
Integrated Waste Strategy Executive Summary

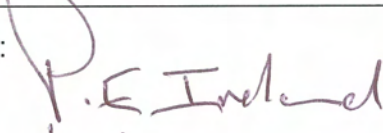
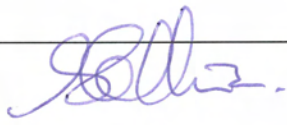

Magnox Limited

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Document Approval

Integrated Waste Strategy

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EXECUTIVE SUMMARY

Magnox Limited, a company owned by EnergySolutions, manages ten nuclear sites and one hydroelectric power station across England, Scotland and Wales on behalf of the Nuclear Decommissioning Authority (NDA). As the Site Licence Company, Magnox Ltd is responsible for safe delivery at each site – whether it be electricity generation, defuelling or decommissioning.



The Integrated Waste Strategy (IWS) summarises the overarching waste management strategy for radioactive and non-radioactive solid, aqueous and gaseous wastes. It focuses on opportunities for improved waste management including the pragmatic application of the waste management hierarchy.

The IWS is presented in three component parts: (i) an Executive Summary (this document), which focuses on giving an overview of the Magnox Decommissioning and Waste Strategy, the changes from last year and the progress made; (ii) the Magnox Ltd IWS Report, which outlines our approach to decommissioning and identifies the main waste types produced and the strategies to manage them, including an overview of site specific activities; and (iii) separate appendices for each site providing specific details of their waste management strategies, constraints, achievements and opportunities.

Executive Summary

DECOMMISSIONING STRATEGY

The current strategy for decommissioning is based upon systematic and pragmatic hazard reduction, which takes advantage where possible of the process of natural radioactive decay to reduce levels of radioactivity and hence risk to the workforce. The lifecycle of the sites is divided into five broadly consecutive phases as described below.

Site Lifecycle Phases



Generation: during the generation phase, operational wastes that arise are disposed of routinely or stored for conditioning and disposal in later phases.

Defuelling: all fuel removed from the reactors and fuel storage facilities and dispatched to Sellafield for reprocessing, drain-down of chemicals and removal of some plant machinery. Defuelling has been completed at five Magnox sites.

Care and Maintenance Preparations (C&MP): includes: the removal of the majority of the plant and structures, including the turbine hall; deliver all ponds into a safe and passive safe state, removal of waste from vaults and storage vessels and their structure. The reactors themselves will be left in a safe, secure, weather-proof structure known as a 'Safestore'. ILW will be packaged and stored in a purpose-built interim facility.

Care and Maintenance (C&M): during which the site will be largely quiescent with routine maintenance and continued storage of identified wastes on site, to maximise the benefits of radioactive decay. Packaged ILW will be moved to the Geological Disposal Facility (GDF) from 2040 onwards during this phase.

Final Site Clearance (FSC): with the dismantling and removal of all remaining buildings and wastes.

Key Phases at Magnox Sites



WASTE ARISING

The broad categories of waste found at the Magnox sites are given below:

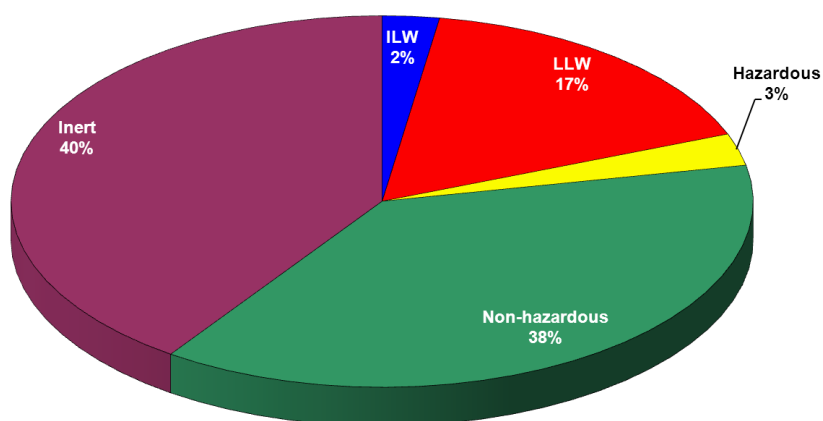
Low Level Waste (LLW) - Wastes not exceeding specified levels of radioactivity.

Intermediate Level Waste (ILW) - Wastes exceeding the upper boundaries for LLW that do not generate sufficient heat for this to be taken into account in the design of waste storage or disposal facilities.

Non-Radioactive Waste - These wastes are considered here under the categories Hazardous, Non-hazardous and Inert.

Solid waste volumes, by main waste type, anticipated to arise during the remaining operational phases of Generation (Oldbury and Wylfa), Defuelling, C&MP, C&M and FSC, are summarised below.

Total Relative Percentage of Each Waste Type Arising



Radioactive wastes are a small fraction of the total. Most of the remaining wastes are inert (typically concrete and demolition rubble that may be used for infill) or non-hazardous wastes.

Waste arising during decommissioning

Waste Category	Waste Arising (m ³)			
	C&M Preps	C&M	FSC	Total
ILW	12,274	-	41,753	54,026
LLW	43,513	1,210	317,182	361,905
Hazardous	60,493	18	73	60,584
Non-hazardous	353,729	4,845	463,314	821,888
Inert	622,516	20,475	235,918	878,910
Grand Total	1,092,526	26,548	1,058,239	2,177,313

The strategy of early hazard reduction results in the management of almost all hazardous waste during C&MP. Waste projected to arise during C&M is expected to be low during this quiescent phase. The remaining waste will be removed at FSC when the safestores are dismantled.

SIGNIFICANT CHANGES FROM PREVIOUS IWS

The significant change from the March 2010 issue of the IWS is the introduction of the Magnox Optimised Decommissioning Programme (MODP):

Magnox Ltd, EnergySolutions, and the NDA have developed and implemented an optimised approach to the future decommissioning of the Magnox Sites known as MODP. The programme sets out what the business will deliver over the next five years, including pioneering innovative ways of working, accelerating Bradwell and Trawsfynydd sites to a state of care and maintenance and carrying out safe and efficient clean-up. Other sites have also received additional funding to accelerate some decommissioning projects. Acceleration of work on key sites is counter balanced by a reduction in scope or deferred demolition across other parts of the programme. The MODP offers a saving of about £1.2 billion from the original Magnox decommissioning strategy.

MODP establishes common decommissioning projects across the company that allow the experience that has been gained in developing improved, fit for purpose approaches and technologies to be transferred from site to site. This is known as Programmisation and encompasses the following supporting programmes:

- *ILW Management*

A change in baseline strategy has been achieved for the majority of Magnox sites for the management of operational Solid and Wet ILW by unencapsulated placement in resilient, self-shielding containers suitable for interim storage, transport and final disposal. This change in strategy is supported by both generic and site specific options studies. Further underpinning work is required for the strategy change at Berkeley site. Hunterston A and Trawsfynydd, where decommissioning is well advanced, will continue with the encapsulation baseline.

The main benefits of MiniStores are the potential to save considerable cost and time in decommissioning over the lifecycle of a site. MiniStores eliminate the requirement for encapsulation plant and negate the requirement to build a more costly shielded ILW Store, due to their inherent self-shielding properties. This, together with the availability of MiniStores and proprietary waste handling equipment enables earlier hazard reduction.

- *Fuel Element Debris (FED) Treatment*

A co-ordinated campaign to deliver dissolution technology for FED processing is being undertaken. This is providing significant benefits by substantial volume reduction of FED. Following consultation with the NDA, Stakeholders and Regulators, the site baseline for the management of FED has changed from encapsulation to dissolution treatment for FED.

This has been inserted into the baseline strategy for Magnox FED, which will be volume reduced by dissolution at Bradwell, Sizewell A, Hinkley Point A and Oldbury. Secondary ILW arisings from this process will be disposed of in MiniStores.

- *Ponds Decommissioning*

Magnox is making use of the best experience, skills and equipment from across the sites to safely drain, seal and decommission cooling ponds. Four sites (Bradwell, Chapelcross, Hunterston A and Trawsfynydd) are currently progressing different stages of pond clean up, while Hinkley is to benefit from additional scope agreed with the NDA for 2011/12.

- *Plant & Structures*

The repair, deplant and demolition of plant and structures forms a major part of decommissioning. The key objectives of the programme include decommissioning all plant and structures cost effectively by offering consistent solutions to deliver bulk asbestos stripping and deplant and demolition projects both inside and outside of reactor controlled areas. The programme also includes addressing land quality issues, preparation of the reactor buildings for safestore and supporting the transition of Magnox sites into the care and maintenance phase.

Other changes include:

- **Magnox Ltd:** Creation of Magnox Ltd from Magnox North Ltd and Magnox South Ltd has resulted in a single Magnox Ltd IWS. Both Magnox North Ltd and Magnox South Ltd produced separate IWS documents in March 2010. In establishing Magnox Ltd the opportunity has been taken to implement a new Waste Department with a wider remit and greater resources than either of the precursor companies.
- **RWMC¹:** Following consultation with the Regulators and the NDA, a decision was made by the Company to produce enhanced site IWS appendices to take account of the Joint Guidance on Radioactive Waste Management Cases (RWMC). The site appendices detail, in a logical structure, the underpinning strategy for each group of Intermediate Level Waste (ILW) and describe how the key elements of long-term safety and environmental performance will be delivered.
- **Joint Waste Management Plan²:** A plan has been developed through collaborative working between Magnox Ltd and LLWR Ltd. It is a proactive plan designed to assist in implementing and integrating the UK LLW Strategy over the next five years.

¹ The Health and Safety Executive (HSE), the Environment Agency (EA) and the Scottish Environment Protection Agency (SEPA) have published the 'Joint Guidance' with respect to the management of higher activity waste. This guidance describes regulatory expectations with respect to the production, content, maintenance and review of radioactive waste management cases (RWMCs).

² Magnox & LLWR Joint Waste Management Plan, Issue 1, September 2011

MODP SUCCESSES IN 2010 /11

Since the 2010 IWS, the Company is pleased to report a number of successes in the following areas of the programme:

Accelerated Sites

Bradwell's accelerated programme has seen the successful clean-up of the two bays in the ponds, including removal of ponds sludge using a new freeze dredging process to minimise volumes. Other successes include the demolition of the turbine hall and auxiliary turbine hall, which included the complete removal of asbestos from the buildings. Around 9,000 tonnes of scrap metal has been recycled from the turbine hall deplanting and the pile cap project has now deplanted 100 tonnes of waste from the pile caps.

Trawsfynydd has been given the go ahead to start preparing buildings for entering the Safestore phase of their lifecycle. More than 50 packages of waste have now been successfully transferred to the ILW interim facility - a huge milestone for the only operational Magnox ILW store in the UK. The final concrete pour on the roof capping project has taken place. A total of 850m³ has been poured so far. This is a key enabler for the reactor building height reduction.

ILW Management

Five Magnox sites have now filled MiniStores to demonstrate the compatibility for different waste types. As part of a feasibility study, Berkeley site has successfully demonstrated the retrieval of FED from the Active Waste Vaults and filling of a MOSAIK container (a type of MiniStore).

The MiniStores programme team continues to work on gaining approval for long-term disposal. A cLoC (Conceptual letter of Compliance) has been received from RWMD recognising the approval in principle for the use of MiniStores for ILW disposal. The recent agreement by the Office for Nuclear Regulation for changes to strategy for all proposed sites except Berkeley for the use of MiniStores is also a major achievement.

Significant progress has been made at Bradwell and Berkeley in particular in the design and manufacture of facilities and equipment to support ILW retrieval activity. The Berkeley team has removed and transported a Chute Silo Manipulator off site for refurbishment as part of the preparations for work on the site's ILW Programme.

The learning from Bradwell and Berkeley is being applied to other sites as part of Programmisation. For example Hinkley Point A are learning from Bradwell in terms of the best technical solutions for sludge and resin retrieval and conditioning

FED Treatment

Factory acceptance tests on the early FED retrieval project were successfully completed, bringing Bradwell one step closer to retrieving FED. This will allow the site to develop an understanding of the physical and radiological characteristics of the waste and demonstrate the site capability for FED retrieval, movement and storage.

The FED dissolution team at Dungeness A celebrated another success with the dissolution of the 100th tonne of FED on site. A contract has been let and work started to design a FED dissolution facility at Bradwell.

Ponds Decommissioning

All the ponds fuel skips at Bradwell have now been removed from site. The ponds at Bradwell have been drained with all the pond water processed and discharged. The pond main bays and transfer tunnels have been cleaned and sealed to fix any remaining contamination in situ. The experience gained and sharing resources is enabling the safe and effective delivery for ponds decommissioning within Magnox.

The ponds programme team at Hunterston A has successfully completed the first Magnox milestone ahead of schedule. Approximately 30m³ of sludge waste produced in the Cartridge Cooling Pond has been pumped out of the pond and transferred to the sludge retention tank for onward disposal as part of the site's ILW management strategy. The risk of exposure to high levels of radiation and contamination has been dramatically reduced and preparation can begin to drain the ponds and decontaminate and decommission the entire ponds complex.

At Chapelcross site Pond 1 has been drained and stabilised. Hinkley Point A achieved a major milestone when the last of its huge inventory of nearly 1,800 skips used to store spent fuel elements in the cooling ponds was decontaminated for beneficial re-use in the nuclear industry. This was completed eight months ahead of schedule saving £2 million.

The second pass of scabbling to remove concrete from pond surfaces at Trawsfynydd has been mobilised.

Plant & Structures

In a first for the UK, Berkeley site has completed all works to place both its Magnox reactors into passive Safestore until final site clearance planned to start in 2074 and setting a benchmark for the remaining Magnox fleet. Work continues to prepare the reactor buildings at Trawsfynydd for passive Safestore with work on the capping roofs coming to completion.

Chapelcross have now stripped over 1200 tonnes of asbestos from 12 out of 16 Heat exchangers and half their turbine hall. They are currently on target to complete in September 2012, a 13 month acceleration over the baseline date of October 2013. Bulk asbestos removal also continues at Hinkley Point A and Sizewell A sites.

Enabling works to facilitate Decommissioning and Care & Maintenance are progressing across a number of sites. Implementation of Electrical Overlay projects is in progress at Chapelcross, Sizewell and Dungeness. A programme of enabling works is underway at Dungeness to facilitate entry to the Interim Care & Maintenance phase.

Major deplant and demolition work has continued across the Magnox Sites. At Bradwell, the Turbine Hall has been deplanted and the building demolished ahead of schedule and under budget. Major projects to deplant the reactor pile caps, reactor buildings and boiler houses have commenced.

Work to monitor land quality across the Magnox fleet is well established. Monitoring activities

continue along with the development of schemes to address land quality issues at Chapelcross.

The programme is working with regulators to define Care & Maintenance entry states. Work on the Care & Maintenance entry transition programme is underway at both Bradwell and Trawsfynydd

Other Successes

Magnox Ltd scooped the coveted Rushlight Clean Environmental award. This was in recognition of their partnership with a contractor in developing a new highly innovative solution for the treatment of radioactive oil waste. The system has the potential to not only save on resources and reduce environmental impact, but also improve safety and efficiency.

Bradwell has been shortlisted for a national training award in recognition of its work in partnership with a contractor to train local people in radiological protection. To date, the 12 month partnership has seen 40 people qualify as radiological protection monitors, a skill that is in demand during its accelerated programme.

A new and innovative approach to BPEO management has been developed by Magnox Ltd. The new approach has opened the way for a more open, transparent and proportionate approach to BPEO regulation with the Environment Agency, which has been welcomed on both sides.

19 corroded fuel elements within Wylfa's Dry Store Cell have been successfully removed following pioneering work on use of a modified 'powered' grab system. This represents a significant hazard reduction for the site and opening up greater flexibility for when the site enters the defuelling and decommissioning stage of its life-cycle.

Hinkley Point A achieved a major milestone when the last few fuel fragments were recovered from the site's cooling ponds and dispatched to Sellafield, this marks the last flask shipment from the site and declares the site fuel free.

Collaborative Working

Magnox Ltd has been working closely with other Site Licence Companies (SLCs) and the NDA. Examples of collaborative working include:

Berkeley site successfully transferred a fuel transport flask for reuse to the Dounreay site, where it will be used as part of their decommissioning programme. The transfer was made under the NDA asset management scheme and achieved significant savings.

A Joint LLW Management Plan has been developed through collaborative working between Magnox Ltd and LLWR Ltd. It is a proactive plan designed to assist in implementing and integrating the UK LLW Strategy, over the next five years.

Magnox Ltd is supporting the implementation and delivery of improvements to other SLCs on their estimates for LLW volumes. The support work is based on the comprehensive review of site LLW volumes (the SMART Inventory programme) by Magnox Ltd, which led to a significant improvement in the understanding and confidence of LLW volumes at Magnox sites and will

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enable the NDA's LLW National Liability Estimate (NLE) to be accurately re-assessed and better underpinned.

Co-operation between decommissioning and new build is progressing well between Magnox Ltd and EDF Energy at Hinkley Point. Spoil is being transferred from the Hinkley Point C site preparation works to the Hinkley Point A site turbine hall realising cost savings to both parties. This work also removes heavy traffic from the local roads to the benefit of the local community.

Magnox Ltd has provided a leading role in the NDA Integrated Project Team (IPT) on developing the Industry Guidance on the Interim Storage of Higher Active Waste Packages. Other IPT work includes participation on the development for the replacement tool for the 'Waste Accountancy Template'.

Magnox have collaborated with LLWR in a joint project team to facilitate the removal of the 15 boilers from the Berkeley Site. The conclusion of contract agreement will result in 4,650 tonnes of metals being transported for metal melt and re-cycling.

Magnox have been working in collaboration with LLWR and DRS to pilot the new transport and logistics service at Bradwell site prior to it becoming available to the NDA estate.

Magnox have worked with NDA, EdF and the supply chain to prepare consolidated LLW disposal packages consisting of Bradwell higher activity pond skips and AGR desiccant.