# Driving digital in the NHS



---

# Quality and Continuous Improvement – First Generation Magnox Storage Pond (FGMSP)

The use of continuous improvement has long been associated with manufacturing organisations such as car producers. This approach is fairly new to the NDA group businesses and one of the main reasons for not adopting it before now has been a lack of recognition that a manufacturing approach would be beneficial. What is helping gain traction is the realisation that each of our businesses needs to be able to deliver products, as do manufacturing companies, whether that is quantities of waste for interim storage or demolition of facilities and clean-up of land. There are significant benefits from applying these techniques.

A collaborative approach to continuous improvement is being implemented across the NDA group. This has identified various levels of continuous improvement implementation, maturity and many different standards. In order to effectively manage implementation, experience from other sectors has helped define the priority improvement areas:

- ensuring that strategic objectives are cascaded at all levels in increasing detail throughout our businesses
- associated performance targets are clearly defined and applied on a daily, weekly and monthly basis
- a strategy is embedded to align capability in order to address gaps identified between actual performance and targets
- establish an expectation to expose and close performance gaps at all levels, in all departments.

Sellafield Limited has realigned itself to the approach described above, created a strategy, adopted a One NDA continuous improvement model, implemented a roadmap and created and started to deliver accredited industry good practice training to embed its strategy into the organisation. In

addition, a baseline assessment tool to understand the maturity of continuous improvement across the organisation is now in use.

A good practice approach within the First Generation Magnox Storage Pond (FGMSP) shows how continuous improvement can improve performance. The mission delivery outcome to retrieve all Intermediate Level Waste (ILW) from FGMSP by the required end date (SO31) has been cascaded through all levels of the team focussed on FGMSP using a range of appropriate measures and targets.

What this means in FGMSP is that the objective of removing all the sludge and pond contents has been converted to a reduction in the metre cubed (m3) of contents per year to meet the currently planned completion date. Figure 14 shows the required annual sludge removal and the cumulative lifetime cost of doing so, which is used to track performance.

The information on how much sludge has been removed can also be used to show the impact that more or less than planned sludge removal has on the estimated cost. In this example, each year the project is extended an additional sum of approximately £60 million would be needed showing how important it is to prevent timescales extending into the future.

In cascading the decommissioning objective, the annual target is broken down into a weekly plan within which daily throughput (beat rate i.e. two sludge batches a day) is identified and incorporated in a Master Production Schedule. Linking the annual target number of sludge removed to achieve the m3 retrieval targets allows individuals to clearly understand how they contribute to mission delivery and become involved in solving any problems to achieve the throughput and then record any changes to the way they work in operations, maintenance, engineering, commercial or people issues within their Quality Management System (QMS).

Visualisation and reviewing performance against targets not just for quantities of material but for safety, quality, cost and skills availability on a weekly basis allows gaps in performance to be exposed immediately and then closed by embedding improved capability in the workforce to problem solve systematically. Any learning can then be recorded and used in a continuously improving QMS.

This approach is now accepted as good practice at all levels within FGMSP.

Adopting this approach has contributed to 2019/20 delivery where all sludge targeted for removal was achieved against its most stretching target, increasing confidence that all of the sludge will be removed by 2026.

---

# Ponds and Silos at Sellafield

---

# Timing of the Magnox Reactor Decommissioning Strategy

The previous strategy for decommissioning Magnox reactor sites was developed over 30 years ago and involved deferring reactor decommissioning at all sites for approximately 85 years from reactor shutdown (SO42). In 2016, we committed to reviewing this strategy with Magnox Limited to take account of new experience and developments in the decommissioning landscape (ref 3).

Bradwell had previously been named as a lead site when the strategy was blanket deferral, and much of this new experience has come from placing Bradwell into an interim state suitable for long-term deferral. As well as developing innovative approaches to decommissioning (e.g. developing techniques to retrieve, condition and package ILW), the experience at Bradwell has improved our understanding of the costs and risks associated with preparing sites for deferral.

It has also demonstrated that some sites are unsuitable for longer periods of deferral. The work completed by Magnox Limited at Bradwell has helped to demonstrate that interim storage of waste in a dedicated facility is neither as complex nor as expensive as previously thought, albeit dependent on site-specific factors including the views of local stakeholders.

The review of the Magnox reactor decommissioning strategy (SO42) is now complete. We have concluded that whilst the deferred decommissioning strategy continues to have benefits in some cases, it is not appropriate as a blanket strategy for all reactors in the Magnox fleet because of their different design, location, age and physical condition. Consequently, the NDA has endorsed a site-specific approach to Magnox reactor decommissioning which will involve a mix of decommissioning strategies.

For some sites this will result in their decommissioning being brought forward whilst for others a deferral strategy with varying deferral periods will be the chosen approach. Magnox Limited will now prepare a business case (or cases), informed by local and national stakeholder views, for implementing this strategic change.

We have worked with both local and national stakeholders to identify factors from the NDA Value Framework (ref 17) that will discriminate between strategies for each site. This engagement has included discussion at the NDA

Stakeholder Summit and various Site Stakeholder Group meetings, as well as strategy development groups involving government, regulators and local authorities. In November 2018 a large joint stakeholder event expressed the Value Framework factors as discriminatory questions (see table 2).

| Value Framework Factor | Discriminatory question |
|---|---|
| **Health and safety Risk and hazard reduction** | For each credible decommissioning strategy, what work (level of effort) is required to manage risks to people (workers and public)? |
| **Environment** | For each credible decommissioning strategy, what work (level of effort) is required to protect the environment? For each credible decommissioning strategy, what is the volume and nature of waste arising? |
| **Socio-economic impact** | To what extent does the community and local supply chain depend upon work at the site? What opportunities (value and likelihood) exist for alternative use of land at the site? How great is the visual impact of reactors? |
| **Enabling the mission** | What is the potential for reactor decommissioning to generate learning of relevance to other reactors? To what extent will reactor decommissioning allow the trial of new technologies or other strategic opportunities? |
| **Lifetime cost** | What work is required to prepare the reactors for deferral, and how much of this could be avoided by progressing with reactor dismantling? What opportunities exist for aligning decommissioning on neighbouring sites and what are the associated benefits? |
| **Achievability (resources and logistics)** | What capacity exists for interim storage of waste? Will interim storage of waste be problematic? How easy would it be to maintain or acquire a suitably qualified workforce after a period of deferral? |

Table 2: NDA Value Framework factors and their discriminatory questions

Magnox Limited has begun the process of selecting the optimum decommissioning strategy (SO42&43) for each of the Magnox reactors and, based on a review using factors listed above and in the NDA Value Framework (ref 17), Trawsfynydd has been chosen as a lead site for Magnox reactor decommissioning.

This is primarily because the external structure has degraded extensively since it was shutdown in 1991 such that substantial amounts of work would be required to make it safe for a long period of deferral; work that would then need to be undone to complete reactor dismantling. Furthermore, the site is located in Snowdonia National Park and in an area with a relatively weak local economy that is strongly dependent on work at the site.

The intention is that together the site-specific strategies will result in a rolling programme of activity as the Magnox fleet is decommissioned. This will maximise the opportunity for sharing any lessons learned, developing and implementing new technologies and strengthening wider capability. As a whole, the programme will collectively be geared towards reducing risk, reducing

lifetime costs and growing skills and knowledge to deliver benefits both nationally and to local communities.

While we expect the new site-specific decommissioning strategies to be defined over the next 12 to 18 months, they will be continually reviewed and optimised using the learning obtained from the sites being decommissioned (SO42&43).

It is expected that the strategy for decommissioning Calder Hall (a former Magnox reactor on the Sellafield site) will also incorporate learning from the lead Magnox site, Trawsfynydd. The development of site-specific strategies at the Magnox reactor sites does not affect programmes at Harwell and Winfrith. Continued focus on safety and risk reduction will remain the overriding priorities across all the sites.

---

## Optimising Site End States

A key benefit of the UK government's proposal to amend the legislative framework for nuclear sites (ref 22) is that operators will have greater flexibility to optimise site end states (SO46). The new framework will allow operators to balance the overall safety and environmental risks associated with remediation and consider a broader range of options in pursuit of the optimised solution.

Pressure on parliamentary time has delayed the necessary amendments to primary legislation. The NDA has continued to work with regulators (safety regulators, environment agencies and local authorities) and the UK government to identify secondary legislation and guidance that will be required to realise the full extent of benefits that the change is expected to deliver. This has included supporting the environment agencies with development of their GRR (ref 23). In particular, the GRR, issued in 2018, incorporates learning from trial applications of previous drafts at 3 NDA sites: Winfrith in Dorset; Trawsfynydd in north Wales; and Dounreay in Caithness, Scotland.

Magnox Limited and Dounreay Site Restoration Limited (DSRL) are optimising the site end state for the 3 'lead and learn' sites because decisions about remediation are imminent. With the exception of Winfrith, it is not expected that the site end state will be achieved for many years. Therefore the focus is on defining an end state assumption in enough detail to inform the next interim state.

The existing end state assumptions were established in 2006 following the formation of the NDA. The recent reviews of end states at the 3 'lead and learn' sites have all highlighted the importance of considering structures below ground (e.g. foundations and basements). All 3 sites have extensive subsurface structures. Excavating these structures would reduce contamination on site and allow immediate unrestricted use of the land, but transporting

the waste to be disposed of below ground elsewhere would result in a number of impacts on people and the environment.

The reviews note risks to workers, the public and the environment associated with excavating substructures, transporting waste and importing fresh material to fill voids.

In September 2017, following a period of public consultation, Magnox Limited revised the site end state assumption for the Winfrith site to include leaving structures below ground at the 2 closed reactors (Steam Generating Heavy Water Reactor (SGHWR) and DRAGON), along with some ground contamination. The revision was informed by modelling that predicts land will be suitable for its next planned use (publicly accessible heathland) without removing the subsurface contamination.

Likewise, in March 2019, Magnox Limited revised the site end state assumption for Trawsfynydd to include leaving in place some of the lightly contaminated subsurface structures (e.g. subsurface portion of reactor bioshields and pond structures) and using concrete from demolition of above ground structures as infill for unwanted sub-surface voids. Assessments predict that as a consequence of radioactive decay and the natural degradation of contaminants, the associated land would be suitable for unrestricted use shortly after the existing ILW store has been demolished.

Both of these end state assumptions remain subject to further optimisation, evaluation by regulators and wider stakeholder engagement. Learning from this exercise will feed into work by Magnox Limited to develop site end state assumptions for their remaining sites.

The Dounreay site is more complex. Consequently, DSRL has chosen to look at individual components of the site that together contribute to the site end state. These components include installations, current and future disposals, areas of land contamination, sub-surface structures and other discrete site conditions. Work will initially focus on the key components whose individual end states will have the greatest impact on the overall site end state. DSRL has reached the stage of updating the credible options for the site end state assumption at Dounreay.

These options are informing technical studies which, with the input of key stakeholders, will be used to identify an underpinned and optimised site end state assumption over the next 2 years. This assumption will be subject to an ongoing programme of optimisation.

Building on the work undertaken at the ‘lead and learn’ sites, Sellafield Limited and Low Level Waste Repository Limited (LLWR Limited) have begun to review and optimise the site end state assumptions for their sites. For the LLWR site, the end state assumption for the disposal area is largely defined by the Environmental Safety Case. Work has now commenced on considering the options for the remainder of the site to form a balanced, coherent solution for the whole site.

Site end state options are currently being developed and evaluated taking

into account future disposal site operational requirements. These options will be discussed with stakeholders prior to adoption.

Sellafield Limited has initiated a programme of work to review the current site end state assumption, which makes reference to an inner and outer zone. Work is underway to identify credible options for the end state and then initiate assessment of these options. Sellafield Limited will work with stakeholders to ensure that the work is informed by the views of the community around the site. The first proposed steps are to improve on the end state assumption by:

1. No longer considering the site in terms of inner and outer spatial zones, but instead by identifying optimised and sustainable options for components at a smaller scale than the site as a whole
2. Building up the picture of the site end state over time, one component at a time and balancing these in the context of the entire site to ensure that the most sustainable site end state assumption is realised
3. Undertaking an in depth analysis of the component of lightly radioactively contaminated soils and subsurface structures to find the right initial end state assumption based on the benefits and drawbacks of each option. It is important to determine an end state assumption for this component because it affects remediation decisions being made now.