Nuclear Decommissioning Authority

Optimising the number and location of FED Treatment (Dissolution) Facilities in Magnox Limited

Credible Options

Main Paper

May 2013

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Contents

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Executive Summary

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 locations[1]. The consolidation of Fuel Element Debris (FED) treatment by dissolution offers a significant opportunity of this nature.

Therefore, Magnox Limited (hereafter known as 'Magnox) is reviewing the case for consolidating the treatment of Magnox Fuel Element Debris (FED) through the use of shared facilities. Specifically, the project aim is:

> ***"To establish the most appropriate location or locations for treating Fuel Element Debris (FED) currently stored at Hinkley Point A, Oldbury and Sizewell A sites."***

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).

In this study a long-list of 15 possible options has been identified and is presented.

Because all of the long-list options are technically feasible, lawful (provided the necessary consents are first obtained) and could be implemented within the constraints of the Magnox Optimised Decommissioning Programme (MODP), the approach to the screening exercise was to eliminate long-list options that on balance are clearly sub-optimal on those safety and environmental factors which were identified as important to stakeholders during a workshop held on 12th - 13th February 2013.

Based on the application of the screening process, the long-list of options has been reduced to a shortlist of nine credible options. This document provides this credible options list, with a summary of reasons for screening out other options.

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

1 Introduction

1.1 Purpose

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 locations [Ref. 1]. The consolidation of Fuel Element Debris (FED) treatment by dissolution offers a significant opportunity of this nature.

Therefore, Magnox Limited (hereafter known as 'Magnox') is reviewing the case for consolidating the treatment of Magnox FED through the use of shared facilities. Specifically, the project aim is:

> ***"To establish the most appropriate location or locations for treating Fuel Element Debris (FED) currently stored at Hinkley Point A, Oldbury and Sizewell A sites."***

This study is being undertaken following the NDA's Strategy Management System (SMS) [2]. 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).

1.2 Background

Fuel Element Debris (FED) consists of the splitters or lugs[3] removed from Magnox fuel elements before the spent fuel is sent to Sellafield for reprocessing. The fuel casing, including the splitters / lugs, used in Magnox reactors is a magnesium alloy. Although the specific alloy used is non-oxidising (from which the Magnox reactors derive their name), magnesium is inherently a reactive metal.

The baseline plan for FED is for each site to manage their own wastes on their own site. For each of the three sites within the scope of this study, treatment by dissolution was identified as the preferred approach within site-specific Best Practicable Environment Option (BPEO) studies. In each case, the preferred option was found to be robust within the sensitivity analyses undertaken.

Through treatment with acid, FED dissolution produces a non-reactive waste, reducing the solid waste volume by more than a factor of 20 whilst retaining more

[2] This work will utilise NDA's Value Framework process [Ref. 2]. The study will also address the Environment Agency's (EA's) optimisation (Best Available Techniques (BAT)) requirements under environmental permitting regulations. As such, the study takes account of the Nuclear Industry Code of Practice (NICoP) on BAT [Ref. 3].

[3] Essentially "fins" that optimised in-reactor fuel element cooling during generation.

than 85% of the radioactivity in residues that will be managed along with other ILW wastes at the site.

The reduction in solid waste volumes has the knock-on effect of reducing the size of store required for interim storage of ILW though it does lead to some discharges of radioactive and non-radioactive by-products to the environment. All such discharges have to be both minimised and authorised under the environmental permitting regulations.

1.3 Scope

This study only considers which are sites are the best locations to treat FED by dissolution and does not consider the choice of technology for doing so i.e. the type of any new dissolution plant.

The FED in scope is that currently stored at Hinkley Point A, Oldbury, and Sizewell A (Table 1).

Table 1. Summary of Waste Considered to be in Scope

Site	Raw Magnox FED (tonnes)[4]
Hinkley Point A	261
Oldbury	144
Sizewell A	134

Bradwell site FED is not included in the scope of the study because Bradwell is well-advanced in implementing dissolution of its own FED on its own site in line with its accelerated Care & Maintenance programme. Dungeness A FED is also not included as the site has recently completed its own dissolution on-site.

The baseline plan for the remaining sites with a significant amount of Magnox FED waste, namely Berkeley, Hunterston A and Trawsfynydd, is packaging for long-term storage and disposal without the prior application of dissolution. Dissolution is not considered to be an appropriate treatment for FED at these sites due to progress in the construction of interim waste storage facilities and because much of the FED currently stored at Berkeley and Hunterston A is mixed or contaminated with other waste types, making dissolution technically difficult.

Other nuclear operators either do not generate FED in the first instance (e.g. EDF Energy), or else the FED that they hold is unlikely to be suitable for treatment by dissolution (e.g. Sellafield). Therefore, no FED generated or held by other operators falls within the scope of this study.

[4] Excluding vault sludges. In the case of Hinkley Point A, this would add around 36 tonnes.

2 Case for Change

2.1 Current Position

The baseline plan for the Magnox FED at all of the sites in scope is treatment of the FED by a process of dissolution on the site of origin.

2.2 Reason for Review of Approach

Within the Higher Activity Waste section of NDA Strategy (2011) [Ref. 1], NDA commits to investigate opportunities to share waste management infrastructure across the estate. The consolidation of Magnox FED treatment by dissolution offers a significant opportunity of this nature.

Further to this, support for the investigation of consolidation of waste treatment has been expressed previously by the EA particularly in relation to the dissolution of FED material[5]. Even outwith any consolidation opportunities, some review of the location of dissolution facilities is required to address the EA's optimisation (BAT) requirements.

The following sub-sections outline potential reasons for change associated with this opportunity.

2.2.1 Potential Safety and Environmental Benefits

The implementation of a shared approach to FED treatment has the potential to offer benefits in safety and environmental terms. The following provides a short summary of these. This list is not intended to be exhaustive and it is possible that additional benefits will be identified by the project as the options become further developed and explored:

- Consolidation of facilities would result in reduced facility construction which could avoid the use of a large amount of materials primarily concrete and steel and associated energy; in turn this would reduce the volume of waste generated from decommissioning and plant demolition.
- With fewer plants being built the risks associated with construction and demolition to both people and the environment are reduced.
- Whilst it is considered that the discharge environments at the sites considered are all suitable for the receipt of the aqueous discharges associated with dissolution, some environments may be considered better suited than others.

[5] The introduction of the EPR 2010, allows the transfer of radioactive waste to any site where the operator of that site holds an environmental permit to accumulate or dispose of the relevant waste type. This will be subject to a BAT assessment.

Implementation of a shared facility approach would have an impact upon both non-radioactive and radioactive discharges. Whilst the total volume and amount of activity which would be discharged across the company would not increase, it is recognised that the distribution of these discharges across the affected sites would change. As noted, this change could represent an overall environmental benefit, particularly with respect to aqueous discharges. However such a change in discharge distribution could result in a longer period of discharge at the recipient site(s).

In achieving the safety and environmental benefits described above, there would be the need to transport the FED material between sites, and also the potential requirement for greater buffer storage capacity. These potential detriments and any others identified are being investigated to determine whether, on balance, consolidation of FED treatment by dissolution offers an overall benefit.

2.2.2 Economic Benefits

The implementation of a shared facility approach could offer significant economic benefits in terms of overall programme cost savings. Any saving is likely to be achieved principally through a reduction in design, construction, commissioning and decommissioning costs. The potential to optimise consumable and energy usage during operations may also lead to a cost saving.

An estimation of the cost of implementation of the options has been made. The costs of implementation of the options range from an estimated £85M (for the least expensive option) to £150M (for the most expensive option). It should be noted that waste retrieval and dissolution facility operations costs remain the same regardless of which option is implemented as these costs are directly proportional to the amount of FED waste and not the location at which it is treated. It is recognised that options which involve inter-site transfers will incur some additional costs associated with transport.

2.2.3 Strategic Benefits

Strategic benefit may be realised from the ability to manage the FED treatment programme in a coordinated manner to optimise the throughput, thus increasing the operational flexibility across all the sites involved. For example, this would allow for outages / maintenance of sites' retrieval plants to be planned and therefore not affect the shared facility operations i.e. due to up-take of spare capacity from another donor site.

Stage B of this project will investigate these and other strategic benefits that could result from a shared facility approach; for example, whether it would provide the opportunity to bring forward waste retrievals and therefore hazard reduction (this in turn may lead to the ability to accelerate other interdependent projects, such as FED vault or active effluent management plant decontamination and demolition).

2.3 Risks & Constraints

2.3.1 Assumptions

There are a number of assumptions which have been identified at this stage of the project:

- It is assumed that all new FED treatment plants will be as the Bradwell design.
- It is assumed that the 2010 UK Radioactive Waste Inventory provides a reasonable estimate of the volume and radioactive content of the FED waste considered in this study.
- It is assumed that the transport of ILW FED in compliance with transport regulations is feasible.
- It is assumed that necessary discharge authorisations can be obtained.

2.3.2 Constraints

There are a number of constraints which have been identified at this stage of the project. The most significant of these relates to the fact that there is a limited 'window of opportunity' which exists within the current programme to allow for the investigation of this opportunity before significant funds are spent on implementation of the site-centric baseline.

No site constraints have been identified at this stage of the assessment that would affect the outcome (e.g. the lack of available space for the facilities). This will be considered further during Stage B of this options assessment process.

2.3.3 Risks

Dissolution itself carries some risk in terms of the ability of the process to deliver the required throughput. However, this risk will diminish as more experience of the dissolution process is obtained at Bradwell.

The primary risks to the successful delivery of any proposal other than the baseline that have been identified at this stage are the following:

- Acceptance of the justification supporting implementation of the preferred option by local authorities, the EA, and Office for Nuclear Regulation (and the Radioactive Materials Transport Team (RMTT)).
- Potential for increased consequences of plant breakdown.
- Key assumptions and data used in the options assessments are found to be invalid at a later stage. For example if there is a significant change in the known volume or radioactive content of the FED waste.

- That options otherwise preferred may involve significant scheduling conflicts with other waste management or decommissioning projects, such as other ILW processing operations or vault post-operational clean-out (POCO). This will be considered further during Stage B of this options assessment process.

2.4 Stakeholder Engagement

Magnox has a strong presence with regulators, and local and national stakeholders. Stakeholder engagement is continuous with a strong focus on creating, maintaining and building upon relationships through open dialogue and proactive engagement. As the project develops, Magnox will endeavour to maintain and build upon stakeholder relations through honest and transparent communications.

It is clear that a project of this nature will require engagement with a wide variety of stakeholders to determine the acceptability or otherwise of the preferred option and, therefore, the degree of confidence that the outcome is deliverable.

To date there have been a number of stakeholder engagement activities already undertaken. These have included letters, attendance of project team members at some SSG meetings / sub-group meetings, regulator meetings and a workshop held in London on 12th – 13th February 2013[6]. These have provided an opportunity for Magnox to take into account the views of stakeholders on a number of safety and environmental issues as an input into the option screening process that is presented here.

[6] The scope of this workshop also included consultation on the separate issue of ILW storage optimisation.

3 Credible Options Assessment

3.1 Overview

In line with the NDA's SMS process [Ref. 2] and the Nuclear Industry Code of Practice on Best Available Techniques (BAT) [Ref. 3], a staged and proportionate approach to the assessment of potential options is being undertaken, described below[7].

OVERALL PROCESS FOR THE METHODOLOGY ADOPTED IN THIS ASSESSMENT		
STAGE A	Set Study Objectives	A clearly defined purpose / objective needs to be identified supported by a well-defined scope (described in Section 1.1 & 1.3).
	Define Study Constraints	Define the bounding constraints that would prevent or affect the delivery of an option achieving the overall objectives (Section 2.3).
	Identify Long-List Options	Produce a wide-ranging list of feasible options that can be considered to achieve the goals of the study (Appendix A).
	Screen Long-List Options	The identified options should each be screened against the study constraints or other screening criteria to determine which should be taken forward to the next stage (Section 3.2 - 3.6).
STAGE B	Evaluate Short-List Options	The options should be evaluated to determine the benefits and detriments of each option and allow comparison.
	Identify Preferred Option(s)	The process will draw together the relevant conclusions and recommendations.

[7] Principle 4 of the Environment Agency's Regulatory Environmental Principles states that, "The best available techniques should be identified by a methodology that is timely, transparent, inclusive, based on good quality data, and properly documented."

3.2 Long-List of Options

A long-list of 14 options was generated within five high level categories:

- Baseline option – each site has its own treatment plant.
- Regional options – transfers may happen between sites on a regional basis.
- Consolidation of lower volume FED sites only (i.e. Oldbury and Sizewell A FED processed at the same location).
- Minimisation of future plants (not included in categories above) – two new plants.
- Minimisation of future plants – one new plant.

Most of the options involve the construction and use of new plants that do not yet exist, these being located at one or more of the Hinkley Point A, Oldbury, Sizewell A and Dungeness A sites. In some options, FED from Sizewell A is transferred for processing at the existing dissolution plant at Dungeness A. The full long-list of options is given in Appendix A.

These options were discussed at a stakeholder meeting on 12th - 13th February 2013[8]. Stakeholders were given the opportunity to add further options and a number of suggestions were made[9]. Magnox has subsequently considered these suggestions, resulting in the addition of one further option to the list: that Hinkley Point A has its own new plant for treating its own FED and that there is a new plant at Dungeness A for treating FED from Sizewell A and Oldbury.

There are two potential long-list options that have been suggested by stakeholders which are not being taken forward. These are:

i. Use of the Bradwell dissolution plant that is currently under construction as a single facility option; and
ii. Use of the existing Dungeness A carbonic acid plant as a single facility option.

The first of these would involve the Bradwell site continuing to undertake operations after its planned entry into Care and Maintenance (C&M). Magnox does not wish to pursue this option as the undertaking of active operations over a number of years is not consistent with the concept of C&M. In addition whilst the short-term impacts of discharges have been deemed to be acceptable (and the relevant permit obtained), the Bradwell site is sub-optimal in terms of longer term environmental impacts, as would occur if Bradwell was used as a shared plant. For this reason, the Environment Agency has stated that the continued use of the Bradwell site in this way would

[8] Stakeholders at this meeting included Site Stakeholder Group / Local Community Liaison Committee members; representatives from local authorities; the regulators, the NDA and also the Industry.
[9] Details of the additional options suggested and Magnox's consideration of these are available on request.

require strong justification. It is intended that components from the Bradwell dissolution plant will be re-used elsewhere where practicable.

The use of the existing Dungeness A plant as a single facility is not being taken forward by Magnox due to limitations on its throughput rate: to process the FED from all three potential donor sites would take circa 40 years and again require sites to be operating within their Care and Maintenance periods. Therefore, within the long-list options the use of the Dungeness A carbonic plant is considered for Sizewell A FED only; this is because it is a relatively small volume which is located in the same broad region of the UK.

3.3 Value Framework Compliance

The attributes which were used to perform the option screening are consistent with the NDA Value Framework process [Ref. 2]. Table 3 provides a summary of the high-level Value Framework attributes and shows at which stage of the project these attributes are/will be considered and the level of detail of the assessments conducted to support Stage A.

Table 3. Value Framework Attribute Compliance Assessment

Value Framework Attribute	Used in Stage A?	To be used in Stage B?	Stage A Specific Attributes
Safety	✓	✓	Public dose Worker dose Public conventional safety Worker conventional safety
Environment	✓	✓	Material use Waste arisings Carbon dioxide emissions Disturbance Aqueous discharges Aerial discharges
Hazard Reduction	×	✓	
Security	×	✓	
Socio-economic	×	✓	
Cost	×	✓	

3.4 Identification and Application of Screening Criteria

3.4.1 General Approach

The screening of the options to reduce the long-list of options to a shortlist of credible options took place by means of an Options Assessment Panel (OAP) on 13th March 2013. The screening meeting involved radioactive waste management consultants, radiological safety experts, an industrial safety expert and environmental specialists.

Because all of the long-list options are technically feasible, lawful (provided the necessary consents are first obtained) and could be implemented within the constraints of the Magnox Optimised Decommissioning Programme (MODP), the approach to the screening exercise was to eliminate long-list options that on balance are clearly sub-optimal on those safety and environmental issues which were identified as important to stakeholders during the workshop of 12th - 13th February 2013. The methodology is described further below.

3.4.2 Safety and Environmental Factors

It is considered that all of the relevant safety and environment factors relate to three issues: construction; transport of radioactive waste; and the suitability of the receiving environment for discharges. These are discussed in turn below.

The options that involve more new dissolution plants 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 (with associated risk of accidents; carbon dioxide emissions etc.)

However, options which involve fewer new dissolution plants require more transport of radioactive wastes, leading to increased:

- Public and worker radiation exposure (note that implementation of any of the options would not give rise to doses which would challenge relevant legal limits)
- Risk of accidents (from transport)
- Carbon dioxide emissions

Options which involve moving FED from the site on which it originated for processing elsewhere (e.g. to reduce the number of new plants required) have the potential to result in lesser or greater environmental impacts as a result of radioactive or chemical discharges, depending on the receiving environment.

In order to achieve the best overall balance of these issues referred to above, it is necessary to decide which of these should be most important in the decisions to be made.

3.4.3 Safety and Environmental Factors Identified as Important by Stakeholders

Stakeholders' views were sought at the February workshop to identify the safety and environmental issues considered to be the most important for use in an exercise to

screen the long list of options. The specific issues considered most important by stakeholders (in no particular order) were:

- Public individual and collective dose from the transport of radioactive waste.
- Public individual and collective dose from radioactive discharges.
- Worker collective dose[10].
- Public conventional safety from transport of radioactive waste, and construction and demolition materials.
- Worker conventional safety – construction and demolition.
- Disturbance caused directly by on-site construction and demolition activities.
- Disturbance by HGVs.
- Nitrates discharges to the marine environment.
- Sensitivity of the locality to emissions.

The screening exercise considered the overall performance of all the issues listed above in order to remove sub-optimal options, leaving a list of credible options to be taken forward for more detailed assessment during Stage B.

"Other factors" identified by stakeholders as being of importance, such as cost and stakeholder acceptability, will be considered during Stages B and C of this project.

3.4.4 Screening Methodology

For each attribute information on the relative performance of the long-list options was provided to the OAP. This allowed the OAP to rate the performance of each long-list option against each attribute as being (relatively) good, average or sub-optimal (see Appendix B for details). By inspection, it was then possible to determine which long-list options should be rated overall as sub-optimal on the safety and environmental issues of most importance to stakeholders.

Using this approach required a number of sensitivity analyses to be undertaken to ensure that the outcome of the screening process was robust. These included re-scoring under the assumption that FED material would be transported by rail instead of road, using alternative measures for public individual dose or the impact of nitrates discharges, or the removal of (some) individual attributes.

3.5 Options Screened Out

It was found that six options, shown in Table 4, were clearly sub-optimal to the other nine options, and that this was robust in the sensitivity analysis.

In Table 4 each row represents one possible option and each column is a potential host site. For example, in option 2c there is a dissolution facility at Oldbury (for Oldbury and Hinkley Point A FED) and also a facility at Sizewell A (for Sizewell A's own FED).

[10] For use in screening as a surrogate for industrial safety.

Table 4. Sub-Optimal Option List

Option ID	Dissolution Facility Host Sites			
	Hinkley Point A	Oldbury	Sizewell A	Dungeness A
2c		Oldbury FED Hinkley Point A FED	Sizewell A FED	
2d		Oldbury FED Hinkley Point A FED		Sizewell A FED (using existing carbonic plant)
4a		Oldbury FED	Sizewell A FED Hinkley Point A FED	
5b		Oldbury FED Hinkley Point A FED Sizewell A FED		
5c			Sizewell A FED Hinkley Point A FED Oldbury FED	
5d				Hinkley Point A FED Oldbury FED Sizewell A FED (using new nitric plant)

Options 2c and 2d both involve the transfer of FED from Hinkley Point A, which of the three donor sites has the largest volume of FED material and the highest levels of radioactivity, to a new plant at Oldbury, which has the least favourable aquatic dispersion characteristics of the sites considered.

Option 4a involves the transfer of the FED from Hinkley Point A to a new plant at Sizewell A. This involves the transfer of the largest volume of FED material with the highest levels of radioactivity over the greatest distance of all the options considered. The location at Sizewell A also has poorer dispersion characteristics than the location at Hinkley Point A, a lower (i.e. more challenging) Environmental Quality Standard for nitrates, and a higher collective dose per unit of radioactivity released.

Options 5b, 5c and 5d are all single site options, again involving the transfer of the largest volume of FED material and the highest levels of radioactivity to other locations, and are not favourable for similar reasons to those given above in relation to options 2c, 2d and 4a. In addition, Dungeness A and Sizewell A are ecologically sensitive locations, and thus to locate a new nitric plant at these locations might require more mitigation and / or more complex arguments to demonstrate that the environmental impacts would be acceptable. That said, the baseline for Sizewell A

would have to address this regardless of whether FED from any other site is transferred there for processing.

3.6 Credible Option List

The remaining options are given in Table 5. In this table each row represents one possible option and each column is a potential host site. For example, in option C there is a new treatment plant at Hinkley Point A which would be used to treat FED from that site and also from Oldbury, and another new treatment plant at Sizewell A. Option H is the same as regards Hinkley Point A and Oldbury, but in this option Sizewell A FED would be transferred for processing at the existing treatment plant at Dungeness A. As a further example, in option E there is one new plant at Hinkley Point A and another new plant at Dungeness A, in the latter case that plant being used to process FED from the Oldbury and Sizewell A sites.

The baseline option of each site treating its own FED remains (option A), and one option remains that involves all FED in scope being treated at a single location (option I). In between these, there are a number of options that variously include elements of regional and cross-regional transfer; low volume consolidation; and use of the existing plant at Dungeness A.

Table 5. Credible Options List

Option ID	Option Type	Number of Locations	Number of New Plants	Dissolution Facility Host Sites			
				Hinkley Point A	Oldbury	Sizewell A	Dungeness A
A	Baseline	Three	Three	Hinkley Point A FED	Oldbury FED	Sizewell A FED	N/A
B	Regional	Three	Two	Hinkley Point A FED	Oldbury FED		Sizewell A FED (using existing plant)
C	Regional	Two	Two	Hinkley Point A FED Oldbury FED		Sizewell A FED	
D	Cross-regional	Two	Two	Hinkley Point A FED Sizewell A FED	Oldbury FED		
E	Cross-regional	Two	Two	Hinkley Point A FED			Sizewell A FED & Oldbury FED (using new plant)
F	Cross-regional	Two	Two	Hinkley Point A FED	Oldbury FED Sizewell A FED		
G	Cross-regional	Two	Two	Hinkley Point A FED		Sizewell A FED Oldbury FED	
H	Regional	Two	One	Hinkley Point A FED Oldbury FED			Sizewell A FED (using existing plant)
I	Cross-regional	One	One	Hinkley Point A FED Oldbury FED Sizewell A FED			

Increasing Number of New Plants

Note that for simplicity the options have be re-numbered and therefore no longer reflect the options ID numbers in the long-list of options.

The baseline option (FED treatment plants at all three sites) performs relatively poorly on worker conventional safety and on disturbance from construction and demolition activities, as these attributes are a function of the number of plants constructed and this is the only option requiring three new plants. However, it is the only option that does not involve the off-site transport of any FED material with the associated impacts that brings, and therefore performs well on all issues relating to this. For this reason, on balance, the baseline option is not screened out.

At the other end of the range of options, only one single site option remains after the screening exercise. This is Option I – all FED is treated at a new plant located at Hinkley Point A. This performs better than the other one location options because Hinkley Point A is where the largest volume and most radioactive FED is located. It also has relatively good dispersion characteristics and performs well on issues relating to this, for reasons given earlier in this paper.

In addition there are a number of options which have not been screened out which involve one or two new plants. These perform relatively well overall due to not requiring as much construction as the baseline option, and not requiring as much off-site transport of radioactive waste as some of the other options. In addition, the majority of the FED remains at the "better" location with regards to discharge issues.

3.7 Delivery Plan

3.7.1 Stakeholder Engagement Plan

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). As in Stage A, stakeholders will have an opportunity to provide input into the assessment in a workshop. This 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.

3.7.2 Options Assessment Plan (for Stage B)

To compare the remaining options it is proposed that the assessment process is constructed as described below. Options are placed into the following groupings, reflecting the objective of the study given in Section 1.1.

Category 1. One location is required for the FED plant.	Category 2. Two locations are required for the FED plant.	Category 3. Three locations are required for the FED plant.
Option I Hinkley Point A (Sizewell A) (Oldbury)	**Option C** 1) Hinkley Point A (Oldbury) 2) Sizewell A	**A Baseline** 1) Hinkley Point A 2) Sizewell A 3) Oldbury
	Option D 1) Hinkley Point A (Sizewell A) 2) Oldbury	**Option B** 1) Hinkley Point A 2) Oldbury 3) Dungeness A (Sizewell A processed through the existing carbonic plant)
	Option E 1) Hinkley Point A 2) Dungeness A (Sizewell A & Oldbury processed through a new nitric plant)	
	Option F 1) Hinkley Point A 2) Oldbury (Sizewell A)	
	Option G 1) Hinkley Point A 2) Sizewell A (Oldbury)	
	Option H 1) Hinkley Point A (Oldbury) 2) Dungeness A (carbonic) (Sizewell A)	

To compare the remaining options it is proposed that the assessment process first identifies the lead option in each category (this will take into account project cost and schedule factors in more detail, and other local characteristics such as the nature of the roads around the sites). The lead options from each category can then be compared to arrive at a preferred option.

References

1. NDA (2011), NDA Strategy, Effective from April 2011, March 2011.

2. EGG08, NDA Guidance for the Production of Business Cases, Rev 7, January 2010.

3. Nuclear Industry Safety Directors Forum (December 2010). Best Available Techniques (BAT) for the Management of the Generation and Disposal of Radioactive Wastes – A Nuclear Industry Code of Practice. Issue 1.

APPENDIX A – Long-List of Options

Option	Recipient Site			
	Hinkley Point A	Oldbury	Sizewell A	Dungeness A
BASELINE				
1	Hinkley Point A FED	Oldbury FED	Sizewell A FED	N/A
REGIONAL				
2a	Hinkley Point A FED Oldbury FED		Sizewell A FED	
2b	Hinkley Point A FED Oldbury FED			Sizewell A FED (using existing carbonic plant)
2c		Oldbury FED Hinkley Point A FED	Sizewell A FED	
2d		Oldbury FED Hinkley Point A FED		Sizewell A FED (using existing carbonic plant)
2e	Hinkley Point A FED	Oldbury FED		Sizewell A FED (using existing carbonic plant)
CONSOLIDATION OF LOWER VOLUME FED SITES				
3a	Hinkley Point A FED	Oldbury FED Sizewell A FED		
3b	Hinkley Point A FED		Sizewell A FED Oldbury FED	
3c[11]	Hinkley Point A FED			Sizewell A FED (new nitric plant)

[11] Additional option introduced following the workshop of 12th – 13th February 2013.

Option	Recipient Site			
	Hinkley Point A	Oldbury	Sizewell A	Dungeness A
				Oldbury FED (new nitric plant)
MINIMISATION OF FUTURE PLANT: TWO NEW PLANTS				
4a		Oldbury FED	Sizewell A FED Hinkley Point A FED	
4b	Hinkley Point A FED Sizewell A FED	Oldbury FED		
MINIMISATION OF FUTURE PLANT: ONE NEW PLANT				
5a	Hinkley Point A FED Oldbury FED Sizewell A FED			
5b		Oldbury FED Hinkley Point A FED Sizewell A FED		
5c			Sizewell A FED Hinkley Point A FED Oldbury FED	
5d				Hinkley Point A FED (new nitric plant) Oldbury FED (new nitric plant) Sizewell A FED (new nitric plant)

APPENDIX B - Summary of Option Screening Assessment

For the purposes of option screening (reducing the long-list of options to a short-list) only the safety and environment Value Framework attributes were considered. Only those factors detailed in the table for safety and environment were used in the screening process (as these were identified as being of significance to stakeholders).

During Stage B of the project, assessment will be carried out on the remaining Value Framework attributes, these being, Hazard Reduction, Security, Socio-economic Impact and Cost.

The options assessment presented in this table is based upon a Red, Amber, Green scoring system of relative option performance on each of the factors considered to be of significance to stakeholders. The descriptions below provide more detail on the scoring system applied:

Red	The option was either the worst performing option (or performed similarly to the worst) on a particular factor.
Amber	The option was neither one of the best or worst performing options on a particular factor. Note that the Amber score was not used for all factors as for some factors there were only two clear groups of options in terms of performance.
Green	The option was either the best performing option (or performed similarly to the best) on a particular factor.

It should be noted that none of the options performed at a level for any of the factors assessed which would be considered to be unacceptable by Magnox. This assessment of acceptability took account of relevant regulatory limits and also company derived working limits. For example the assessment of the acceptability of the worker dose uptake associated with an option took account of Office of Nuclear Regulation set Basic Safety Limits and Objectives and also Magnox company dose limits.

Also note that Worker Collective dose was not considered to be an important issue by stakeholders but was retained for screening as a surrogate for conventional safety risk during loading and unloading of packages, which was considered to be important.

OPTION (See Appendix A)	Value Framework Attribute – Safety							Value Framework Attribute – Environment			
	Public Conv. Safety – Transport of Rad. Waste and C&D Materials	Worker Conv. Safety – C&D	Public Individual Dose from the Transport of Rad. Waste	Public Collective Dose from the Transport of Rad. Waste	Worker Collective Dose	Public Individual Dose – Max. Ann. Dose Rate from Rad. Discharges to Most Exposed Individual Across an Option	Total Public Collective Dose from Rad. Discharges	Disturbance Caused Directly by C&D (site years)	Disturbance Caused by HGV Movements – Transport of Rad. Waste and C&D Materials (Total No. of HGVs)	Disturbance Caused by HGV Movements – Transport of Rad. Waste (Max. No. of HGVs to a Single Site)	Nitrates Discharge to the Env. – Weighted Ave. Process Contn. as a %age of an EQS over all Sites Involved in the Option
5d											
4a											
5c											
2d											
5b											
2c											
Options above this row are those which were screened out											
2e											
1											
2b											
3a											
3b											
4b											
5a											
2a											
3c											