

# **UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry:**

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## **Strategic Environmental Assessment**

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**Non-Technical Summary of Environmental and Sustainability  
Report - June 2009**

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This document is the Non-Technical Summary of the Environmental and Sustainability Report produced as part of the Strategic Environmental Assessment (SEA) undertaken to inform the Nuclear Decommissioning Authority's (NDA) draft UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry (henceforth referred to as the UK Nuclear Industry LLW Strategy).

This summary supports the public consultation on UK Nuclear Industry LLW Strategy and the full Environmental and Sustainability Report which informs it. It outlines the content of the UK Nuclear Industry LLW Strategy, describes the environmental and sustainability assessment process, and identifies the findings and recommendations arising from the assessment of the UK Nuclear Industry LLW Strategy.

The following sections explain what nuclear industry Low Level Waste (LLW) is and the aims and content of the UK Nuclear Industry LLW Strategy. The SEA process and the role of the Environmental and Sustainability Report, of which this is a summary, within this process is described on page 6. Appendix A contains a list of abbreviations and glossary of terms.

**For more information on this public consultation and how to give us your views on the UK Nuclear Industry LLW Strategy and its environmental and sustainability implications please see page 21.**

## What is Nuclear Industry Low Level Waste?

The UK nuclear industry includes a range of different organisations, for example public civil nuclear licensed sites owned by the NDA and operated by its site licence companies, nuclear power generation plants operated by British Energy and defence sites owned by the Ministry of Defence.

Solid radioactive waste produced by most of the nuclear industry is often similar in its physical and chemical nature to the wide variety of other municipal, commercial and industrial wastes. However, it is distinguished from these (controlled) wastes in that it contains radioactive constituents that are additional to those that are present naturally and unmodified in the earth's rocks, minerals and soils, and so called "non radioactive" wastes.

Most radioactive waste produced by the nuclear industry contains small quantities of this additional radioactivity, and falls into the lowest categories of the formal definitions of solid radioactive waste, i.e. Very Low Level Waste (VLLW) and LLW. Although UK wide estimates of nuclear industry waste are being updated and reviewed in light of ongoing studies, radioactive waste arisings are very unlikely to exceed 0.01% by volume of the annual quantities of total UK waste arisings<sup>1</sup>.

<sup>1</sup> Defra (2009) e-Digest of Environmental Statistics  
[<http://www.defra.gov.uk/environment/statistics/index.htm>].

## What is the NDA's UK Nuclear Industry LLW Strategy?

The UK Nuclear Industry LLW Strategy is the first UK strategy that has been formulated for the sustainable management of solid radioactive waste arising from the nuclear industry. It has been prepared by the NDA in response to the UK policy for the long term management of solid low level radioactive waste (Defra, 2007).

The NDA was established under the Energy Act 2004 with responsibility for the decommissioning of a number of civil public sector nuclear sites safely, securely, and cost-effectively, whilst protecting the environment. The NDA's functions and responsibilities are set out in the Energy Act 2004 and in the Secretary of State's designations relating to each of the sites for which it is responsible. The LLWR near the village of Drigg in west Cumbria is one of the sites for which NDA is responsible for under the Act. This is the only dedicated engineered LLW disposal facility in the UK. NDA are able to make this facility available under suitable commercial terms to nuclear and non-nuclear waste producers.

In addition to these primary responsibilities, in 2007 the NDA was tasked with producing a UK wide strategy for the management of LLW from nuclear operators. At the same time, the NDA was also asked to support Government in developing and maintaining a UK wide strategy for waste arising from the non-nuclear industry. This is to help ensure the integration of the strategies for the nuclear and non-nuclear sectors. DECC (the Department of Energy and Climate Change) will be consulting separately on this UK Strategy for the Management of Solid Radioactive Waste from the Non Nuclear Industry later in 2009.

Analysis of the UK LLW inventory shows that around 3 million m<sup>3</sup> of LLW will require management. LLWR has a potential volumetric capacity of around 0.7 million m<sup>3</sup>, subject to planning and regulatory approvals<sup>2</sup>. The analysis demonstrates that, even with such approvals, without a different approach to the management of LLW, a new repository could be required by 2037, or possibly even earlier.

The UK Nuclear Industry LLW Strategy identifies this challenge and proposes a strategy to ensure availability of management and disposal routes for Low Level Waste (LLW) and Very Low Level Waste (VLLW) by:

- Application of the waste management hierarchy (ensuring, for example, that materials that can be reused or recycled are not disposed, and that the fraction of waste that is not radioactive is separated out before disposal of the remainder as LLW);
- best use of existing facilities, working more efficiently and potentially extending the life of the existing national repository.

<sup>2</sup> NDA (2008) LLW Strategic Review, LLW Repository Ltd.

- development and use of new fit for purpose management and disposal routes, so waste producers have more choice in determining implementing waste management routes.

Various organisations have roles to play in the implementation of the UK Nuclear Industry LLW Strategy to achieve a sustainable UK-wide disposal network:

- The NDA LLW strategy is expected to influence the potential supply of treatment and disposal facilities available to accept nuclear and non-nuclear industry waste. This aspect of the strategy is of relevance to both existing and new disposal facilities.
- Waste planning bodies and authorities have important roles, both as consultees to the environmental regulators, and when they review their Regional Spatial Strategies and prepare Local Development Frameworks covering waste. This aspect of the strategy is of particular relevance to new applications from disposal facility operators who wish to take radioactive waste, and to new disposal facilities.
- Waste producers will be required to ensure better application of the waste hierarchy and optimum use of the network of facilities that is available for disposals of their waste. This aspect of the strategy is of particular relevance to the use of existing disposal facilities, and the regulators will be expected to play an important role in its implementation.

The UK Nuclear Industry LLW Strategy aims to provide a framework for the development of plans for the management of waste and support decision making in this area, having considered the impacts of waste management options at a national scale.

The UK Nuclear Industry LLW Strategy seeks to provide the UK tax payer with a best value approach to the management of LLW, whilst trying to minimise any potential environmental and social impacts. A key part of this will be achieving the most advantageous use of the UK Low Level Waste Repository near Drigg.

**Table NTS 1 – UK Nuclear Industry LLW Strategy Options**

Consideration 1 - LLW treatment and disposal options or how LLW will be treated	
Option	Description of Option
Decay Storage of LLW prior to further treatment and disposal of waste as VLLW or exempt material.	The safe decay storage of radioactive wastes to the point of exemption or the point where it can be classified as VLLW. The time over which decay storage can be justified will influence the types of wastes for which this option will be appropriate.
Decontamination of facilities and equipment at end of life prior to consignment as waste.	The appropriate application of characterisation, segregation and decontamination techniques to wastes and facilities will serve to minimise the amount of material requiring further management and disposal.

## The NDA’s UK Nuclear Industry LLW Strategy: Options

In order to achieve the objectives outlined above and having taken into consideration the ongoing work, existing studies and waste inventories, the UK Nuclear Industry LLW Strategy needs to formulate an optimum overall approach to the wide range of issues arising from waste management. Specifically, it needs to address the challenges from three distinct but inter-related perspectives:

1. LLW treatment and disposal options or how LLW will be treated;
2. The location of waste management facilities or where LLW will be treated; and
3. The provision of disposal capacity or when facilities will exist for LLW disposal.

As a result, a number of options have been developed for each of these considerations. In terms of how LLW may be treated (Consideration 1), thirteen separate options have been formulated. Five options were developed for Consideration 2 relating to where facilities may be located, and four options were developed for Consideration 3 relating to when the facilities for disposal will be available. These options are presented in Table NTS 1. The options are not mutually exclusive, since more than one may be applied to the waste streams. The options were further developed through an iterative assessment process.

Option	Description of Option
Reuse LLW to avoid consigning as radioactive waste.	The reuse of material above current UK levels for the exemption of waste from (Radioactive Substances Act) regulation as radioactive waste in construction, landscaping, shielding etc.
Recycling of metallic wastes including melting, decontamination and recycling.	The recycling of metallic wastes either within or outside the UK nuclear industry. This does not include melting processes applied primarily for volume reduction.
Recovery of energy from waste through thermal treatment.	The thermal treatment of LLW with other (non-active) wastes to recover energy. Information suggests that to be viable for large scale energy recovery, a significant additional volume of non radioactive waste would need to be thermally treated along with the LLW.
Volume reduction and waste conditioning through thermal treatment.	The incineration or other thermal treatment of combustible wastes to achieve a reduction in volume or waste conditioning to open new disposal options.
Volume reduction through compaction.	The reduction of waste volumes through compaction or super compaction to maximise the capacity of the relevant disposal facilities.
Surface disposal of LLW to landfill with non radioactive waste subject to approval by industry regulators.	The use of new or existing landfill facilities that could be available for the authorised disposal of LLW or VLLW for co disposal of radioactive and non radioactive wastes.
Surface disposal of LLW in non engineered surface facilities subject to approval by industry regulators.	The disposal of LLW or VLLW in dedicated facilities which use landfill style or novel approaches for LLW management to avoid the need for engineered disposal vaults. This option includes the in situ disposal (the waste is not moved from its original location) of contaminated land with containment.
Surface disposal of LLW grouted in a single use transport container in engineered disposal cell subject to approval by industry regulators.	This option is effectively the current disposal practice used in Vault 8 at the LLW Repository.
Surface disposal of LLW grouted in alternative containers in engineered disposal cell subject to approval by industry regulators.	The disposal of LLW in engineered vaults as per the current disposal practice at the LLW Repository but using alternative waste packaging and conditioning to maximise packaging efficiency and minimise resource use.
Deep disposal of LLW that falls outside the LLWR conditions for acceptance together with ILW in a geological disposal facility subject to approval by industry regulators.	The disposal of some forms of LLW that do not meet the LLWR conditions of acceptance with ILW in a geological disposal facility because surface disposal would either substantially constrain the radiological capacity of surface facilities or increase potential peak risks from surface disposal facilities to an unacceptable level.
Surface disposal of ILW with a relatively short half life.	Surface disposal of ILW with a relatively short half life will result in a fall in radioactivity relatively quickly through natural radioactive decay. This option considers the potential for surface engineered disposal facilities to be used to dispose of short lived ILW where, because of natural radioactive decay, the disposal of this higher activity waste does not compromise the ability of a surface facility to meet relevant regulatory risk targets.
Use international facilities for treatment and disposal of wastes.	Use of existing international facilities to treat radioactive wastes. This may include disposal overseas although this is currently constrained by Government Policy.

## Consideration 2 – Location of facilities for the treatment and disposal of LLW or where LLW will be treated

Option	Description of Option
Single national facility near to Sellafield.	The use of a single national facility near to Sellafield. This includes the use of the current national LLW Repository near Drigg.
Single national facility not near to Sellafield.	The use of a single national facility not near to Sellafield. This is relevant to future national facilities to replace the current LLW Repository near Drigg.
Small number of 'regional' facilities receiving waste from a number of facilities.	There would be a number (indicatively 2 -5) of 'regional' facilities that would receive wastes from a number of sites.
Multiple local facilities, either close to or on nuclear site.	This option involves multiple local facilities, either close to or on nuclear sites and usually receiving waste from one site or a small number of nearby sites.

## Consideration 3 - provision of capacity or when facilities will exist for LLW disposal

Use of LLW Repository without additional optimisation and replace when required.	This involves the continued use of the LLW Repository as the national facility. The capacity will be used as required to ensure the continued availability of disposal capacity for all wastes. There will be little or no additional application of the waste management hierarchy above the existing approach (which includes super-compaction of waste at Sellafield prior to disposal). The Environmental Safety Case will continue to be met. A new facility will be constructed when the LLW Repository is full. This is assumed to represent 'business as usual' in the absence of the UK Nuclear Industry LLW Strategy.
Optimised use of LLW Repository with replacement facility if required.	This involves the continued use of the LLW Repository as the national facility. The capacity will be efficiently used by ensuring that the site is used only for wastes that require the level of safety and security offered by engineered disposal. There will be a rigorous application of the waste management hierarchy. The Environmental Safety Case will continue to be met. A new facility will be constructed if LLW exceeds the capacity of LLWR and is deemed necessary.
Early replacement of the LLW Repository and retrieve waste currently in the LLW Repository.	There will be the provision of a new, alternative UK authorised LLW disposal facility for engineered vault disposal developed as soon as possible. The existing LLW Repository will be closed and the wastes currently disposed of will be retrieved for disposal into the new facility.
Early replacement of the LLW Repository without retrieval of waste.	Provision of new, alternative UK authorised LLW disposal facilities for engineered vault disposal will be developed as soon as possible. The existing LLW Repository will be closed and the current waste contained within it will be left in situ.

## What is Strategic Environmental Assessment?

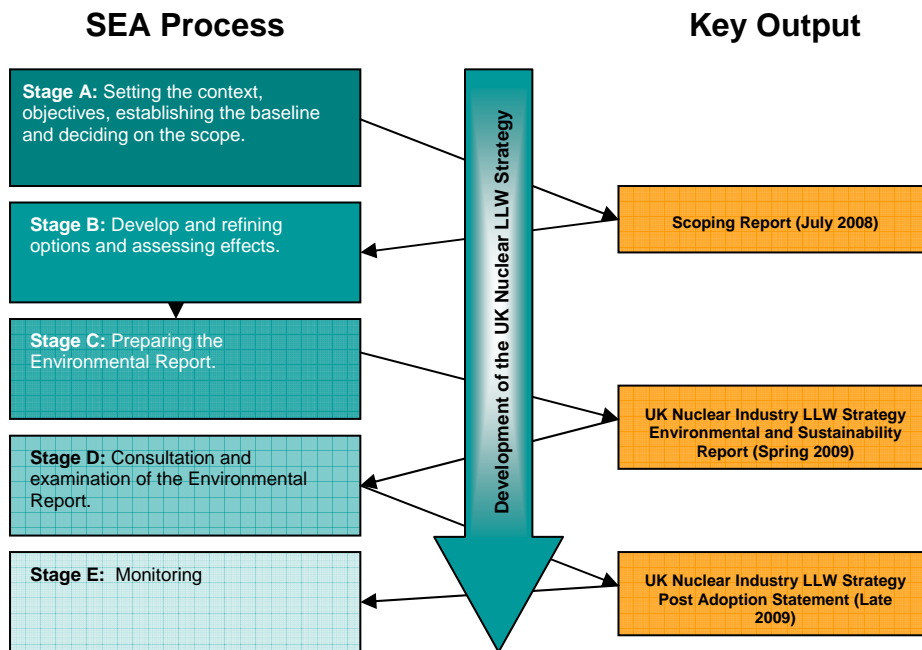
SEA is a statutory requirement following the adoption of European Union Directive 2001/42/EC which was transposed into UK legislation on the 20th July 2004 as Statutory Instrument No. 1633 – The Environmental Assessment of Plans and Programmes Regulations 2004. The objective of SEA is to provide high level protection of the environment (including population and society) and contribute to sustainable development by considering the environment and society in the preparation of plans and programmes from the outset.

The aim of the SEA is to identify the associated environmental effects of implementing the UK Nuclear Industry LLW Strategy and how to avoid, manage or

mitigate significant adverse effects, whilst enhancing positive effects. The assessment of the NDA's UK Nuclear Industry LLW Strategy has been expanded to provide consideration to all relevant potential environmental, social and economic effects and therefore also covers, where relevant, the wider sustainability effects. This has been done to ensure the scope of the assessment is equivalent to that which would be used in a Sustainability Appraisal. In addition to this, value for money and affordability has also been included within the assessment given the significant costs to the UK taxpayer and commercial operators resulting from the management of ILW over the next century and to enable a fuller consideration of the strategy. The SEA therefore informs the development of the UK Nuclear Industry LLW Strategy from a sustainability perspective.

An overview of the key stages of the SEA process is presented in Figure NTS 1.

Figure NTS 1 Outline of the SEA Process



The Scoping Report was published in July 2008. It presented the proposed methodology and set of sustainability objectives against which the UK Nuclear Industry LLW Strategy would be assessed. The Scoping Report was made available for consultation for 6 weeks concluding in September 2008.

A formal response to the consultation feedback received was made in a Response to the Scoping Report Consultation which was issued in November 2008. Further changes to the approach have been made following consultees' comments and ongoing engagement through the National Stakeholder Group on the development of the UK Nuclear Industry LLW Strategy and the SEA which underpins it. These have

been included as appropriate in the Environmental and Sustainability Report.

In addition to the revised methodology, the Environmental and Sustainability Report also presents the assessment of the UK Nuclear Industry LLW Strategy and includes the conclusions and recommendations arising.

## Review of Plans and Programmes

The SEA Directive requires a review of the UK Nuclear Industry LLW Strategy's 'relationship with other relevant plans and programmes'. Thirty-eight European and international, 60 national and 17 regional documents

were reviewed as presented in Appendix C of the main report. The results of the review were used to inform the development of the sustainability objectives and baseline.

## Baseline Information

The SEA Directive requires a compilation of *'the environmental characteristics of areas likely to be significantly affected'*. A wide range of information was collected from a number of sources including NDA, the

Environment Agency, the Scottish Environment Protection Agency, the Food Standards Agency, Magic ([www.magic.gov.uk](http://www.magic.gov.uk)) and the Office for National Statistics ([www.statistics.gov.uk](http://www.statistics.gov.uk)), among others. Following feedback from the consultation on the Scoping Report, the baseline data presented in the Scoping report was used to develop a national baseline presented under each sustainability objective heading. The baseline data also was tailored specifically to the UK Nuclear Industry LLW Strategy and is presented in Appendix D of the main report.

The existing approach to managing LLW is highlighted in Box NTS 1.

### Box NTS 1 Existing Approach to the Management of LLW

According to the *2007 UK Radioactive Waste Inventory*, it is estimated that there is around 3 million m<sup>3</sup> of LLW in the UK from all sectors. It is estimated that nuclear sites will generate nearly 93 % of this, which once conditioned and packaged for disposal will result in around 3.1 million m<sup>3</sup>. The largest volumes of LLW and VLLW are located at Sellafield (45% and 70% respectively).

LLW is generated in a wide range of forms from soft organic material to inert rubble. In terms of volume, LLW predominantly arises in the form of contaminated soils, demolition rubble and steel items such as framework, cladding and piping. Smaller volumes of wastes such as papers, plastics and scrap metals also arise as a result of day to day operational activities associated with decommissioning.

Waste is currently packaged and grouted into single use transport containers prior to disposal to the LLW Repository near Drigg. The packing efficiency achieved at present is relatively low. Currently, some 60% of LLW is designated for disposal to the LLW Repository with another 16% of designated for disposal to other LLW facilities. With this in mind, it is recognised that the LLW Repository has already received 1 million m<sup>3</sup> of LLW and is estimated to have some 700,000 m<sup>3</sup> of capacity remaining subject to future planning and regulatory approvals.

## Key Issues Identified

The SEA Directive requires the identification of 'the existing environmental problems which are relevant to the plan or programme'. From an analysis of the review of plans and programmes and the evidence base, the key issues that the UK Nuclear Industry LLW Strategy needs to address can be summarised as follows;

- **Deferring or Avoiding the Development of a new Disposal Facility** - Continuing the present approach and techniques to the management of LLW, a new repository will be required by 2037, or possibly even earlier. However, there, is an opportunity to significantly delay or even avoid the need for a new facility through improved optimisation of LLW management.
- **Consequences of Climate Change for Very Long Term Containment** – Whilst the baseline information collected indicates that the management of LLW does not result in significant discharges of radioactive material in the short, medium or long term, such issues remain potentially contentious. In particular, concerns have previously been raised regarding the potential very long term consequences of climate change and coastal erosion on the integrity of the LLWR.
- **Hazard Reduction** – Although LLW does not contribute significantly to the level of hazard on the NDA's sites, the maintenance of treatment and disposal routes for management of LLW is a key factor enabling work on reducing priority hazards to continue.
- **Transport** – The principle of proximity in waste management is a key element of the UK's waste policy. Whilst the baseline information gathered indicates that in a national context, transport does not have a significant effect on the environment, public safety or society, the transport of radioactive material (including LLW) remains likely to be a key issue for consideration in the development of specific proposals due to the importance of the potential disturbance to local communities near facilities and to those communities' and public perception of the risks involved in transporting radioactive waste.
- **Value for Money** – The current estimates put the financial costs of managing the LLW that is predicted to arise from the operation and decommissioning of NDA's designated sites over the next century or so at around £10 billion (undiscounted). However, there is an opportunity to significantly reduce this liability and in so doing provide better value for taxpayers.

## The SEA Methodology and Objectives

The assessment of the UK Nuclear Industry LLW Strategy has been undertaken using an objective led approach. The baseline information, the review of plans and programmes and the key issues identified were used to develop 15 sustainability objectives for this assessment (presented in Table NTS 3). Each objective is supported by a series of guide questions.

The sustainability objectives cover all of the topics that the assessment is required to include information on, as set out in the SEA Directive, and highlighted in Table NTS 2. In addition, the scope of the SEA of the UK Nuclear Industry LLW Strategy has been expanded to include social and economic topics.

**Table NTS 2 SEA Directive Topics**

### Annex I of the SEA Directive Topics

- Biodiversity;
- Population;
- Human Health;
- Fauna;
- Flora;
- Soil;
- Water;
- Air;
- Climatic Factors;
- Material Assets;
- Cultural Heritage (including architectural and archaeological heritage);
- Landscape;
- And the inter-relationship between the issues referred to above.

The sustainability objectives for the assessment of the UK Nuclear Industry LLW Strategy are set out in Table NTS 3.

The UK Nuclear Industry LLW Strategy options have each then been assessed in terms of the extent to which they contribute towards achieving the sustainability objectives for each topic (e.g. Biodiversity), considering the effect on the existing baseline. The guide questions have been used to assist the assessment of the potential effects in a qualitative manner, ensuring consideration is given to relevant influencing factors.

**Table NTS 3 Sustainability Objectives**

Sustainability Objective	
1. Air Quality: Minimise emissions of pollutant gases and particulates to the air and enhance air quality.	9. Economy, Society and Skills: Contribute to sustainable local economies and social well-being by enhancing the population's skill base and contributing to employment opportunities, recognising workforce needs, thus supporting vibrant local communities.
2. Global Climate Change and Energy: Minimise detrimental effects on the climate from greenhouse gases and ozone depleting substances and maximise resilience and adaptability to climate change.	10. Traffic and Transport: Minimise the detrimental impacts of travel and transport on communities and the environment, whilst maximising positive effects.
3. Biodiversity, Flora and Fauna: Protect and enhance habitats and species and promote opportunities to conserve and enhance wildlife.	11. Land Use, Natural and Material Assets: Contribute to the sustainable use of land and natural and material assets within environmental limits.
4. Landscape and Visual: Protect and enhance the character and visual elements of landscapes.	12. Noise and Vibration: Minimise disturbance to people and wildlife from noise and vibration.
5. Cultural Heritage: Protect and, where appropriate, enhance the historic environment including historic assets and archaeological features.	13. Health and Safety: Ensure the continued protection of people's safety and health.
6. Geology, Ground and Groundwater Quality: Minimise the detrimental impact and maintain, restore and enhance to maximise the positive impact on groundwater, soil function and quality and geological features.	14. Hazard Reduction: Reduce the hazard potential posed by radioactive materials, and minimising the environmental risk as soon as possible.
7. Surface Water Resources and Quality: Minimise the consumption of water resources and detrimental impact on surface water quality, enhancing it where appropriate.	15. Value for Money and Affordability: To achieve the NDA's mission in a manner which maximises the value for money for taxpayers by considering the lifecycle cost, and the taxpayers contribution to NDA funding within each spending review period.
8. Waste: Provide optimised waste solutions and apply the waste management hierarchy to minimise waste arisings and the detrimental impacts of waste management on the environment and communities.	

The assessment was recorded in an SEA assessment matrix developed for this purpose. This matrix which forms Appendix E of the Environmental and Sustainability Report includes the following information:

- **Timescale** – Anticipated effects on each sustainability objective are identified and scored in short term (up to 2020), medium term (between 2020 and 2100) and long term (beyond 2100) to provide an indication of when the anticipated effect is likely to become apparent.
- **Scores** – Anticipated effects are scored to indicate the extent to which an option contributes towards the achievement of each sustainability objective. A 5 tier scoring system was used to highlight the anticipated magnitude of the effect ranging from major positive (++) to major negative (--). In addition unrelated (0) and uncertain (?) scores were also used where appropriate.
- **Commentary** – The assessment commentary describes in more detail the likely nature of the effect and geographic scale of the effects identified in the scoring.

To aid the assessment, a number of assumptions were made. These included: that all relevant legal requirements would be met; the use of the term 'minimisation' refers to minimisation subject to the consideration of the potential costs and benefits; and that the scoring system applies no weighting as each sustainability objective is examined separately, with no attempt to judge the relative importance of the individual sustainability objectives.

Additionally, a number of assumptions were made relating to the three considerations. Key assumptions are recorded in the summary of assessment findings.

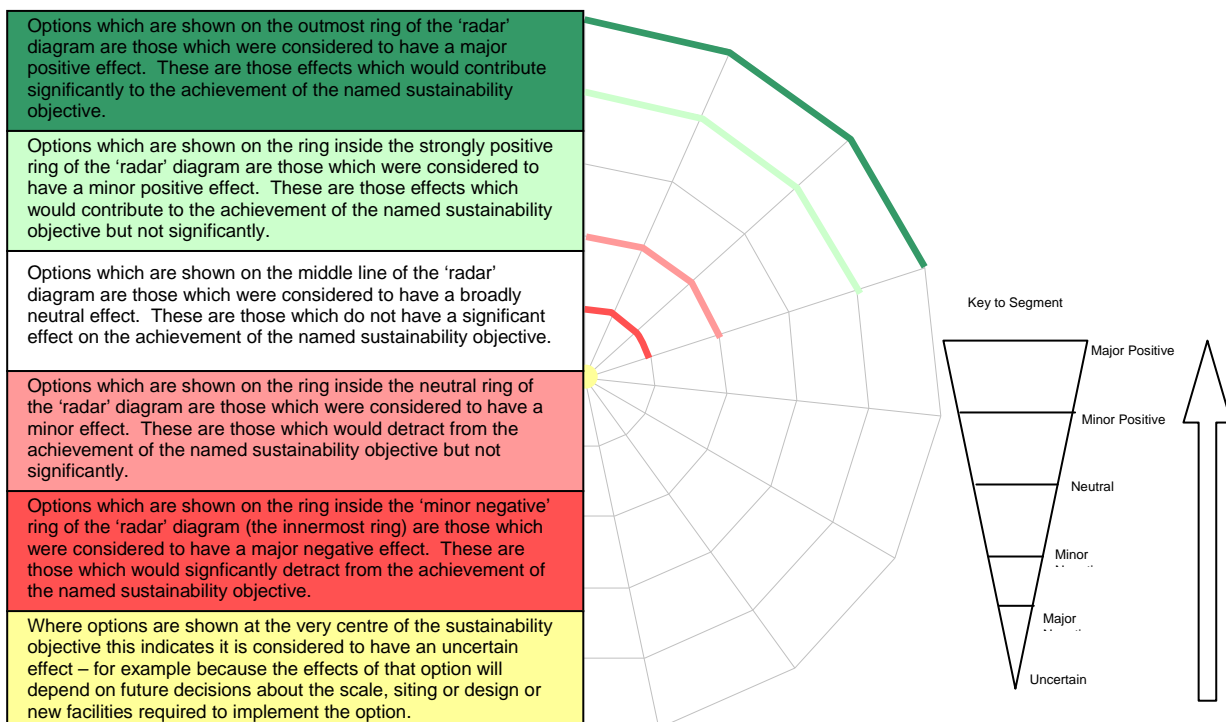
## Summary of the Assessment Key Findings of the Assessment

A summary of the findings of the assessment is provided on the following pages. These summaries include a set of 'radar' diagrams in addition to text summarising the consideration, the realistic options identified within that consideration, a summary of the assessment and key assumptions relevant to the assessment of each consideration and the key conclusions for that consideration.

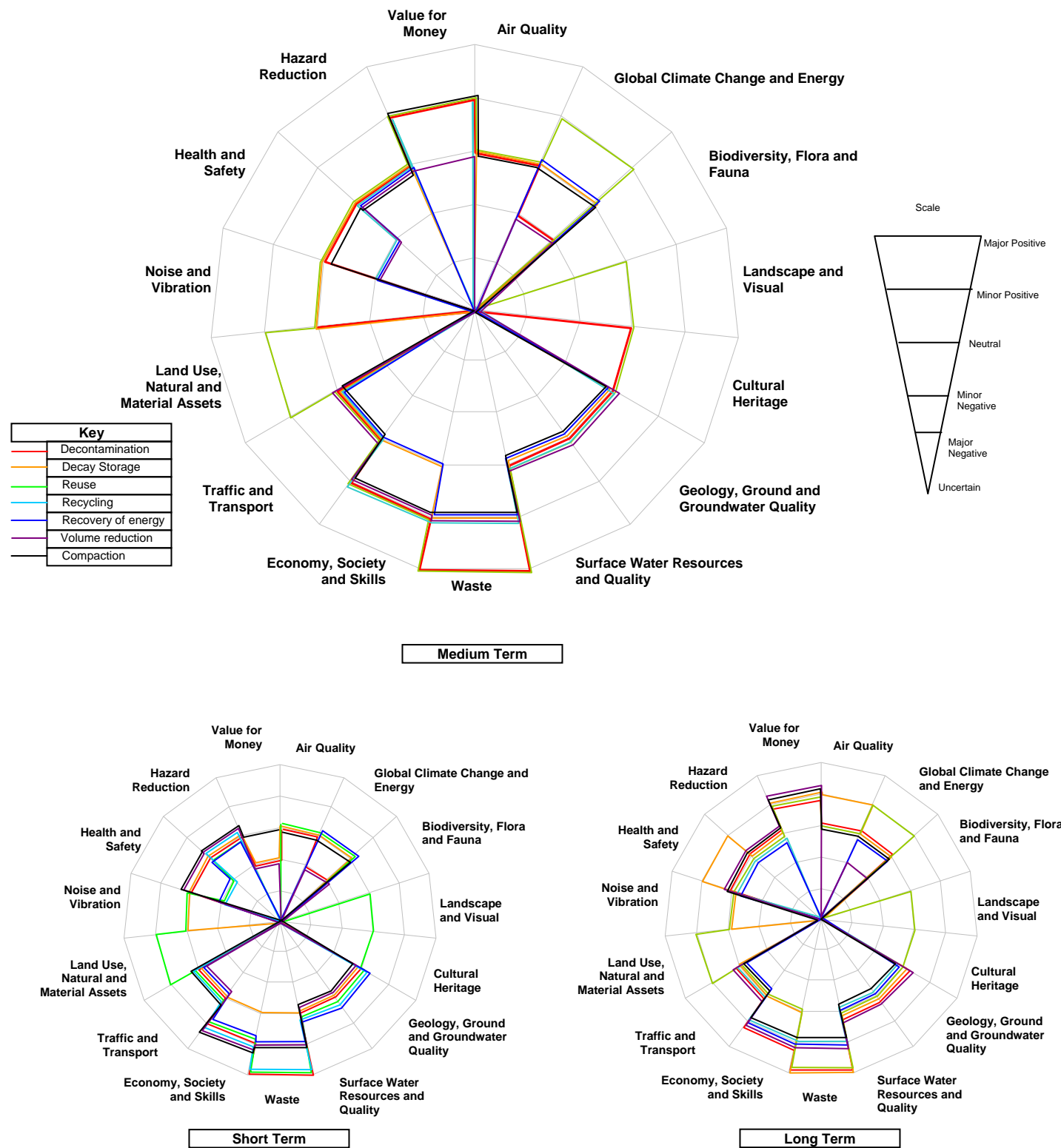
Each consideration includes 3 separate 'radar' diagrams showing how each option performs against each sustainability objective in the short, medium and long term. Consideration 1 has been split into 2 sets of 'radar' diagrams (6 diagrams in total) due to the larger number of options forming Consideration 1 – one set of diagrams describe the treatment options and the other describes disposal options.

Each segment of the 'radar' diagram shows how each option performs against a single named sustainability objective, as explained in Figure NTS 2. A separate coloured line is used to show each option's performance. Where multiple options perform the same, the lines showing the performance of each option have been offset for clarity. Such offsetting does not indicate a difference in the performance of different options.

Figure NTS 2 Key to Sustainability 'Radar' Diagrams



**Assessment Summary - Consideration 1: LLW Treatment and Disposal Options 1 - 7**



**DESCRIPTION:** This consideration examines LLW treatment and disposal options or how LLW will be treated

**REALISTIC OPTIONS:** 13 options representing different approaches for the treatment and disposal of radioactive waste were assessed, including the Disposal of LLW grouted into a single use transport container which effectively represents the baseline for most of the UK's LLW.

**SUMMARY OF THE ASSESSMENT:** The assessment identified a number of objectives where, broadly speaking, the potential effects of the options were dependent on the receiving environment. As such, they were considered to be uncertain at this stage. These included: Biodiversity, flora and fauna; Landscape and visual; Cultural heritage; and Land use, natural and material assets.

The key sustainability objectives for this consideration were:

- Objective 1: Air Quality:** There are likely to be increases in discharges associated with the treatment of LLW. However, based on existing facilities in the UK and elsewhere these are not anticipated to significantly effect air quality. Any new facilities will be subject to environmental regulation requiring prior authorisation thereby preventing unacceptable effects.
- Objective 2: Global Climate Change and Energy:** There is likely to be some negative effects from the increase consumption of energy directly associated with decontamination, recycling and thermal treatment processes in the short to medium terms. However, these may be offset through the positive effects associated with the reduction in energy consumption from the reuse of LLW, alternative packaging, reducing the use of virgin metal/materials likely to be seen in the medium and longer term, and the increased use of less engineered facilities for lower hazard wastes.
- Objective 7: Surface Water Resources and Surface Water Quality:** There are likely to be increases in discharges associated with the treatment of LLW. However, based on existing facilities in the UK and elsewhere these are not anticipated to significantly effect water quality. Any new facilities will be subject to environmental regulation and require prior authorisation thereby preventing unacceptable environmental effects.
- Objective 8: Waste:** There is broadly considered to be a positive effect against this objective as a result of: the application of the waste management hierarchy to minimise the volume of LLW requiring disposal; developing and exploiting new risk based routes for the management and disposal of LLW; and optimising the use of existing facilities by using them in such a way as to maximise their capacity.
- Objective 9: Economy, Society and Skills:** There is likely to be a general positive effect as a result of the creation of employment opportunities (for all options) and the potential increase in research and development for some techniques. Positive impacts from increased employment are most significant for options involving the creation of new facilities but even here are likely to be relatively modest. Stakeholder concerns regarding potential negative effects from the development of LLW management facilities away from current nuclear sites are addressed under Consideration 2.
- Objective 13: Health and Safety:** It is considered that there may be a detrimental effect on health and safety of workers as a result of the increase in potential exposure to existing and new hazards (for example from increased contact with waste or decontamination chemicals during decontamination). However, the risks resulting from such hazards should be amenable to effective control by nuclear operators as is highlighted by the current safety performance of NDA sites, given that most of the options identified currently occur to a limited extent on nuclear sites or within the waste management sector.

**KEY ASSUMPTIONS:** Any new disposal facilities will be designed with the aim of meeting the regulatory risk targets for facilities for the disposal of solid radioactive waste. Consideration 1 does not consider the implications about the scale and numbers of facilities as these are covered in Consideration 2. As such, the effects of construction activities are not considered in detail. It is assumed

that these would predominantly occur in the short term, but may also arise in the medium and long term. They are likely to be uncertain.

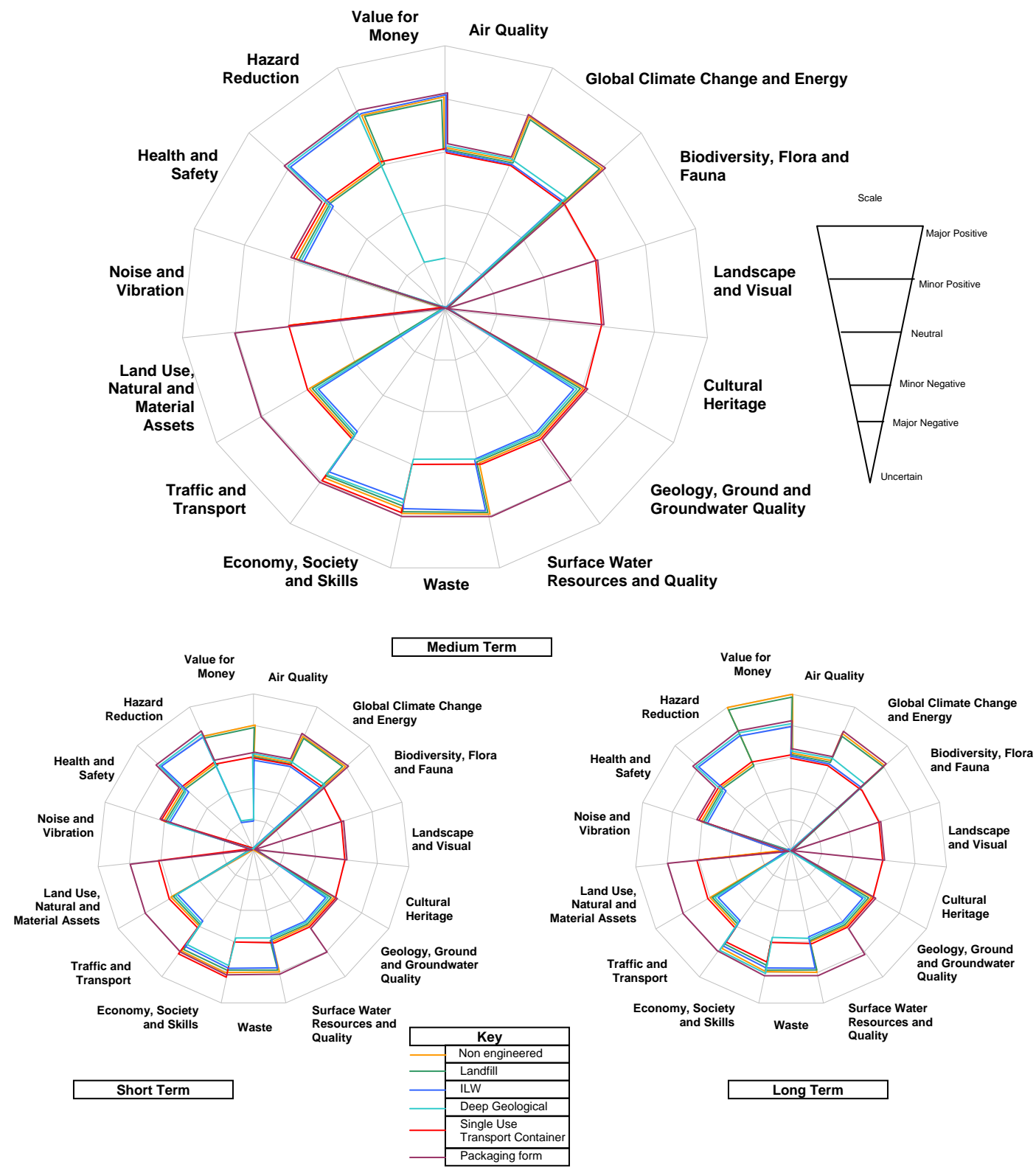
**KEY CONCLUSIONS:** The assessment supports the use of a full range of waste management options to be used to manage LLW as none of the options identified had effects which would rule out their use in management of UK LLW. Different options will be more or less appropriate for the management for LLW with different characteristics (recognising the diverse nature of LLW).

- Decontamination to clean contaminated waste to allow it to be managed as exempt waste or to facilitate its onward management has a positive role to play where the benefits of decontamination in terms of enabling alternative waste management options outweighs the potential detrimental impacts of decontamination.
- The reuse of materials which would otherwise be disposed of as radioactive waste has potential benefit. However the scope to make use of reuse will be limited by the need to identify circumstances in which material can be reused under appropriate regulatory control and to demonstrating the suitability of material for reuse.
- Metal treatment and recycling has the potential to significantly reduce the volumes of LLW requiring disposal either through volume reduction or by allowing metal to be recycled where recycled metal is expected to meet relevant standards for release from regulatory control.
- Thermal treatment has the potential to significantly reduce the volumes of LLW requiring disposal through volume reduction where the benefits of this option outweigh the potential negative impacts of thermal treatment. The use of thermal treatment with energy recovery presents potential environmental benefits over thermal treatment without energy recovery. However, the volume of combustible LLW which is suitable for thermal treatment is expected to be insufficient to support a dedicated waste to energy facility and co-treatment with non radioactive waste presents a number of challenges.
- As LLW encompasses waste with a broad range of levels of radioactivity and radioactivity of widely differing half life, there is scope to use disposal facilities of different designs for waste of differing characteristics. The use of existing landfills and non engineered facilities present benefits in terms of reduced resource use and improved packing efficiency, and represents a potentially viable option for diverting significant volumes of VLLW, which does not require significant engineered facilities to meet the regulatory risk standards, away from the LLWR near the village of Drigg.
- The increased resource use involved in geological disposal facilities suggests that such facilities should only be used for wastes where geological disposal is necessary to ensure the relevant regulatory risk targets for the disposal of radioactive waste are met. The assessment also suggests that there may be opportunities for the disposal of short lived ILW in surface facilities where its short half life means surface disposal would not threaten the achievement of regulatory risk targets.
- Alternative packaging designs have potential environmental benefits in terms of reduced resource use and improved packaging efficiency and therefore their use should be encouraged providing its use does not compromise the ability for disposal facilities to be regulatory risk targets.

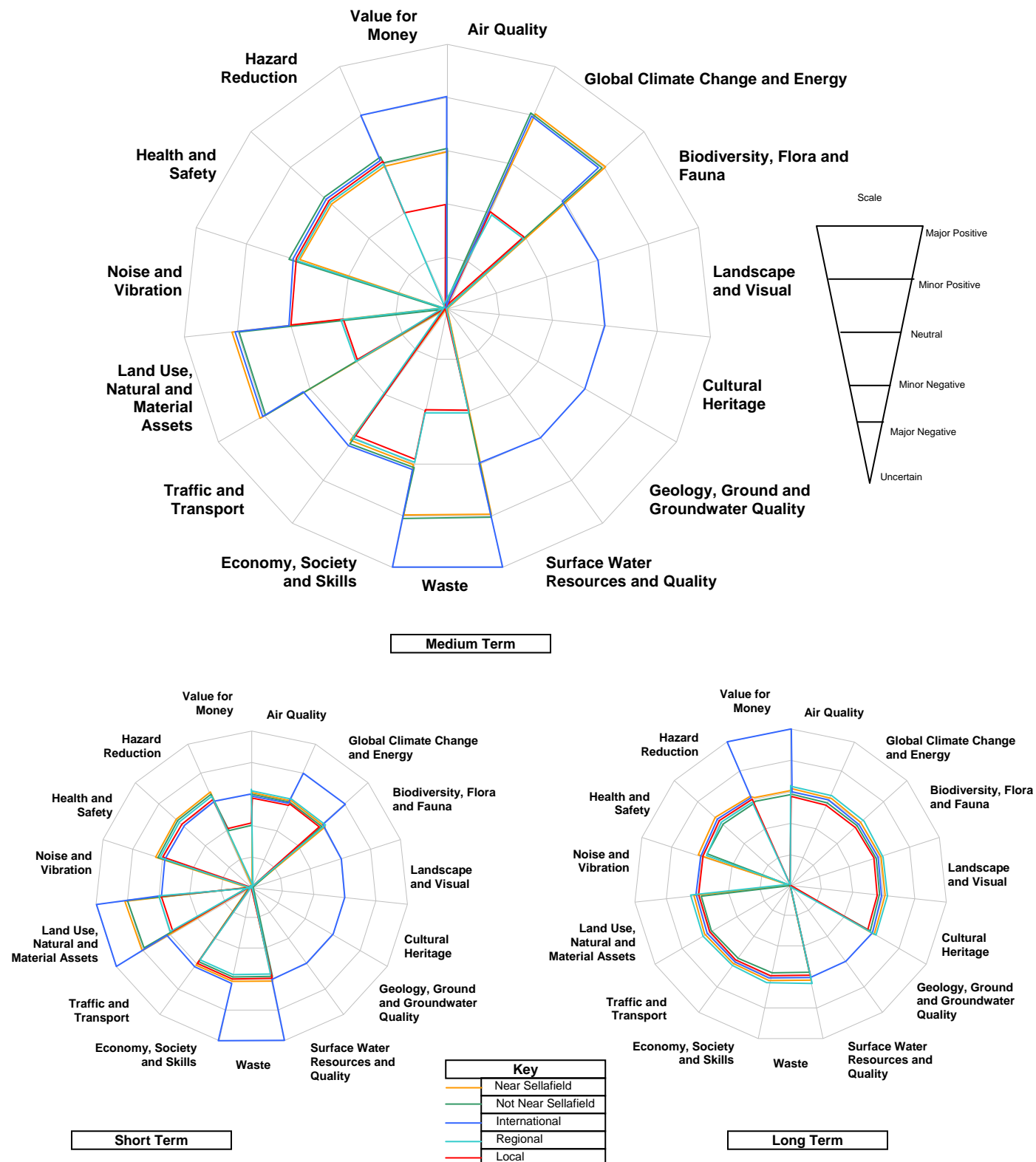
**ISSUES FOR FUTURE CONSIDERATION:** Once the design and location of proposed facilities has been identified, future assessments will be able to examine potential impacts in more detail. In particular the implications for biodiversity, cultural heritage, visual impact, noise levels and local transport patterns can be explored once specific proposed locations are identified. Also the characteristics of specific arisings of LLW will allow the most appropriate treatment type to be determined in light of its suitability for different treatment and disposal options.

**STRATEGIC MITIGATION:** Mitigation may include adopting the most appropriate techniques for the waste stream requiring treatment as required by operators' obligation to use the best practical means or best available techniques to manage LLW.

**Assessment Summary - Consideration 1: LLW Treatment and Disposal Options 8-13**



## Assessment Summary - Consideration 2: Options for the Location of Waste Management Facilities or Where LLW will be Treated



**DESCRIPTION:** Examines options for the location of waste management facilities or where LLW will be treated.

**REALISTIC OPTIONS:** 5 options were assessed, identifying the scale of the facility from the use of single national facility to manage specific types of LLW to multiple local facilities on or close to existing nuclear sites.

**SUMMARY OF THE ASSESSMENT:** The assessment identified a number of objectives where, broadly speaking, the potential effects of the options were dependent on the receiving environment or the type of facility (see Consideration 1). As such, they were considered to be uncertain at this stage. These included: Biodiversity, flora and fauna; Landscape and visual; Cultural heritage; Geology, Ground and Groundwater; Surface Water Resources and Quality; Traffic and Transport; and Noise and Vibration.

The key sustainability objectives for this consideration were:

- Objective 1: Air Quality:** A large single national facility may be able to practicably employ more sophisticated abatement technology than smaller facilities reducing discharges. However, as such discharges from LLW management in existing UK and overseas facilities are generally low and require prior permission from environmental regulators these are not expected to have a significant effect on air quality.
- Objective 2: Global Climate Change:** A large single national facility may be able to make better use of economies of scale associated with energy use (the converse is true for smaller facilities).
- Objective 8: Waste:** A large single national facility may be able to process waste more efficiently than smaller facilities reducing secondary wastes arising from such processing. The presence and magnitude of such economies of scale will depend on the type of facility in question.
- Objective 9: Economy, Society and Skills:** While the assessment found impacts on economy society and skills to be uncertain, a number of stakeholders raised concerns regarding potential negative impacts on property prices, the local economy, and community well being due to proximity of radioactive waste management facilities. While the assessment has not found evidence that adverse impacts on local economies are likely to be significant, such considerations can only be fully considered in the context of specific local circumstances and these issues are likely to be important aspects of any engagement with local communities around specific proposals.
- Objective 10: Traffic and Transport:** While the assessment found impacts on traffic and transport to be uncertain, a number of stakeholders raised concerns regarding the effects of traffic and transport. The assessment suggests that LLW is unlikely to be a significant contributor to transport associated with nuclear sites. Transport also does not make up a significant part of the nuclear industries carbon footprint and the risks associated with LLW transport are very low. However, the development of new disposal or treatment options (especially national scale facilities) could result in localised disturbance depending on the capacity of such facilities and the nature of local transport infrastructure. Transport is also an important issue for local communities both in the context of potential disturbance arising from transport and in terms of the perceived risk associated with the transport of radioactive waste.
- Objective 11: Land use, natural and material assets:** A single national facility is likely to be able to benefit from economies of scale and therefore have a positive effect on the efficient use of natural and material assets and land take, compared with a smaller facility.

**KEY CONCLUSIONS:** The assessment concludes that while there are distinguishing factors resulting from choices between local and regional or national facilities these are not likely to be sufficient to rule out any of the options considered here. Choices are therefore likely to be driven by the scale needed for certain treatment or disposal options to be practical (indeed as shown under consideration 1, thermal treatment with energy recovery, the whole

national inventory of combustible LLW is unlikely to be sufficient to justify a dedicated thermal treatment facility dealing with LLW).

There are also benefits in using existing facilities (local, regional, national or international) which have the capacity to manage LLW safely and environmentally responsibly as this avoids additional construction impacts while conserving capacity in the LLW Repository near Drigg and any other dedicated facilities for the management of LLW. Existing facilities also have the potential advantage of being rapidly made available for the management of UK LLW subject to the necessary regulatory and planning approvals.

The assessment also concluded:

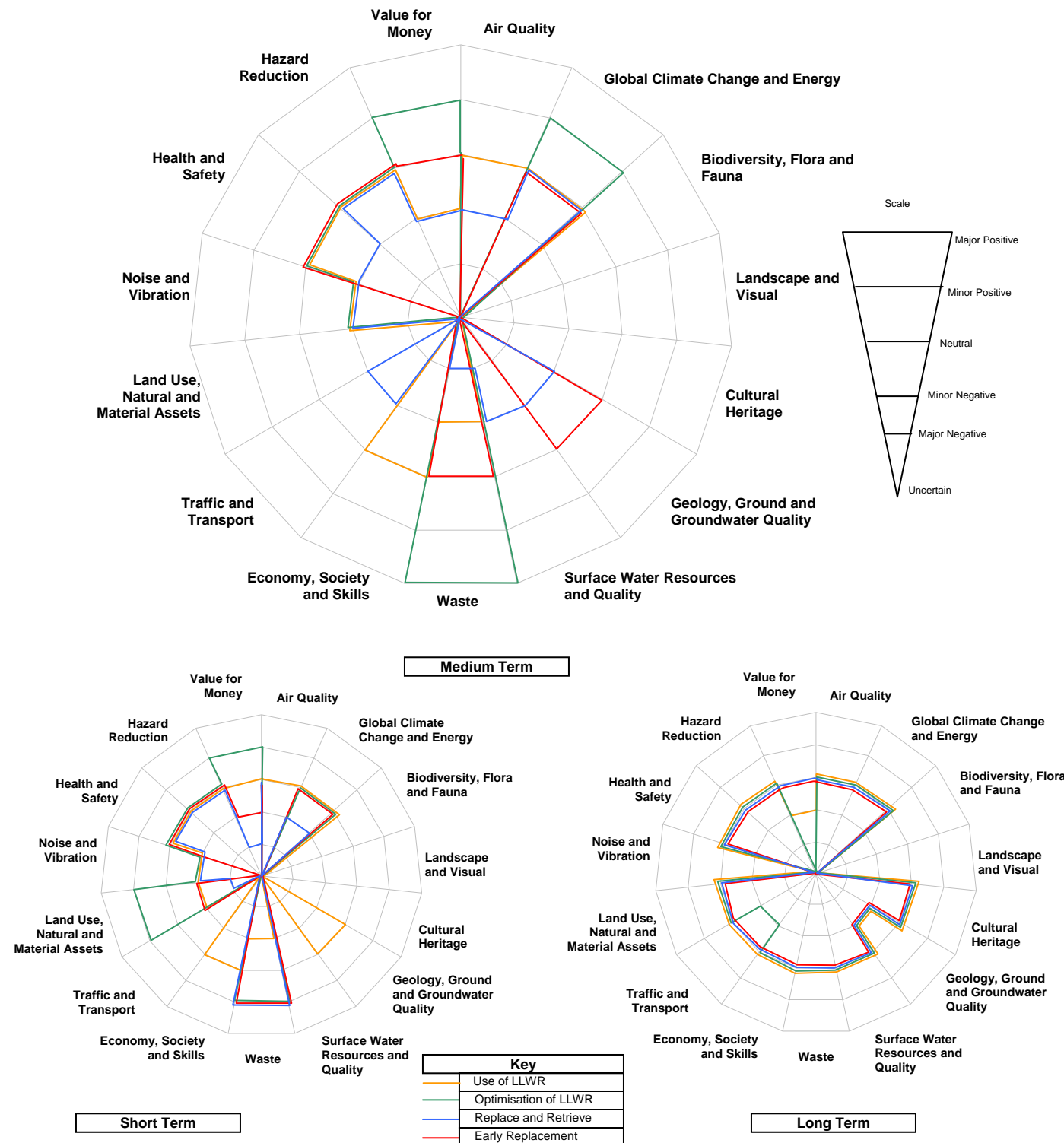
- While the proximity principle is an important consideration in waste management decisions, the limited environmental consequences of LLW transport and the limited volumes of LLW expected to arise compared to non radioactive waste arisings suggest it should not be an overriding consideration. Instead it should be part of seeking the best overall outcome for people, environment, society and the taxpayer.
- Disposal on or adjacent to, nuclear sites has been suggested as a means of minimising LLW transport and consequent disturbance to local communities. However, as described above, with the possible expectation of high volume waste from final site clearance, such impacts are not likely to be significant and potentially transport from constructing an engineered on-site facility may offset any positive impact from avoiding LLW transport from the facility. Such issues should be considered on a case by case basis taking account of effects on transport over the whole lifecycle of any proposal.
- Disposal on or adjacent to nuclear sites has also been suggested by some stakeholders to avoid potential detrimental effects on the local economy and community wellbeing due to proximity to new waste management facilities. While the assessment has not found evidence that adverse impacts on local economies are likely to be significant, such considerations can only be fully considered in the context of specific local circumstances and these issues are likely to be important aspects of any engagement with local communities around specific proposals.

**KEY ASSUMPTIONS:** Any new disposal facilities will be designed to meet the regulatory risk targets for facilities for the disposal of solid radioactive waste. It is assumed that facilities will predominantly be constructed in the short term, although it is recognised that temporary construction activities may also take place in the medium or long term as a result of facility expansion or capping. It is assumed that the operational activities will commence towards the end of the short term and take place primarily in the medium term. Closure will occur in the long term. Consideration 2 does not consider the implications about the type of waste management facilities as these are covered in Consideration 1.

**ISSUES FOR FUTURE CONSIDERATION:** Once the design and location of proposed facilities has been identified, future assessments will be able to examine potential impacts in more detail. In particular, the implications for biodiversity, cultural heritage, visual impact, noise levels and local transport patterns can be explored once locations are identified.

**STRATEGIC MITIGATION:** Mitigation may include adopting the principle of proximity and treating wastes near to their generation when all other considerations are equal. However, the use of national or regional facilities for the specialist treatment of wastes or disposal of wastes may be preferred where the environmental, social or financial benefits of a single large facility or a small number of regional facilities outweigh the benefits of proximity.

**Assessment Summary - Consideration 3: Provision of Capacity or When Facilities will exist for LLW Disposal**



**DESCRIPTION:** Examines various options regarding the availability of capacity at the LLW Repository and the provision of a replacement facility or when facilities will exist for LLW disposal.

**REALISTIC OPTIONS:** Four separate options were assessed. Two options illustrated choices relating to the use of optimisation to prolong the life of the LLW Repository and minimise the need for a replacement facility. Two options explore the early replacement of the LLW Repository either with or without retrieving LLW disposed to the current facility near the village of Drigg.

**SUMMARY OF THE ASSESSMENT:** The assessment identified a number of objectives where, broadly speaking, the potential effects of the options were dependent on the receiving environment or the scale of facilities for the optimisation of LLW management or the design and location of any replacement facilities (see Considerations 1 and 2). These included: Biodiversity, flora and fauna; Landscape and visual; and Cultural heritage.

The key sustainability objectives for this consideration were:

- **Objective 6: Geology, Ground and Groundwater Quality:** In the very long-term (beyond 1,000 years) there is a potential risk from the loss of integrity of any surface disposal facility. However, it is assumed that any new facilities will be designed with the aim of meeting the regulatory risk targets for facilities for the disposal of solid radioactive waste so that even in the event of the failure of disposal sites risks are expected to remain acceptable.
- **Objective 8: Waste:** The use of the current LLWR without optimisation performs negatively against this objective as it does not make the best use of this exiting asset and would require greater replacement capacity to be provided. The early replacement of the LLWR near Drigg with recovery of historic disposal also performs very negatively due to the additional substantial volume of historically disposed wastes which would need to be managed under this option.
- **Objective 11: Land Use, Natural and Material Assets:** There is likely to be a significant increase in the use of resources (e.g. water and cement) and an increase in area of land dedicated to LLW disposal in the short term without higher levels of optimisation being implemented to minimise the volumes of waste requiring engineered disposal.
- **Objective 12: Noise and Vibration:** In the short and medium term there is likely to be a noticeable increase in the levels of noise and vibration associated with the construction of new vaults or a replacement facility.
- **Objective 15: Value for Money and Affordability:** The optimised use of the LLWR near the village of Drigg has the potential to significantly reduce lifetime costs associated with LLW management. By comparison, options involving early replacement of the LLWR entail significant costs early on in establishing a replacement facility. Additionally, the early replacement with retrieval would result in further significant costs due to the large volume of retrieved waste requiring management.

**KEY CONCLUSIONS:** The optimised use of the LLWR is the preferred option provided an environmental safety case for the continued use of the facility can be made and subject to any necessary regulatory and planning approvals.

Optimised disposal at the LLWR near Drigg is preferred to non optimised disposal as it reduces the volume of LLW requiring engineered disposal, involves the application of the waste management hierarchy and the development of new LLW management facilities. It will also reduce the land take and resource use involved in LLW disposal at the LLWR and any replacement facility.

Early replacement without retrieval will have limited environmental effects, although this does depend on the specific location of the replacement facility. It would, however, require the early identification of a site, or sites, for a replacement facility and require considerable additional early investment.

The retrieval of waste currently disposed in the disposal trenches at the LLWR would result in a range of potential negative environmental effects and would need to be justified by clear

information that regulatory risk targets could not be met without retrieval. Additionally, retrieval would need to be shown to deliver a significant reduction in risk that outweighs any residual detriment resulting from retrieval.

**KEY ASSUMPTIONS:** Consideration 3 assumes that any new facilities will be designed with the aim of meeting the regulatory risk targets for facilities for the disposal of solid radioactive waste. It is assumed that new facilities will predominantly be constructed in the short term, although it is recognised that construction activities may also occur in the longer term. It is assumed that the operational activities will commence towards the end of the short term and will primarily take place in the medium term. Closure will occur in the long term. A significant release of radioactivity from disposed LLW in engineered vaults is only likely to occur when containment is threatened which is likely to be in the long term. Finally it is assumed that LLWR Ltd. will be able to make an acceptable Environmental Safety Case for the LLWR and gain the permissions and authorisations necessary to continue operations and dispose of waste.

**ISSUES FOR FUTURE CONSIDERATION:** The LLWR Environmental Safety Case will address the suitability of the facility for ongoing LLW disposal, the total radiological capacity of the facility and the characteristics of waste which can be disposed of in the facility. Once the design and location of any replacement facility has been identified future assessments will be able to examine potential impacts in more detail. In particular, the implications for biodiversity, cultural heritage, visual impact, noise levels and local transport patterns can be explored once locations are identified.

**STRATEGIC MITIGATION:** Optimisation of LLW using the approaches described in Consideration 1 will minimise the overall scale of LLWR and any replacement facility. The LLWR Environmental Safety Case will address the potential for retrieval of waste to minimise long term risks associated with LLWR and the balance of such benefits against the potential detriments of retrieval. Environmental Impact Assessments supporting future planning will consider the potential for design construction and operation of future vaults and caps to mitigate implications of those facilities and in particular for biodiversity, cultural heritage, visual impact, noise levels and local transport patterns.

## Assessing the Sustainability Performance of the UK Nuclear Industry LLW Strategy

The anticipated effects of the UK Nuclear Industry LLW Strategy on each sustainability objective are:

**Air Quality** – The UK Nuclear Industry LLW Strategy identifies a number of treatment and disposal techniques that have the potential to effect air quality (e.g. thermal treatment techniques that are likely to increase the gaseous emission of radionuclides and particulate matter). Changes in air quality may also occur during construction of any facility for example due to the generation of dust but these will be temporary localised effects. Any treatment or disposal technique will only be implemented if it can be demonstrated that it will operate within regulatory permitted limits. As such, it is unlikely that the strategy will contribute significantly to a decrease in air quality.

**Global Climate Change and Energy** – There is likely to be a change in energy consumption and the emission of greenhouse gases as a result of implementing a number of treatment or disposal options, such as the replacement of and retrieval of wastes from the LLWR, or thermal treatment techniques. However, on the whole, a significant proportion of the options presented in the UK Nuclear Industry LLW Strategy are unlikely to have a significant effect on the consumption of energy or emission of greenhouse gases. Any effect would be negligible in comparison to current nuclear industry greenhouse gas emissions. Therefore, the strategy is unlikely to contribute significantly to climate change.

The resilience of LLW disposal facilities to the effects of climate change is a key issue in the development of these facilities to ensure climate change does not threaten the ability of any facility to meet the relevant regulatory risk targets. This will, however, be primarily addressed as part of the authorisation of specific facilities as described under Geology, Ground and Groundwater Quality.

**Biodiversity, Flora and Fauna** – Many of the proposed options associated with the UK Nuclear Industry LLW Strategy have the potential to affect sensitive ecological receptors through the development of new facilities. However, any such effects are dependent on where a facility is located relative to sensitive receptors and at what scale it is implemented. As the UK Nuclear Industry LLW Strategy provides a national framework for the development of plans for the management of waste and does not consider the design or location of specific facilities, its effect on biodiversity, flora or fauna is uncertain until a specific location identified. Future assessments of specific developments (where appropriate) are expected to identify, characterise and consider the significance of any such effects and any project level mitigation that may be applicable.

**Landscape and Visual** – Some of the proposed options considered have the potential to affect landscape and visual assets through the construction of new waste management facilities or expansion of existing facilities.

However, any effects will be dependent on where such a facility is located (both in terms of the sensitivity of receptors and visibility from sensitive locations) and at what scale it is implemented. As the UK Nuclear Industry LLW Strategy provides a national framework for the development of plans for the management of LLW and does not consider the design or location of specific facilities, its effect on landscape or visual receptors is uncertain. Future assessments of specific developments (where appropriate) are expected to identify, characterise and consider the significance of any such effects and any project level mitigation that may be necessary.

**Cultural Heritage** – Some of the proposed options considered have the potential to affect cultural heritage assets. However, any such effects are dependent on where a facility is located relative to cultural heritage assets and sites and at what scale it is implemented. As the UK Nuclear Industry LLW Strategy provides a national framework for the development of plans for the management of LLW and does not consider the design or location of specific facilities, its effect on cultural heritage assets is uncertain. Future assessments of specific developments (where appropriate) are expected to identify, characterise and consider the significance of any such effects and any project level mitigation that may be necessary.

**Geology, Ground and Groundwater Quality** – On the whole, the options associated with the UK Nuclear Industry LLW Strategy are not expected to have an effect on geology, ground or groundwater quality. With regards to the LLWR (or replacement facility), in the very long term the containment of contaminants may be reduced due to structural failure caused by material fatigue or as a result of climate change. However, any disposal facility will need to be demonstrated to be consistent with relevant regulatory risk targets even in this eventuality. Therefore, significant effects are not expected to arise from the implementation of the UK Nuclear Industry LLW Strategy.

**Surface Water Resources and Quality** – On the whole, the options associated with the UK Nuclear Industry LLW Strategy are not expected to have a significant effect on surface water quality although some may result in small increases in liquid discharges. Any treatment or disposal technique will only be implemented if it can be demonstrated that it will operate within regulatory permitted limits. As such, it is unlikely that the strategy will contribute significantly to a decrease in water quality.

Some of the options associated with the UK Nuclear Industry LLW Strategy will involve water use. There may be some benefits from using fewer larger facilities in terms of improved water efficiency. However, water use from LLW management is not believed to be significant in terms of nuclear industry water use. As such, it is unlikely that the strategy will contribute significantly to the use of surface water resources.

**Waste** – The UK Nuclear Industry LLW Strategy will contribute significantly to the optimal management of LLW. This is because, collectively, the options considered will enable a strategy that will ensure the availability of

management and disposal routes for Low Level Waste (LLW) and Very Low Level Waste (VLLW) by enabling:

- Application of the waste management hierarchy to minimise the volume of LLW requiring disposal
- Developing and exploiting new risk based routes for the management and disposal of LLW; and
- Optimising the use of existing facilities by using them in such a way as to maximise their capacity to accept waste and minimising the need for replacement facilities.

**Economy, Society and Skills** – The UK Nuclear Industry LLW Strategy presents a number of opportunities to advance the UK's knowledge and skills relating to treatment techniques associated with LLW. It will also provide a small number of employment opportunities and investment in local communities as a result of some of the options. However, some stakeholders have expressed concern that the development of new facilities for the management of LLW could have localised detrimental effects on the economy and community well being. These effects are unlikely to be significant or widespread, as described in Appendix D. Any effects are likely to be specific to the local circumstances (for example they may be less relevant to proposals on or adjacent to existing nuclear or waste management sites). These issues are likely to be important aspects of the engagement with local communities around specific proposals.

**Traffic and Transport** – The UK Nuclear Industry LLW Strategy is unlikely to have a significant effect on transport issues as LLW transport accounts for a small proportion of the transport associated with the operation of nuclear sites where waste is generated. LLW transport also does not make up a significant part of the nuclear industry's carbon footprint and the risks associated with LLW transport are very low. However, the development of new disposal or treatment options (especially national scale facilities) could result in localised disturbance depending on the capacity of such facilities and the nature of local transport infrastructure.

Transport is also an important issue for local communities both in the context of the potential disturbance arising from transport and in terms of the perceived risk associated with the transport of radioactive waste. Therefore, whilst the strategy is not anticipated to have significant transport effects any potential localised effects will need to be captured in subsequent tiers of assessment (where appropriate) prior to the implementation of an option and in engagement with local communities.

**Land Use, Natural and Material Assets** – There may be a short term increase in the consumption of resources and land take as new facilities to treat or dispose of LLW are established. However, in the medium and long term, the UK Nuclear Industry LLW Strategy is likely to optimise the use of resources to manage and dispose of LLW by ensuring flexible management routes are available for LLW that are tailored to the specific characteristics of that waste.

**Noise and Vibration** – The options associated with the UK Nuclear Industry LLW Strategy have the potential to affect

sensitive noise and vibration receptors. However, such effects are dependent on where a facility is located and at what scale it is implemented. The UK Nuclear Industry LLW Strategy provides a framework for the development of plans for the management of waste and does not consider specific siting issues. Consequently, the strategy itself will have an uncertain effect on noise and vibration until a specific location is identified. However, it is noted, that there may be some detrimental effects arising from the LLW disposal options in Consideration 3. Future assessments of specific developments (where appropriate) will identify, characterise and consider the significance of any such effects and any project level mitigation that may be necessary.

**Health and Safety** – There is unlikely to be a significant change in the health and safety of the public or the workforce as a result of the UK Nuclear Industry LLW Strategy. Whilst some treatment techniques may introduce new potential hazards to the workforce these should be amenable to effective control by site operators to reduce the risk to workers, so far as is reasonably practical, and to a level where residual risks are acceptable. Similarly, some treatment options may increase the potential exposure of the workforce to radioactivity as part of the segregation, monitoring and treatment of LLW but operators should still be able to keep such exposure as low as reasonably achievable and well within the relevant dose limits.

**Hazard Reduction** – The UK Nuclear Industry LLW Strategy is likely to have a positive effect on hazard reduction as although LLW is not a significant contributor to the hazards present on nuclear sites, maintaining disposal routes for LLW as well as higher activity wastes is a necessary enabler of hazard reduction programmes.

**Value for Money** – The effect of various options on achieving value for money is dependent on the requirement to introduce new facilities and the type and scale of such facilities. However, collectively the UK Nuclear Industry LLW Strategy seeks to encourage a supply chain led approach and will optimise use of existing facilities and disposal routes. Therefore, on the whole, the strategy is expected to contribute to value for money for the UK tax payer and to reducing civil public sector liabilities associated with LLW management.

## Conclusions and Key Findings

A number of key findings have been identified from the assessment of the UK Nuclear Industry LLW Strategy. The findings have been drawn together under the following three themes that form the framework of the strategy itself:

### Application of the waste management hierarchy

The SEA examined decontamination, reuse and recycling options. It concluded that:

- Decontamination to clean contaminated waste to allow it to be managed as exempt waste or to facilitate its onward management has a positive role to play. However, specific circumstances will determine the degree to which this should be implemented (if at all) to ensure that the benefits outweigh the potential

detrimental effects of decontamination, such as energy use, resource use, discharges, secondary waste generation and the risk of exposure to workers involved in decontamination.

- The reuse of materials that would otherwise be disposed of as radioactive waste has potential benefit by deferring the need to dispose of existing waste and by avoiding the need for new material to be used, which would itself become contaminated. Reuse under appropriate control is also expected to result in limited environmental effects. However, the scope of implementation will be limited by the practicability of identifying circumstances in which material can be reused under appropriate regulatory oversight and the challenges of demonstrating the suitability of material for reuse.

The SEA also considered options relating to the recycling of metallic wastes. It concluded that:

- Metal treatment and recycling has the potential to significantly reduce the volumes of LLW requiring disposal, either through volume reduction or by allowing metal to be recycled (provided it can be demonstrated that treated metal meets the relevant safety standards). Therefore, metal treatment is an appropriate option for the management of LLW. Specific circumstances will need to be considered to ensure the benefits of this option outweigh the potential negative effects of metal treatment such as energy use, resource use, discharges, secondary waste generation, the risk of exposure to workers and any additional transport.

The SEA also considered options relating to thermal treatment with energy recovery. It concluded that:

- Thermal treatment has the potential to significantly reduce the volumes of LLW requiring disposal through volume reduction. Thermal treatment is an appropriate option for the management of LLW. Specific circumstances will need to be considered to ensure the benefits of this option outweigh the potential negative effects of thermal treatment such as energy use, resource use, discharges, secondary waste generation, the risk of exposure of workers and any additional transport.
- The use of thermal treatment with energy recovery presents potential environmental benefits over thermal treatment without energy recovery. However, this benefit is likely to be offset as the volumes of LLW which are suitable for thermal treatment are expected to be insufficient to support a substantial waste to energy facility. Therefore, unless practical technology for smaller scale energy recovery is identified, this option is only likely to be implemented through the co-treatment of radioactive and non radioactive waste by the wider waste management supply chain. This latter option presents significant challenges as described in the Strategy itself.

## Make best use of existing assets

The SEA considered a number of options (in consideration 3) around the future use of the LLWR near Drigg. It concluded that:

- Optimised use of the LLWR is the preferred approach, provided a safety case for the continued use of the facility can be made and subject to any necessary regulatory and planning approvals. This option is preferred to the “non optimised” use and replacement of the facility, due to the reduced volume of LLW requiring disposal in this type of facility and thus the reduced land take and resources used during construction and capping of successor facilities.
- It is difficult to determine what the effects of the early replacement of the LLWR without retrieval of existing wastes would be, without knowledge of the specific location of the replacement facility. It would, however, result in significant expenditure in the near term.
- The retrieval of waste currently disposed of in the trenches at the LLWR would result in a range of potential environmental, safety and cost effects. The Environmental Safety Case project at LLWR is considering these implications in more detail. To implement this approach, a detailed Environmental and Safety Case would need to be made to demonstrate that these effects were outweighed by a significant reduction in risk and that regulators’ risk targets could not be met without undertaking this course of action.

The SEA also considered the use of alternative disposal packaging (in consideration 1). It concluded that:

- There is an opportunity to reduce both the cost and environmental effect of LLW disposal through the use of waste packaged which use less resources or enable improved packaging efficiency than the current methods, provided it is demonstrated that alternative packaging does not compromise the ability of a disposal site to meet regulatory risk targets and make an acceptable Environmental Safety Case.

The SEA also considered the potential issues associated with traffic and transport. It concluded that:

- Transport is a distinguishing factor in choices between waste management options and the transport of radioactive materials is an issue of stakeholder concern. Therefore, as with conventional waste management the principle of proximity between the location of waste arising and the location of treatment and disposal facilities is a key consideration. However, whilst transport is an issue of stakeholder interest, the actual effects of LLW transport are relatively small and so this issue is not a strong differentiator between options on a national scale, since the contribution of LLW to local transport is a very small constituent of the total transport associated with the operation of the site. Similarly, CO<sub>2</sub> emissions from transport are not a significant contributor to the carbon emissions of the nuclear sector, or from transport at a national scale.

## Open and exploit new fit for purpose waste routes

The SEA considered alternative disposal options. The assessment concluded that:

- As LLW encompasses a large range of radioactivity and a highly engineered facility such as LLWR is not necessary required for lower activity waste and wastes containing short lived radioactivity, the use of conventional landfills presents potential benefits to the management of LLW. These alternative disposal options will be required to demonstrate that disposal will meet the regulatory risk targets prior to authorisation. The benefit of this approach is achieved through reducing the raw materials used in the disposal of radioactive waste, ensuring the optimised use of the LLWR and improving the efficiency with which waste is packaged, thereby reducing the total volume of packaged waste requiring disposal.
- The use of landfill disposal for VLLW and other LLW will not significantly affect the remaining UK landfill capacity as the total estimated LLW arisings are 3 million m<sup>3</sup> over a period of 120 years. Predicted annual arisings of VLLW vary considerably, although an annual average arising in the order of 30,000 m<sup>3</sup> is expected. This compares with 335 million tonnes of non radioactive waste arising each year and the total remaining landfill capacity in England and Wales as of 2006 was 694 million m<sup>3</sup>.

The SEA also considered local disposal options. It concluded that:

- One of the benefits identified with disposal on or adjacent to nuclear sites is reducing LLW transport. However, when considering disposal on or adjacent to nuclear sites there is a need to consider the net effect on transport. The transport implications of some LLW management options, such as disposal in engineered vaults, involve significant amounts of construction transport and it is therefore possible that any benefit from avoiding the need to transport waste from the site could be offset by additional (short term) transport to construct an on site facility.
- The widespread use of on site disposal involves a larger number of relatively small facilities compared with a smaller number of larger facilities.
- The location of nuclear facilities has been determined by their suitability for nuclear operations rather than as waste disposal sites. It is therefore not necessarily the case that existing nuclear sites are suited to radioactive waste disposal, although they may be suited to other waste management facilities.

The above conclusions have informed the development of the UK Nuclear Industry LLW Strategy and are identified where relevant in the draft Strategy which is being

consulted on in parallel with this Environmental and Sustainability Report.

The overall conclusion is that, on the whole, the UK Nuclear Industry LLW Strategy will contribute positively to improving LLW management by optimising existing facilities and ensuring that cost intensive disposal routes (such as the engineered LLWR) are used efficiently and the capacity required from them is minimised, thereby reducing the costs.

## Monitoring

It is a requirement of the SEA Directive to establish how the significant sustainability effects of implementing the Nuclear LLW Strategy will be monitored. However, as ODPM Guidance<sup>4</sup> (ODPM, 2005) notes, *'it is not necessary to monitor everything, or monitor an effect indefinitely. Instead, monitoring needs to be focused on significant sustainability effects'*.

Monitoring the Strategy for sustainability effects can help to answer questions such as:

- Were the assessment's predictions of sustainability effects accurate?
- Is the Strategy contributing to the achievement of desired SEA objectives?
- Are mitigation measures performing as well as expected?
- Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?

Monitoring should therefore be focussed on:

- Significant sustainability effects that may give rise to irreversible damage, with a view to identifying trends before such damage is caused.
- Significant effects where there was uncertainty in the SA and where monitoring would enable preventative or mitigation measures to be undertaken.

Table NTS 4 identifies a number of potential indicators that could be used for monitoring the sustainability impacts of the Nuclear LLW Strategy. The list contains a number of indicators which are already in common use.

Your views on the monitoring of the implementation of the strategy would be welcome, and measures concerning monitoring will be confirmed in the post adoption statement which will be made available after the final UK Nuclear Industry LLW Strategy is issued.

<sup>3</sup> Sources: [www.defra.gov.uk](http://www.defra.gov.uk) and [www.environment-agency.gov.uk](http://www.environment-agency.gov.uk).

<sup>4</sup> Practical Guide to the Strategic Environmental Assessment Directive (ODPM, September 2005)

**Table NTS 4 Potential Monitoring Measures**

Objective	Monitoring Measure	Source(s) of Information
Air Quality	Authorised gaseous discharges of radioactivity.	<b>Radioactivity in Food and the Environment (RIFE) Annual Reports</b> (Food Standards Agency (FSA), the Environment Agency, SEPA, and the Environment and Heritage Services of Northern Ireland).
Global Climate Change and Energy	Energy consumption at facilities.	NDA; Site Licensed Companies and facility site operators; and Environment Agency ( <a href="http://www.environment-agency.gov.uk">www.environment-agency.gov.uk</a> )
	Emission of greenhouse gases	Defra ( <a href="http://www.defra.gov.uk">www.defra.gov.uk</a> ); Nuclear Sector Plan
Biodiversity	Condition Reports for Designated Sites	Scottish Natural Heritage; Countryside Council Wales; Natural England.
Landscape and Visual	Changes in the visual appearance of facilities.	Relevant Landscape Character Assessments EIA associated with the facility or other major developments in the area.
Cultural Heritage	Condition of historic assets	English Heritage; Historic Scotland; Cadw
Groundwater, Geology and Soil Quality	RIFE aqueous discharges.	<b>Radioactivity in Food and the Environment (RIFE) Annual Reports</b> (Food Standards Agency (FSA), the Environment Agency, SEPA, and the Environment and Heritage Services of Northern Ireland).
Surface Water Resources and Quality	RIFE aqueous discharges.	<b>Radioactivity in Food and the Environment (RIFE) Annual Reports</b> (Food Standards Agency (FSA), the Environment Agency, SEPA, and the Environment and Heritage Services of Northern Ireland). Environment Agency; SEPA; DoENI. Nuclear Sector Plan
	Water quality monitoring Water Use	
Waste	LLW inventory	UK National Radioactive Waste Inventory, LLW Strategic Review
Economy, Society and Skills	National Statistics data – unemployment level, level of qualifications etc.	National Statistics
Traffic and Transport	Traffic activity levels around NDA sites (Annual Average Daily Traffic Flows)	Department for Transport ( <a href="http://www.dft.gov.uk">www.dft.gov.uk</a> )
Land Use, Natural and Material Assets	Quantity of materials ordered by sites / facilities	Facility operators; Site Licensed Companies
Noise and Vibration	Monitoring of noise levels at facilities or on NDA sites	Facility operators; Site Licensed Companies
Health and Safety	RIFE radiological dose levels	<b>Radioactivity in Food and the Environment (RIFE) Annual Reports</b> (Food Standards Agency (FSA), the Environment Agency, SEPA, and the Environment and Heritage Services of Northern Ireland).
	Radiological Exposure to workers; TRIR; RIDDOR rates	NDA; Site Licensed Companies NDA; Site Licensed Companies

Objective	Monitoring Measure	Source(s) of Information
	National Statistics – Long term ill etc.	National Statistics
Hazard Reduction	Safety and Environmental Detriment	NDA; Site Licensed Companies
Value for Money and Affordability	Estimated costs to the NDA;	NDA

## Next Steps

This Non-Technical Summary of the Environmental and Sustainability Report provides a summary of the information presented in the Environmental and Sustainability Report, which should be referred to for more detailed information. The Environmental and Sustainability Report and the consultation on it fulfil the requirements of Stage C of the SEA process and sets out the assessment of the UK Nuclear Industry LLW Strategy.

The Environmental and Sustainability Report and the draft UK Nuclear Industry LLW Strategy have been sent to the statutory consultees listed in the SEA Regulations<sup>5</sup>. It has also been sent to the Health and Safety Executive, the Health Protection Agency, the Food Standards Agency, the Department for Transport, the Nuclear Legacy Advisory Forum of the Local Government Association, and the Convention of Scottish Local Authorities.

Comments from key stakeholders and consultees are invited during the 14 week consultation period between the 5<sup>th</sup> of June 2009 and the 11<sup>th</sup> of September 2009, as described below.

<sup>5</sup> Environment Agency, English Heritage, Natural England, Department of the Environment's Environment and Heritage Service (Northern Ireland), Historic Scotland, Scottish Natural Heritage, The Scottish Environment Protection Agency, Cadw (Welsh Historic Monuments), Countryside Council for Wales, and Environment Agency Wales.

## This Consultation: How to Give us Your Views

We would welcome your views on this Environment and Sustainability Report on the draft UK Nuclear Industry LLW Strategy. The consultation period will run for 14 weeks from the 5<sup>th</sup> of June 2009 to the 11<sup>th</sup> of September 2009.

We are particularly interested to receive your views on the following questions:

1. **Do you agree that the key issues identified correctly articulate the key issues which the UK Nuclear Industry LLW Strategy needs to address?** If not, what do you feel are the key issues?
2. **Do you agree that the baseline information provides an appropriate amount of information on relevant aspects of the current state of the environment and the characteristics of the areas likely to be affected by the implementation of the UK Nuclear Industry LLW Strategy?** If not, what information is missing or incorrect and where can it be acquired from?
3. **Do you agree that the review of plans and programmes identifies all relevant plans and programmes that relate to the UK Nuclear Industry LLW Strategy?** If not, what additional plans or programmes do you believe are relevant and why?
4. **Do you believe that the environmental and sustainability assessment identifies the likely significant effects arising from the proposed strategies and potential alternatives?** If not, what effects do you feel are not correctly identified and why?
5. **Do you believe any further strategic measures are necessary to prevent, reduce or offset likely significant effects of the UK Nuclear LLW Strategy?** If so, what further strategic mitigation do you believe is necessary?
6. **Do you believe any further monitoring measures are necessary to monitor the significant effects or implementing the UK Nuclear Industry LLW Strategy?** If so, what measures do you propose be adopted?
7. **Do you have any further comments on the Environmental and Sustainability Report or the assessment described therein?**
8. **Do you agree with the conclusions and recommendations of the Report?** If not, what do you think should be the key recommendations and why?

We are also interested in your comments on the draft UK Nuclear Industry LLW Strategy which this Environment and Sustainability Report has informed. This draft UK Nuclear Industry LLW Strategy has been published for consultation in parallel with this report and copies of both documents are available from [www.nda.gov.uk/consultations](http://www.nda.gov.uk/consultations) or printed copies can be requested by writing to the address below.

Comments should be submitted online at [www.nda.gov.uk/consultations](http://www.nda.gov.uk/consultations) or be sent to the address below by the 11<sup>th</sup> of September 2009:

**Post:** LLW Strategy

Nuclear Decommissioning Authority

Herdus House,

Westlakes Science and Technology Park

Moor Row, Cumbria

CA24 3HU

**Email:** [llwstrategy@nda.gov.uk](mailto:llwstrategy@nda.gov.uk)

Individual responses and information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information regimes (these are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) and the Environmental Information Regulations 2004). If you want other information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this, it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the NDA. The NDA will process your personal data in accordance with the DPA. In the majority of circumstances, this will mean that your personal data will not be disclosed to third parties.

Individual responses will not be acknowledged unless specifically requested.

## Appendix A

### Abbreviations

Term	Description
<b>Alpha radiation</b>	Alpha radiation takes the form of particles (helium nuclei) ejected from some decaying (radioactive) atoms. Alpha particles cause ionisations in biological tissue which may lead to damage. The particles have a very short range in air (typically about 5cm) and if present in materials that are outside the body, they are prevented from causing biological damage by the superficial dead skin cells, but become significant if inhaled or swallowed.
<b>AONB</b>	Area of Outstanding Natural Beauty
<b>Ash</b>	Two types of ash arise from incineration – bottom ash which remains in the grate after combustion, and smaller particles comprising fly ash which is present in the emissions, and which is removed from the gases prior to their discharge. Ash is sent to landfill although a proportion is reused in construction.
<b>BAT</b>	Best Available Technology (OSPAR) or Best Available Technique (PPC Directive)
<b>BEP</b>	Best Environmental Practice
<b>BERR</b>	Department of Business, Enterprise and Regulatory Reform (formerly Department of Trade and Industry).
<b>Beta radiation</b>	Beta radiation takes the form of particles (electrons) emitted from the nucleus of some decaying (radioactive) atoms. Beta particles cause ionisations in biological tissue which may lead to damage. Most beta particles can pass through the skin and penetrate the body, but a few millimetres of light materials, such as aluminium, will generally shield against them.
<b>Beta/gamma radiation</b>	Beta radiation is usually accompanied by the emission of gamma rays, hence the term “beta/gamma activity”.
<b>BNFL</b>	British Nuclear Fuels Plc.
<b>Bq (Becquerel)</b>	Becquerel.  The standard international unit of radioactivity equal to one radioactive transformation per second. LLW and VLLW are classified according to their radioactive content per unit mass. Multiples of becquerels commonly used in quantifying radioactive waste are: kilobecquerel (kBq) equal to one thousand Bq and megabecquerel (MBq) equal to one million Bq.
<b>CoRWM</b>	Committee on Radioactive Waste Management
<b>CO<sub>2</sub></b>	Carbon Dioxide.  The most commonly referred to of a number of pollutants known as greenhouse gases. Increasing concentrations of CO <sub>2</sub> in the atmosphere contribute to global climatic change.
<b>Contaminated land</b>	In this report, contaminated land refers to radioactive contaminated land. It is a special case of land that is determined as Contaminated Land under Part 2A of the Environmental Protection Act as it is causing harm or there is a significant possibility of such harm being caused. Harm is defined as “lasting exposure resulting from the after effects of a radiological emergency, part practice or past work activity”.

Term	Description
<b>Controlled burial (called special precautions burial in Scotland)</b>	Also known as “special precautions burial”. A process for disposal for solid LLW that has an activity level above that which would allow it to be disposed of as VLLW. Controlled burial takes place at landfill sites used for the deposit of substantial quantities of non-radioactive waste but which are approved for the disposal of radioactive substances. Controlled burial has various limitations placed on its use in terms of maximum activity per waste container, type of container, surface dose rate of container, and depth of burial beneath earth or non-radioactive waste.
<b>Controlled waste</b>	Defined in the Environmental Protection Act 1990 as waste arising from household (municipal), industrial and commercial premises. Ultimate disposal is via landfill and incineration.
<b>DCMS</b>	Department for Culture, Media and Sports
<b>Decay chains</b>	These generally refer to the three naturally occurring series of radionuclides, all of which start with a single parent (uranium-238, uranium-235 and thorium-232) each of which decays via a number of radioactive daughters of different half-lives, eventually ending with stable nuclides of lead.
<b>DECC</b>	Department of Energy and Climate Change (formed from the energy section of BERR and climate change section of Defra)
<b>Defra</b>	Department of the Environment, Food and Rural Affairs.
<b>DoENI</b>	Department of the Environment Northern Ireland
<b>Dose constraint</b>	When a practice involving ionising radiation is being planned, a level of dose is often set to restrict future doses that might be received from that practice. This level of dose is called a dose constraint, and will differ depending on the practice being planned. Dose constraints are less than the legal dose limit.
<b>Dose limit</b>	Dose limits are maximum levels of radiation dose per year which are laid down in UK Law. For members of the public, the dose limit is 1 millisievert per year. Dose limits apply to all non-medical practices which involve a risk from ionising radiation coming from an artificial source, or from a natural radiation source in cases where natural radionuclides are, or have been, processed because of their radioactive, fissile or fertile properties. Different dose limits apply to workers.
<b>DTI</b>	Department of Trade and Industry (now BERR)
<b>EIA</b>	Environmental Impact Assessment
<b>Environmental Safety Case (ESC)</b>	The collection of arguments, provided by the developer or operator of a facility, that seeks to demonstrate that the required standard of the safety of people and the environment (at present and in the future) is achieved.
<b>EU</b>	European Union
<b>Exemption Orders (EO)</b>	The Radioactive Substance Act 1993 makes provision for certain low activity wastes, when used for certain purposes and when managed in particular ways, to be excluded from particular regulatory provisions made under the Act.
<b>Gamma radiation</b>	An electromagnetic radiation similar in some respects to visible light but with higher energy. Gamma rays cause ionisations in biological tissue which may lead to damage. Gamma rays are very penetrating and are attenuated only by shields of dense metal or concrete, perhaps some metres thick, depending on their energy. Their emission from a radionuclide during radioactive decay is usually accompanied by particle emissions (beta or alpha particles).
<b>Half life</b>	The time required for one half of the atoms of a given amount of a particular radionuclide to disintegrate through radioactive decay. Each radionuclide has a unique half-life and half-lives vary from fractions of a second through to many millions of years. The half-life of a radionuclide is therefore of fundamental importance when considering its safe long-term management.
<b>Hazardous waste</b>	A special type of controlled waste that must be disposed of to certain types of facility (usually special landfills).

Term	Description
<b>HLW</b>	<p>High Level Waste.</p> <p>Radioactive waste above 4 GBq/tonne of alpha or 12 GBq/tonne of beta-gamma activity which releases heat to the extent that it needs to be considered in the design of storage facilities.</p>
<b>ILW</b>	<p>Intermediate Level Waste.</p> <p>Radioactive waste exceeding the upper activity boundaries for LLW (above 4 GBq/tonne of alpha or 12 GBq/tonne of beta-gamma activity), but which does not generate sufficient levels of heat to require it to be factored into the design of disposal facilities.</p>
<b>ILW (Short Lived)</b>	<p>ILW that does not contain significant levels of radionuclides with half lives greater than 30 years.</p>
<b>Leachate</b>	<p>Liquid that has seeped through a landfill (waste disposal) site, and which contains a variety of soluble constituents of the waste.</p>
<b>Lime (in the context of incineration)</b>	<p>Lime is used to neutralise acidic gases present in emissions. Reacted lime is part of an incinerator's air pollution control residues (along with ash and sludges), and is sometimes reused or recycled in the chemicals industry.</p>
<b>LLW</b>	<p>Low Level Waste.</p> <p>Covers a variety of materials which arise principally as lightly contaminated miscellaneous scrap and redundant equipment from both the nuclear and non-nuclear industries. Organic materials in LLW are mainly in the form of paper towels, clothing and laboratory equipment that have been used in areas where radioactive materials are used – such as hospitals, research establishments and industry. Both waste producers and sites accepting LLW have to have authorisations under the Radioactive Substances Act 1993, although this requirement has only applied recently, as a consequence of the Government's new policy statement on the management of LLW.</p> <p>LLW is defined as radioactive waste that is below 4 Gbq of alpha activity per tonne and below 12 GBq of beta-gamma activity per tonne.</p>
<b>Low Level Waste Repository (LLWR)</b>	<p>A facility taking only LLW. The UK's only LLWR is currently near Drigg in Cumbria, which has operated as a national LLW disposal facility since 1959. Wastes are compacted and placed in containers before being transferred to the facility. Following a major upgrade of disposal operations in 1995, all LLW is now disposed of in engineered concrete vaults. The LLWR near Drigg is owned by the Nuclear Decommissioning Authority and currently managed by UK Nuclear Waste Management Ltd.</p>
<b>mSv</b>	<p>Milli-Sievert</p> <p>One thousandth of a Sv (sievert), measuring the effect on biological matter (particularly humans). 1 Joule of beta-gamma radiation absorbed per kg of biological tissue has 1 Sv biological effect. 1 Joule of alpha radiation absorbed per kg of biological tissue has 20 Sv effect.</p>
<b>NDA</b>	<p>Nuclear Decommissioning Authority.</p> <p>A non-departmental public body, established under the Energy Act 2004. The NDA is responsible for the decommissioning and clean-up of the UK's civil public sector nuclear sites. Its sponsoring Government department is the Department for Business, Enterprise and Regulatory Reform (BERR) which approves its strategy, plans and budget. The NDA also reports to the Scottish Ministers who agree its strategy and plans for Scottish sites.</p>
<b>NII</b>	<p>Nuclear Installations Inspectorate.</p>
<b>NO<sub>x</sub> / NO<sub>2</sub></b>	<p>Nitrogen Oxides / Nitrogen Dioxide.</p> <p>This is a common measure of air quality which can affect health and can react with moisture in the atmosphere to result in a nitric acid solution (acidic rain).</p>

Term	Description
<b>Non- nuclear industry</b>	A collective term for a wide range of organisations that handle radioactivity for specific purposes, and/or that create radioactive waste as a result of their operations, as a consequence of which they are required to be registered or authorised under the Radioactive Substance Act 1993. The non-nuclear industry is distinguished from the nuclear industry by the fact that the latter covers industries involved with nuclear energy, the production of nuclear weapons and large scale radioisotope production. The nuclear industry is subject to additional regulation.
<b>OSHA</b>	Occupational Safety and Health Administration.  Part of the U.S. Department of Labour which measures the Total Recordable Incident Rate. This is used to allow international comparisons.
<b>OSPAR</b>	Oslo and Paris Convention (Convention for the Protection of the Marine Environment of the North East Atlantic)
<b>PM<sub>10</sub></b>	Particulate Matter up to 10 micrometers in diameter.  A common measure of air quality. PM <sub>10</sub> can affect the respiratory system, contributing to a number of health conditions.
<b>Radioactive decay</b>	The process by which a radionuclide undergoes transformation with the emission of ionising radiation (see also half life).
<b>Radioactive Substances Act 1993 (RSA93)</b>	UK legislation which provides for regulation of the disposal of radioactive wastes, including liquid and gaseous discharges to the environment. It also provides for regulation of the accumulation of radioactive wastes on non-nuclear sites.
<b>Radioisotope</b>	Different radioactive forms of the same element, for example phosphorous-32 and phosphorous-33 are both radioisotopes of the element phosphorous.
<b>Radionuclide</b>	A generic term which refers to any radioisotope of any element, so for example, tritium (H-3), carbon-14 and caesium-137 are all described as radionuclides.
<b>Ramsar</b>	An internationally designated site under the Ramsar Convention on Wetlands of International Importance.
<b>RIDDOR</b>	Reporting of Injuries, Diseases and Dangerous Occurrence Regulations.  The UK's Health and Safety Executive's common measure of safety in the workplace.
<b>SA</b>	Sustainability Appraisal.  A form of assessment used in England, particularly in regional and local planning, covering the social, environmental and economic effects of proposed plans and appraising them in relation to the aims of sustainable development. SAs fully incorporating the requirements of the SEA Directive (2001/42/EC) and are mandatory for a range of regional and local planning documents under the Planning and Compulsory Purchase Act 2004.
<b>SAC</b>	Special Area of Conservation.
<b>SAM</b>	Scheduled Ancient Monument.
<b>SEA</b>	Strategic Environmental Assessment.  In this document, SEA refers to the type of environmental assessment legally required by EC Directive 2001/42/EC in the preparation of certain plans and programmes. The authority responsible for the plan or programme must prepare an environmental report on its likely significant effects, consult the public on the report and the plan or programme proposals, take the findings into account, and provide information on the plan or programme as finally adopted.

Term	Description
<b>SED</b>	Safety and Environmental Detriment score – Measures hazard reduction on NDA sites.
<b>SPA</b>	Special Protection Area.
<b>SSSI</b>	Site of Special Scientific Interest.
<b>(Sv) Sievert</b>	A unit of radiation dose to living tissue, equal to 1 joule per kilogram (which is a measure of energy lost as radiation passes through matter). It is a very large unit, and sub multiples of the Sv are more commonly used, for example, the microsievert (one millionth of a Sv) or the millisievert (one thousandth of a Sv).
<b>TRIR</b>	Total Recordable Incident Rate.
<b>VLLW</b>	<p>Very Low Level Waste.</p> <p>Covers miscellaneous waste arising from both the nuclear and non-nuclear industries with very low concentrations of radioactivity. VLLW is divided into two types: low volume VLLW and high volume VLLW (see Box 2 for formal definitions of low volume VLLW and high volume VLLW). VLLW producers must hold authorisations under the Radioactive Substances Act 1993. Depending on its physical form, low volume VLLW is incinerated or disposed of to landfill, and neither type of facility has to hold an authorisation under RSA93. However, high volume VLLW will need to go to landfills that do hold authorisations under RSA93.</p> <p>Low volume VLLW is defined as radioactive waste that may be disposed of to an unspecified destination, with each 0.1m<sup>3</sup> having less than 400 KBq total activity or single items with less than 40 KBq of total activity.</p> <p>High volume VLLW is defined as having a maximum concentration of 4 MBq/tonne of total activity which may be disposed of to specified landfill sites.</p>
<b>WHO</b>	World Health Organisation
<b>µg<sup>m</sup><sup>3</sup></b>	<p>Micrograms per Cubic Meter.</p> <p>1 µg is the equivalent of one millionth of a gram (or 1x10<sup>-6</sup> grams).</p>