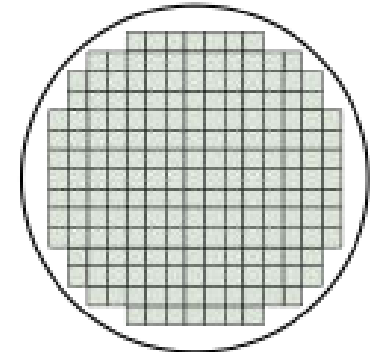
**Huw Morgan**  
Director,



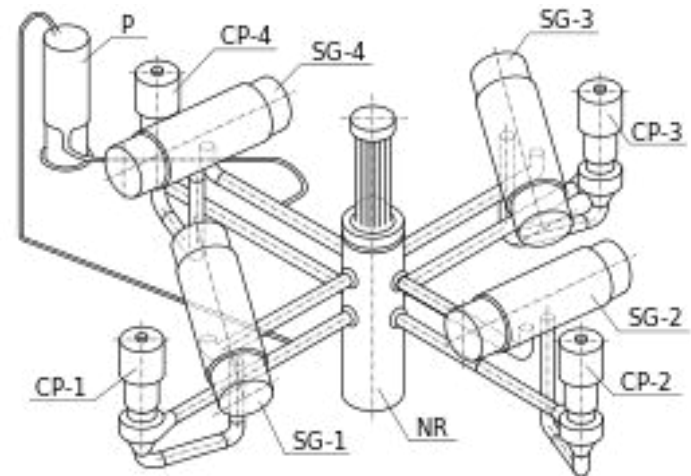
# VVER



BB3P-1000



Westinghouse 4-loop PWR



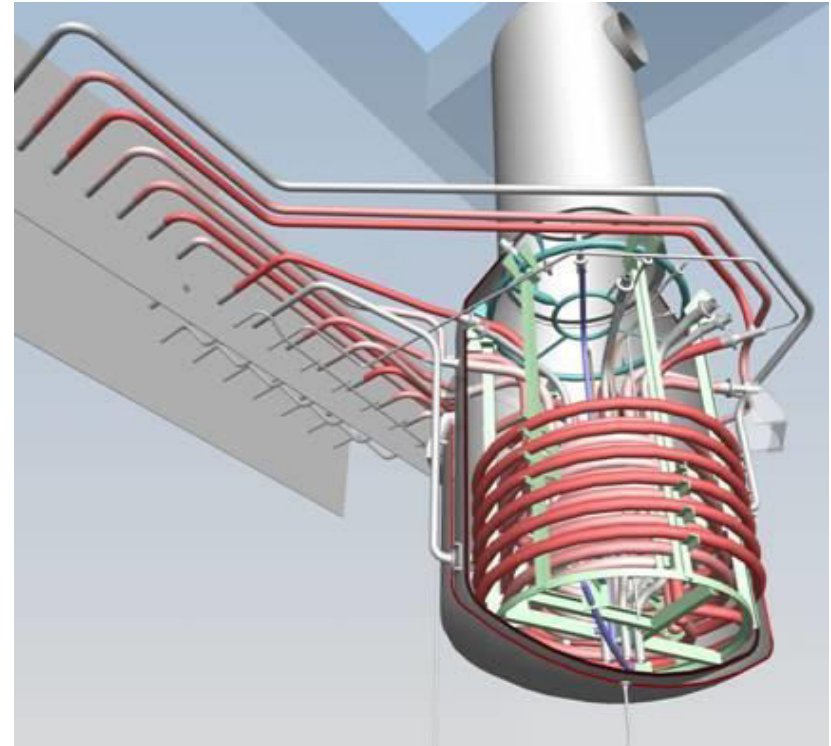






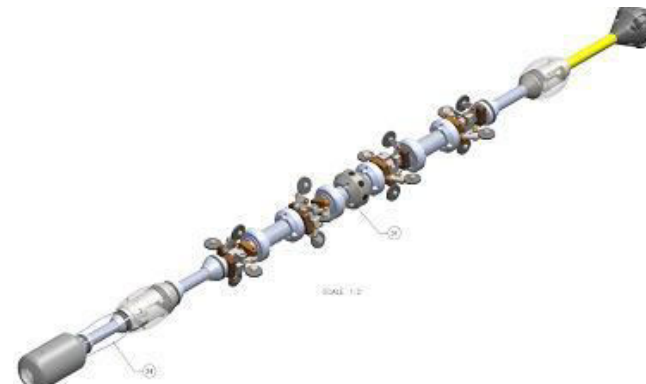
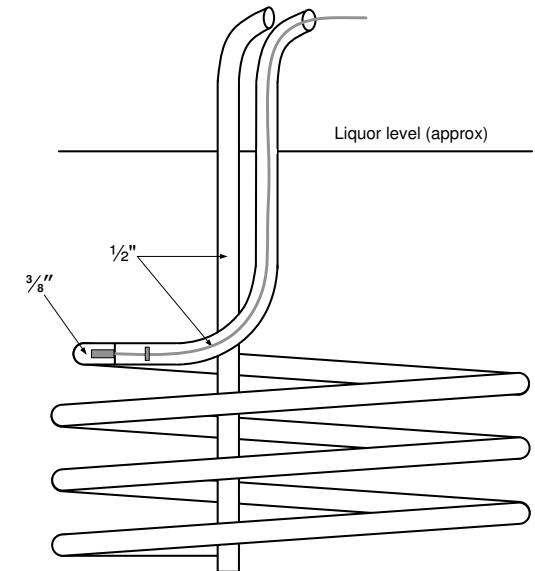
# Critical Plant items - HA Evaporators

- Three HA Evaporators – built in the 1970s
- Critical link in converting liquor from fuel reprocessing into vitrified waste product.
- Needed to validate safe operation against known programme lifetime (a new evaporator is > £500M and 5 years !)
- Challenge was to:
  - undertake inspection
  - Understand material condition
  - Model corrosion processes
  - Develop predictive lifetime model



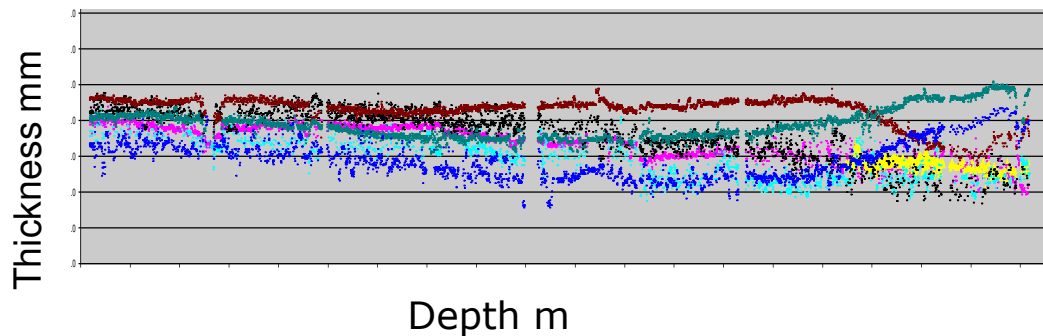
# Technology to be applied

- Inspect internal coils of HA evaporator for determination of Lifetime extension – CCTV and Ultrasound
- Innovative - designed to meet the following criteria;
  - Radiation tolerant
  - Remote deployment – no human access
  - Inspection up to 45 m from insertion point
  - Robust/recoverable (ie dissolvable)
  - Inspect every 5 mm around internal circumference
  - Automated

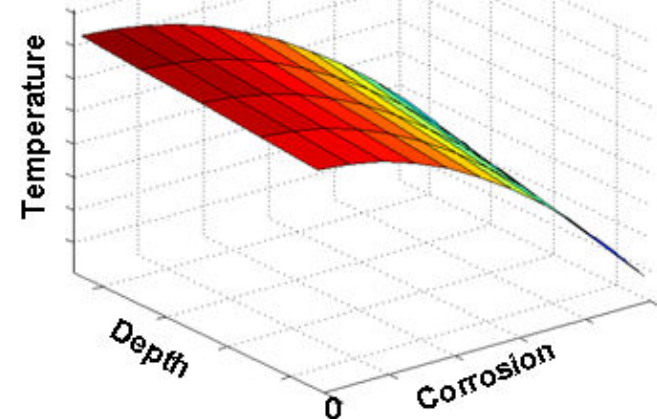


- In service cell inspections visually assessed the external condition of the HA evaporator components.
- Ultrasonic coil inspection corrosion and thickness measurements determined the condition of the evaporator components.
- Routine ultrasonic inspections identified corrosion loss;
  - Increased with submerged depth
  - And with each fuel type processed
- Extrapolation of the coil inspection data is used in structural and thermal Finite Element Analysis, statistical analysis and the assessment of uninspected components.
- The condition and remnant life assessments of the evaporators can now be determined.

Ultrasonic Thickness Measurements



Corrosion vs. Depth vs. Temperature



# Benefits

- Significant improvements made to evaporator operations to increase plant life.
- Stress ranges for the various load cycles have been generated using Finite Element Analysis.
- Remaining fatigue life of the evaporator estimated for a range of operational options.
- Improved coil heating and cooling management implemented.
- Substantiation for additional evaporator capacity.
- New evaporator construction optimised to reduce costs and meet the requirements of reprocessing, POCO and decommissioning.





# Plant Life Extension – What can the UK offer

**Huw Morgan**  
Director,





- Magnox
    - Design lives extended from 25 years to 42 years
      - Pressure vessel embrittlement
      - Boiler corrosion
      - Graphite
  - AGR
    - Average 7-year life extensions to all plants
      - Structural re-validation
      - Boiler corrosion
      - Fuel failures
      - graphite
  - Sizewell PWR
    - 20-year life extension to 60 years
  - Chemical Reprocessing/Waste Plants
    - Remote inspection
    - Corrosion
    - Fatigue/stress corrosion cracking
  - Naval Reactors
-

# PLEX, - What can the UK offer

- Current experience in assessment against a modern Regulatory regime
- Reactor and station plant chemistry (primary side, storage (incl ponds) and associated plant), technical governance support for plant.
- Materials performance assessment (steels and Zr alloys including embrittlement and irradiation issues)
- Modelling (reactor chemistry/corrosion)
- Peer review of plant data and reviewing technical standards/documents
- Ageing plant strategy management
- Plant Inspection regimes
- Fuel cycle extension programmes (eg 24 months compared to 18 month fuel cycle and its impact on the plant)
- International guideline implementation
- Obsolete instrumentation evaluation/verification/re-qualification
- Irradiated fuel and component assessment
- Emergency Management (advice to Government on Emergency Scenarios, eg Fukushima)

