

Optimising the number and location of interim Intermediate Level Waste (ILW) storage facilities on Magnox Limited and EDF Energy sites in England and Wales

Credible Options Summary Paper

May 2013





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1 Introduction

The Nuclear Decommissioning Authority (NDA) has made a commitment to consider the possibilities to reduce the overall costs, environmental impacts, and timescales of decommissioning by consolidating Intermediate Level Waste (ILW) management at fewer locations¹. The consolidation of interim storage of packaged ILW prior to disposal offers a significant opportunity of this nature.

Therefore, Magnox Limited (hereafter known as ‘Magnox’) and EDF Energy are reviewing the case for consolidating the interim storage of operational packaged ILW². Specifically the project aim is:

“To establish the most appropriate locations for the interim storage of Intermediate Level Waste across Magnox and EDF Energy Sites within England and Wales.”

This study is being undertaken following the NDA’s Strategy Management System (SMS). Within this system, the development of an individual strategy is managed in distinct stages. Stage A, “Define Credible Options,” distils the initial options into a list of approaches that can credibly deliver the objective by applying screening criteria. Further work is then undertaken to identify the preferred option(s) (Stage B) and to test the ability to implement the preferred option(s) (Stage C).

This document presents a summary of the findings in Stage A so far. The Credible Options list will be finalised following stakeholder review of this document.

2 Background

The baseline plan for operational ILW interim storage at all of the sites included in the scope of this paper is to retrieve, package and store the waste on the site of origin in purpose-built storage facilities, taking due account of both regulatory and NDA guidance until final disposal in a Geological Disposal Facility (GDF). However, there are some company and site-specific differences in the plans at a more detailed level:

- At most Magnox sites, the packaging strategy is to use Ductile Cast Iron Containers (DCICs). These are to be held on site in purpose-built interim storage facilities that provide weather protection (and some shielding). However, at Trawsfynydd and Hunterston A sites the strategy is to encapsulate ILW within 3m³ containers or other packages suitable for eventual disposal and to transfer these packages to an on-site purpose-built shielded ILW store.

¹ Nuclear Decommissioning Authority NDA Strategy, effective from May 2011.

² Magnox Limited are leading this study with EDF Energy sites in the scope.



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- At most EDF Energy sites, the current packaging strategy is to produce encapsulated packages in 500l stainless steel containers. An on-site ILW store would be required to provide physical and environmental protection; radiation shielding will be provided by concrete over-packs and the ILW store itself. However, at Sizewell B the use of DCICs is proposed for ILW resins.

These differences affect ILW store designs, how the packages are handled and transported, and influence the credible interim storage options that are available in this study. In particular, where adjacent A and B sites have different waste packaging strategies, co-location of waste in the same storage building may not be practicable.

It should be noted that the use DCICs (at those Magnox sites where this is now planned) is the result of site-specific options assessment studies undertaken in 2010 which compared conditioning in DCICs to encapsulation in 3m³ containers. In all cases, external stakeholders were involved in the 2010 option studies in workshop settings. Such studies were not undertaken for Trawsfynydd or Hunterston A as ILW stores and treatment facilities for those sites were constructed some time ago, before the use of DCICs became an option.

3 Scope

The scope of this opportunity includes Magnox and EDF Energy operational ILW held within England and Wales as shown in Figure 1. The scope does not include ILW which will be generated during the Final Site Clearance (FSC) period as the plan is that this will be dispatched directly to the GDF. Figure 1 provides a useful comparison of the amount of packaged ILW at the various sites in scope which will require interim storage^{3,4}. Note that this study only considers which are sites are the best locations to store ILW and does not consider the choice of technology for doing so i.e. the type of package or store.

A number of Magnox and EDF Energy sites in England are co-located, specifically at Dungeness, Hinkley Point and Sizewell. Only EDF Energy sites that are co-located with Magnox sites have been included within the study⁵.

For Magnox sites, it is assumed that Berkeley, Bradwell and Trawsfynydd will have interim ILW stores that will be used to store their own wastes (Bradwell and Trawsfynydd stores have already been constructed, and Berkeley's store is currently

³ 2010 UK Radioactive Waste Inventory data (which includes future arisings) have been converted into a common package type to allow a fair comparison of package numbers.

⁴ The Scottish sites of Chapelcross, Hunterston A & B and Torness are the subject of a separate study [Intermediate Level Waste Storage Solutions: Central and Southern Scotland, Preferred Option, NDA, April 2013].

⁵ As such, Heysham I and II and Hartlepool are excluded from this study.

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under construction). It is also assumed that there may be opportunities to store waste from others sites in these stores.

All other Magnox sites are potential donor sites and most are potential host sites, i.e. all other sites may transfer packaged waste for storage at another location, or may have a store for its own and potentially other sites' wastes.

At the stakeholder engagement workshop in February 2013 the relationship between this study and the nuclear new build programme was raised. The scope of this study does not include new build wastes, though Magnox will remain cognisant of the issues raised by new build and the stakeholder views received on this topic throughout this study.

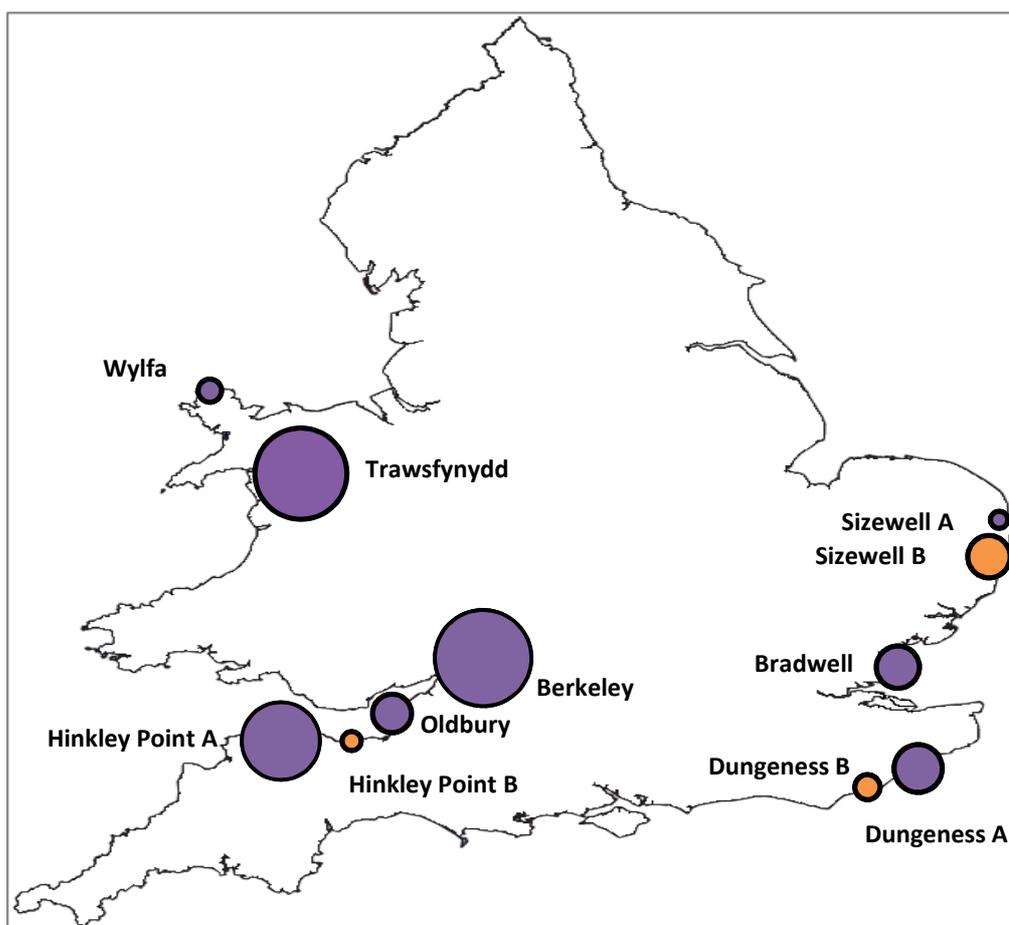


Figure 1. Summary of Intermediate Level Waste Considered in Scope

4 Long-List of Options

Initially, the long-list of options considered Magnox wastes only. The reasons for this approach were that, at most sites, the volume of Magnox waste is larger than at the adjacent B stations and that, generally, Magnox wastes will be retrieved and packaged sooner than B site wastes, requiring the construction of one or more Magnox interim waste storage facilities.

A long-list of 22 options was generated within three high level categories:

- Baseline Storage Options - each site builds its own store for its own wastes.
- Regional Storage Options - sites may share storage facilities but only if they are located in the same broad region within the UK.
- Minimisation of Future Stores (if not included in regional) - includes 3 store, 4 store etc. options whereby waste is transported across regional boundaries.

These options were discussed at a stakeholder meeting on 12th - 13th February 2013⁶. Stakeholders were given the opportunity to add further options and a number of suggestions were made⁷. Magnox has subsequently considered these suggestions, resulting in the development of a second scenario and set of options based on the alternative assumption that all EDF Energy wastes are packaged in DCICs: i.e. all packaged in the same way as resins at Sizewell B. This alternative long-list of options also includes the baseline, regional options and minimisation of stores options.

This paper proposes that the question of where best to store Wylfa's waste should be addressed in a separate project at a later stage. The main reasons for this are that Wylfa will only produce a small number of waste packages and the retrieval and packaging of Wylfa ILW is the last in the Magnox decommissioning schedule. Magnox will continue to apply the waste hierarchy, seeking to minimise, recycle and reuse waste where possible. This action may result in a reduction in the number of ILW packages to be stored on Magnox sites. Subject to obtaining the necessary consents and permissions and to stakeholder acceptability, DCICs containing Wylfa waste could, in theory, be transferred for interim storage at any appropriate host site

⁶ Stakeholders at this meeting included Site Stakeholder Group / Local Community Liaison Committee members; representatives from local authorities; regulators; industry (Magnox and EDF Energy), and the NDA.

⁷ Details of the additional options suggested and Magnox's consideration of these are available on request.



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in England or Wales. Accordingly, there will be a much clearer picture of where spare storage capacity exists at a future date.

The scope of this options assessment is, as a result, limited to consideration of sites in England. In all options, Trawsfynydd waste will to be stored in the ILW store that already exists at that site and in no option would waste from any site other than Wylfa be transferred to Trawsfynydd.

5 Optimisation Factors

In this optimisation study, it is necessary to determine the best overall balance of all relevant factors. This is being done in two phases. In the first phase (Stage A), safety and environmental factors are being used to eliminate clearly sub-optimal options. This is the subject of this paper. In the next phase (Stage B), issues such as cost, implementation risk, operability etc. will be taken into account when comparing the remaining options. This will include issues required to be considered under the NDA's Value Framework process. Note that for Stage A it is a working assumption that the construction of fewer stores would result in a reduced cost of ILW interim storage.

Within this study, it is considered that all of the relevant safety and environment factors relate to two issues: construction and the transport of radioactive waste. These are discussed in turn below.

The options that involve more storage locations in general involve a larger amount of construction. This in turn leads to increased:

- Conventional risks to workers.
- Materials use.
- Demolition arisings.
- Transport of construction and waste materials (leading to increased risk of accidents; carbon dioxide emissions).

However, options which involve fewer storage locations require more transport of radioactive wastes, leading to increased:

- Public and worker radiation exposure.
- Transport of radioactive wastes (leading to increased risk of accidents; carbon dioxide emissions).



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Most of the factors listed above arise in the relatively short term. In the longer term, issues such as store maintenance and inspection, and the logistics of dispatching wastes to the GDF when available, are also affected by the number of storage locations.

In order to identify options with the best overall balance of these issues referred to above, it is necessary to decide which factors are most important in the decisions to be made.

6 Option Screening

Stakeholders' views were sought at the February workshop to identify the safety and environmental factors considered to be the most important for use in an exercise to screen the options. The issues considered to be most important by stakeholders were:

- Public individual dose from the transport of ILW packages.
- Public collective dose from the transport of ILW packages.
- Worker collective dose from transport of ILW packages⁸.
- Public conventional safety from transport of ILW packages and construction and demolition materials.
- Worker conventional safety from construction and demolition.
- Disturbance caused directly by construction and demolition.
- Disturbance from HGV movements.

In both scenarios (i.e. EDF Energy and Magnox continue to adopt different waste packaging strategies or, alternatively, EDF Energy adopts a packaging strategy based on DCICs), the screening exercise considered the performance of each option against all factors listed above. This screening exercise then reduced the long list in each scenario to shorter lists of options. It is the short list of options based on current packaging strategies that will be taken forward. Whether or not options are also on the alternative short list will then be a consideration in arriving at the final preferred option.

In summary, the options being rejected at this stage all involve transferring Hinkley Point A's waste to another single site location. Otherwise all other options remain. Fundamentally, this is because Hinkley Point A has the largest number of waste packages of any potential donor sites. The transfer of Hinkley Point A wastes to another location therefore results in relatively high disturbance to local stakeholders

⁸ For use in screening as a surrogate for industrial safety.



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and relative to other options under consideration, increased public dose and conventional safety risk from transport, and therefore these options are screened out.

To transfer the Hinkley Point A packages to another location would also be inconsistent with the principle that, if any waste transportation is required, it is preferable to transfer wastes from sites with smaller volumes to sites with larger volumes than the other way round. This principle was discussed at the stakeholder workshop in February.

Though not directly considered within the option screening process, retaining Hinkley Point A's waste at Hinkley Point does not foreclose A-B site consolidation options at that location; retains the waste at a location identified as one of the UK Government's preferred sites for new build; and does not require the very significant increase in the storage capacity at any other site that would be required if these waste packages were to be re-located.

7 Credible Options

The remaining options for Magnox waste packages are given in Table 1 below.

In Table 1 each row represents one possible option and each column is a potential host site. For example, in option 4c there is a store at Berkeley (for Berkeley and Oldbury waste packages); a store at Hinkley Point A (for Hinkley Point A and Dungeness A waste packages); a store at Bradwell (for Bradwell, Sizewell A and Dungeness A waste packages); and a store at Trawsfynydd. As noted below, the storage location for Wylfa waste packages would be decided nearer the time those packages are created (Wylfa is last in programme and is expected to have a small number of waste packages).

As can be seen in Table 1, the options for Magnox wastes range from the baseline (each site has its own store for its own wastes) through to all Magnox wastes being stored between Berkeley, Bradwell, Hinkley Point A and Trawsfynydd. Between these are a number of options which involve some degree of consolidation on a regional level. There are a small number of options remaining in which wastes are transferred outside of the region of origin, these all involve the transfer of some (but not all) of Dungeness A's wastes to sites in the south-west (with the remainder staying in the south-east).

There are four options remaining which are on both the credible options list for both scenarios. As noted earlier, whilst both scenarios have been assessed during this screening stage, this study in its entirety will be undertaken primarily on the basis of current waste packaging strategies. This is because Magnox will be required to commence construction of one or more stores ahead of any potential strategy change by EDF Energy. Magnox will, however, remain cognisant of the views



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expressed by stakeholders that it would be preferable for A and B sites to share storage facilities at any A-B locations where stores are required.

Table 1. Credible Options List for Magnox Waste Packages

OPTION ID.	OPTION DESCRIPTION	ILW STORAGE SITES								OPTIONS IDENTIFIED AS CREDIBLE IN SENSITIVITY ANALYSIS INCLUDING EDF ENERGY SITES ⁹
		BERKELEY	HINKLEY POINT A	OLDBURY	BRADWELL	DUNGENESS A	SIZEWELL A	TRAWSFYNYDD	WYLFA	
7a ¹⁰	Baseline	Berkeley	Hinkley Point A	Oldbury	Bradwell	Dungeness A	Sizewell A	Trawsfynydd	See main text	Yes
6c	Six Stores – Regional	Berkeley	Hinkley Point A	Oldbury	Bradwell Dungeness A		Sizewell A Dungeness A	Trawsfynydd	See main text	Yes
6b	Six Stores – Regional	Berkeley	Hinkley Point A	Oldbury	Bradwell Sizewell A	Dungeness A		Trawsfynydd	See main text	
6a	Six Stores – Regional	Berkeley Oldbury	Hinkley Point A		Bradwell	Dungeness A	Sizewell A	Trawsfynydd	See main text	Yes
5f	Five Stores – Minimisation of Future Stores	Berkeley Dungeness A	Hinkley Point A	Oldbury	Bradwell Sizewell A Dungeness A			Trawsfynydd	See main text	
5b	Five Stores – Regional	Berkeley Oldbury	Hinkley Point A		Bradwell Dungeness A		Sizewell A Dungeness A	Trawsfynydd	See main text	Yes
5a	Five Stores – Regional	Berkeley Oldbury	Hinkley Point A		Bradwell Sizewell A	Dungeness A		Trawsfynydd	See main text	
4c	Four Stores – Minimisation of Future Stores	Berkeley Oldbury	Hinkley Point A Dungeness A		Bradwell Sizewell A Dungeness A			Trawsfynydd	See main text	



Note that the option ID numbering system reflects the number of stores required to implement the option e.g. Option 4c would require 4 stores whilst Option 6c would require 6 stores.

⁹ This tests the alternative assumption that EDF change packaging strategy across their fleet to the use of DCICs.

¹⁰ Option 7a becomes the baseline (previously Option 8a), following removal of the Wylfa variant.



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8 Way Forward

Following stakeholder review this Stage A paper will be revised as appropriate. This revised paper will include the finalised credible options list.

Following completion of Stage A, work will commence on the identification of a preferred option(s). The proposed approach is to compare different sub-sets of the credible options in a structured optioneering assessment. As in Stage A, stakeholders will have an opportunity to provide input into the assessment in a workshop. This workshop is currently planned for July 2013. A paper outlining the preferred option in Stage B is aimed to be published for stakeholder review during November 2013.

Following completion of Stage B, the ability to implement the preferred option(s) will be tested. It is aimed to complete this phase of the project (Stage C) by the end of March 2014. *Note that any implementation phase would require further specific stakeholder engagement such as in relation to planning permissions and regulatory applications.*