

Optimising the number and location of FED treatment facilities and ILW storage facilities on Magnox Limited sites

Final Preferred Option

March 2015



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Decommissioning
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Executive Summary

A new Magnox PBO became effective on September 1st 2014. This transfer in ownership has led to a review of radioactive waste management strategies in a number of key areas, including: ILW packaging, ILW interim storage and FED management.

These strategies were the subject of a previous study and the publication of a preliminary preferred option. The recent review looked again at all of the credible options and increased the scope of the study to include the approach to ILW packaging and the technical approach to management of FED (not just the location of facilities as was the case with the previous studies).

The new assessment has also been informed by the development of new waste treatment routes and a better understanding of performance of the existing strategy and waste arisings. On this basis, a new, final Preferred Option has been identified.

The final Preferred Option differs from the preferred option published in 2014, although only modestly. In establishing our revised preferred option we engaged with all stakeholders, particularly those affected by the proposed changes, and believe the strategy is acceptable, deliverable and offers enhanced benefits.

The final preferred option is summarised as follows:

ILW Packaging -

Site	DCIC (current baseline)	Self-shielded encapsulation	Unshielded packages
Berkeley	✓	✓	✗
Dungeness A	✓	✗	✗
Hinkley Point A	✗	✓	✗
Oldbury	Either (subject to future evaluation)		✗
Sizewell A	✓	✗	✗
Wylfa	Either (subject to future evaluation)		✗

ILW Interim Storage – use of alternative waste management routes and consolidation where appropriate will avoid building ILW stores at Dungeness A, Sizewell A, Oldbury and Wylfa. To enable this ILW package transfers are proposed to existing ILW stores; in the South East to Bradwell; and in the South West to Berkeley.

FED management – segregation and prompt disposal of LLW FED from Sizewell A and Oldbury to LLWR. Packaging of Hinkley Point A FED for ILW disposal.

1 Introduction

1.1 Purpose

The purpose of this paper is to outline the proposed changes to Intermediate Level Waste (ILW) management strategy at Magnox sites in England and Wales. This paper describes Magnox's recent strategic reviews of ILW and Fuel Element Debris (FED) management¹ (Refs 1 and 2 respectively) (henceforth referred to as the final Preferred Option). For completeness, the paper includes a description of the differences between this final Preferred Option and the Preferred Option arrived at by the previous ILW interim storage and FED management optimisation project (Ref 3).

1.2 Scope

The scope of this paper includes the ILW management strategy for all operational ILW at Magnox sites in England and Wales. Specifically it addresses:

- ILW packaging and interim storage
- Management of FED

It should be noted that the previous optimisation project considered only the optimal location for siting ILW interim storage and FED treatment facilities. The scope of the recent strategic reviews covered here (Refs 1 and 2) is wider. The recent reviews (described in more detail in Section 3) have considered both the approach to waste management and the location of facilities. Specifically, the types of ILW containers and methods of ILW packaging (Ref 1) have been reviewed along with the approach to management of FED (Ref 2).

1.3 Paper Structure

This paper includes a summary of the Preferred Option determined by the previous optimisation project (Section 2; Ref 3) and then describes the final Preferred Option identified by more recent work (Section 3). Areas of significant difference between the two are identified and addressed both in terms of potential benefits realisation, alignment with previously expressed stakeholder views (Section 4) and finally with respect to any key risks or uncertainties presented by the final Preferred Option (Section 5).

¹ Changes which are being put forward following transition to the new Magnox PBO on 1st September 2014.

2 Strategic Context

2.1 Previous ILW Interim Storage and FED treatment Optimisation Studies

2.1.1 Background

During 2012 and 2013 Magnox (on behalf of the NDA) conducted two strategic options assessment studies to investigate opportunities for optimisation (consolidation) of ILW management activities on the English and Welsh Magnox sites. These were:

- A review of the location of ILW interim storage facilities, considering opportunities for storage consolidation,
- A review of the case for consolidation of FED treatment activities at fewer locations.

Both studies were undertaken in accordance with the NDA's Strategy Management System (SMS). Separate Stage A papers (Ref 4 & 5) were produced for interim storage of packaged ILW and for FED treatment. At Stage B the studies were combined into a single paper (Ref 3); this enabled stakeholders and decision-makers to understand the combined impact of both studies on individual sites.

2.1.2 Options Assessment and Outcome

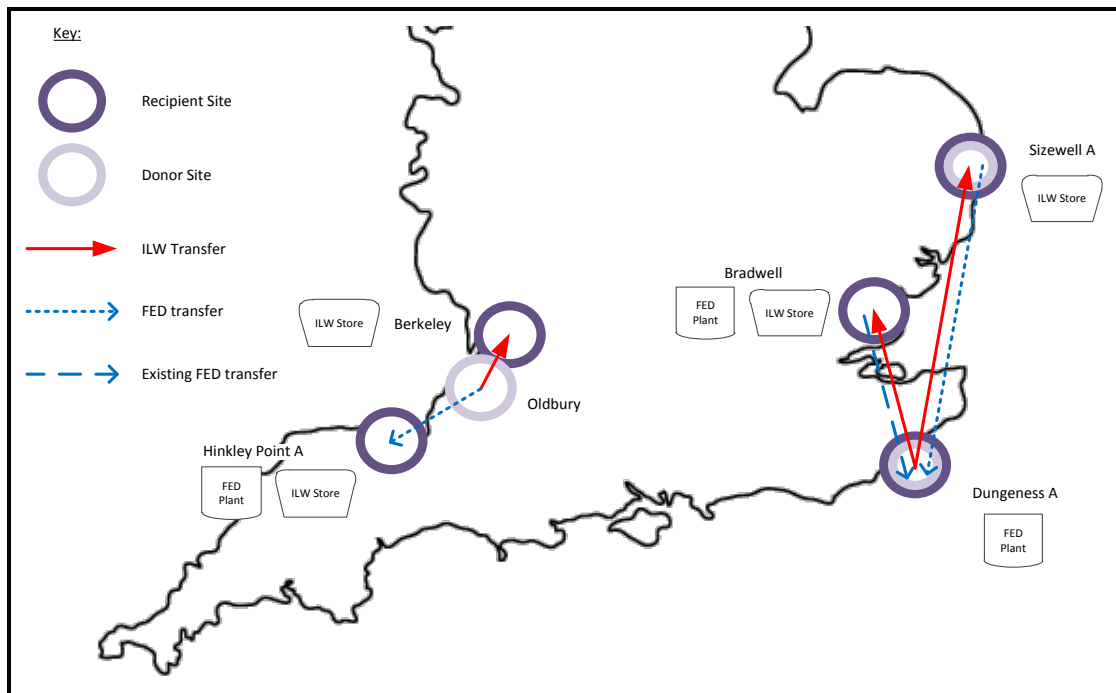
For both studies the approach taken was to identify a preferred location(s) for consolidation and then compare this to the baseline (no consolidation) to determine the overall preferred option. Stakeholder feedback provided at two workshops and on the published papers was taken into account during the assessment.

The conclusion of the assessment was that the following options were preferred:

FED Treatment	ILW Interim Storage
Treatment of FED from Hinkley Point A and Oldbury at one new plant at Hinkley Point A, and treatment of FED from Sizewell A at the existing carbonic plant at Dungeness A.	Oldbury ILW packages transferred to Berkeley, and Dungeness A ILW packages transferred to Bradwell and if necessary Sizewell A for interim storage.

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The key reasons for selecting the preferred option were that it would:

- make best use of existing facilities and avoids unnecessary construction,
- ensure that there is a balance of development across the sites,
- reduce overall environmental impact,
- reduce costs by approximately £90M whilst maintaining the highest safety and environmental standards,
- would not impact on Care and Maintenance (C&M) entry dates,
- provide opportunities for future consolidation of ILW package interim storage with EDF Energy.

These factors have been taken into account in revising the strategy.

It was considered that the advantages of the proposal outweighed potential disadvantages that were identified (such as the transport of some radioactive waste by public road), especially when mitigations are taken into account. The proposal was aligned to key elements of NDA Strategy by minimising new construction and making the best use of assets.

2.1.3 Noted uncertainty

During the previous study it was recognised that there were a number of factors that could have a significant impact upon the implementation of the proposal, and could lead to a change in strategy. These included a change of Parent Body Organisation at Magnox and RSRL and uncertainties in waste volumes.

These important caveats were identified and communicated with both decision makers and stakeholders during the ILW management optimisation projects, and are of direct relevance given the more recent review (as detailed in Section 3).

3 Final Preferred Option

3.1 Background and drivers for review of preferred option

The new Magnox PBO became effective on September 1st 2014. This transfer in ownership has led to a review of radioactive waste management strategies in a number of key areas. Of particular relevance here are the reviews of the strategies for:

- ILW packaging and interim storage
- FED management.

These reviews have taken into account the following key factors:

- The progress made in implementing the baseline strategy,
- The development or potential availability of new waste management routes,
- New proposals for waste packages.

The reviews have been conducted in-accordance with the Magnox Company Standard for options assessment (Ref 6). Whilst the approach differs slightly the level of technical underpinning and justification is equivalent to that supporting the previous optimisation studies' proposals.

For purposes of clarity, Section 4 identifies and addresses key differences between the previous Preferred Option and the final Preferred Option presented here. It includes a summary of how stakeholder input provided in the previous work has been taken into account in the development of the final Preferred Option. In addition, Section 6 outlines the Communications Plan, which will ensure that communications with stakeholders are managed in a structured and coordinated manner.

A key focus of the strategic review has been to retain the benefits of the previous proposals (for example through the use of self-shielding packages and minimising further construction works), whilst offering greater value for money. However, there are risks associated with this change in strategy, for example:

- threats to interim storage capacity resulting from waste volume uncertainty
- the ability to gain regulatory/stakeholder acceptance

These issues are discussed further in Section 5.

The final Preferred Option, and the process for determining it, is described below.

3.2 ILW packaging

Options Considered:

The assessment of ILW packaging strategies (Ref 1) has considered a wide range of options. A screening process was applied to ensure that the options taken forward for detailed assessment were credible and could be implemented during the Care and Maintenance (C&M) Preparations period. In applying this screening process the

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4 m and 2 m boxes² and also the French concrete drum³ were removed from the assessment on the basis that the time to develop these containers was too great and would be highly likely to result in delays to the planned C&M entry dates. The three container options taken forward in the assessment have been categorised into two packaging and interim storage strategies:

Unshielded Packages

- **Encapsulation in stainless steel containers:** the waste would be retrieved and then immobilised by encapsulation in a cementitious matrix within an unshielded stainless steel container (3m³ box or 3m³ drum) suitable for final disposal. The packages would be stored in a shielded ILW Store. This strategy is currently being implemented at Hunterston A Site as well as elsewhere in the nuclear industry (e.g. Sellafield).

Shielded Packages

- **Conditioning in self-shielding Ductile Cast Iron Containers (DCICs):** the waste would be retrieved and then dewatered or dried⁴ in thick-walled shielded DCICs (MOSAİK or Type VI) suitable for final disposal. The waste packages would be stored in an ILW Store where shielding is provided primarily by the containers. This strategy is the current baseline for Magnox sites, except Trawsfynydd and Hunterston A.
- **Encapsulation in concrete or stainless steel self-shielding containers:** The waste would be retrieved and then immobilised by encapsulation in containers (6m³ concrete box and TRUShield containers⁵) suitable for final disposal. The waste packages would be stored in an ILW Store or an existing building with the radiological shielding provided primarily by the containers. This strategy is the baseline for some wastes at Dounreay, Harwell and Winfrith.

Option Assessment Outcome & Rationale:

A summary of the options assessment and the rationale for selection of the packaging approach is presented here. Reference 1 provides the detailed options assessment.

Firstly it should be noted that there are no proposals to change packaging strategy at Bradwell or Trawsfynydd sites. These sites are well advanced with ILW packaging operations and have existing ILW Stores. For the remaining sites, the outcome of the assessment is shown in Table 1.

² Planned to be used by Magnox during Final Site Clearance operations

³ Understood to be being considered by EDF Energy as part of preparations for decommissioning the new fleet of reactors being planned

⁴ Dependent on the waste form.

⁵ MOSAİKs may still be used in this baseline for some high dose waste streams not suitable for packaging in TRUShields. No encapsulation will be required for these waste streams.

Site	DCIC (current baseline)	Self-shielded encapsulation	Unshielded containers
Berkeley	✓	✓	✗
Dungeness A	✓	✗	✗
Hinkley Point A	✗	✓	✗
Oldbury	Either (subject to future evaluation)		✗
Sizewell A	✓	✗	✗
Wylfa	Either (subject to future evaluation)		✗

Table 1: Proposed Site ILW management baseline

A significant conclusion of the assessment was that self-shielding containers are still preferred to unshielded containers. The self-shielding container approach is preferred because of the technical complexity⁶ and significant cost associated with implementation of the unshielded approach.

Within the shielded packages strategy, different options were selected for different sites. For sites with larger volumes of ILW (Berkeley and Hinkley Point A) the self-shielding encapsulation variant was selected. For these sites any increased cost and packaged waste volume (and associated environmental impact) associated with encapsulation infrastructure is justified by the significant benefit gained from the use of lower cost containers⁷. The sites with lower ILW volumes (Dungeness A and Sizewell A) benefit from remaining with a DCIC approach because of the relatively low infrastructure costs associated with packaging and conditioning waste in DCICs.

For Oldbury and Wylfa it is proposed to defer the decision on a final packaging strategy to allow experience to be gained at lead sites (Berkeley and Hinkley Point A). This takes advantage of the relatively late C&M entry dates at these sites and can be accommodated within the overall strategy.

3.3 ILW Interim Storage

The options assessment (Ref 1) also considers ILW storage optimisation options that are available, taking account of the ILW packaging strategy outlined above. The assessment takes into account significant changes since the previous study in the

⁶ For example, with respect to the development and implementation of remote operations processes and equipment necessary to limit dose to workers from the unshielded packages.

⁷ For example, the unit cost of a Type VI DCIC is approximately £130k compared to the unit cost of a 6 m³ concrete box (which is able to contain the same, if not more waste) which is approximately £20k.

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number of ILW packages Magnox expects to produce at each of the sites, in particular package number estimates for Dungeness A and Sizewell A sites.

Reduction in package number is partly due to the application of learning from other sites (principally Bradwell), changes to the proposed approach to the management of FED (as discussed in Section 3.4) and the potential to optimise the management of some specific waste streams (for example: ILW pond skips and IONSIV cartridges).

The reduction in expected package numbers for the South East sites has a direct influence on storage strategy because it is now expected that all of the packaged waste at Bradwell, Dungeness A and Sizewell A can be accommodated in the existing Bradwell ILW store. Because this would avoid construction of another store in the south-east, the preferred option is to interim store the ILW from all three sites at Bradwell.

With respect to ILW packages originating at Oldbury, Magnox does not propose to modify the previous Preferred Option. The stakeholder feedback which Magnox and NDA received broadly supports the proposal to transfer these waste packages to Berkeley for interim storage.

For Wylfa, there is an opportunity to avoid store construction, which will be considered following further review of the site's ILW inventory. The Wylfa inventory is expected to be very small and therefore potentially suitable for either storage within the Reactor Safestore or consolidation to a site with spare interim storage capacity. This will be underpinned by a suitable characterisation programme and further strategic options assessment at the appropriate time.

In conclusion the final Preferred Option is to avoid constructing ILW Stores at Oldbury, Dungeness A, Sizewell A and Wylfa (see Figure 1). The final Preferred Option makes best use of the existing ILW Stores at Bradwell and Berkeley through transfer of waste packages to these stores on a regional basis. As previously explained in the ILW storage optimisation project Magnox believes that the significant benefits associated with avoiding construction of these stores (in terms of reduced traffic movements, direct construction impacts and cost) justify the transport of waste packages between the sites.

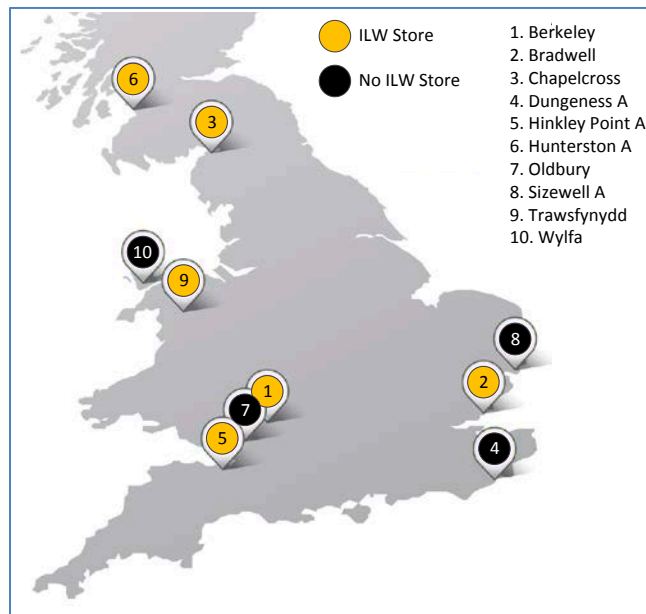


Figure 1: Location of Magnox ILW Stores

3.4 FED management strategy

The assessment of FED management strategies (Ref 2) considered a range of possible options:

- Treatment by dissolution,
- Segregate high activity components and package for LLW disposal where appropriate,
- Package for ILW disposal,
- Decay storage for LLW disposal.

The final preferred option for the management of FED is segregation of high activity components (e.g. nimonic springs) followed by direct disposal of the separated LLW FED magnox. This is a new option being developed by a joint team from Magnox and LLWR. The option performs well from safety, environmental and cost perspectives and facilitates prompt liability management. The option also supports the NDA HAW Strategy by minimising the volume of waste requiring long-term management. It is recognised that there are some technical risks associated with this new option, which are described in Section 5.2.

Where some, or all, of a site's FED inventory is not suitable for this new route (e.g. segregated higher activity components and higher activity FED Magnox not suitable for disposal at LLWR) it is proposed that this proportion of the waste is packaged for ILW disposal in the same manner as other ILW at the site.

Implementation at the site level will be informed by further detailed characterisation of the waste. Given our current understanding of the waste, the strategy would be implemented as follows:

- Oldbury and Sizewell A – segregation followed by LLW disposal,

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- Hinkley Point A – package for ILW disposal⁸.

In summary the key benefits of the proposed strategy are:

- A significant reduction in cost compared to other options offering better value to the tax payer.
- Low technical complexity, with good safety performance, minimising risk to workers.
- It provides opportunities to remove or stabilise hazards earlier.
- It delivers NDA HAW Strategy to minimise the volume of HAW requiring long-term management.
- It delivers Government policy and NDA Strategy to deliver prompt liability management where possible.

It should be noted that these conclusions have been reached taking account of the significant amount of experience which Magnox has gained through the implementation of the dissolution process at Bradwell. Magnox has every confidence that the plant at Bradwell is safe, for the both the public and worker, and it will produce discharges to the environment which are acceptable to Regulators and Magnox's own standards. However, it has been recognised that this approach has been far more technically complex and challenging to implement than first envisaged. This complexity has led to significant increases in terms of the time and cost of implementation. As such, the strategic assessment detailed in Reference 2 concludes that the benefits to be gained by dissolving FED at other sites are no longer justified by the expense and time required to implement the approach.

⁸ There may be an opportunity to divert a portion of the Hinkley Point A FED to the LLW Repository for disposal, which will be informed by further characterisation during waste retrievals.

4 Preferred Options Implications

Key Strategic Differences & Implications

In this section the key strategic differences between the Preferred Option put forward during the previous optimisation studies (Section 2) and the final Preferred Option (Section 3) are described.

4.1 ILW packaging and interim storage

At a strategic level the final Preferred Option for ILW packaging and interim storage are considered to be broadly the same as the previous preferred option. However, it is recognised that implementation of the proposed strategy may result in some noticeable differences at a site level e.g. the construction of further ILW storage capacity at Berkeley. Further detail is provided below.

4.1.1 Key Differences and Implications

1. Transfer of ILW packages from Sizewell A to Bradwell for interim storage and avoiding construction of an ILW store at Sizewell A.

This change has arisen due a combination of the following:

- The proposal to dispose of Sizewell A FED to LLWR after segregation. This change means that there will be a significantly reduced volume of ILW secondary waste, associated with FED management, requiring interim storage.
- A re-evaluation of the likely ILW package numbers that will be produced by the sites that will continue with the DCIC strategy (as discussed in Section 3.2). This work has been informed by the implementation of the DCIC strategy at Bradwell and Berkeley.

This change in the South East ILW interim storage proposal is broadly consistent with the rationale put forward to support the previous proposal for the South East sites. Specifically the final preferred option:

- Makes best use of existing facilities and avoids unnecessary construction,
- Reduces overall environmental impact,
- Significantly reduces costs,
- Does not impact on C&M entry dates.

The final Preferred Option will result in significant additional benefits (cost, environmental impact and safety) compared to the previous proposal.

2. Construction of a new ILW store at Berkeley for the storage of 6 m³ concrete boxes.

The strategic options review for Berkeley indicates that a switch to the self-shielding encapsulation approach is preferred. The intention is that the switch from a DCIC to a self-shielding encapsulation approach at Berkeley would occur at the point at which the current DCIC stocks are depleted. A consequence of adopting this approach is that a new ILW store may be required at the Berkeley site, because the existing store may not be suitable for the new waste packages. There is an opportunity to store the new 6 m³ concrete boxes in the existing ILW store, which is being investigated. The principal technical issues associated with this opportunity are the package handling arrangements (relating to the greater mass and dimensions of the 6 m³ concrete box) and store capacity.

Given the relatively large volume of ILW at Berkeley, the self-shielding encapsulation option offers a significant financial benefit (even after accounting for the cost of a new storage facility) compared to the extant baseline (using DCICs). In addition the approach offers many of the same benefits afforded by the DCIC approach, i.e. reduced shielding requirements during package handling meaning that greater flexibility can be introduced with respect to ILW management operations.

As noted above, for a number of technical reasons there remains uncertainty as to whether the existing ILW store at Berkeley will be able to accept 6 m³ concrete packages. It is proposed to adopt the following approach to manage this uncertainty: assume that a new store will be required, whilst retaining the opportunity to store the packages in the existing ILW store. In practice this means pursuing both approaches until a time when a clear way forward can be determined. A new store provides a robust and reliable way forward should use of the current store not be possible. Progressing with this assumption will reduce the risk of transition from DCIC to 6 m³ packages. However, retaining the opportunity to store the new packages in the existing store and undertaking further work to substantiate that opportunity reflects the desire of both Magnox and stakeholders to adopt the more simple solution of a single store.

Development of a new storage capability at Berkeley for 6 m³ concrete boxes would provide flexibility for Oldbury to adopt either ILW packaging strategy (DCICs or self-shielding encapsulation).

4.2 FED Management Strategy

4.2.1 Key Differences and Implications

The key strategic change in this area is that under the new preferred option there will be no transfer of FED between Magnox sites. This difference results from: a new route being established for the prompt disposal of LLW FED following segregation; and, learning from experience at Bradwell that segregation and packaging ILW FED for interim storage will have significant cost and schedule benefits over dissolution. It is noted that dissolution remains the most appropriate approach for those sites with existing facilities (Dungeness A and Bradwell). For these sites, dissolution offers significant environmental and waste hierarchy benefits and cost implications are not as significant because the capital expenditure has already been incurred.

The final preferred option for FED wastes at Hinkley Point A, Oldbury and Sizewell A delivers the majority of the benefits which were put forward for the previous preferred option in this area:

- Making best use of existing facilities (specifically the LLW Repository) and avoiding unnecessary construction (specifically further dissolution plants).
- Reducing the overall environmental impact.
- Significantly reducing costs.
- It delivers NDA HAW Strategy to minimise the volume of HAW requiring long-term management.
- It delivers Government policy and NDA Strategy to deliver prompt liability management where possible.
- It has no impact on C&M entry dates – the relatively low complexity increases confidence in delivery to time.

The final Preferred Option will result in significant additional benefits (cost, environmental impact and safety) compared to the previous optimisation proposal.

4.3 Stakeholder Considerations

A significant amount of stakeholder engagement was conducted during the previous optimisation projects. The feedback and views expressed by stakeholders have been taken into account during the development of the final Preferred Option. This feedback includes:

- That transfers should be made on a regional basis where practicable,
- Rail transport should be used for waste transfers where practicable,
- HGV movements should be minimised,
- Safety and environmental impact are important (particularly with respect to discharges to the environment),
- That opportunities for sharing of facilities between A and B sites (adjacent Magnox and EDF Energy sites) should be pursued where possible.

During engagement with the Environment Agency (EA) on the previous optimisation projects the EA were supportive of considering consolidation options. In particular, the EA promoted the adoption of options that make best use of existing facilities and reduce impacts associated with further construction (where the approaches can be demonstrated to be BAT).

There is broad alignment with the feedback identified above and the final Preferred Option. For example, the avoidance of construction of an ILW store at Sizewell A and a FED treatment facility at Hinkley Point A will reduce the number of HGV movements and the ILW package transfers required to enable the proposed ILW interim storage strategy are regional in nature.

However, a challenge is presented by the potential for building an additional ILW store at Berkeley. Should this store be required this would result in additional HGV movements and construction impacts. It is recognised that this may be unpopular with some local stakeholders. Engagement on this issue has commenced with local stakeholders and Local Authorities, who have been informed of the situation, and are generally supportive of Magnox's efforts to minimise local impacts. As noted above, work will continue on the opportunity to adapt the existing store to accept the new waste packages and avoid building a second store if at all possible.

5 Strategic Risks

The following sections outline the key strategic risks associated with the final Preferred Option. Appendix A provides a more detailed breakdown of all of the risks associated with the final preferred option, including those identified in the earlier optimisation study.

5.1 South East ILW Interim Storage Capacity

With respect to consolidation of waste from the South East sites at Bradwell, there is a risk that there will be insufficient capacity within the store. Current estimates suggest there will be sufficient space and a small amount of contingency (ca. 20 MOSAIK or 10 Type VI package spaces). However, it is recognised that there is uncertainty in the waste inventory, which could have the potential to exceed the contingency.

One of the most significant sources of uncertainty is that associated with the operation of the Bradwell FED dissolution plant. It is assumed that the plant will operate at a throughput which makes the plant's continued operation viable. However, implementing the dissolution approach has proved more difficult than expected and if the plant does not operate in accordance with its design intent, there is a risk that a portion of the Bradwell FED inventory may require interim storage in the Bradwell ILW store.

Other potential causes that could exceed store capacity include uncertainties in the waste inventory at all three sites, waste packing factors and conditioning plant performance. However, it should be noted that experience at Bradwell suggests that it is more likely that ILW package numbers will reduce rather than increase.

A contingency option for managing exceedance of capacity at Bradwell could be building an ILW store at Sizewell A⁹. Alternatively spare capacity at other Magnox stores could be utilised.

5.2 LLWR are unable to accept LLW FED

The final Preferred Option relies on the availability of a disposal route for LLW FED to LLWR. Whilst there is a joint-SLC project between Magnox and LLWR to open this route, it is recognised that there are some key technical issues still to be addressed (e.g. packaging; segregation). A programme of work is underway to provide greater confidence in the viability of this route. This confidence is illustrated by the recently received 'letter of comfort' from LLWR on this issue which is positive on the development of the route and details the remaining issues to be resolved (Ref 7).

However, should this route not become available then this would impact upon the new strategy, with the next best performing option being packaging for ILW disposal. This would be particularly significant at Sizewell A. For Sizewell A, an ILW packaging strategy would result in the generation of a large additional number of packages. For example were the FED to be packaged into DCICs (in-line with the

⁹ Noting that this site would be chosen over Dungeness A on the basis of better alignment with the previous proposals made in the ILW interim storage optimisation study. Also this would offer the opportunity to continue to pursue a co-storage approach with EDF Energy at Sizewell.



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rest of the sites' waste) *ca.* 170 waste packages would be produced with an additional cost of *ca.* £22M purely in terms of container cost. Should LLW FED disposal not become available, there would be a need to revisit the ILW packaging and interim storage strategy for Sizewell A.

6 Further Stakeholder Engagement

A Communications Plan has been developed (Ref 8). The first engagement with SSG/LCLC Chairs occurred on the 18th December 2014 and was very constructive. Following this a variety of engagement activities have taken place, including presentations at SSG/LCLC meetings¹⁰, public meetings and also meetings with affected Local Authorities¹¹. A number of the individual aspects of the proposals (e.g. transferring packaged ILW from Oldbury to Berkeley) will likely require planning applications with statutory public consultations as part of the determination process in each case.

Magnox and the NDA Communications team will work together in further development and delivery of the Communications Plan. Approval has been sought and received from NDA Communications Team to implement the plan developed thus far.

¹⁰ These meetings occurred between the end of January and beginning of March 2015. Full details are available in the Magnox Communications Plan.

¹¹ Preliminary meetings with affected Local Authorities have occurred during January and February 2015.

7 Conclusion

A final Preferred Option has been identified and the reasons for adopting this option assessed. The final preferred option can be summarised as follows:

ILW Packaging - The table below summarises the proposals for each site:

Site	DCIC (current baseline)	Self-shielded encapsulation	Unshielded packages
Berkeley	✓	✓	✗
Dungeness A	✓	✗	✗
Hinkley Point A	✗	✓	✗
Oldbury	Either (subject to future evaluation)		✗
Sizewell A	✓	✗	✗
Wylfa	Either (subject to future evaluation)		✗

ILW Interim Storage – use of alternative waste management routes and consolidation where appropriate will avoid building ILW stores at Dungeness A, Sizewell A, Oldbury and Wylfa. To enable this ILW package transfers are proposed to existing ILW stores; in the South East to Bradwell; and in the South West to Berkeley.

FED management – segregation and prompt disposal of LLW FED from Sizewell A and Oldbury to LLWR. Packaging of Hinkley Point A FED for ILW disposal.

The differences between the final preferred option and the previous proposals put forward during the ILW interim storage and FED treatment optimisation projects have been identified and addressed. It is considered that, on balance, the final Preferred Option offer significant additional benefits compared to both the previous optimisation proposals and the extant baseline.

Appendix A – Strategic Risks

No.	Risk	Cause	Likelihood	Strategic Consequence	Mitigations	Strategic Tolerance	Significant dates
1	There is insufficient space within the existing Bradwell ILW store to accommodate all of the ILW packages produced by the South East Sites	The most significant sub-risks which could cause realisation of the broader risk are: 1. That the Bradwell FED dissolution plant does not perform at an acceptable throughput rate meaning that some Bradwell magnox FED is packaged for ILW disposal. 2. That the proposal to dispose of some/all of the Sizewell A magnox FED to LLWR is not deliverable (see risk 2 below) meaning that some/all of the magnox FED is packaged for ILW disposal. 3. That there is significantly more ILW requiring packaging for disposal at the South East sites than reported in the waste inventory.	1. Low - Magnox has limited confidence that the dissolution plant will deliver an acceptable throughput rate based on current project information. In addition the first mitigation in the event of this occurring is to package for LLW disposal. 2. Low – opening a new disposal route has some inherent risks however Magnox's judgement is that these risks are within the control of Magnox and LLWR and can be resolved. 3. Low – there is inherent uncertainty associated with the waste inventory data for all sites. However, Magnox experience to date indicates that the waste inventory is generally pessimistic.	Note that spare store capacity available for ca. 40 MOSAIK or 20 Type VI packages. 1. High – ca. 44% of the Bradwell magnox FED is currently assessed to be suitable for LLW disposal. Should the remaining 56% require packaging for ILW disposal this would produce ca. 45 Type VI packages. 2. High – should Sizewell FED require packaging for ILW disposal this would produce ca. 170 Type VI packages. 3. High – any increase greater than 40 MOSAIK or 20 Type VI packages will exceed spare capacity.	1. Establish a project to dispose of Bradwell LLW FED to LLWR. 2. Joint working arrangement established with LLWR to ensure that priority is given to this work. 3. A prioritised characterisation programme should be implemented. <u>All sub-risks:</u> Develop contingency plans which would include: A. Developing shared storage plans with Sizewell B Site.	The strategy is robust up to an increase in package number by: 40 MOSAIKs or 20 Type VIs	1. Early 2015 – the Bradwell dissolution plant is expected to enter into full operations providing underpinning for throughput assessments 2. Jan/Feb 2015 – LLWR scheduled to provide a Letter of Compliance to Magnox providing assurance for disposability of Magnox FED to LLWR. 3. This uncertainty will reduce over time as waste retrievals will enable further characterisation.
2	The disposal of FED to LLWR is not possible for some/all of the Sizewell A and Oldbury magnox FED.	There are a number of technical sub-risks associated with demonstrating that magnox FED can be segregated and packaged in a manner which meets the requirements of the LLWR WAC. These sub-risks include failure to meet the LLWR WAC due to: 1. High dose rate items (HDRIs) missed via the segregation process. 2. Irradiated fuel fragments and particles missed via the segregation process. 3. The overall waste-form being consigned exceeds the hydrogen evolution and inaccessible voidage limits.	1 & 2. Low – • Magnox has successfully demonstrated that HDRIs can be segregated from magnox FED at Bradwell and Dungeness A (sites with a similar number of HDRIs to Sizewell A). • In-active trial work completed to underpin the segregation of Hinkley Point A FED (the FED in the Magnox fleet with the greatest number of included HDRIs). This work provides Magnox and LLWR with additional confidence that HDRIs and fuel fragments can be segregated from magnox FED to the required level. • Technical assessment produced which demonstrates that any missed HDRIs or fuel fragments/particles will comply with the LLWR WAC. 3. Low – In-active magnox FED packaging trials have been conducted providing Magnox and LLWR with confidence that a compliant packaging approach can be demonstrated.	<u>Sizewell A:</u> High – as described for risk 1 the need to package magnox FED for ILW disposal will impact upon the ILW interim storage strategy for the South East sites. <u>Oldbury:</u> Medium – packaging all of Oldbury magnox FED for ILW disposal would produce ca. 245 Type VI packages or ca.120 6 m ³ concrete boxes. Whilst this may make delivery of the strategy more difficult, such a package number increase could be accommodated depending on the availability of storage capacity at Berkeley.	<u>All sub-risks:</u> Develop contingency plans which would include: To package magnox FED that cannot be demonstrated to meet the LLWR WAC for ILW disposal. Then to modify the ILW interim storage strategy and implementation to accommodate the associated increase in ILW package numbers	The strategy wrt. FED management will remain robust. However this risk will impact the ILW interim storage strategy, particularly at Sizewell A & Bradwell and Oldbury & Berkeley. The impact upon Berkeley is most pressing as there is a requirement to begin design work on a new storage facility during FY 2015/16.	<ul style="list-style-type: none"> January 2015 – Inactive magnox FED packaging trials report due for completion. Jan/Feb 2015 – LLWR scheduled to provide a Letter of Compliance to Magnox providing assurance for disposability of Magnox FED to LLWR.
3	That it is not	Further delays in GNS (the DCIC	Low – GNS have indicated that a new	Go/No go issue.	To develop a Type B overpack for	Should a Type B	<ul style="list-style-type: none"> February 2015 – GNS

No.	Risk	Cause	Likelihood	Strategic Consequence	Mitigations	Strategic Tolerance	Significant dates
	possible to obtain (in a timely manner) the necessary Type B transport licences (principally for the MOSAIK DCIC) to implement the proposed waste transfers.	supplier) obtaining the necessary re-licencing in Germany. Noting that Type B licences have previously been approved by the German Regulator for the MOSAIK container.	Type B licence should be available before the end of the 14/15 FY.	That the wastes at Dungeness A, Sizewell A and Oldbury which require a Type B container cannot be transferred to their respective interim storage sites.	the MOSAIK containers. For Oldbury only - to transfer the waste in another Type B approved container and then to package into a disposal container at the interim storage site (Berkeley). ¹²	licence not be obtained and the mitigations not be successful by early 2016 then the proposed strategy for ILW interim storage will not work and stores will be required at all of the sites.	provide new Type B licence for the MOSAIK container.
4	That it is not possible to obtain the planning consents necessary to implement the proposed waste transfers.	The most likely cause of this risk is adverse public/media reaction to the proposals leading to rejection of the planning application.	The likelihood varies dependent on the site and the understood position of the stakeholders. <u>Berkeley</u> - Medium <i>Consent required for import of Oldbury ILW packages for storage and potentially for construction of additional storage capacity.</i> Minimal reaction can be expected to the importation of Oldbury ILW packages. Strong reaction can be expected to the construction of further storage capacity. <u>Bradwell</u> - Medium <i>Consent required for import of Dungeness A and Sizewell A ILW packages for storage.</i> Some reaction expected for example due to concerns regarding HGV movements from the Southminster railhead to the site.	Go/No go issue. The waste cannot be imported for interim storage at either Berkeley or Bradwell.	Early and continued engagement with the relevant Local Authorities. Early and continued engagement with the Site Stakeholder Groups. Media engagement as necessary with lines-to-take developed.	Should necessary planning consents not be obtained by early 2016 then the proposed strategy for ILW interim storage will not work and stores will be required at all of the sites.	<ul style="list-style-type: none"> January-March 2015 preliminary engagement with Local Authorities and Site Stakeholder Groups regarding final Preferred Option.

¹² Note that this mitigation is not considered to be available for the sites in the South East as Bradwell will have already completed ILW packaging and conditioning (and be in a Care and Maintenance state) prior to Dungeness A and Sizewell A waste being received at the site.



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References

1 Strategic Options Assessment Study: ILW Packaging and Interim Storage Strategy; SCOPE: Sites: English and Welsh Magnox Sites (excluding Trawsfynydd), WASTE STREAMS: All Operational ILW Requiring Packaging for Interim Storage, M/WF/GEN/REP/0013/14, March 2015.

2 Fuel Element Debris (FED) Strategic Options Assessment Study; Sites: Hinkley Point A (9D33-34, 9D39-44, 9D67-70), Oldbury (9E24-28, 9E40-43) and Sizewell A (9F20-22, 9F43), M/WF/GEN/REP/0003/13, March 2015.

3 Optimising the Number and Location of FED Treatment Facilities and ILW Storage Facilities on Magnox Limited Sites, Issue 2, May 2014.

4 Optimising the Number and Location of Interim ILW Storage Facilities on Magnox Limited and EDF Energy Sites in England and Wales - Credible Options (Stage A). Issue 1. May 2013.

5 Optimising the Number and Location of FED Treatment (Dissolution) Facilities in Magnox Limited - Credible Options (Stage A). Issue 1. May 2013.

6 Optimisation and Options Assessment During Operations, Decommissioning and Radioactive Waste Management, Magnox Company Standard S-391, Issue 3, August 2014.

7 Letter to Waste Programme Director, Magnox Ltd from Head of Science and Engineering, Low Level Waste Repository Site, 23/01/2015,

8 Magnox ILW Strategy Change Communications Plan, December 2014.