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Spent Fuel Management in the UK

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Waste Management 2015

Brief

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- Overview on the UK's current plans for dealing with
  - MAGNOX fuel
  - AGR fuel
  - PWR fuel
  - Vitrified fission products
- UK perspective of reprocessing versus geologic disposal of fuel

Overview

- **Spent Fuel in the UK**
- Spent Fuel Management Strategies
- Reprocessing v Disposal

UK R&D and Generation I Fuels

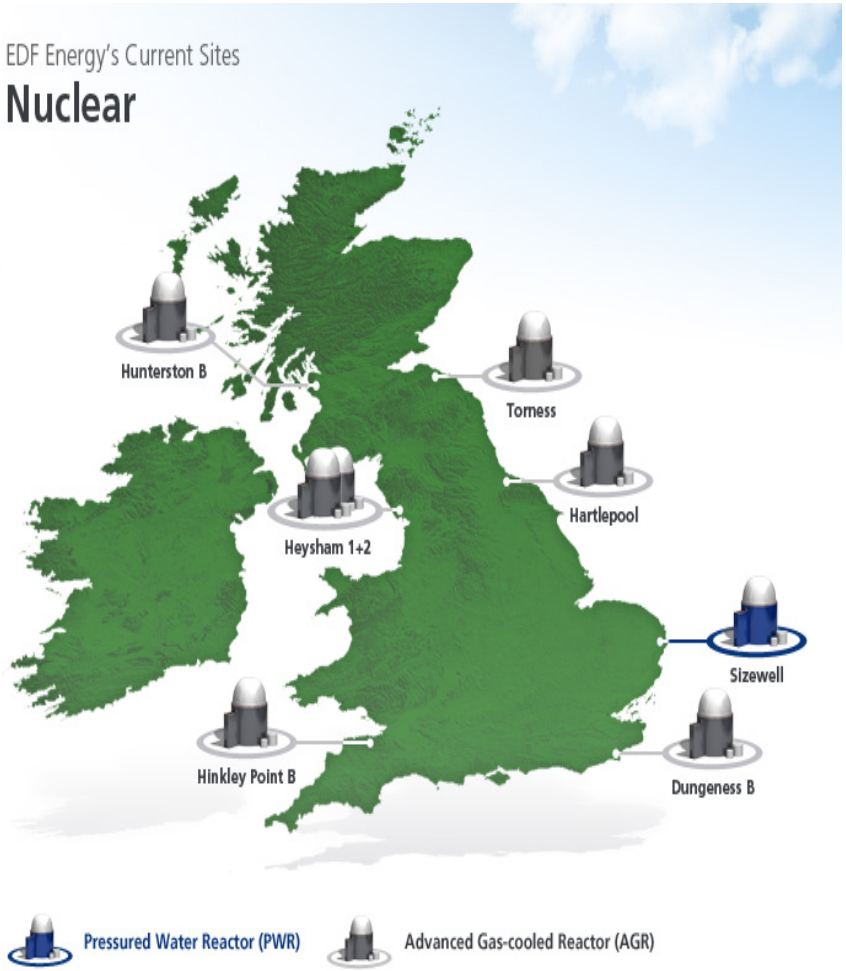
"Exotics" in order of 500 tHM

Magnox Fuel <3,000 tHM

Images courtesy of NDA

UK Current Nuclear Fleet

- AGR
  - 6 stations
  - 880 – 1220 MWe each
  - scheduled closure 2018-2023
  - anticipate 5-7 years extension
  - spent fuel 5,000 - 6,000 tHM
- PWR
  - 1 station
  - 1198 MWe
  - scheduled closure 2035
  - anticipate 20 years extension
  - spent fuel ~1,200tHM



http://www.edfenergy.com/about-us/energy-generation/nuclear-generation/nuclear-power-stations/

UK Fuel Storage – Future

- New Build Programme
  - potential 16 GW capacity by 2030
  - 3.2 GW capacity approved (Hinkley C)
  - may include EPR, AP1000 and ABWR
  - up to 16,000 tHM spent fuel by ~2080
- Possibility of Expanded Programme
  - up to 75 GW
  - up to 80,000 tHM spent fuel by ~2120
- Reuse Pu fuels
  - Potential for introduction of MOX into new build programme (replacement for UOX)

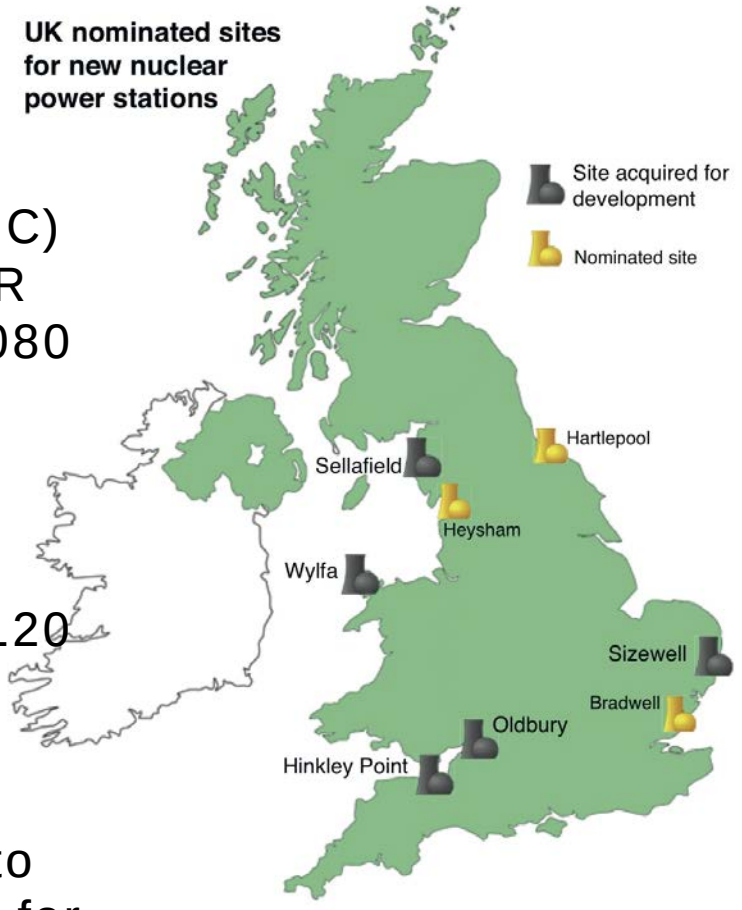


Image courtesy of NAMRC

Overview

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- **Spent Fuel Management Strategies**
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UK Nuclear Fuel Cycle Position

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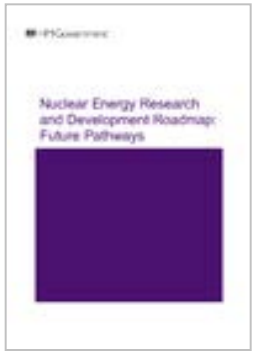
- Spent fuel management is a matter for the commercial judgement of its owners, subject to meeting the necessary regulatory requirements.
- UK is pursuing an Open Fuel Cycle post 2020
- UK Government recognises nuclear power as a low carbon energy source, and are considering pathways that could deliver up to 75GW installed nuclear capacity by ~2050
- The option for a future transition to a Closed Fuel Cycle remains

https://www.gov.uk/government/publications/the-carbon-plan-reducing-greenhouse-gas-emissions--2
https://www.gov.uk/government/publications/nuclear-energy-research-and-development-roadmap-future-pathways



UK Spent Fuel Management - NDA

Current strategy for spent Magnox fuel management is:

- Interim stored and reprocessed
  - *Reprocessing contracts expected to be complete by end 2020*

Current strategy for AGR spent fuel management is:

- Interim stored and reprocessed
  - *Reprocessing contracts expected to be complete by end 2018*
- Long term stored pending geological disposal
  - *Centralised ("Away from Reactor") storage*
- **"Exotic" fuel will be stored pending geological disposal**
  - *Consolidate fuel to centralised storage*
  - *Characterisation and repacking for long term storage*
  - *Preference for pond storage*

UK Spent Fuel Management - LWR

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Current strategy for LWR spent fuel management is:

- **Long term stored pending geological disposal**

- Current Reactor (EDF)
  - *"At Reactor" storage*
  - *Reactor storage pond nearing capacity*
  - *Implementing limited dry storage*

- New Build
  - "At Reactor" storage
    - whole-life station fuel generation
    - remains after reactor decommissioning
  - Storage technology selection not finalised
    - EPR GDA includes interim pond storage
    - ABWR GDA includes pond and dry storage options
- Utilities have option to set own strategies and provide alternative justifications if they so choose

Images courtesy of EdF

Vitrified Waste

- Historically UK has reprocessed its spent fuel from power reactors
  - 50,000 tHM of Magnox fuel
  - 10,000 tHM of oxide fuel (AGR, SGHWR & overseas LWR)
- Vitrified HLW is stored in air-cooled vault stores pending geological disposal
- Vitrified HLW is a core part of the GDF baseline inventory

Overview

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- **Reprocessing v Disposal**

Historical Perspective

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Original case for reprocessing

- Requirement for separated Pu for fast reactors
- Concerns over storage of AGR fuel
- International reprocessing business benefits

Considerations

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- Economic
  - Investment requirements for reprocessing beyond baseload
  - Economic advantage arising from reduced GDF footprint not significant
  - No new build operator indicating desire to reprocess fuel
- Technical
  - Long term storage of AGR fuel is technically underpinned for current storage needs and ongoing R&D is expected to close gaps and maintain critical skills and capabilities.
  - AGR fuel assessed as being disposable.
  - Fast reactor deployment too far in future
- For NDA, storage and disposal is most cost effective solution for its liabilities

Nuclear Fuel Cycle Analysis

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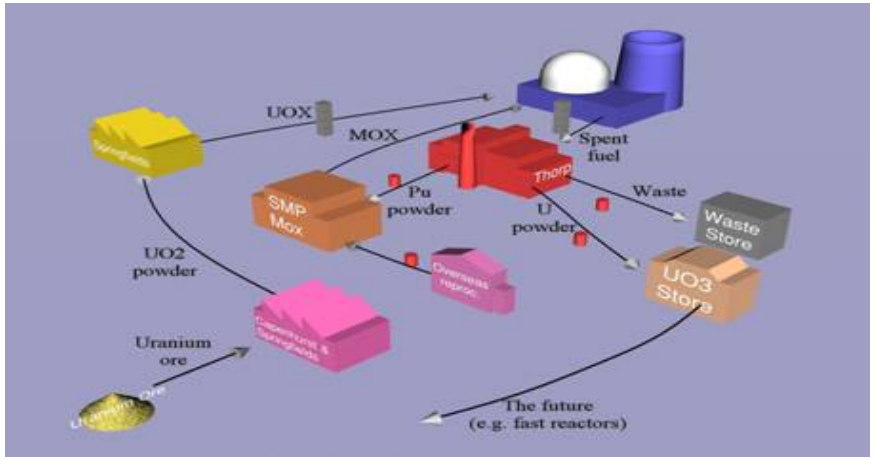
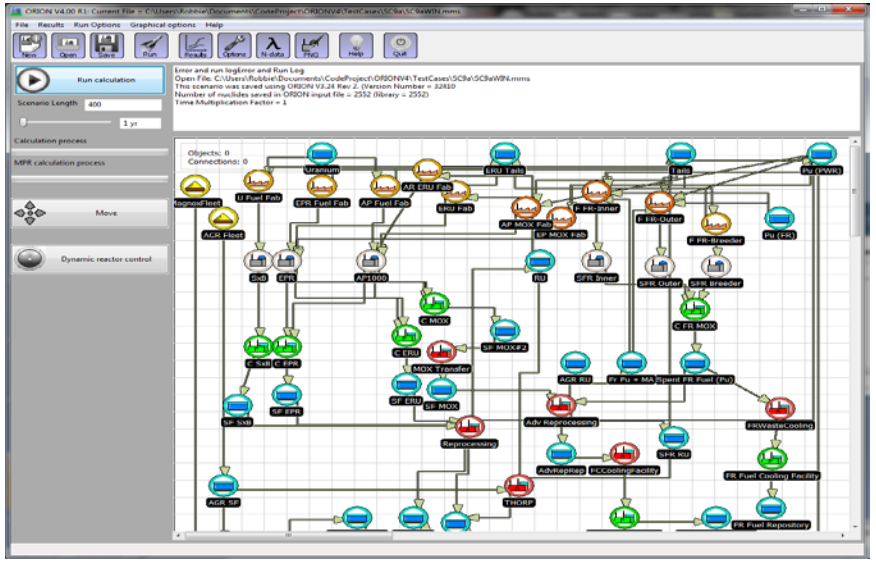
- Nuclear Scenario Roadmaps
  - Open and Closed fuel cycles
  - Various reactor and fuel systems
  - Implications and decision points explored
- NNL have modelled
  - LWR to SFR transition
  - Np and Am recycle





Impact of Plutonium Availability on Installed Capacity

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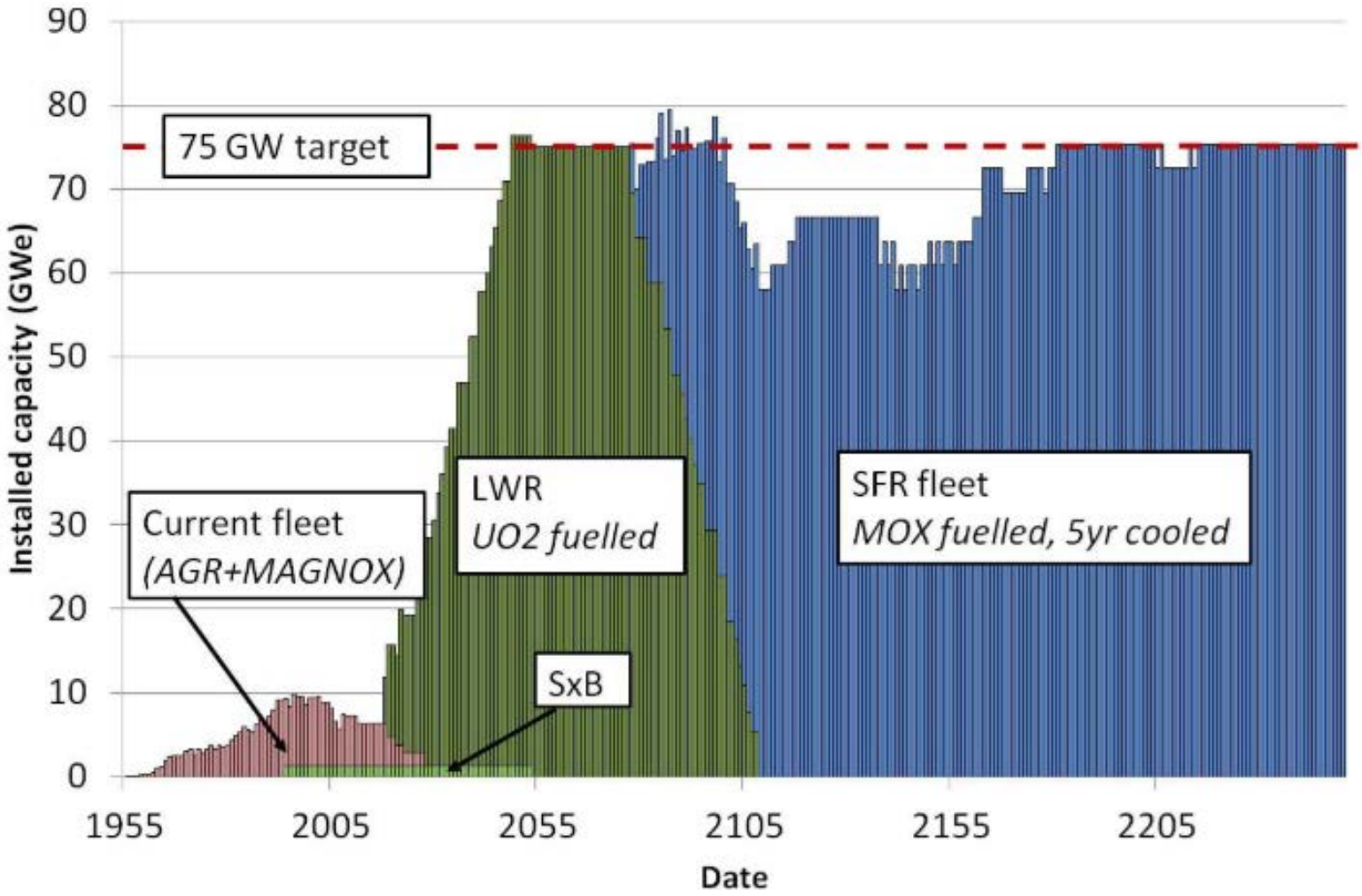

Decay Heat in Repository for Different Fuel Cycle Scenarios

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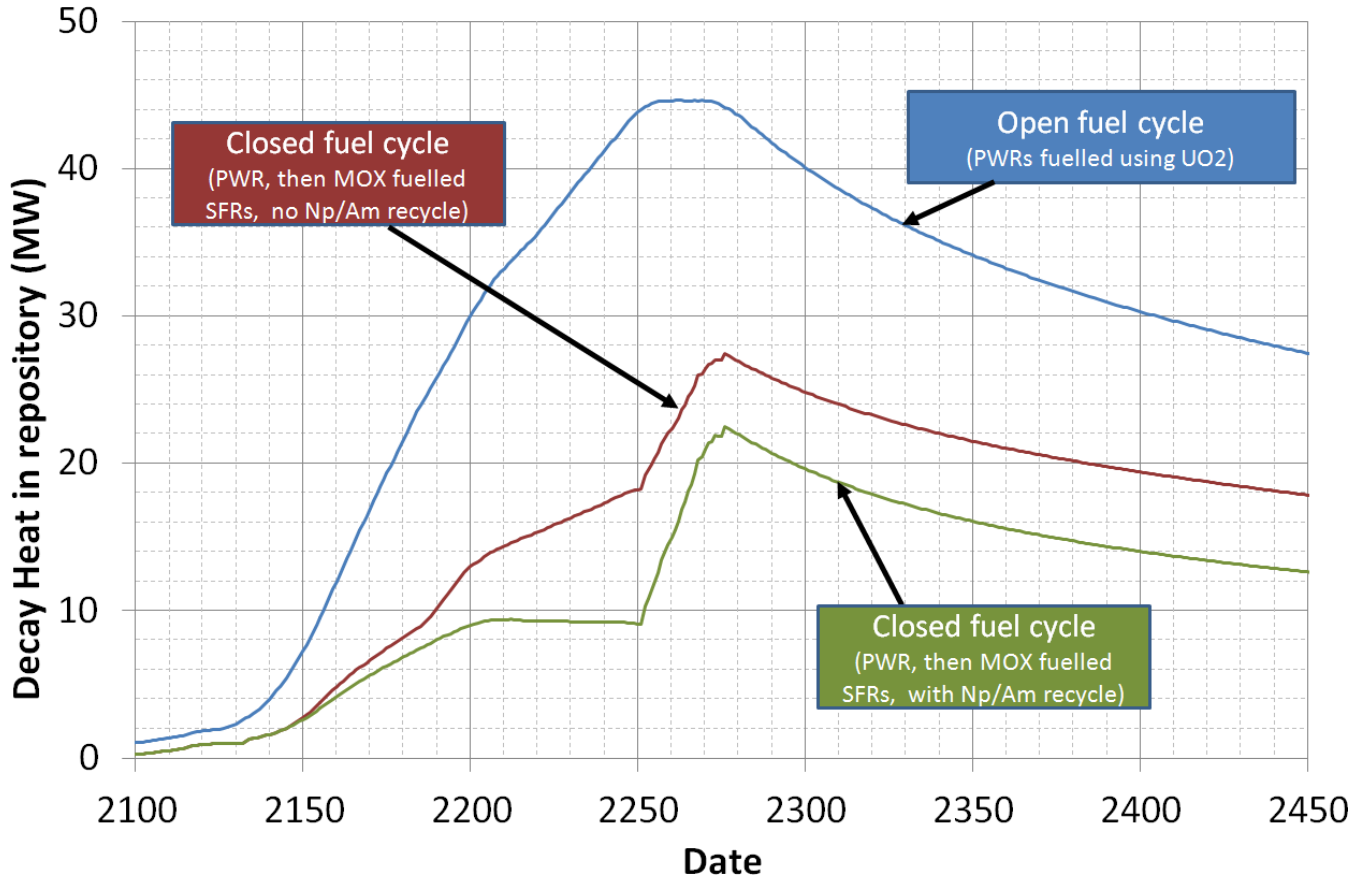
HLW repository size dependent on total energy deposited in scenario



Thank you for your time