Magnox Reprocessing
- 50 not out -

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A Nuclear Management Partners company operated under contract to the NDA
The origins of Magnox Reprocessing

- Fuel
- Cladding
- Magnox Generation Programme
- Early days
- Overseas Business
50 years in overview

1940s/50s
- 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.

1960s/70s
- 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

1980s
- Main expansion of site
- Major waste treatment focus
- Environmental impact substantially reduced
- Decommissioning programme started

1990s
- True commercialisation of reprocessing - Thorp comes online
- Waste arising from processes treated in ‘real time’
- Product waste forms compatible with disposal concepts
- Decommissioning gathering pace
- Health and safety executive reports

2000s
- 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

- Metal Fuel Rods
  - Dissolved Fuel
    - Uranium & Plutonium Solution
      - Uranium Purification
        - Conversion to Uranium Oxide
          - Storage of UO₃
      - Plutonium Purification
        - Evaporation to Plutonium Nitrate Concentrate
          - Conversion to Plutonium Oxide
      - Fission Products Solution
        - Evaporation & Storage
          - Vitrification

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Charge Machine & Dissolver

- Flask
- Flask door
- Clearing Rammer
- Nitrogen inlet
- Concrete Shield
- Fume absorber
- Reflux condenser
- Dissolver
- Rod solution to process
Mixer-Settlers

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Plant construction

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

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.
Magnox Operation

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Maintaining Nuclear Safety

- Modern Safety Case
- Plant upgrades
- Improving flowsheet performance
- Site context
Spent Fuel Storage

- Open Ponds
- pH7
- Covered Ponds
- pH11.3 – pH13
- Containers
- Waste treatment
## Improved site infrastructure

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

50 Years of Success

- Nuclear skills
- Knowledge
- Dedication
Finish the Mission with Pride

• Approximately 1,500te of fuel left to reprocess

• Planning for POCO

• Enhanced Human Performance Challenges

• Equipment reliability
Contingencies

• Fuel drying

• Modular approach to implementation
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