

Magnox Reprocessing - 50 not out -

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International Conference on Management of Spent Fuel from Nuclear Power Reactors - An
Integrated Approach to the Back-End of the Fuel Cycle CN-226
15 – 19 June 2015

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The origins of Magnox Reprocessing

- Fuel
- Cladding
- Magnox Generation Programme
- Early days
- Overseas Business



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50 years in overview



1940s/50s



1960s/70s



1980s



1990s

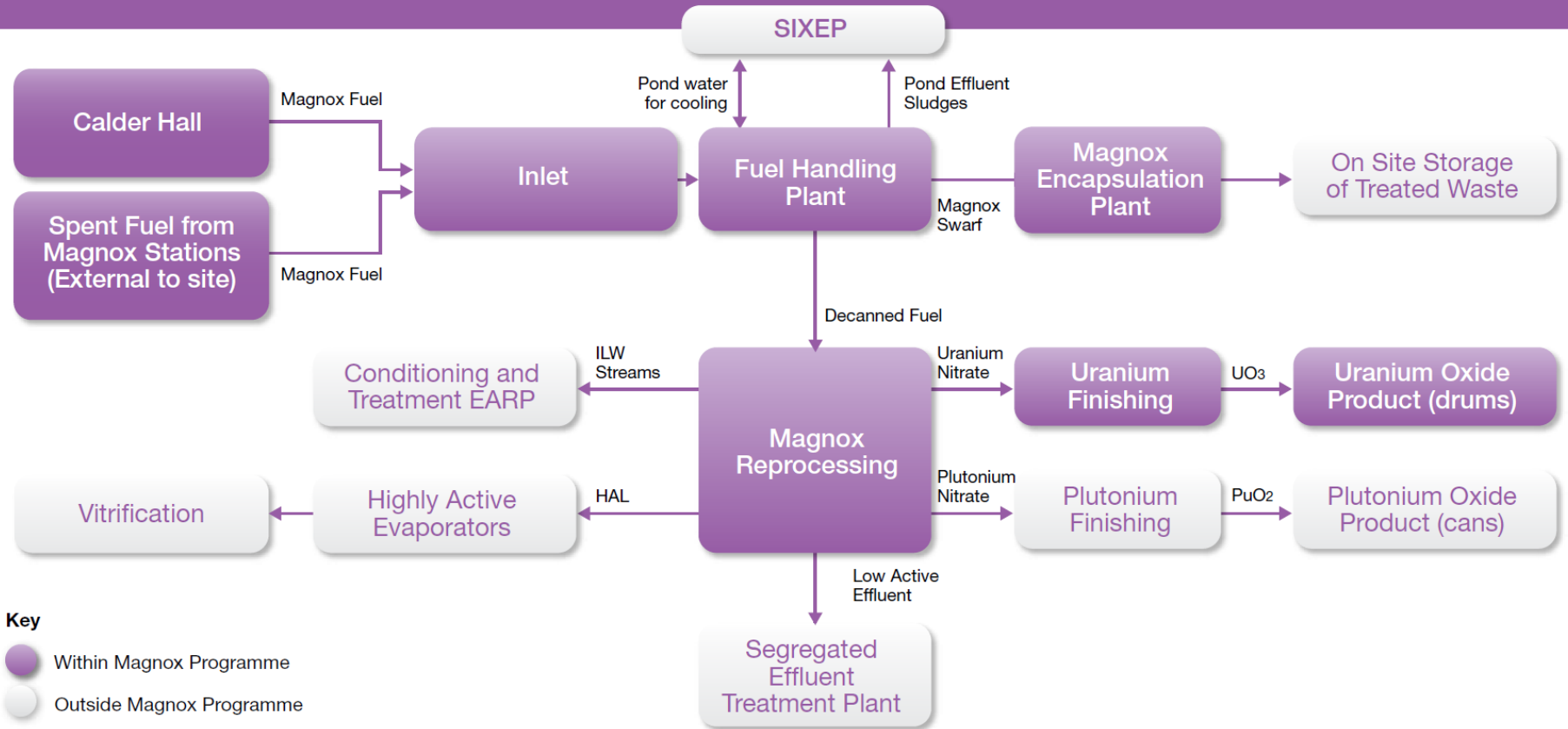


2000s

- | | | | | |
|--|--|---|--|---|
| <ul style="list-style-type: none">• Royal Ordnance Factory developed into Windscale site to create plutonium for the nuclear deterrent• Civil programme begins. The world's first commercial plant opened at Calder Hall. | <ul style="list-style-type: none">• Waste stored safely pending treatment• Storage capacity extended incrementally• Coarse segregation of waste arising from process• Magnox reprocessing start• No real plan for future decommissioning | <ul style="list-style-type: none">• Main expansion of site• Major waste treatment focus• Environmental impact substantially reduced• Decommissioning programme started | <ul style="list-style-type: none">• True commercialisation of reprocessing -Thorp comes online• Waste arising from processes treated in 'real time'• Product waste forms compatible with disposal concepts• Health and safety executive reports | <ul style="list-style-type: none">• Decommissioning gathering pace• Sellafield landscape changing forever• NDA formed• NMP become Parent Body Organisation |
|--|--|---|--|---|

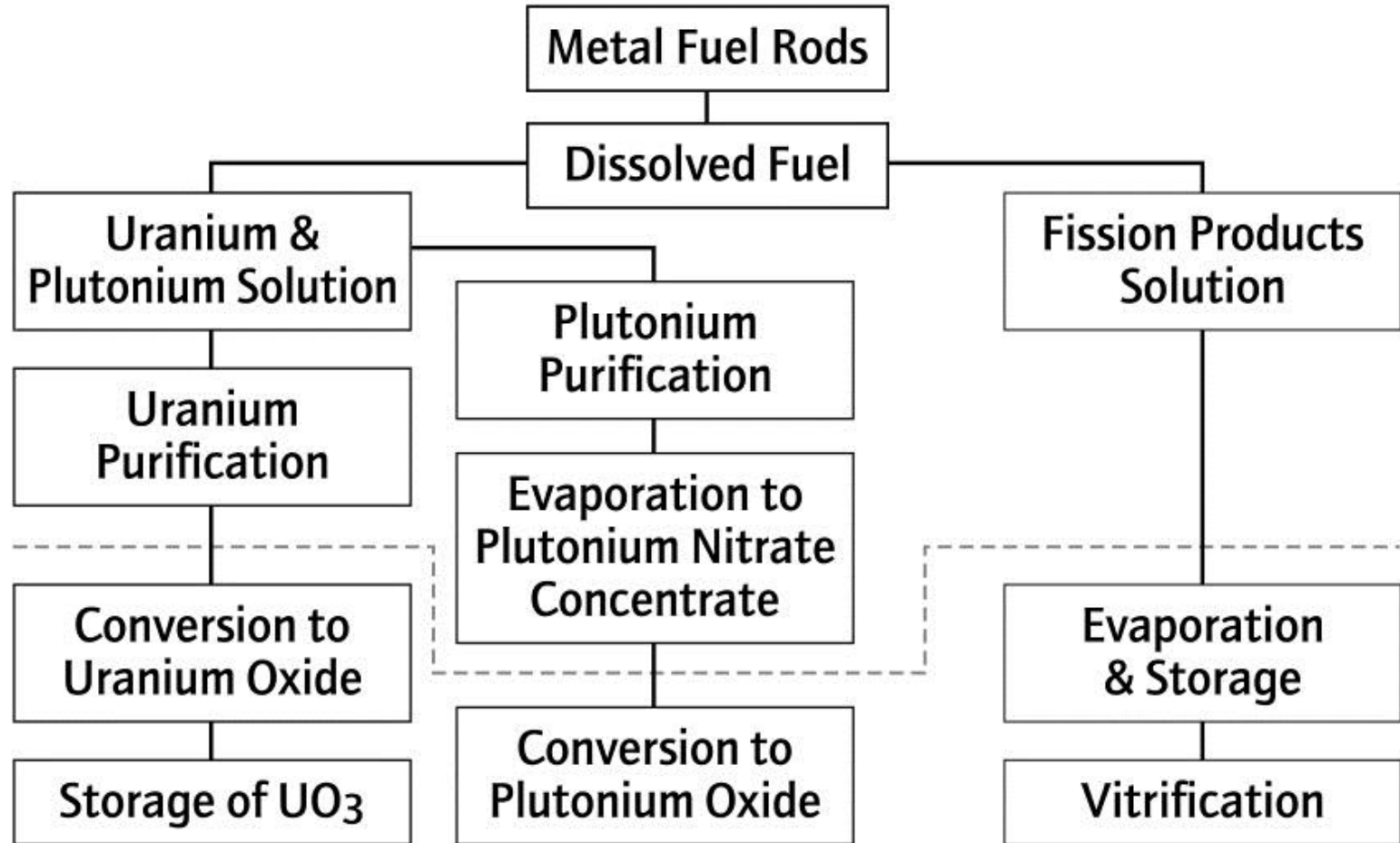
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Plant interactions



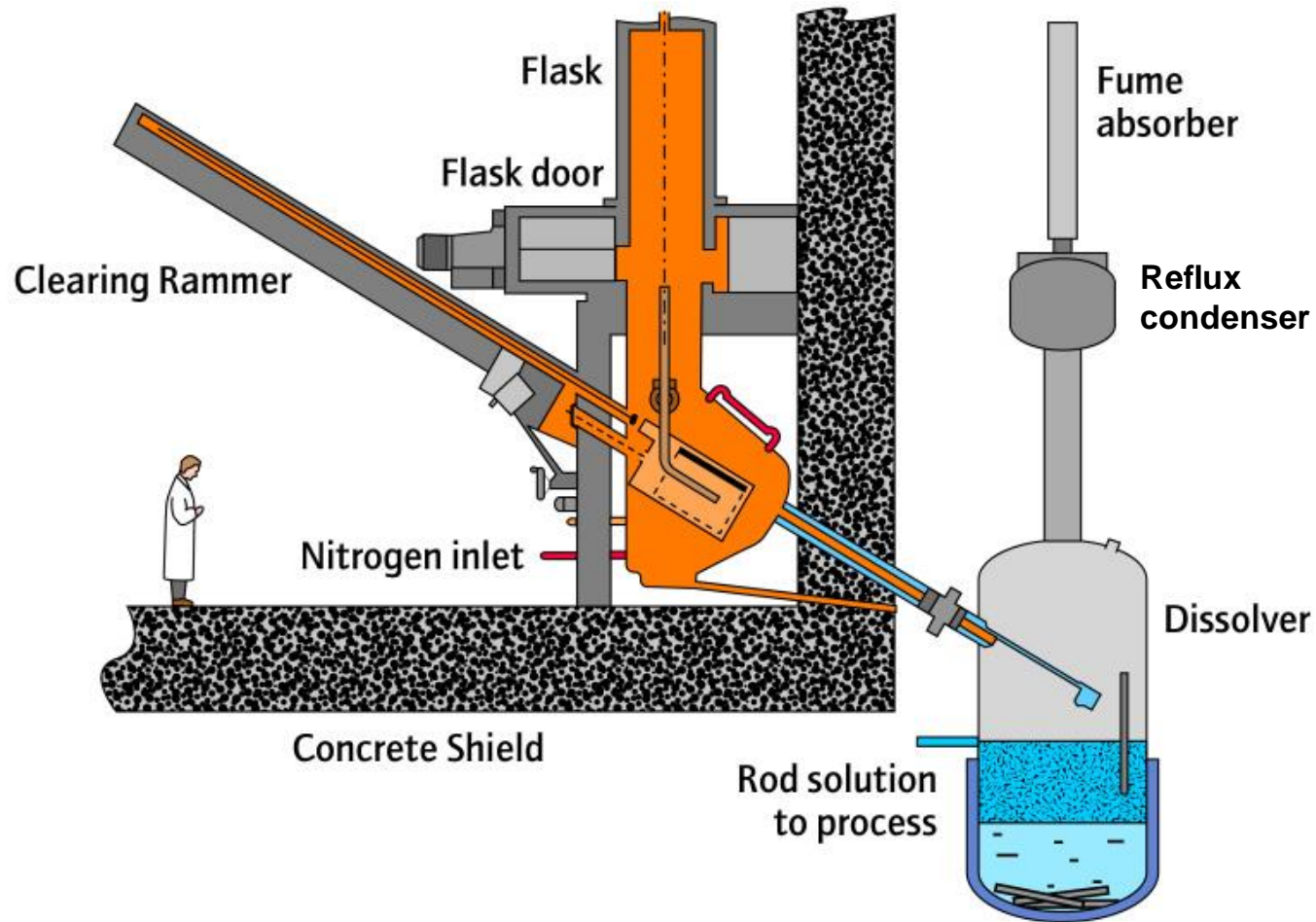
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Separation Process



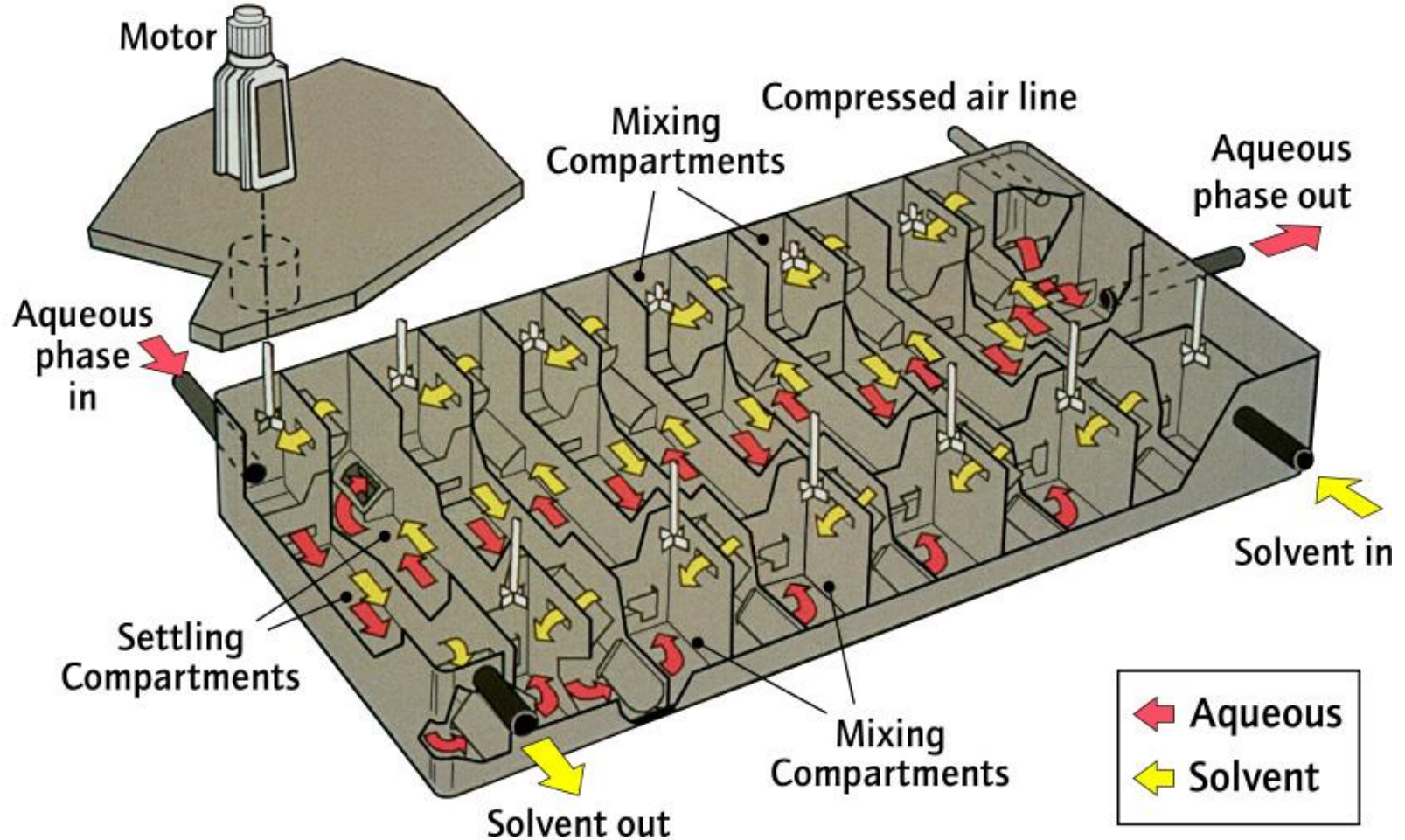
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Charge Machine & Dissolver



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Mixer-Settlers



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Plant construction



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Press release from July 1964



PRESS RELEASE ON B.205 (Revised Draft 1/7/64).

TOP RELEASE
18.00hrs 6 July

NEW FUEL REPROCESSING PLANT STARTS OPERATING.

The world's largest commercial plant for reprocessing irradiated nuclear fuel recently began active operation at the Windscale Works of the United Kingdom Atomic Energy Authority. The plant achieved the throughput for which it was designed within the first week of active operation. This plant is an important part of the Authority's complete nuclear fuel service, available to customers throughout the world.

The new plant supersedes the first separation plant which has proved most reliable during its twelve years of operation but is now too small for the increasing demand. The new plant will have capacity sufficient to meet the needs of the British nuclear power programme as well as to process some irradiated fuel from abroad. It will, in fact, be able to deal with an annual return approaching 2,000 tonnes of fuel.

The efficient and economic extraction of the by-product plutonium from used fuel is increasing in importance because of the studies into its use as a fuel itself, which could lead to cheaper nuclear power. The large capacity of the new plant will significantly reduce basic reprocessing costs, giving more economic fuel cycles.

There are also plans to add a pre-treatment plant for reprocessing enriched oxide fuels used in advanced reactor systems; this supplementary plant will be adaptable to a wide range of fuel designs.

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Magnox Operation



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Maintaining Nuclear Safety

- Modern Safety Case
- Plant upgrades
- Improving flowsheet performance
- Site context

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Spent Fuel Storage

- Open Ponds
- pH7
- Covered Ponds
- pH11.3 – pH13
- Containers
- Waste treatment



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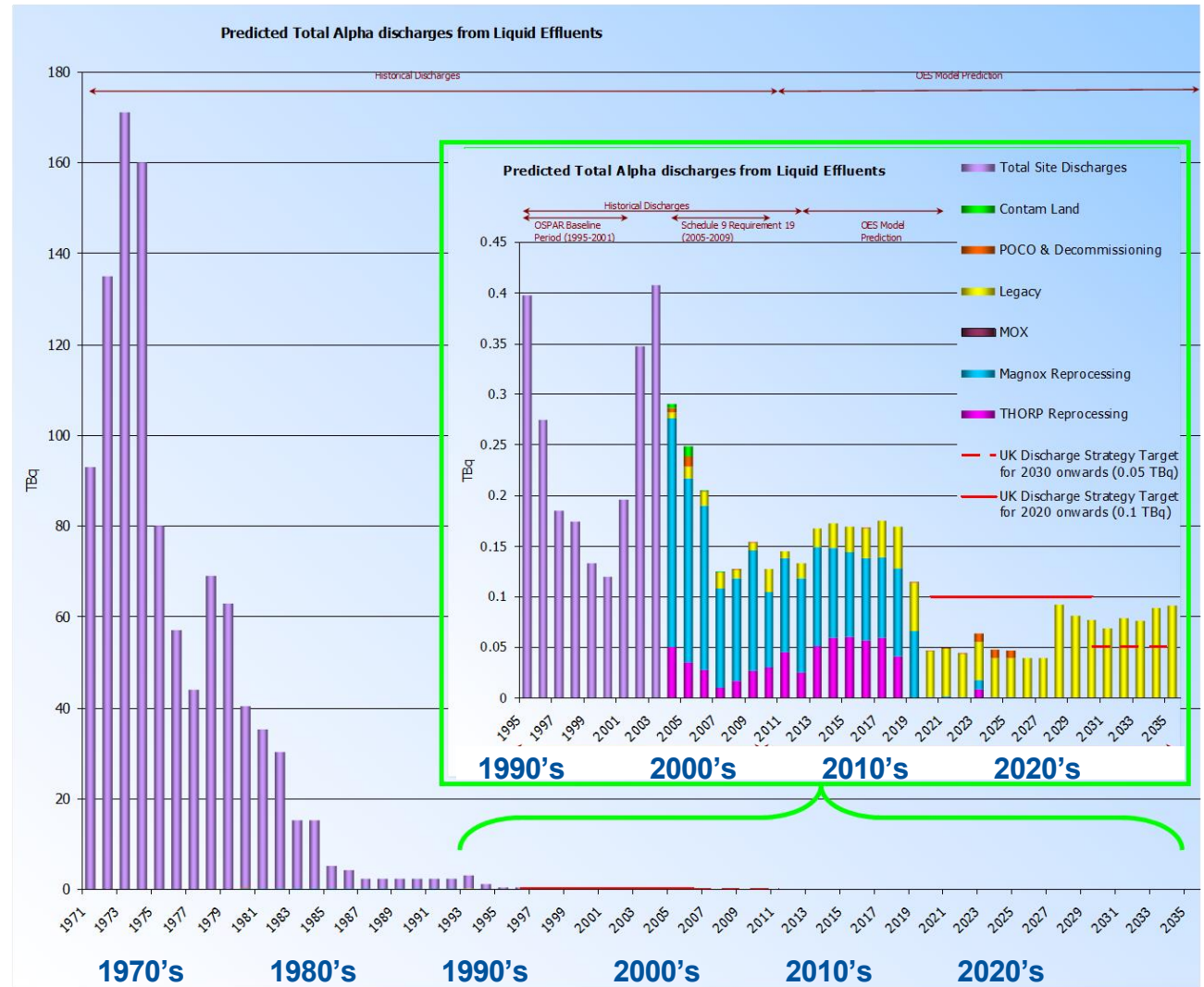
Improved site infrastructure

Name	Effective Date	Function
Salt-Evaporator facility	1984	Minimise the volume of MA effluent
Site Ion Exchange, Effluent Treatment Plant (SIXEP)	1985	Abate the predominating Caesium and Strontium content of LA HIGH RISK - beta effluents
Enhanced Actinide Removal Plant (EARP)	1994	Removal of alpha activity from current arisings and historic stocks of actinide-containing MA effluents and LA HIGH RISK - alpha effluents
Segregated Effluent Treatment Plant (SETP)	1994	Pre-discharge screening, neutralisation and solids-removal of LA LOW RISK effluents
Diversion of medium-active concentrate	2004	Reduce marine discharges of Technetium by ~ 90% by consigning Tc-rich MA effluents into the HA liquid waste treatment route
Low iron flowsheet	2010	Reduces the burden on the downstream effluent process

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Environmental impact –

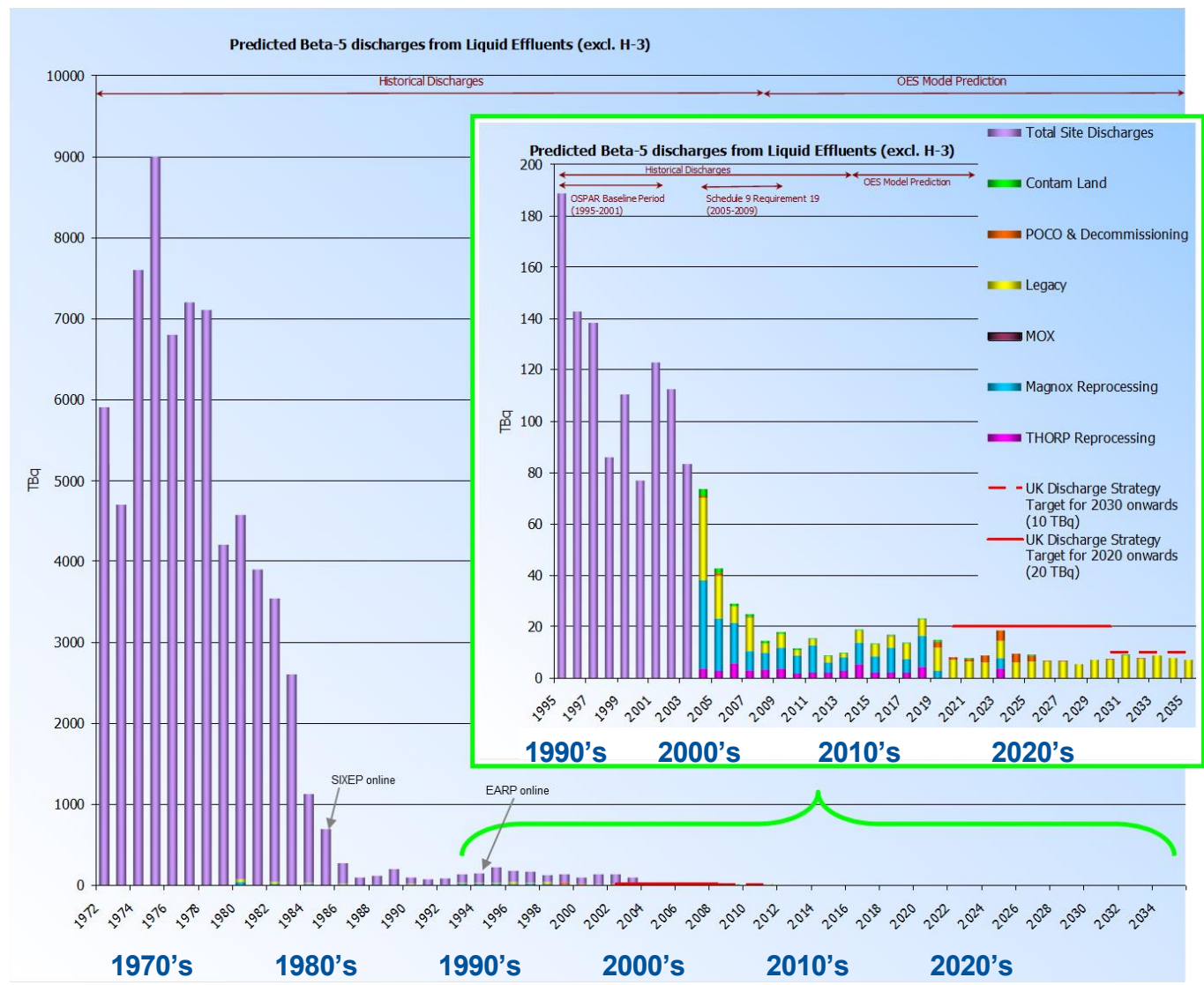
Alpha discharges from Liquid Effluents



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Environmental impact –

Beta discharges from Liquid Effluents



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Magnox Operating Programme

- NDA
- Holistic approach
- End of life issues
- NO NEW LEGACY



<http://www.nda.gov.uk/publication/the-magnox-operating-programme-mop9-july-2012/>

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50 Years of Success

- Nuclear skills
- Knowledge
- Dedication



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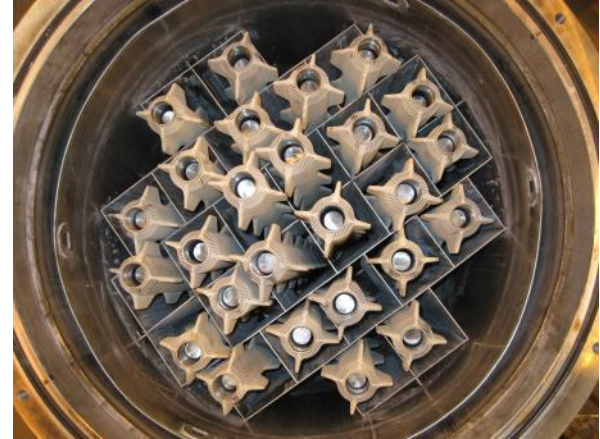
Finish the Mission with Pride

- Approximately 1,500te of fuel left to reprocess
- Planning for POCO
- Enhanced Human Performance Challenges
- Equipment reliability

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Contingencies

- Fuel drying
- Modular approach to implementation



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Summary

- Hugely successful programme of spent fuel management supporting low carbon electricity generation
- Safety and reliability sustained over half a century
- Continued development against modern requirements
- Focus now on the end of mission
- Source of great pride for our workforce and the Industry

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