How Government policy on spent fuel management is being implemented in the UK

WM Symposia Phoenix

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Spent Fuels in the UK

- **NDA-owned (or managed) from civil nuclear legacy comprising;**
  - Magnox spent fuel from the UK's first fleet of commercial reactors
  - AGR spent fuel from the UK's second fleet of commercial reactors
    - Spent fuel generated following the restructuring of British Energy in 2005 is owned by NDA
  - Few hundred tonnes of prototype and fast reactor fuels, referred to as Exotics
  - Few hundered tonnes of overseas-origin scheduled for reprocessing in THORP

- **EDF Energy owned;**
  - AGR fuel generated prior to British Energy restructuring in 2005 is owned by EDFE and the greater part is committed for reprocessing in THORP
  - Ca. 1,000 tU are estimated to arise from the Sizewell B PWR station

- **A New build programme in the UK;**
  - A 16GWe programme **could** give rise to 16,000+ te SF
  - This spent fuel will be owned by the utility that generates it

Government policy on Spent Fuels

- **For commercial oxide fuels, Government policy is that it is for the owner to decide on the spent fuel management option to implement based on commercial judgement and subject to Regulatory requirements**
- **For Magnox fuel, Government policy is to reprocess as this is the proven technical route**

- **See, United Kingdom Civil Nuclear Policy including Plutonium, http://www.berr.gov.uk/files/file26400.doc**

- **This allows for owners to reprocess or store the fuel pending disposal**

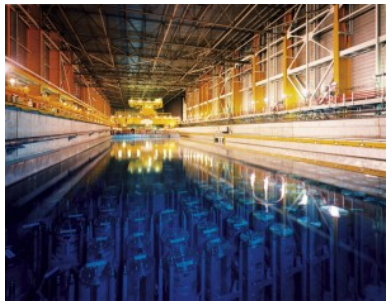
- **What does this mean in practise?**
  - What strategies are the NDA, EDFE and new build operators pursuing in the UK to manage their spent fuel?
  - What guidance has Government provided to new build operators to support its nuclear strategy?

NDA: spent fuel management

- **Magnox fuels**
  - To complete the reprocessing of Magnox fuels
  - Plant started in 1964 and is expected to **complete in ca. 2017**
  - Aging facility with about 3,000 te left to do
  - One reactor, Wylfa, is still operating

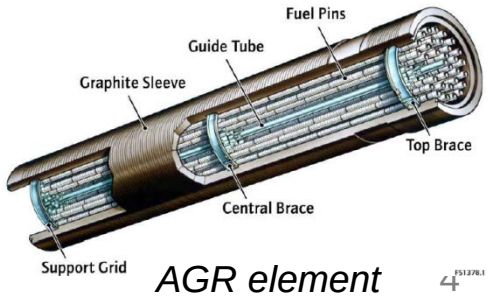
Magnox repro' under construction

- **Oxide fuels**
  - To complete the domestic and overseas reprocessing contracts **(circa 2018)** and return wastes to customers
  - To prepare the THORP pond for the storage of AGR fuel
  - Including fuel from lifetime extensions to the AGR fleet



THORP pond

- **Exotic fuels**
  - To manage, where possible, exotic fuels alongside bulk fuels
  - To reprocess where **cost-effective** in THORP or Magnox
  - To consolidate fuels at Sellafield to enable timely and **cost-effective clean-up of Dounreay**
  - Case study: the reprocessing of DFR fuel in Magnox



AGR element

Spent Fuels *not* owned by NDA

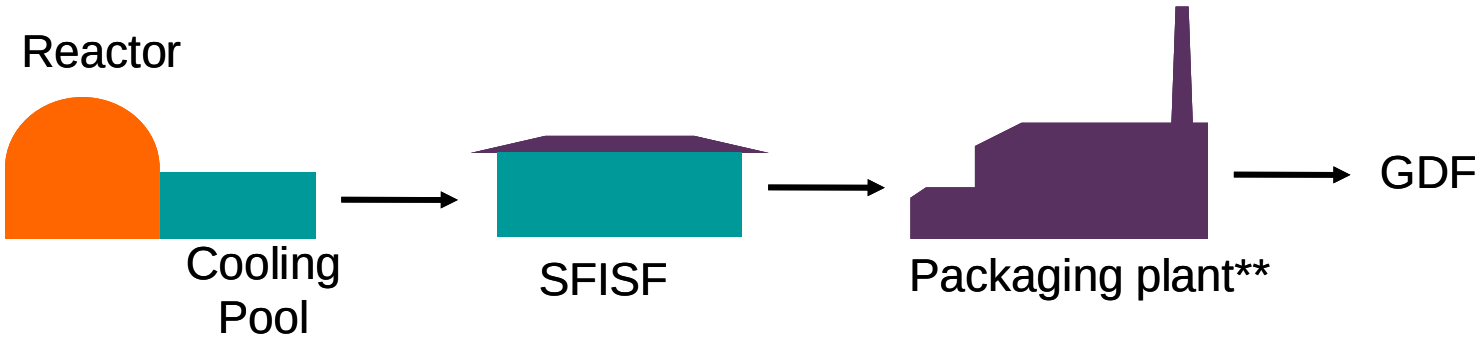
- **Sizewell B: UK's only commercial pressurised water reactor (PWR) power station, with a single reactor.**
- **Owned and operated by EDF Energy**
- **Built and commissioned between 1987 and 1995**
- **EDFE's are aiming for a 20 year life extension for Sizewell B beyond its closure date of 2035**
- **At least 1000+ tU of spent PWR fuel expected to arise from Sizewell B**
  - Owned by EDFE, currently in pond storage at the reactor
  - From about 2016 spent fuel will be transferred to the “Dry Fuel Store”
  - Fuel held in welded metal canister within a concrete cask
  - This fuel will be packaged for disposal at the NPP and transported to the GDF

http://www.edfenergy.com/media-centre/press-news/Sizewell-B-dry-fuel-store-update.shtml

New Build Programme

"The Government's policy is that in the absence of any proposals from industry, new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed."

- **A 16GWe programme could give rise to 16,000+ te SF**
- **Spent fuel is owned by the utility and is stored at NPP**
- **Interim spent fuel management decisions yet to be made**
- **SF will be packaged for disposal at NPP, sent to GDF**



End

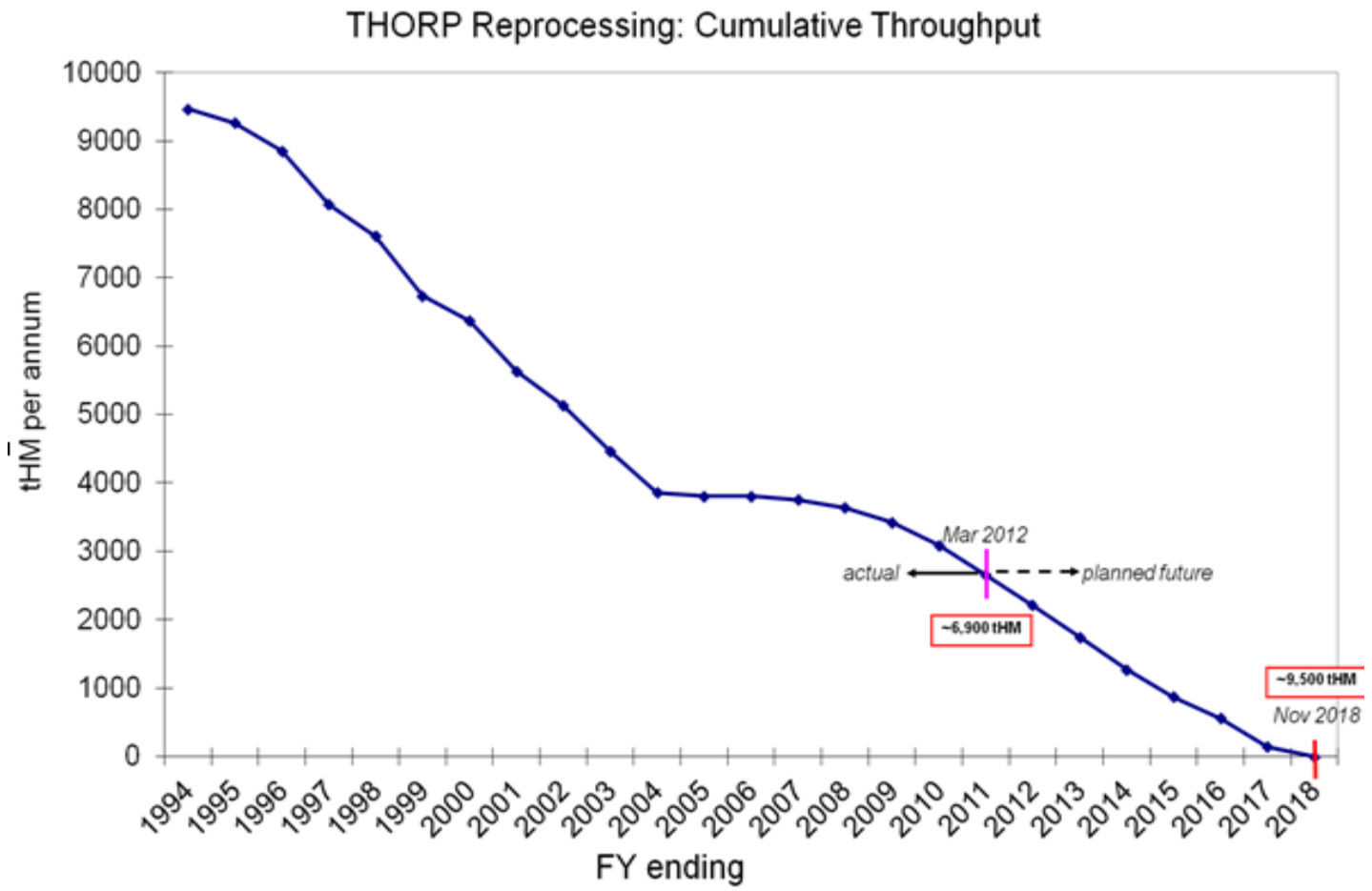
Our Strategy for Oxide fuels

- **Our strategy for oxide fuels is to complete the reprocessing contracts, as far as reasonably practicable**
  - This strategy sees THORP reprocessing completed in late 2018

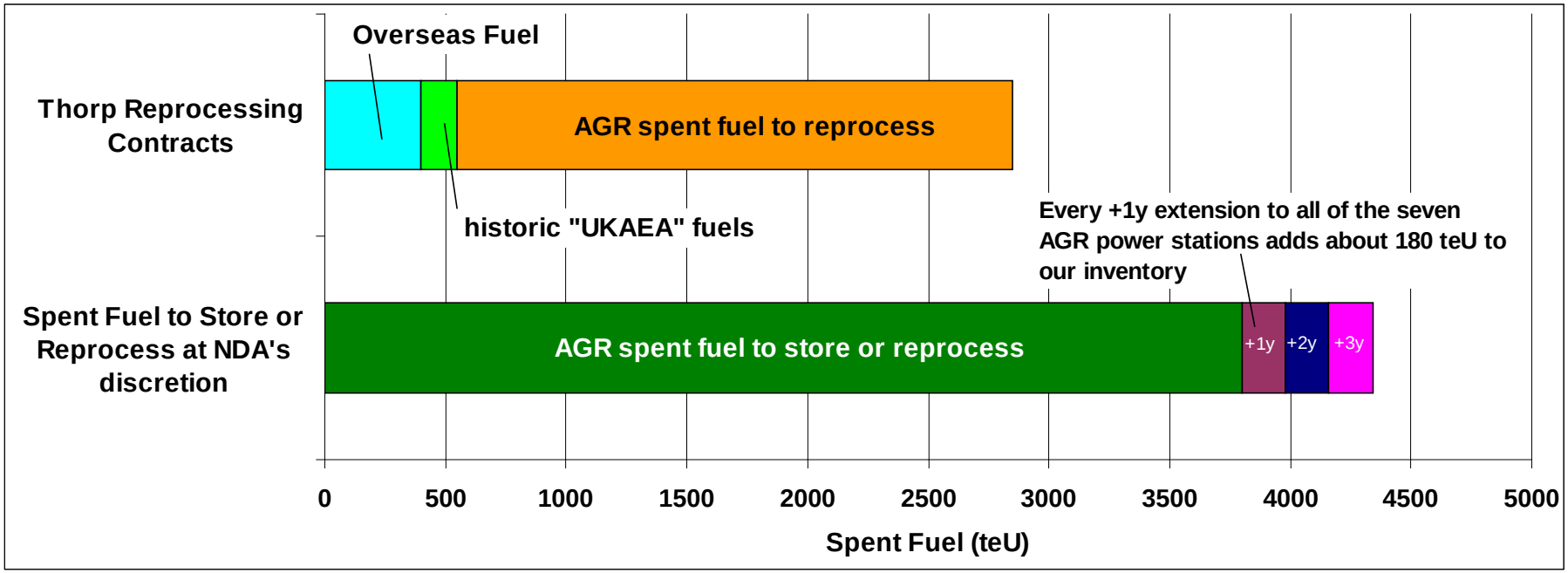
- **Plan to place the remaining fuel, and any future arisings, into interim wet storage pending a future decision on disposal**

- **Completion of the reprocessing programme;**
  - Meets our commitments to customers
  - Ensures sufficient capacity to store the remaining AGR fuel (including future arisings)
  - Allows those fuels more susceptible to corrosion in storage to be reprocessed
  - Viable and assessed to be the most cost-effective

Oxide Fuels


THORP Reprocessing: Cumulative Throughput
tHM per annum
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
FY ending
Mar 2012
actual
planned future
~6,900 tHM
~9,500 tHM
Nov 2018

Inventory of Oxide fuels (Mar 2012)



- Contractually committed to receive and manage all spent fuel arising from the AGR power stations;
- We own all of the AGR fuel loaded into reactors after midnight on 14th Jan 2005

Approach to interim storage

- **Not to foreclose any options for future or final spent fuel conditioning ie retrievable, transportable**
- **Primary containment barrier (fuel cladding) to have sufficient mechanical integrity after 80 years' storage to enable the above**
  - Corresponds to about half wall clad thickness
- **Cost-effective: maximise the use of existing assets (facilities and furniture)**
- **Readily inspectable: spent fuel condition can be established at any point in time**
- **Meets regulatory requirements (BAT and SAPs) and in-line with international best practice (IAEA, SSG-15)**

- **Accommodate the nature and types of AGR fuel (intact, sensitised, failed) and potential station extensions**

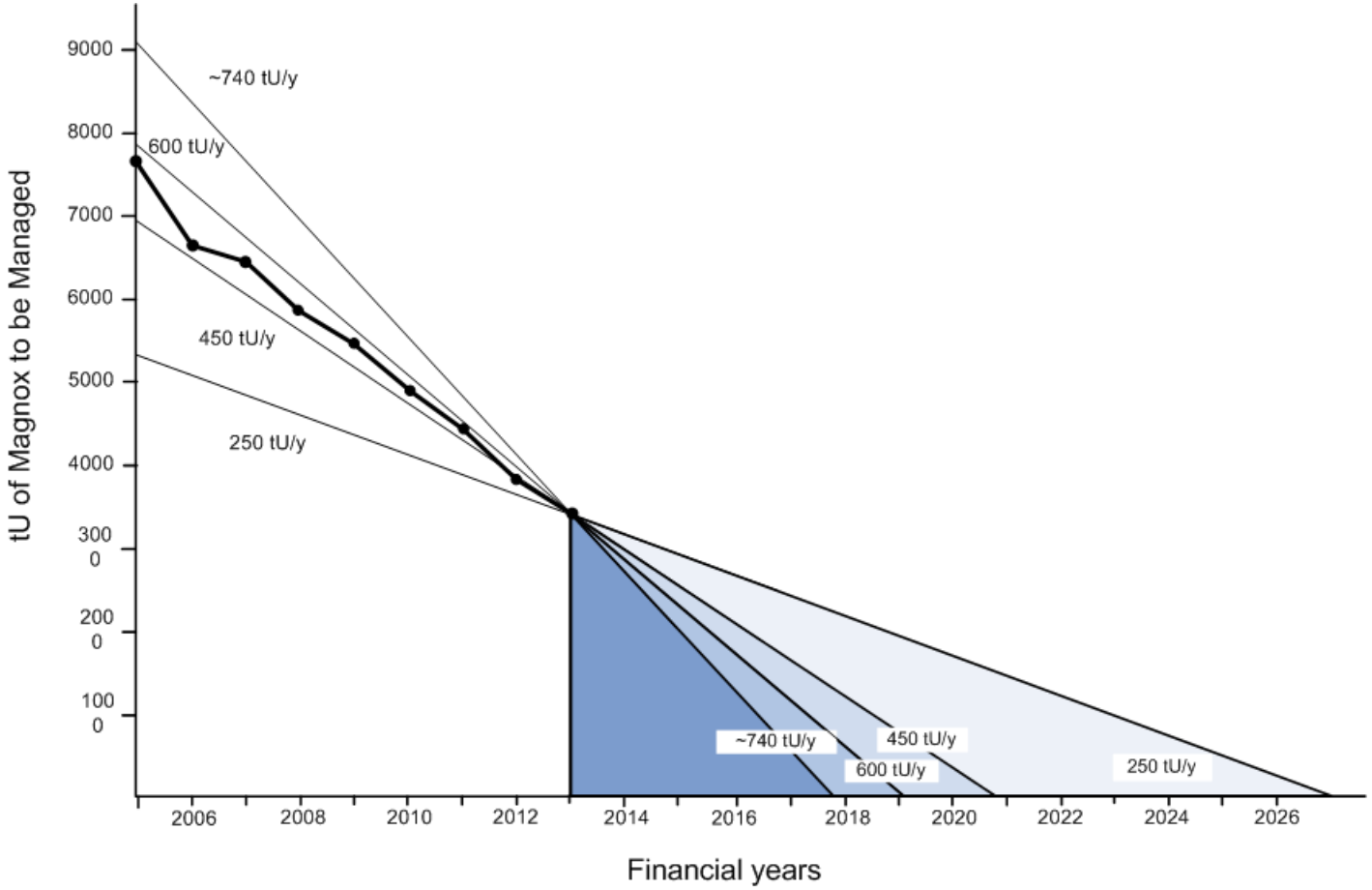
The transition to interim storage

- **The inventory of oxide fuels**
- **Our strategy**
  - In-line with contractual commitments; part reprocess, part interim storage

- **The approach to interim storage ie away from ‘buffer for reprocessing’ to interim**
- **Timeline and phases of interim storage**

- **The storage facility, THORP pond, and its substantiation**
- **The Transition plan**
  - Operational and logistical activities
  - Safety and technical case

Magnox Throughput Curves



Dounreay Exotics Inventory

MATERIAL	MAIN FORM	Approx. Tonnes
Irradiated DFR Breeder Material	Metallic fuel elements or slugs	44
Irradiated Spent Fuels	Mainly mixed oxide fuels as full assemblies but some carbide fuel as well	15
Unirradiated plutonium bearing fuels	Mainly oxide but some carbide A mixture of full assemblies, pins, pellets and powders	13
Unirradiated high enriched uranium fuel	Powders, pellets, metal and some alloy	~1
Low/Nat/Dep Uranic materials	Oxide (powder and pellets)	~36