

Evolving an Integrated Waste Strategy for the UK Magnox Sites - 9038

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ABSTRACT

Since 2005, the nuclear sites in the United Kingdom (UK) owned by the UK's Nuclear Decommissioning Authority (NDA) have each been charged with the production of an annual Integrated Waste Strategy (IWS) that for the remaining lifecycle of the site describes all wastes (both radioactive and non-radioactive) arising and all waste management activities. The underlying need for an IWS is discussed, as are the uncertainties surrounding waste management in the UK and the key strategies and legislation affecting it. The evolution of the understanding of what an IWS should contain undergone by the UK's Magnox Sites and how this can be best presented is described from the first attempts at simple site based summaries through to more integrated Site Licensee documents with common formats and content for Magnox North and Magnox South. The lessons learnt through this process are shared and the visions for the future are outlined.

INTRODUCTION

A growing proportion of the UK's civil public sector nuclear facilities have reached or are reaching the end of their operational life. Of the 11 Magnox nuclear power stations built in the 1950s and 1960s, only 2 are still operating, and these are due to cease in operation in 2008 and 2010. Once they cease to operate and decommissioning begins, their primary purpose switches from electricity generation to waste production. It is vital that a strategy for this waste is developed to ensure it is managed in a sustainable manner, achieving an equitable balance between the competing demands of society, cost and protection of the environment.

This paper looks at how Integrated Waste Strategies (IWS) for the UK Magnox Sites have been introduced, developed and continue to evolve, the benefits thus far realised, those anticipated, lessons learnt and how this experience could benefit other sites throughout the world.

BACKGROUND TO THE IWS - WASTE ISSUES IN THE UK

There are many uncertainties regarding the future of management of both radioactive and non-radioactive waste in the UK:

- **Waste Inventory**

When the Magnox stations were designed and built, they were not constructed with decommissioning in mind, and in the early days, record keeping was not always sufficiently detailed to inform the decommissioning process several decades later. Therefore, no Magnox site can say with absolute certainty how much waste of each type is actually present, although significant efforts are now being extended to improve this.

- **Lack of HLW/ILW Disposal Facility**

There is no agreed location yet within the UK for the long-term disposal of either HLW or ILW and each stage of the decision-making process is subject to lengthy public consultation. Sites are therefore required

to design and build interim stores for this ILW until such a facility is available. These have been sized, based on estimates of the ILW present at each Site and an assumption that all the waste would be encapsulated. The Sites have been advised to use a date for planning purposes of 2040 for when the facility will be available, but this is not guaranteed. A recent study by the Environment Agency [1] has also challenged the newly imposed NDA container integrity target of 500 years for package lifetimes on the basis of lack of justification and assessment of the impacts of it.

- **Limited capacity at LLW Repository**

The UK national LLW Repository, near Drigg in Cumbria, has limited capacity and cannot take all the LLW forecast to arise from decommissioning. Recent changes in Government policy have enabled nuclear sites to consider other disposal options, such as on-site facilities and disposal of very low activity to waste to conventional landfill. On-site disposal options have been progressed through to submission of planning applications but placed on hold primarily due to concerns over setting a precedent with respect to socio-economic factors.

- **Fuel Reprocessing**

Fuel from Magnox sites is sent to Sellafield for reprocessing but the recent problems and ongoing limited capacity of the THORP reprocessing plant has affected defuelling timetables.

- **Decreasing availability and desirability of landfill**

The UK Waste Strategy, 2000 [2], introduced the concept of a hierarchy of preference for waste management options from waste prevention and minimisation, through reuse and recycling, to recovery of energy from waste, e.g. by incineration, to finally that of waste disposal by landfill. This preference has been reinforced through a raft of legislation, policy statements and financial instruments, as discussed later. As a result, landfill, as a disposal option for non-radioactive waste is decreasing in availability, and in particular, due to recent changes placing tighter requirements on landfills that accept hazardous waste, e.g. asbestos, these are now extremely limited with the result disposal is more expensive. This scarcity also means that hazardous waste may have to travel long distances in UK terms to landfill contrary to the proximity principle. Although higher in the strategic waste hierarchy than landfill, new waste incineration (energy from waste) plants frequently face extreme public opposition due to the poor environmental performance of early incinerators, and the lack of available siting locations in the UK at a distance from public dwellings.

- **Funding**

When the Nuclear Decommissioning Authority (NDA) was established in 2005, it encouraged the non-operational Magnox sites to put forward and progress accelerated plans for decommissioning, with a resultant increase in on-site activity and enthusiasm within the supply chain. Towards the end of 2006, the funding was reduced and consequently, projects that had been started had to be placed on hold, contractors laid off and decommissioning timescales revised. In 2007 and 2008, decommissioning funds were directed to those Sites deemed to pose the highest hazard, namely Sellafield and Dounreay, non-Magnox sites. As a government funded body, the NDA can only provide funding on an annual basis and even then, it is not certain. This funding reduction has led to a substantial extension of the first phase of decommissioning from end dates before 2020 out to end dates after 2030. This funding uncertainty has created disquiet in the supply chain and in some cases caused them to redirect their attentions to contracts with more certainty of continuity such as the Olympic sites in London. Furthermore, as the timescales extend, there is significant doubt that sufficient resource with the necessary decommissioning skills will be available when required.

- **Economic Uncertainty**

Some materials identified in the waste inventories are more appropriately viewed as resources, as they have a recoverable financial value through reuse or recycling. However, the value of this resource is highly volatile and dependent upon global demand. In an environment of limited funding, it is vital that the Magnox sites are able to recover as much value as possible from their principal resource, i.e. waste, but it is difficult for the Sites to react quickly.

KEY STRATEGIES/LEGISLATION

The UK Government's waste policy is formed within the context of international and European guidelines and regulations, the key aspects of which are described below.

Radioactive Waste

The Committee on Radioactive Waste Management (CoRWM) was formed in 2003 following a consultation [3] conducted by the UK Government in 2001. CoRWM reviewed options for safely managing the UK's solid, long-lived radioactive waste and reported in July 2006 [4] recommending geological disposal as the final end state but recognising that interim storage would be required for several decades. In October 2006, the Government and devolved administrations published a response accepting the main recommendations and consultations on its implementation are ongoing.

Cm2919, published in 1995 [5], was the last full statement of government policy on radioactive waste management. Amongst other matters, it states with respect to decommissioning that:

- The process of decommissioning should be undertaken as soon as it is reasonably practicable to do so.
- Nuclear operators will be asked to draw up strategies for decommissioning their redundant plant which will be reviewed every 5 years by the HSE in consultation with the Environment Agencies.
- Segregated funds for decommissioning should be established for those parts of the industry that are privatised.

It also states that radioactive waste should not be imported or exported from the UK except for the purposes of recovery or treatment.

This policy was updated in 2004 [6] with respect to decommissioning of nuclear facilities and in March 2007 [7] with respect to all aspects of the generation, management and regulation of solid LLW. The latter revision was driven by the severe future shortage of LLW disposal capacity in the UK. It relaxed the previous ban on greater use of controlled burial to landfill from the nuclear industry and allowed high volume, bulk disposals to specified landfill sites provided these met required criteria [8].

The UK is a contracting party to the Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR Convention) [9]. The objective of the OSPAR Radioactive Substances Strategy is to prevent pollution of the maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment being near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances.

The discharge of solid, liquid and gaseous radioactive wastes from nuclear sites in the UK is regulated under the Radioactive Substances Act 1993 (RSA93). Under this Act, each Site is issued with a single multi-media authorisation regulated by the environment agencies. The authorisation applies various

discharge limits, notification limits, monitoring requirements and conditions of operation. All authorisations currently require operators to ensure that Best Practicable Means (BPM) are adopted with respect to radioactive discharges ensuring that as far as reasonable radioactive dose, conventional safety risk and environmental impact are minimised.

The Environment Agencies may require operators to review their waste management strategies to demonstrate that they represent the Best Practicable Environmental Option (BPEO). This is not a legal requirement at those Sites where this is not included in their Authorisation but represents best practice and is a regulatory expectation. The BPEO concept was defined in by the Royal Commission on Environmental Pollution (1998) as, “*The outcome of a systematic and consultative decision-making procedure which emphasises the protection and conservation of the environment across land, air and water.*” The BPEO is, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at an acceptable cost, in the long term as well as the short term. It is commonly said that the BPEO defines the strategic waste approach, whereas the BPM defines how it will actually be implemented. It is important to recognise that there is an expectation of stakeholder involvement and/or consultation within the BPEO procedure.

Non-Radioactive Waste

The key elements of Government Policy with regard to non-radioactive waste are: the 2006 EC Waste Directive [10] which consolidates and replaces earlier EC Waste directives; the UK Government Waste Strategy for England 2007 [11]; and the EC Waste Incineration Directive (WID) [12].

The EC Waste directive sets the overall policy context for waste management and disposal within Europe and defines waste as “*all substances or objects which the holder disposes of or is obliged to dispose of pursuant to the national provisions in force in the Member States...*” but excludes “*gaseous effluents, or to radioactive waste, mineral waste, animal carcasses and agricultural waste, waste water, and decommissioned explosives where these types of waste are subject to specific Community rules.*” The requirements of the directive are transposed into UK law through waste regulations affecting hazardous, non-hazardous and inert waste streams.

The principles of the earlier EC Waste Directives were incorporated in the UK Waste Strategy 2000 [2]. The recent 2007 version [11] builds on the previous strategy and progress achieved since then but aims for greater ambition by addressing the key challenges for the future.

Incineration is defined in EU legislation as “the thermal treatment of wastes with or without recovery of the combustion heat generated”. As well as conventional burning, it includes thermal treatment processes such as pyrolysis, gasification or plasma processes, provided the substances resulting from the treatment are subsequently incinerated. The directive has been implemented through the Pollution Prevention and Control regime in the UK. Permits have been drawn up to include the WID requirements.

The management of non-radioactive industrial and commercial processes that could have a direct environmental impact is largely controlled through the Environmental Permitting Regulations 2008 (EP08). These regulations require that operators demonstrate that they have used Best Available Techniques (BAT) to minimise the impact on the environment. This concept derives from European legislation, and elsewhere in Europe it is also used instead of BPM when considering radioactive waste. The EP08 regulations consolidated a large number of previous regulations into a single regime. There are plans for further phases of consolidation, including the RSA93 Authorisations, which would ultimately mean that each Site would have a single Permit covering all the ways in which they could impact the environment and the requirement to demonstrate BPM would be replaced by BAT.

NDA Strategy

The NDA issued its strategy in 2006 [13]. The key waste management issues of this strategy are:

- Whether, and how, to rationalise the interim storage of ILW pending the availability of long-term management arrangements.
- How best to dispose of increasing volumes of LLW.
- How to move forward the process to agree site end states.
- Gaining a full understanding of the extent and nature of the contamination on its sites.
- Whether decommissioning of Magnox reactors can be completed much sooner than the established 125 year programme.
- Creation of new SLCs to enable the completion of its competition schedule, e.g. Magnox North and South.

NEED FOR INTEGRATED WASTE STRATEGY (IWS)

The formal requirement for nuclear operators to have strategies for the management of radioactive wastes derives from UK government policy published in 1995 [5]. In 2005, the NDA translated this into a contractual requirement for each of its Site License Companies (SLCs) to base their plans on optimised and integrated site waste strategies described in a document, updated annually, covering:

- All wastes, both radioactive and non-radioactive, their on-site management and disposal into all three environmental media, i.e. air, water and land.
- All operational and decommissioning activities planned over the site's remaining lifecycle including wastes arising from contaminated land management.
- Any actions required to improve the sites approach to waste management.

The NDA's stated aims for the IWS [14,15] are to:

- Provide a coordinated approach to waste management and stakeholder engagement;
- Make the most effective use of existing waste management facilities;
- Provide value for money to the UK taxpayer;
- Provide a framework for the NDA's contractors to use as a tool to optimise their approaches to waste management on a site wide basis; and,
- Support the development of the NDA's national waste strategy.

The NDA recognised that the IWS would and should evolve with time.

EXPERIENCE OF IWS PRODUCTION

The IWS production arrangements in Magnox in 2006, 2007 and 2008 are described; from standalone site documents in 2006; through semi-integrated regional and site documents in 2007; to wholly integrated regional documents with matching format and content in both Magnox regions in 2008.

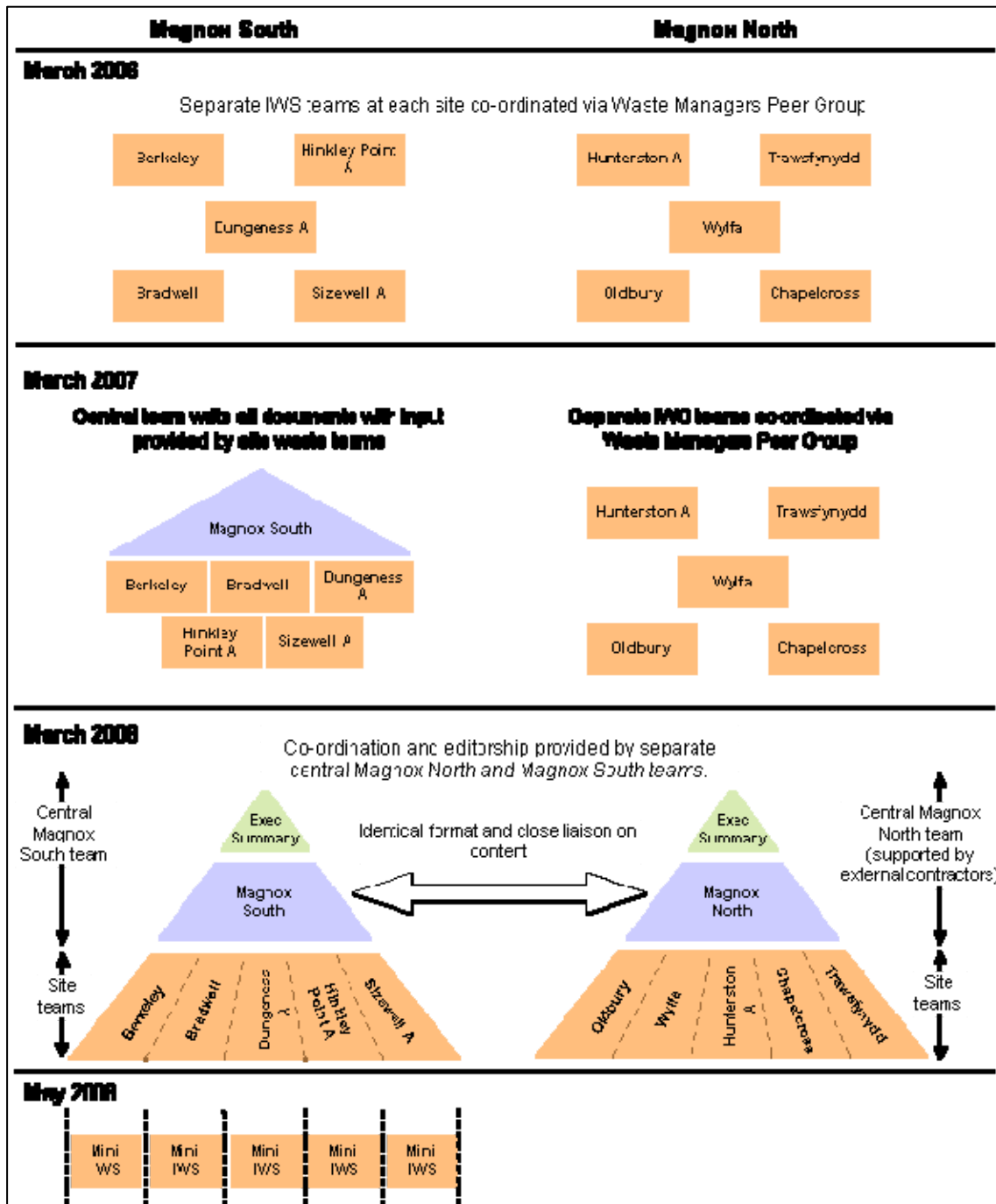


Fig. 1. Evolution of IWS Structure March 2006 - May 2008

Interim IWS, March 2006

In 2005, the NDA published Issue 1 of their specification for the production of an IWS as part of the Lifetime Plan (LTP) process, in March 2006. This guidance required that each Site produced an “interim IWS”. Its aim was to create a baseline of the known waste information at each Site, the current strategies for its management and an identification of the knowledge and strategy gaps. It was recognised that this was not truly a strategy and it was neither integrated nor optimised but an interim step in the process.

Each Site progressed production of its IWS independently, some used external consultants who provided a waste strategy more in line with those seen outside the nuclear industry and others attempted to fit the production alongside existing work using existing Site staff. Some Magnox sites were still operating, e.g. Sizewell and Dungeness, whereas others e.g. Hinkley Point and Berkeley had ceased operation and were some way into decommissioning. Consequently, the draft documents were completely different in format and content. At a peer group meeting in the southern region in February, it was decided that a common approach and appearance was required. As there was insufficient time to bring all IWS up to the highest standard and to avoid highlighting those sites that were struggling, the decision was made to go with a lower standard that all sites could reach in the time available. It was acknowledged that this was unlikely to meet all the requirements of the NDA specification.

There is a regulatory expectation that waste management strategies are underpinned by BPEO studies. One site, Hinkley Point A attempted to address this by holding a Site Wide Waste Management BPEO study facilitated by external consultants to define the preferred waste management options for each waste type and to provide input to their IWS. The results were extremely high-level, and largely reflected the waste management hierarchy, i.e. prevent, reduce, reuse, recycle, energy recovery and disposal. These results were included within the site's IWS but had to be removed later to achieve commonality.

The primary learning from this exercise was that if a common look and feel were required then it was important to agree this at the beginning of the production process, not the end. In addition, it was felt that a central co-ordinating role was crucial to ensure that all sites were aware of what was required. Trying to achieve this level of detail at the monthly or less frequent meeting of waste managers was not an appropriate use of their time, much as they may have liked to get involved at this level.

IWS Version 2, March 2007

In August 2006, the NDA published the next and still current version of the specification. This was much revised, and laid down the requirements and justification for the production of the IWS as described above. In the same timeframe, Magnox Electric introduced the Magnox North and South regional structure. Therefore, for the March 2007 version, Magnox South decided to produce both standalone Site IWSs in conformance with the NDA specification and a Magnox South IWS which also met the specification and covered the overarching issues and opportunities, which would be difficult to discuss within a site document. Magnox North continued with separate uncoordinated production of IWS documents.

The Site IWS content was largely based upon that produced the previous year by Hinkley Point A, as theirs had been the most advanced in 2006 before being revised to the common format. All the documents were produced by a central team of three people in consultation with site IWS representatives. This eased the workload of the site staff but meant that they had no sense of ownership, and it was evident that some had made little input to the content. There was much duplication and repetition within each IWS largely caused by the specification and between the Site IWS and the Magnox South IWS. The documents were large (>100 pages) and contained few pictures or diagrams. As the text was duplicated between documents, a change in one meant that the same change had to be made in the other five.

A post-production review identified the following learning points:

- Significant repetition, both within and between the documents.
- Some duplication between the IWS and other documents comprising the LTP.
- Difficult to read, with dense text, few diagrams and no colour.
- Difficult to navigate around the document.

- Limited usefulness to the sites, i.e. lots of background information but not easy to identify the BPEO for a waste.
- Limited time allowed for revision, production process started to late.
- Lack of ownership by site staff resulting in the work being given low priority for input and review.
- High and conflicting demands on a small number of people, as part of the LTP the IWS was produced at the same time as other LTP documents..
- Interdependence on other LTP production programmes e.g. Prioritisation process, definition of the Technical Baseline and Underpinning Research & Development (TBRD) and the Schedule.
- Lack of understanding outside the Waste Management community of the purpose of the IWS and importance placed on it by the NDA.
- Conflicting demands from the NDA to different site staff, with each part then considering it to be the highest priority.

These last 3 points are discussed in more detail later.

IWS Version 3, March 2008

The specification remained unchanged, but the learning from the previous production exercises was taken onboard and addressed to some extent.

Again, a core team of three was established within Magnox South. They comprised a programme director, a project manager and an editor. To address the lack of ownership and involvement by the sites, it was determined that the role of this team with respect to the Site IWS would be one of project management, peer review and editing for consistency - the intention was that they would not write the IWS on behalf of the sites. A good working relationship was established with the equivalent team in Magnox North and it was discovered that their thinking was progressing on similar lines although they had contracted the editorship to an external consultancy.

The criticism of a limited timeframe was addressed by starting the project three months earlier, i.e. in September 2007, with kick-off meetings with the authors at each Site and presentations to their managers at the Waste Managers Peer Group. It was hoped that by starting earlier the clash of workload priorities in January and February would be avoided with the majority of the textual revisions being completed before Christmas, leaving only the detailed waste inventory tables, produced under another LTP workstream and other minor revisions, such as date changes to be incorporated in January and February. The key milestones were identified and the individuals involved asked to commit to providing the necessary support. The Site waste teams were advised that the structure of the individual Site IWS would be changed to address the criticisms raised in previous years relating to repetition, structure and density. However, they were requested not to wait but to commence collation of updates and changes to waste strategy and knowledge that had occurred since publication of the previous IWS so that they would be ready to update the new template when it was available.

To address the issue of repetition within and between documents, a critical review of the NDA specification was undertaken to identify areas of duplication and those headings that seemed to be out of place. It was agreed that an integrated suite of documents would be produced which together would better satisfy the NDA specification (Fig 2). These were:

- Executive Summary – a short colourful document summarising the key points.
- Magnox South IWS – an overarching document setting the scene, containing information that was common between all sites in the region and information on strategies and plans being addressed at company and regional level.

- Site IWS Appendices – a separate document for each Site, containing only the information that was unique to the Site.

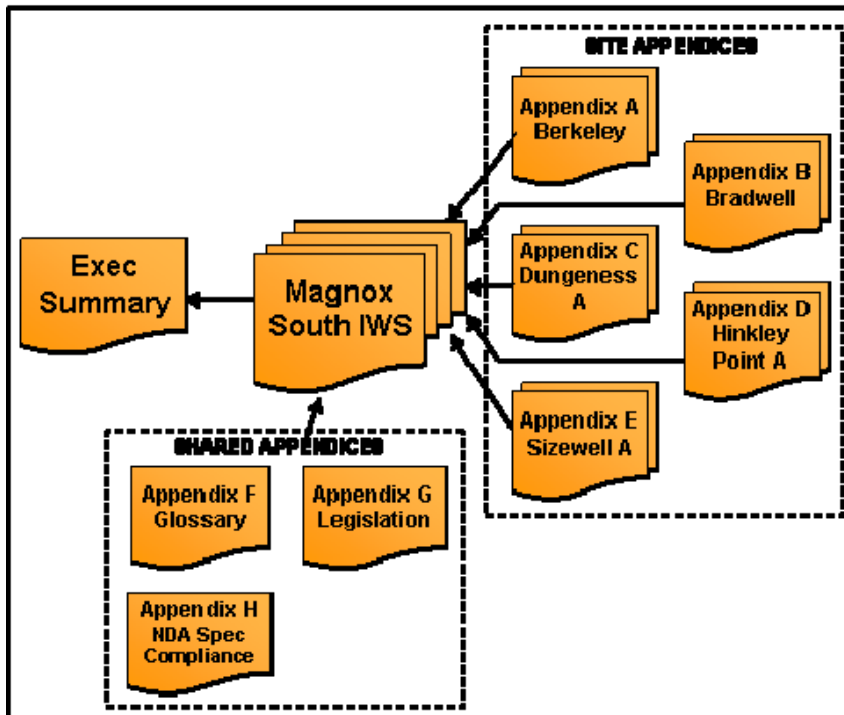


Fig. 2. Magnox South IWS Structure

To address the navigational difficulties, a system of colour coding and symbols in the headers of each page was adopted (Fig. 3).

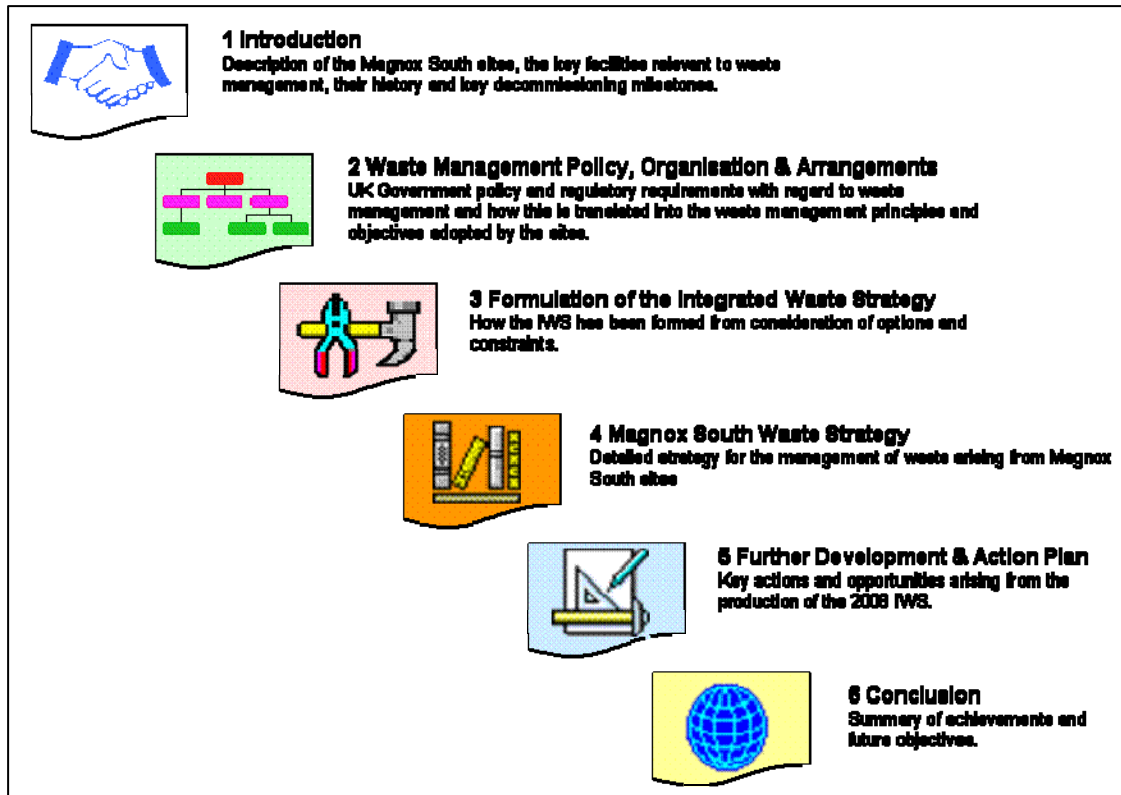


Fig. 3. Use of Colours and Symbols Within the IWS Document

To remove duplication, the 2007 version of each Site IWS was reviewed to identify commonality in content between sites. Sections on legislation, management arrangements, policy, organisation structure, procedures and controls were identified. These were extracted from the site documents and placed in the Magnox South IWS, thereby leaving the site documents as appendices containing only information specific to that site.

To eliminate some of the editing problems of the previous year and to ensure a common format and structure, a Site Template was produced. The proposed content of each section was illustrated using examples based on the previous year's IWS for one site, including many photographs and diagrams to break up the text. The template was provided to all sites for them to cut and paste their information from the previous year's report and update with the changes they should have been collating.

This is where the programme started to fall apart. Despite the presentations and kick-off meetings at the start of the project, the site authors severely underestimated the amount of work required and therefore gave it a low priority. It must be remembered that no additional site resource had been provided and they were therefore attempting to fit this work in beside existing workload. Unsurprisingly, time ran out and some failed to meet the timetable for return to the central team. Finally, after much persuasion, the completed drafts were returned to the centre for comparison. Unfortunately, it became apparent that at least two of the sites had failed to address the update requirements adequately and some sections of text and photographs within the returned documents were identical to that provided in the original template.

The intention of the central team at this point had been to review the documents and remove any new commonality resulting from revision of procedures and sharing of information on waste management best practices between sites during the previous year. Due to the limited confidence in the information provided this was not possible to any great extent. However, obvious commonalities were removed from

those that had been returned; the documents were proofread and returned to the authors for verification and a further request made to update their site-specific information. By this time, it was December and pressure was starting to build on the site authors to divert their attention to produce other waste deliverables and workstreams within the LTP, e.g. Waste Accountancy Templates, Prioritisation. Representations were made by the central team to the Waste Managers and it became apparent that there had been a breakdown in communications between those doing the work at the Sites and their line management.

The learning point for the central team was that the Site Waste Managers needed to be kept up-to-date with the demands being made on their team and that it was not possible to assume that the site team members would do this on their behalf. Human behavioural factors had not been taken into account in the planning process.

The NDA were shown early drafts of the new document format and how this would comply with their template. They were impressed with the use of colour and the readability of the document. At around this time it became apparent to the NDA that Magnox North were running into difficulties with their format and they were instructed to adopt that being used by Magnox South. Magnox South team members were given access to the Magnox North IWS e-room to ease document sharing.

Simultaneously, with this convergence of thinking, one Site Waste Manager decided that the format of the Site Appendix was not appropriate and it should be a standalone document, i.e. renegeing on the approach agreed in September and that subsequently agreed with the NDA. Unfortunately, the central team lacked the authority to quash this and a further month was lost on this site appendix while matters were resolved.

These delays meant that the timetable had now slipped, the contingency had been lost and delivery dates were now the same as those of other LTP deliverables, leading to the same overworked delivery schedule at the beginning of March.

The content of the Magnox South IWS was reviewed to determine its security classification and was agreed to be classifiable as Unrestricted, i.e. releasable to the general public. However, the Magnox North IWS with the same level of detail and content was reviewed by their security and classified as "Restricted". Consequently, the Magnox South IWS was reclassified as "Restricted" meaning that it could not be released. It therefore failed to meet one of the key requirements of the NDA's specification. It is believed that the principal concern was that the waste inventory data provided in some site appendices stated the location of the waste. This will be addressed in the next issue.

One of the separate LTP workstreams is the Waste Accountancy Template (WAT). This required the sites to complete a complex Excel spreadsheet designed by the NDA with detailed waste inventory data for all waste streams. This was first completed in March 2006 and revised in March 2007. The NDA specification called for very similar information to also be provided in Annex 1 of the site IWS. To minimise the work for the site teams it was decided that this data would be sourced from the WAT. It was recognised at the start of the IWS programme that the dates for finalisation of the WAT were very close, if not identical to those of publication of the IWS and that this was a risk to the project but it was crucial that the same data was reported in both deliverables.

It should be noted that the sites were asked to provide waste inventory data to the IWS by waste type rather than location but some were not in a position to do this, hence the problems with security described earlier. The wastestream information collated for the UK Radioactive Waste Inventory is location specific (in some cases down to individual settling tanks) and some sites had not done the work necessary to collate these into types of waste, as required by the IWS. A direct consequence of this lack of investment of time and effort into waste data analysis was that the waste inventory data provided by each

site could not be readily compared. The data was provided at very different levels of detail and quality. Some simply assumed that all waste arising from demolition of the reactor buildings would be ILW and LLW without specifying the nature of the material, e.g. metal, concrete, whereas others had analysed the likely amount of contamination and identified that significant quantities were likely to be non-radioactive. Some provided the data at too low a level of detail, e.g. Reactor 1 LLW steel, Reactor 2 LLW Steel, LLW Steel from ETP etc, where what was required was a volume of LLW steel. These differences arose from the different systems used to hold the data at each site and the different length of time the sites had been in decommissioning, i.e. the time they have had to characterise and quantify the waste data. Even so, the graphical comparison of waste data between sites, which was provided for the first time in the IWS, has brought these differences to the fore and forced investigation to be conducted into these differences. It was apparent that although a lot of effort had been invested into the radioactive waste streams, much less consideration had been given to the non-radioactive waste. One site even had no inert waste being produced during demolition whereas other sites had this as the largest proportion of the waste; leading to the concern that other waste categories for this site could have been substantially overstated.

LESSONS LEARNED

To summarise, the key learning points from the past three years of IWS production are that:

- As with all projects, the human factors cannot be ignored.
- Conflicting views on authority with respect to IWS; is it a Magnox South document or a Site document? Responsibility for production was unclear to some Site Waste Managers and the central team lacked the authority to compel Site Waste Managers to comply.
- A bottom-up approach will always be dependent upon the contributions of the quality and timeliness of input at the bottom level.
- Plan for the unexpected.
- Workloads will always be underestimated.
- Not all site authors were experienced technical authors and therefore underestimated the effort.
- Removal of repetition, through use of a single higher-level document, eased document maintenance, but the usefulness of the site document to the site-based readership is reduced. A single document cannot satisfy all audiences.
- Production as part of the LTP will always result in last minute changes - this should be decoupled if possible.
- Publication as part of the LTP runs the risk of incorrect security classification.
- Importance of the waste strategy as a key driving force behind the decommissioning plans is not understood or accepted by all.
- A common format for all waste data would enable comparison and ease summation.
- Comparison of waste inventory volumes including non-radioactive wastes between similar sites is a valuable validation exercise, it can challenge the volumes declared as radioactive waste.
- Waste inventory data should not specify location on site.

The key role of the IWS suite of documents is to provide a single point of reference for all waste matters relating to nuclear decommissioning within an SLC. It could be a valuable tool for stakeholder engagement. The main audiences for this document are external to the individual Site and include the NDA, other SLCs, and the public. However, the process of compiling the documents can assist the site waste department and the regional teams to identify the gaps and inconsistencies in strategy.

The key role of the Site IWS should be to inform the site workforce of the waste management strategy for each type of waste but the current format does not do this adequately. It discusses the location of the site and the management arrangements but does not give the entire waste strategy for the site as common

information has been removed to the Magnox South IWS to avoid repetition. It could be argued that the procedures, legislation and volumes etc are described in more detail in other site documents and need not be repeated for a site-based readership, and could be replaced by pointers to other documents. Bearing this in mind and to provide a shorter, more useful, reference document to sites, Magnox South issued a Mini IWS for each Site in summer 2008, this is a step in the right direction. .

BENEFITS REALISED

The IWS evolution process has already yielded many benefits that are readily transferable to other nuclear sites within the UK and worldwide, including:

- Eased inter and intra-site (or inter-project) comparison.
- Identification and prioritisation of areas where further work is required to achieve optimisation and integration.
- Identification of historical inconsistencies in site approaches to strategy development and waste accounting.
- Enhanced knowledge sharing between sites and projects.
- Issue identification and escalation mechanism to the NDA and beyond.
- Integration of radioactive and non-radioactive waste strategy.

The use of a common format between all sites has enabled ready comparison between the level of knowledge regarding their waste and the strategy for its treatment. While each Site has its own unique set of conditions stemming from its history from design through to cessation of generation, there should be a high degree of commonality as they are all part of the same company operating the same basic design of reactor. A comparison of the waste data between sites has revealed substantial differences. Exercises are now underway to understand whether these differences are factual or derive from errors in waste characterisation or quantification.

Documentation of the underpinning research, optioneering and consultation behind each strategy and the best practices in waste management have been documented in a single place allowing readers to compare and contrast.

An integration of the information on strategies for all waste types into a single document, particularly radioactive and non-radioactive waste, facilitates communication between radioactive and non-radioactive waste specialists.

To date the greater benefits to Magnox could be said to have come from the process of producing the Strategies rather than the documents themselves.

CONCLUSIONS

To recap, in response to the NDA's stated aims, the IWS for the Magnox sites has evolved thus:

- **Provide a coordinated approach to waste management and stakeholder engagement**

Although the documents are now largely integrated within the separate Magnox regions, the same is not true for the strategies themselves. There is scope for further integration between sites, waste streams, and decommissioning projects, but the steps to get there are now clearer, as are the challenges to be overcome and the potential benefits to be gained.

Collating information on the current approaches to waste management, including those relating to stakeholder engagement with respect to waste management has enabled identification of the areas for improvement within waste management and stakeholder engagement.

- **Provide a framework for the NDA's contractors to use as a tool to optimise their approaches to waste management on a site wide basis**

It is doubtful that the IWS in its current format is useful as a tool to optimise waste management on a single site. It is currently not a live document: as part of the annual LTP process it has only been published on an annual basis and parts may therefore be substantially out of date. Furthermore, there is much repetition and extraction from existing site documents. As before, the process of collating the information may be of benefit in providing an overview but more a focussed tool is required at site level, which gives more detailed information on the waste management options for each waste type and the research that underpins these approaches. However, it is of benefit at the SLC/Regional level as it enables sharing and synthesis of approaches between sites.

Future possibilities for achieving this aim are to publish focused documents for site workers such as the Mini IWS produced and to explore alternative publishing mechanisms such as those based on intranet content management systems.

The aim is for the IWS to become a summary document and an index pointing to all the other research rather than attempting to contain all the information in one place and repeating other documents.

- **Make the most effective use of existing waste management facilities**

The IWS identifies those waste management approaches to be used and the underpinning research and optioneering to ensure that these are the best practicable environmental options. Adoption and reassessment of BPEO with respect to waste management ensures that effective use is made of limited waste management facilities.

Eventually, the Magnox IWS will define the management strategy for each type of waste present at Magnox sites and these will be fully underpinned by optioneering studies in line with regulatory and best practice requirements. This point has not yet been reached but the IWS does now identify the gaps.

- **Provide value for money to the UK taxpayer**

Waste should be considered as a valuable resource that must be managed appropriately. Integrating the development of waste strategies across Magnox sites has enabled synergistic opportunities to be identified and the identification of lead sites for the piloting of certain strategies, e.g. on-site disposal, enabling duplication of effort to be minimised and learning shared across sites.

- **Support the development of the NDA's national waste strategy.**

The NDA has yet to produce its promised NDA national IWS, which will inform future UK government policy and funding. The challenge they face is to produce a document that is timely and yet contains sufficient detail to be of use. It is hoped that the experience recorded here will be of value in this regard.

The potential exists for the SLC based IWS to play a significant role in the identification and development of regional, national and international solutions to waste issues within the UK.

APPENDIX 1

REGULATORY AND POLICY CONTEXT

The NDA was established to ensure the safe and efficient clean up of the UK's first generation of civil public sector nuclear facilities. It owns 19 sites including the 11 sites in the Magnox fleet. The NDA is a non-departmental public body sponsored by the Department for Business, Enterprise and Regulatory Reform (BERR). The NDA also reports to the Scottish Government who agree its strategy and plans for Scottish sites and therefore are also involved in its governance. The NDA's responsibilities are discharged through management and operations contracts with Site License Companies (SLCs) who manage the sites including preparation of site plans, performing and sub-contracting work. Magnox Electric Limited split into two SLCs (Magnox North Ltd and Magnox South Ltd) on 1 October 2008. The SLCs are in turn owned by Parent Body Organisations (PBOs). The PBO for Magnox is currently EnergySolutions. The relationship between the NDA and the PBO is governed by a parent body agreement. This complex arrangement enables the NDA to put the right to be the PBO out to competition whilst retaining the skills and knowledge of staff within the SLC, thereby avoiding the need to relicense a new operator after each competition.

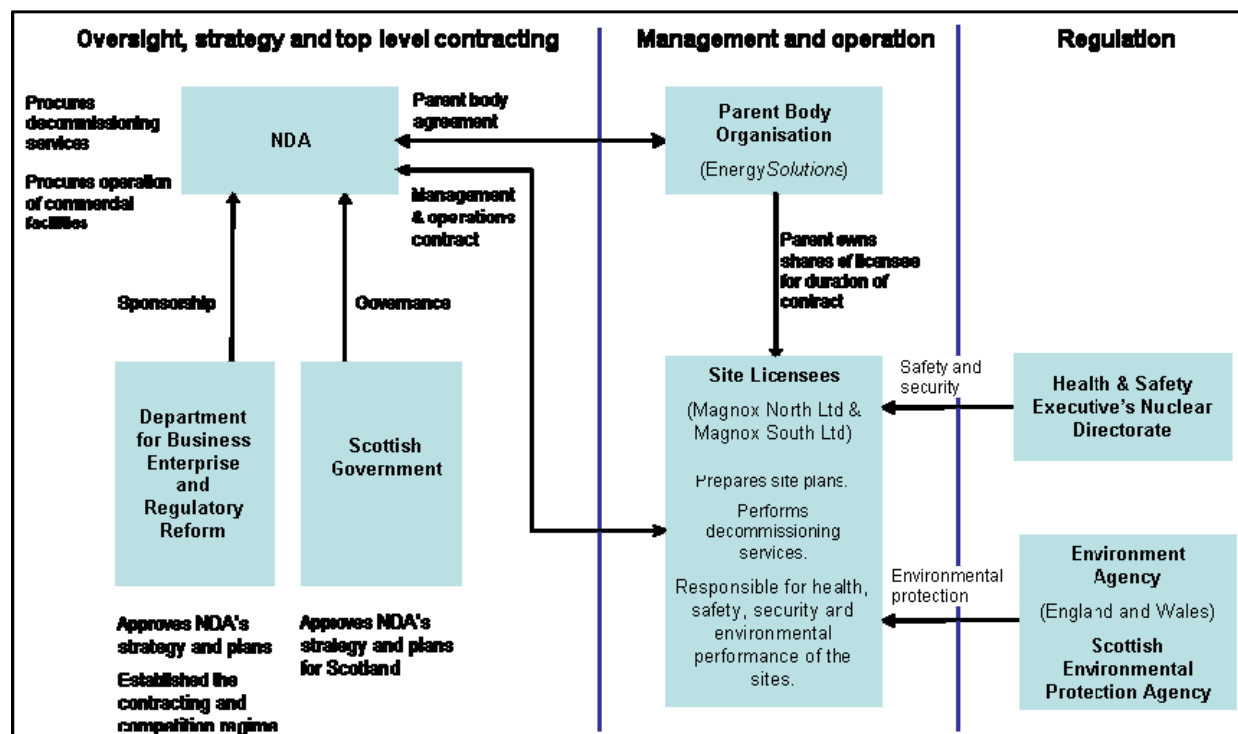


Fig. 4. Magnox's Contractual and Regulatory Arrangements (after NDA)

Autonomy v Controlling Mind

Each Site Licensee is licensed to operate by the safety regulator the Health and Safety Executive's Nuclear Directorate (NII), (which now includes responsibility for security). Sites hold licenses from environmental regulators (Environment Agency (EA) in England and Wales; Scottish Environmental Protection Agency (SEPA) in Scotland) including those for the disposal of radioactive waste and permits for the discharge and management of non-radioactive waste. It is therefore the Site Licensee's responsibility to determine how it will comply with the regulatory requirements and to ensure safe, secure and environmentally responsible operation of the Site. There is therefore a limit on the degree to which the NDA or the PBO can influence how the SLC delivers work paid for by the NDA under its contract. Should a regulator require additional works not included within the LTP and therefore budgeted, this will impact the decommissioning programme and creates a tension between the SLC, the NDA and the regulator.

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