



# Innovation to Implementation

Achievements 2007/2008



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# Introduction

2007/2008 has been an extremely successful year for Magnox North.

We've safely delivered our largest ever programme of work, launched our new brand and welcomed EnergySolutions as our new parent body organisation.

At the same time, we have continued to safely deliver increased income and value to the owner of our sites – the Nuclear Decommissioning Authority (NDA). We have made major inroads into waste retrieval at both Trawsfynydd and Hunterston A sites, we've changed the skyline at Chapelcross and returned Oldbury to service alongside Wylfa to help us generate over 6 TWh of electricity, exceeding our original target.

In this review of our achievements we have focused on the projects which have contributed towards a year of success. We can take pride in what has been accomplished but we must not be satisfied! Let's make 2008/09 an even better year.

**Neil Baldwin**  
Managing Director



# Our Business

**Nuclear decommissioning is a vibrant industry with all involved learning from each other in seeking to implement best practice and adapt to a changing environment.**

Magnox North is committed to continuous improvement in all areas of our operations, establishing our position as a world class contractor and continuing to deliver the best possible value to the taxpayer.

This success is reflected in the delivery of the 2007/08 Lifetime Plan (LTP) for the NDA. A £367m programme of work has been successfully delivered to time with a saving of £44m below the budgeted cost.

Together, Wylfa and Oldbury have generated 6TWh of electricity, worth around £250m to the NDA.

All of these achievements have been secured alongside continuing improvements in the key areas of environment, health, safety and quality (EHS&Q).

In the year 2007/2008 Magnox North employees worked 3.5 million hours alongside agency supplied workers and contractors who worked around 2.5 million hours. It is testament to our commitment to health and safety that we have managed to improve on an already impressive record whilst undertaking major projects involving significant conventional and radiological safety risks.

**Magnox North has lost just four days as a result of injuries at work and experienced only six incidents which have required medical treatment – in almost 6 million hours.**

Whilst our target is zero, we are encouraged by the trend in our performance, which has led to results which are comparable with other world class companies.

We have collected more than 19,000 behavioural safety observations throughout the year and we strongly believe that this proactive approach has contributed to our success.



## What have we achieved in 2007/08?



### 1. Hunterston A

- Constructed Intermediate Level Waste (ILW) store
- Commenced ILW retrievals



### 2. Chapelcross

- Demolished the cooling towers at Chapelcross, the first explosive demolition on a nuclear licensed site in the UK
- Completed the modernisation of the Chapelcross fuel route



### 3. Wylfa

- Maximised output at Wylfa power station to meet the target of generating 5 TWh of electricity



### 4. Trawsfynydd

- Continued retrieval from ILW waste streams at Trawsfynydd
- Constructed ILW store



### 5. Oldbury

- Returned Oldbury to service, optimising its generating capacity
- Started preparations for defuelling



### 6. Magnox North Support Offices – Berkeley Centre – Daresbury

- Succeeded in delivering against NDA's Generic PBIs
- Supported the establishment of a Shared Services Alliance

# A Shared View of Success

## Programme Delivery

During the year, our business has been focused on delivering the programme of work agreed under contract with the NDA and to provide savings and efficiencies to consolidate our success and maximise value for the customer.

We have successfully delivered 95% of all agreed performance based incentives, and separately, Magnox North played a key role in developing 'Generic' PBIs as agreed with the NDA.

- Developing a 'Shared Service Alliance' to deliver savings by providing support services across the various SLCs.
- Accelerating decommissioning through fixed cost reduction, without adversely affecting safety, security, environmental performance or delivery.
- Delivering robust and consistently compiled Lifetime Plans to support the NDA in establishing the UK's civil nuclear liability, measure performance and focus on hazard reduction.
- Ensuring a Resource, Learning and Skills strategy is in place to enable the delivery of the sites' lifetime plans.



## Re-licensing

Magnox North has been working closely with Magnox South to reach a position where we will be able to seek consent from the regulators to legally separate – a key stage in the NDA's competition programme.

## Graduate and Talent Management

Throughout the year, Magnox North has been running a graduate recruitment programme – to maintain appropriate levels of skills in the business and across the wider nuclear industry. We have established a process, with the aim of placing 12 graduates into the business at the five sites and support offices. Magnox North has also been instrumental in developing and launching the NDA's National Graduate Programme.

During the past year, the Magnox North Executive team has focused on developing the company's talent management processes, with the aim of developing existing employees and increasing expertise across the business. As a result, a range of people development moves have been made, most noticeably a series of site management changes which have been of great benefit to individuals and the business.

## 3P

In looking for innovative ways to improve ESH&Q performance, the Magnox North Executive sought best practice from across other industries to develop a more proactive method of benchmarking and measurement.

By adopting an approach which focused on People, Plant and Processes (3P), the organisation was able to develop a 'route-map' for continuous improvement which was not constrained by time or reactive measurement tools. This year's success in the area of EHS&Q has been underpinned by the 3P improvement plan.

# i4 innovation

Inspire, imagine, innovate, implement

We see innovation as essential to our current success, the future of our business and the key to delivering value to our customer and the UK taxpayer. We are committed to encouraging all of our people to innovate in all areas of the business.

The i4 campaign built on the success of previous innovation initiatives, taking the culture of innovation to another level.

i4 has brought to the fore the best of innovation in the UK's nuclear decommissioning industry, recognising excellence by awarding achievements in two categories.

## The EnergySolutions Award

Devised to bring forward original ideas that significantly improved performance in safety, efficiency and speed to the benefit of the customer and the business by delivering hazard reduction.

Magnox North's Managing Director, Neil Baldwin, described his passion for this type of creativity:

**"You can't measure the impact this annual campaign has on the business. I am committed to making innovation, creativity and improvement second nature to everyone in Magnox North."**

The winning idea from Magnox North's Engineering, Waste, Strategy and Technical division (EWST) was entitled the 'Sludge Puppy', and uses technology familiar the water industry. An ice/water mixture is used to remove radioactive sludge from ponds or tanks and scour contaminated surfaces. Because ice scours the surfaces more effectively than water alone, waste volumes can be dramatically reduced.

## The NDA Implementation Award

Sponsored by our customer, the Nuclear Decommissioning Authority (NDA), this award was made for the innovation that had been successfully implemented and made the most significant contribution towards efficiency and delivery.

NDA Programme Director, Brian Burnett, described the importance of the initiative: "In this industry, we need to do things safer, we need to do things cheaper and we need to do things more quickly, therefore, we must innovate."

"Innovation isn't just about having ideas, it's about the courage to carry them out. We've got to create an environment where having the courage to make a difference is allowed."

The winning idea from Hunterston A saw the site take a new approach to characterising contaminated land. The idea has saved around £275,000 initially with the potential for widespread use across all nuclear sites with contaminated land issues.



# Hunterston A site

Hunterston A Site is well along the road to decommissioning and hazard reduction. Extensive work is being carried out to remove and treat various liquid and solid wastes which arose during the site's operational life. An intermediate level waste store is also being commissioned at the site.



## Contaminated Land Sampling and Monitoring

**EnergySolutions Innovation award winner**

Hunterston A Site is located on the Eastern shore of the Firth of Clyde. An area of the foreshore was given consent for use as a very low level waste disposal area during the 1970s, for the burial of radioactively contaminated materials.

In order to fully characterise and manage continuing liabilities, extensive investigations of the foreshore have been made.

Early investigation work used a conventional drilling rig. However, because the work had to be carried out in radiologically controlled conditions, involving lengthy procedures to prepare the area and complicated sampling processes, this resulted in a number of difficulties – including the serious risk of bringing contaminated spoil to the surface.

Members of the team with previous experience of geological investigation soon identified an alternative solution.

They found that by using a cone penetration testing rig, which pushed a cylindrical cone into the ground at a constant rate of 20mm per second, many of the problems could be overcome.

Measurements are now made during the penetration with no risk of bringing waste to the surface. There is no need to set up controlled working conditions or to declassify areas on completion of work, which has led to a massive increase in productivity.

...saving over  
**£275,000**

The foreshore characterisation was completed, saving over £275,000 when compared to conventional drilling techniques – with further efficiency realised through alternative monitoring and the avoidance of LLW creation.

Large areas of land can be characterised in this way and the technique is directly transferable to other sites in the nuclear estate.

## Pond Water Treatment

Following various reconfigurations of the plant and equipment at Hunterston A, a decision had been taken to install an automated dosing system and a Strontium abatement plant to control the pond water chemistry in the Cartridge Cooling Pond. In particular, the dosing system was intended to control pond water pH and thereby prevent algae growth, while the abatement plant would control the Sr<sup>90</sup> concentration.

Through careful control and measurement, a manual system of pond water dosing was established. It was demonstrated that the manual system could be used to accurately control the pH of the pond water to the point where Sr<sup>90</sup> could be precipitated out of the solution without degrading any other pond water characteristics.

Subsequently, human factors analysis enabled the manual systems to be eased and simplified to the point where it could be treated as a viable routine operation.

After 2 years of operation, algae growth has been eliminated and trials have established an optimum pH for the control of Sr<sup>90</sup>.

**By removing the need for an automated dosing plant, the project saved over £808,000. By removing the need for a Sr<sup>90</sup> abatement plant, a further saving of more than £1.4m was achieved.**



Cartridge Cooling Ponds at Hunterston A Site.



# Trawsfynydd site

Trawsfynydd decommissioning site, located on a 15.4 hectare site, on the northern bank of an inland lake in the heart of Snowdonia National Park, North Wales, is a twin reactor station now defuelled and being decommissioned.



## Trawsfynydd Strategic Integrated Framework (TSIF)

TSIF was formed in April 2006 as a partnership to enable Magnox North decommission the Trawsfynydd ponds complex. TSIF is a partnership of industry leading contractors: Costain Civil, Aker Kvaerner, Amec and VT Services, employing around 100 people.

Prior to setting up TSIF, the site used a series of smaller contracts to deliver the £15m annual waste programme. Traditionally, this way of working has presented a number of difficulties and inefficiencies, including: cost and time spent placing the contracts and inducting new people on to site, cost to the supply chain in tendering for work and reduced opportunities to employ people based in the local area.

By using the collaborative arrangement, many of these issues have been overcome and a target has been set of reducing time and cost by 30%.

The longer term nature of the agreement has also meant that TSIF has been able to recruit far more local expertise to deliver the contract. Up to 70% of the contractors working on the site are from the surrounding area.



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## Active Waste Vaults

The Active Waste Vaults (AWV) at Trawsfynydd contain various materials classified as LLW & ILW. By intelligent investigation and validation of the inventory in the AWW, progress has been made in characterising the waste from Intermediate Level (ILW) to Low Level (LLW).

Previously, contractors had returned complicated and expensive proposals to carry out the vault emptying work using shielded cells and remote working. The team recognised that most of the waste had gone in by hand and therefore, with the right kind of preparation and oversight, it could also be removed by hand.

Since the decision was reached to empty the vaults in a 'fit for purpose' way, real progress has been made and substantial savings have been delivered. By re-characterising wastes from ILW to LLW, the savings to date have been identified as approximately £2.72M and ILW waste volumes have been reduced from 51m<sup>3</sup> to just 18.5m<sup>3</sup>.

TSIF has been heavily involved in delivering the project since early 2006, with responsibilities for management of the waste development of the programme.

The current campaign is close to completion, with eight and a half of the nine vaults completed by the end of March 2008.

## Intermediate Level Waste Store

At the beginning of January 2008 Magnox North completed construction of Trawsfynydd's new Intermediate Level Waste Store, which will hold the inventory of radioactive waste produced while the site was generating electricity. Following a public enquiry in 2002 full planning permission was received and construction work on the £20m project began in October 2005.

At an imposing 94m long x 34m wide x 19m high the store was built using a total of 13,500m<sup>3</sup> (32,400 tonnes) of concrete and 1,500 tonnes of reinforcement. The structure has been finished using locally sourced slate walling stone to a height of approximately 6m, to complement the buildings dramatic surroundings amongst the Snowdonia national park.



# Wylfa site

## Maentwrog

Maentwrog is a hydroelectric station in North Wales, which falls under Wylfa's operational portfolio. The station's 30MW output is generated using water from the nearby Trawsfynydd Lake which is channelled down a pipeline and through two turbines.

Last year, Maentwrog generated over 55GWh of electricity – making the most of the region's climate and exceeding the 50GWh target output whilst producing energy in a sustainable and carbon free way. Availability for the year has been greater than 90%.

## Removal of Neutron Absorbers at Wylfa

At the start of 2007, the station was unable to introduce new fuel into its two reactors and as a result began exhibiting states of reduced reactivity and lower efficiency.

It was identified that a quantity of neutron absorbers within both reactors were holding down reactivity levels even further.



A safety case was developed to allow on-load removal of the surplus absorbers, with the aim of increasing efficiency and avoiding any loss of generating revenue that would result from bringing the reactor off line while the removal was carried out.

**Following the work the site recorded an increase of some 60MW output to the grid. Put into financial terms, this equates to an extra £50k per day income from Wylfa's increased generation.**



In the year 2007/2008 Wylfa generated over 5 TWh, approximately 2% of the UK's electricity demand. Magnox North's continuing performance in electricity generation is of paramount importance in funding the NDA's nuclear decommissioning programme.



## Recovering damaged fuel elements from Dry Store Cell 4 (DSC4)

In 1990 around 20 corroded fuel elements were discovered in Wylfa's DSC4 and between 1995 and 2007 a number of campaigns were run to try and remove the corroded elements. These campaigns, which involved using custom-built equipment, had limited success with only one element being successfully recovered during this period.

Both retrieval methods and equipment were subject to various reviews, however significant risks were still identified, including problems with fuel handling, transport and potential impact on continued electricity generation at the site.

It was estimated that, even without the impact of the identified risks, a further cost of £9m would be incurred alongside a likely overrun of 9 months. The project team made the decision – in consultation with the NII and NDA – to halt the work, saving up to £300,000 per month, whilst other more efficient options were assessed.

The store's Diverse Discharge Route (DDR) was highlighted as a lower risk and lower cost alternative recovery option. With relatively minor modifications, the corroded fuel could be loaded directly into a transport flask which is more compatible for handling and receipt at Sellafield.

By following this method the project stands to achieve major savings and realise a number of operational benefits including: reduced risks, earlier removal of damaged fuel, less disruption to generation operations, reduced demand for site resources and opportunities to redeploy resources to other priority work.



# £50k per day income

# Oldbury site

Situated on the Banks of the River Severn, Oldbury is the oldest operating nuclear power station in the UK, and is set to cease generation at the end of December 2008. The station started supplying the grid in 1967 and during the financial year 2006/7.



## Crossover

Despite complications associated with bringing a reactor back to service after a lengthy outage, Oldbury's Reactor 2 was generating in June 2007 when eccentricity was identified in the turbine – forcing the reactor to be shut down to avoid costly damage to the turbine and associated plant.

Whilst the problem was being identified and a solution put in place, staff on the site saw an opportunity to return the station to operation and maximise generating revenue by using a crossover procedure – sending steam from Reactor 2 to turbine 1.

Although the plant was set up to make this process possible, the complex procedure had only been put into operation once before in Oldbury's history.

Human performance tools were seen as the key to ensuring an error free start up, including specific operating instructions, high level awareness briefs and clear communication techniques.

On 23 August 2007, Oldbury synchronised with the national grid – ahead of schedule. Turbine 1 has averaged around 218 MW, with the site exporting almost 210 MW.

**By continuing generation through the period of repair work on Turbine 2, Oldbury has generated around 1TWh of additional electricity.**



## Rescheduled Outage

Oldbury has spent a long period in a non-operational state whilst the Nuclear Installation Inspectorate (NII) approved the graphite safety case for Reactor 2. This presented an opportunity to postpone the full statutory outage and maximise the output of the power station until the end of its scheduled operational life.

A programme was put in place to bring some essential work forward from the planned 2007 outage into 2006/7, with the focus of replacing Reactor 2's statutory outage with a smaller outage post-generation.

Extensive work was done to assess the implications and justify the decision, followed by the production of a safety case which was submitted to the NII and subsequently endorsed.

This innovation has resulted in two major benefits for the business:

**76 days of additional electricity generation and reduced post-operational plant maintenance requirements, delivering over £3.3m of savings.**



# ...1 TWh of electricity

# Chapelcross site

For 50 years, they stood as a symbol of Scotland's first nuclear power station, but on Sunday 20 May 2007 they were reduced to a pile of rubble in less than 10 seconds.



## Cooling Towers Demolition

The cooling towers at Chapelcross were demolished by the controlled use of explosives, the result of more than a year of planning, preparation and analysis.

The local community surrounding the site had developed a great fondness for the landmark structures during their lifetime and there was a great desire for us to manage the demolition as a public event. This was balanced with the need to ensure public safety and ensure the demolition was carried out exactly to plan.

By working closely with the local stakeholders and coordinating our communication work with emergency services and the local council, the project team were able to manage the event safely, enabling an estimated 15,000 people to watch the spectacle from various vantage points.

The demolition was broadcast live over the web and commemorative DVDs were produced and distributed amongst the local community and throughout the schools in the region.

Chair of the Site Stakeholder Group, Ian Lindsay spoke about the day the site achieved the milestone: "The site has been an example of how the UK pioneered the nuclear industry and we must remember how the people of Dumfries and Galloway have played an integral part in this with the 45 years of safe electricity generation from Chapelcross.

**"I think we should also try to look upon this event as a start of a new phase in the life of the site, a phase which can once again see Chapelcross at the leading edge of the nuclear industry as it continues with decommissioning."**

The successful completion of the project paved the way for the similar demolition of the cooling towers at Chapelcross's sister station, Calder Hall, some four months later.

## Use of 'Spoil' Material as Infill

Throughout the operational life of Chapelcross Site a quantity of 'spoil' material was collected. Characterisation of the material identified that there were areas of contamination and pockets of radioactive materials.

Following the demolition of the site's cooling towers in May 2007, there was a need to source material to infill the basins which were left following the demolition. The volume of material required was similar to amount of spoil material available.

Earlier exemptions from the Scottish Environment Protection Agency (SEPA) permitted the disposal of rubble from demolition in the basins. Similar exemptions were appropriate for the spoil, providing an opportunity to characterise, segregate and transport it for use as infill.

By working closely with the regulators and carrying out rigorous sampling and segregation of the contaminated, hazardous and LLW materials the site was left with around 45,000 tonnes of useable material. The alternative and costly disposal route, if no exemption were in place, would be landfill or consignment to the UK's LLW repository.

**Various savings have been realised by this innovative approach:**

- By enabling the use of exempt materials and non-hazardous spoil, as an infill in the cooling tower voids, over £1.7m of disposal costs have been avoided.
- By using material already on site, a saving of £494,000 was made by removing the need to import suitable material.



# Magnox North Support Office and EWST

(Engineering, Waste, Strategy and Technical Division)

## Demolition Safety Case

At 8am on Sunday 20 May 2007, the iconic cooling towers at Chapelcross site were successfully demolished with the controlled use of explosives. After demonstrating that this method of demolition could be carried out safely on a nuclear site, the four cooling towers at the Calder Hall power station (part of the Sellafield site) were flattened in similar spectacular style on 29 September.

This was the first time an explosive demolition of this scale had taken place on a nuclear licensed site, but the benefits of using this method above alternatives were clear and compelling. Manually dismantling the towers would have involved risks associated with working at height in order to bring the towers down over a longer period of time. Controlled explosive demolition, however, significantly reduced the period of time needed to bring the towers down and the need to work at height.

EWST's challenge was to engage with the regulator, the Nuclear Installations Inspectorate (NII), to demonstrate that controlled explosive demolition was a viable option and that the risks of undertaking this type of project on a nuclear licensed site were manageable.

In building the case, explosives experts were drafted in to model the ground effects of the demolition. The team carried out work in parallel to survey the towers and demonstrate that radioactive contamination did not pose any risk.

**With the successful conclusion to both projects, significant savings were delivered over manual dismantling:**

- Chapelcross – £13m
- Calder Hall – £11.2m

# Chapelcross £13m

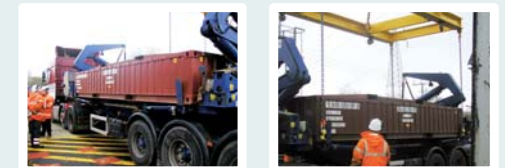


These central functions provide essential support services to the generating and decommissioning sites within Magnox North. They deliver specialist technical expertise, administrative support and management services, developing best practice across the organisation.



## LLW Transport

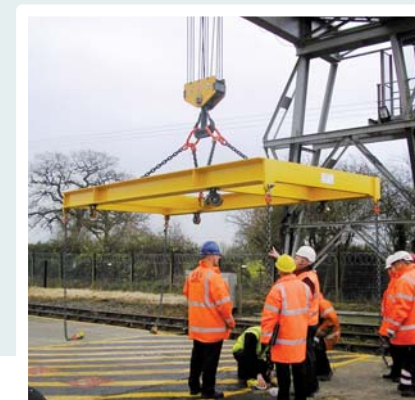
**Magnox North is committed to reducing the environmental impact of our operations wherever possible. EWST is investigating alternative methods of transporting low level waste (LLW).**



LLW is transported from Magnox sites, by road to Sellafield and then by rail to the UK's Low Level Waste Repository.

A study is under way to investigate the option of running a number of LLW shipments by rail, as an alternative to road transport. Spent fuel from the majority of the UK's nuclear power stations has been safely transported by rail since 1962.

The first part of this study took place in the form of a 'lifting trial' which was carried out successfully at Berkeley Railhead on 4 December.



Lifting trial at Berkeley Railhead.





Magnox North Sites,  
1100 Daresbury Park, Daresbury,  
Warrington WA4 4GB  
[www.magnoxnorthsites.com](http://www.magnoxnorthsites.com)