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

# UK Nuclear Industry LLW Strategy

**Consultation Document - June 2009**

Nuclear Decommissioning Authority

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## Executive Summary

This document sets out for consultation the proposed strategy for the management of solid low level radioactive wastes (LLW) arising from the nuclear industry in the UK. It has been prepared in response to the Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom published by Government and the devolved administrations in March 2007. The policy sets out a framework for the flexible management of LLW, recognising that prior policy and strategies were not written with the intent to cover large scale decommissioning and site restoration. There are a large range of material types and levels of radioactivity within the LLW category. A more flexible approach to the management of LLW, for example use of a wider range of waste management options beyond engineered disposal, will be critical to continued provision of capability and capacity for LLW management in the UK. Importantly, the framework allows for development of solutions on a case-by-case basis and decisions to be made flexibly to ensure safe, environmentally acceptable and cost effective management solutions that appropriately reflect the nature of the LLW concerned. The policy also noted that continued provision of capability and capacity for nuclear industry LLW should also consider the needs of the non-nuclear industry.

Health, safety, security, environmental excellence and public acceptability are vital to the development of appropriate waste management plans and their implementation. The proposed strategy is intended to realise the implementation of waste management within the flexible framework and changing the way we manage LLW has the potential to provide significant benefits, including cost savings. However, value does not relate only to cost. There are other wider benefits that are also set out in the document.

NDA must continue to provide a LLW management service to UK nuclear and non-nuclear industries in order to maintain capability and capacity in LLW management to support ongoing hazard reduction and decommissioning activities. The Low Level Waste Repository (LLWR) near the village of Drigg in west Cumbria is the only dedicated engineered LLW disposal facility in the UK. Analysis of the UK LLW inventory shows that around 3 million $m^3$ of LLW will require management over the lifetime of NDA sites (approximately 120 years). Scheduled development at LLWR (i.e. included in the site's Lifetime Plan) has a volumetric capacity of around 0.7 million $m^3$, subject to planning and regulatory approvals. The analysis demonstrates that without a different approach to the management of LLW a new repository could be required by 2037, or possibly even earlier. Consequently, past approaches to operating LLWR and management of UK LLW is no longer sustainable.

The NDA strategy, published in 2006, set out our original contracting strategy and the challenges and opportunities faced in the LLW area. The first site competition was for the contract to operate LLWR. In doing this, we also established LLW Repository Ltd as a partner organisation to NDA and Government. We have developed this strategy working with LLW Repository Ltd. It has been informed by a detailed programme of work over the last year including Strategic Reviews, Strategic Environmental Assessment and input from a wide range of stakeholders.

The proposed strategy will provide continued capability and capacity for the safe, secure and environmentally responsible management and disposal of LLW in the UK, for both the nuclear and non-nuclear industries through:

- application of the waste management hierarchy
- best use of existing facilities, working more efficiently and potentially extending the life of the existing national repository
- development and use of new fit for purpose management and disposal routes, so waste producers have more choice in determining implementing waste management routes

The document sets out these three themes and the actions that will be required to deliver change in the way we manage LLW in the UK. A wide range of topics are covered within the strategy and extracts are included from the Strategic Environmental Assessment (see pale green boxes) that set out the issues and considerations around the approaches proposed. It should be recognised that the strategy is designed to respond to the national need. At a given waste producing site, decisions will still be required in order to manage particular wastes in order to satisfy regulatory requirements. Considerations at the site level, for example local environmental, safety and community issues, will have to be incorporated into decisions along with the direction provided by this national strategy to deliver effective waste management decisions.

Implementation of the strategy will require effort from all parties involved in the management of LLW. In turn, this will require effective communication between all parties, flexibility to respond to changes in the environment in which we are working, development of new waste management routes and the sharing of good practice. As well as setting out the strategy, this document discusses some of these aspects.

During the preparation of this proposed strategy a number of developments have occurred. Firstly, potential new nuclear build arisings will need to be factored into the UK LLW strategy in the future and secondly, planning consent has been given for a plans are developing for a new LLW disposal facility for Dounreay's wastes, adjacent to the Dounreay site.

We have identified a number of key risks that may affect the implementation of the strategy. However, the strategy also represents a significant opportunity, which can be recognised at a number of levels. An analysis of the key risks, our plans for the unlikely event that the strategy should be unsuccessful and an overview of our detailed plan for implementation of the strategy are included.

Nuclear Decommissioning Authority

# Contents

# 1 Introduction

# 1 Introduction

This document sets out for consultation the proposed UK strategy for solid low level radioactive wastes arising from the nuclear industry. The strategy has been prepared by the Nuclear Decommissioning Authority (NDA) in response to the UK policy on solid low level radioactive waste published by Government and the devolved administrations in 2007 (Ref. 1, *Section 2.3. for more information*). We, the NDA, are responsible for the decommissioning of the UK's civil nuclear liability. We do not operate sites; our sites are operated by site licence companies under contract to NDA.

This document is primarily aimed at nuclear industry waste producers (current and future), environmental regulators and waste planning bodies. It is also relevant to non-nuclear industry waste producers, waste management facility operators and suppliers of waste treatment services. The strategy will also be of interest to other parties affected by Low Level Waste (LLW) management, for example communities where waste is managed.

We have developed this strategy working with our LLW strategic partner, the Low Level Waste Repository Ltd, which has three main responsibilities:

- to help NDA develop the Strategy, LLW Management Plan and Strategic Review
- to operate the Low Level Waste Repository (LLWR) under contract to NDA
- to supply waste treatment and disposal services to the nuclear and non-nuclear industry

The continued availability of a disposal route for LLW is considered vital by both the nuclear industry and non-nuclear industry LLW producers. At the present the majority of LLW is consigned to LLWR. Therefore, the role of this strategic asset should have an influence both on this strategy and how LLW waste is managed nationally. The UK will generate significantly more LLW than the potential capacity at LLWR. This will mean finding alternative ways to manage LLW, including both treatment and alternative disposal routes. The contract for the management of LLWR includes a significant role in working with the NDA to develop national strategy for the management of LLW in addition to operating and making optimal use of this critical national asset.

In parallel with the development of this proposed strategy, Government has been developing a strategy for the management of LLW from the non-nuclear industry. It has been important to develop these strategies in awareness of each other. This will ensure that they are suitably integrated and will operate effectively together. Information on the non-nuclear industry LLW strategy can be found here:

www.defra.gov.uk/environment/radioactivity/waste/llw/index.htm

There are also a number of other consultations, reviews of policy and regulation, and strategic initiatives that have an influence on the management of LLW. Therefore, the strategy will need to be reviewed and revised as the influence of these various initiatives is better understood.

This proposed strategy does not cover liquid and gaseous LLW. We will continue to develop our strategic position on these wastes and this will be published in the next version of the NDA Strategy.

## 1.1 Government's Policy for the management of solid LLW in the UK

In March 2007 the UK Government and devolved administrations (for Scotland, Wales and Northern Ireland, from here on referred to as 'Government') published their policy for the management of solid low level waste ('the Policy'). The Policy sets out a number of core principles for the management of low level waste (LLW). This proposed strategy has been developed within the framework of the principles set out in the Policy:

- use of a risk-informed approach to ensure safety and protection of the environment
- minimisation of waste arisings (both activity and mass)
- forecasting of future waste arisings, based upon fit for purpose characterisation of wastes and materials that may become wastes
- consideration of all practicable options for the management of LLW
- a presumption towards early solutions to waste management
- appropriate consideration of the proximity principle and waste transport issues
- in the case of long term storage or disposal facilities, consideration of the potential effects of future climate change

The overall aim of the Policy was to set out the need for greater flexibility in managing LLW, recognising that previous Government policy was not developed to take account of large scale decommissioning and environmental restoration.

The Policy also sets out a number of requirements for the NDA, including:

- develop a UK nuclear industry LLW strategy
- work with Government to ensure alignment with the UK non-nuclear industry LLW strategy
- develop and publish a plan for the optimum use of LLWR
- make NDA LLW management and treatment facilities available to other nuclear and non-nuclear managers of radioactive waste
- assess the need for other disposal options and at what point a replacement for LLWR might be required

## 1.2 Supporting information

There are a number of projects and documents that support the work undertaken in developing this strategy. These include the UK LLW Strategic Review (Ref. 2) and the draft National Low Level Waste Management Plan (Ref. 3) developed and issued early in 2009, which provide substantial information on the overall waste volumes, funding requirements, and waste strategies for the entire NDA estate and numerous initiatives, innovations, and potential options to improve management of LLW. The strategy is underpinned by a Strategic Environmental Assessment (SEA), the output of which is an Environmental and Sustainability Report (Ref. 4), which accompanies this consultation. It meets the requirements of the SEA Directive (see Section 4) and Government's Policy for the management of LLW. The supporting documents are described briefly here (see also Figure 1).

- The UK LLW Strategic Review documents the baseline information and synergies and opportunities for the strategy and management plan to address; this will be updated every two years (Ref. 2). This document provides extensive background information on where nuclear industry LLW arises, what management and disposal options are currently available, and where there are opportunities for change.
- The draft National Low Level Waste Management Plan (Ref. 3) sets out 54 initiatives for implementation of this strategy throughout LLW management in the UK. The first full version of the National LLW Management Plan will be published in February 2010 once this strategy has been finalised.
- An Environment and Sustainability Report (Ref. 4) describing the result of this assessment has been published for consultation in parallel to this draft strategy and is described in Section 4.

Further supporting documentation that provides greater detail on aspects of this strategy has been published on the LLWR website (Ref. 5).

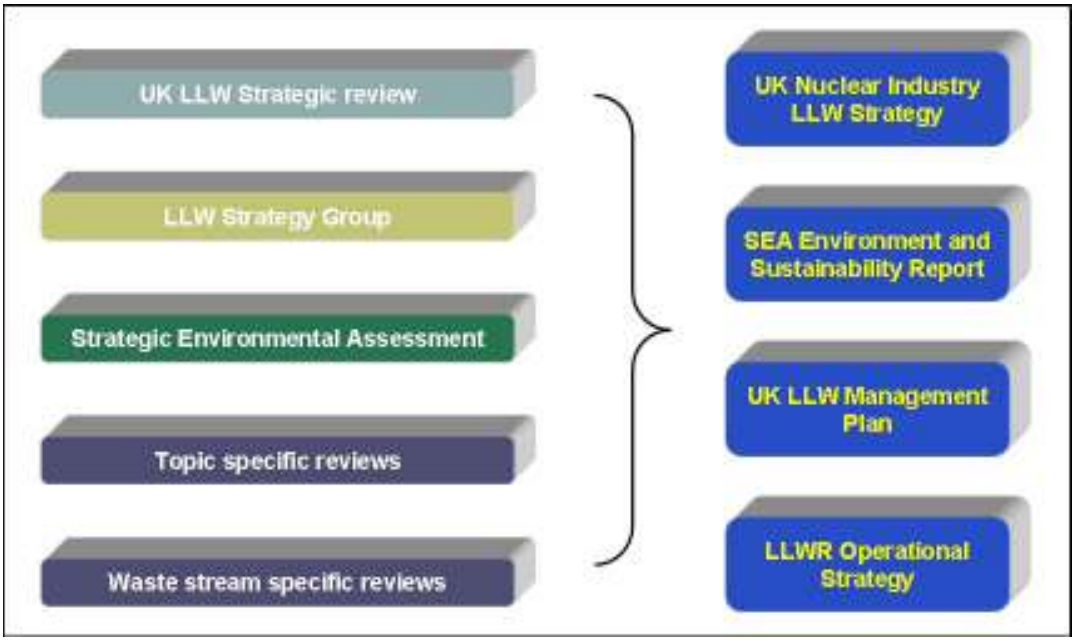


**Figure 1 –** Key inputs and outputs of the UK nuclear industry LLW strategy process.

## 1.3 Consultation

The development of this strategy has already involved a number of key stakeholders, through direct communication and the National LLW Strategy Group (see Appendix 1). The Strategy Group includes LLW waste producers, both from the nuclear industry and the non-nuclear industry, the NDA, LLW Repository Ltd, representatives from Government, Regulators and planning authorities. The interests of the nuclear industry supply chain are represented on the Strategy Group by the Nuclear Industry Association.

The remit of National LLW Strategy Group is a body formed to consult on recommendations for best business practices, economies of scale, standardisation, and the implementation of the waste management hierarchy throughout the UK. A primary goal of the Strategy Group is to minimise waste volumes for disposal at the LLWR and other facilities as applicable. The LLW Strategy Group are not required to formally endorse this strategy.

We have also worked directly with nuclear site Regulators to ensure appropriate consideration of Health, Safety, Security and Environmental issues in developing this draft strategy.

This document provides a formal opportunity for you to give the NDA your views on the proposed strategy. The document includes a number of consultation questions, however, you are welcome to give us your views on any aspects of the proposed strategy. We welcome and will consider all comments provided to us. Following the consultation, we will provide a written summary of how we have responded to your comments.

We are also interested in comments on the Strategic Environmental Assessment which has been published for consultation in parallel with this report. The consultation period for both documents will run for 14 weeks from the 5 June 2009 to the 11 September 2009.

Copies of both documents are available electronically from www.nda.gov.uk/consultations or copies can be requested by writing to the address below. You can provide comments electronically through the web based consultation or email or alternatively by post.

Please provide comments by Friday **11 September 2009**.

Comments should be sent to:

**Post:** **LLW Strategy Consultation**
Nuclear Decommissioning Authority
Herdus House,
Westlakes Science and Technology Park
Moor Row, Cumbria
CA24 3HU

**Email:** 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.

# 2 Background

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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.

## 2.1 Definition of the nuclear industry

Government's LLW Policy requires a strategy for the management of solid LLW from the nuclear industry. For the purposes of this strategy we have broadly defined the nuclear industry as those sites that hold a nuclear site licence. In general, this includes NDA Site Licence Companies (SLCs), British Energy and certain Ministry of Defence sites (i.e. those organisations involved in the generation of electricity by nuclear means, decommissioning of nuclear related facilities and organisations involved in maintaining the UK's nuclear deterrent). Certain healthcare institutions hold nuclear site licences; these organisations will have reference to both this strategy and the strategy for the management of LLW from the non-nuclear industry.

NDA sites are expected to generate approximately 80% of all LLW from the nuclear industry.

The largest NDA site is Sellafield, in Cumbria. A significant amount of LLW (approximately 60%) comes from the Sellafield site and will have an important influence in implementing the LLW strategy. Operations at the Sellafield site include spent fuel reprocessing, fuel manufacture, treatment and storage of radioactive waste and decommissioning of redundant facilities.

Sellafield Ltd have recently developed their own strategy for the management of LLW at the Sellafield site. We have worked closely to ensure that the Sellafield strategy is compatible with the emerging UK nuclear industry LLW strategy and we believe that this has been achieved. However, Sellafield will review its own strategy, as is the case for other sites with respect to their integrated waste strategies, once the final UK nuclear industry LLW strategy has been published.

## 2.2 Low level waste

Solid radioactive wastes have been produced, stored and disposed of by various industries in the UK since the 1920s. The main sources of waste generation since the 1950s onwards have been nuclear energy development, nuclear power generation and the weapons industry. In addition, hundreds of non-nuclear industry users of radioactive materials produce radioactive wastes, for example universities, hospitals, the pharmaceutical industry, research establishments and the oil and gas industry.

In the UK solid radioactive wastes are defined according to three main categories: low, intermediate and high level wastes. Low Level Waste (LLW) represents a broad category spanning a range of five orders of magnitude of radioactivity (See Environment and Sustainability Report for more information on radioactivity and how it is measured). Solid LLW is generated in many locations across the UK today, from the operation of power stations and fuel facilities to the decommissioning and clean-up of nuclear sites.

Ninety-eight percent of UK LLW arises at nuclear sites undertaking the following activities:

- fuel fabrication and uranium enrichment
- nuclear power generation
- spent fuel reprocessing
- nuclear energy research and development
- Ministry of Defence activities
- manufacture of radioactive medical products

Unlike High Level Waste (HLW) and Intermediate Level Wastes (ILW), LLW does not normally require special shielding during handling or transport.

LLW can be sub-divided into operational and decommissioning related material. Operational LLW typically arises from routine monitoring and maintenance activities, and includes plastic, paper, tissue, clothing, wood and metallic items. Decommissioning LLW mostly comprises building rubble, soil and various metal plant, equipment and items.

The UK LLW Strategic Review (Ref.2) indicates that the total volume of LLW arising that will need long-term management is approximately 3 million $m^3$ over the next 120 years. The UK radioactive waste inventory (a national forecast of waste to be generated during the lifetime operation and decommissioning of radioactive waste generating facilities) estimates that LLW makes up some 90% of the total volume of the UK's radioactive waste but contains less than 0.0003% of the total radioactivity (Ref 6).

This volume of LLW should however be seen in the context of UK non radioactive waste arisings of **335 million tonnes per year** (Ref. 7). In comparison, predicted average arisings of LLW are approximately **25,000 $m^3$ per year**[1] (and vary between 83 $m^3$ and 118,359 $m^3$ per year). Annual arisings of LLW by volume are equivalent to 0.0075% of non-radioactive waste arisings.

It should be recognised that many of the challenges that face the management of conventional non-nuclear wastes also apply to LLW. The national waste strategies for England, Scotland, Wales and Northern Ireland set out these challenges and the approaches being adopted to address them.

[1] The figures are derived from the UK LLW Strategic Review. Experience at LLWR shows that broadly speaking, across the LLW inventory 1 $m^3$ of waste is equivalent to 1 tonne.

## 2.3 Regulation of radioactive waste

### *Environment*

In the UK, the Radioactive Substances Act 1993 (RSA93) (Ref. 8) provides the framework for controlling the management of radioactive materials and wastes so as to protect the public and the environment. RSA93 requires prior authorisation to dispose of radioactive waste, including from nuclear installations. It also requires registration for the keeping and use of radioactive material (other than by nuclear sites licensees) and authorisation for the accumulation of radioactive waste (other than on nuclear licensed sites). The Act empowers the appropriate environment agency (the Environment Agency or the Scottish Environment Protection Agency) to attach conditions and limitations to any authorisation that it issues.

Authorisations under RSA93 require operators to demonstrate that they are applying Best Practicable Means (BPM) to minimise the impacts of the authorised activities on people and the environment. This incorporates where appropriate demonstration that the Best Practicable Environmental Option (BPEO) has been adopted to manage radioactive wastes.

### *Safety*

Under UK law (the Health and Safety at Work etc. Act 1974) employers are responsible for ensuring the safety of their workers and the public, and this is just as true for a nuclear site as for any other.

This responsibility is reinforced for nuclear installations by the Nuclear Installations Act 1965 (NIA65), as amended. Under the relevant statutory provisions of the NIA, a site cannot have nuclear plant on it unless the user has been granted a site licence by the Health and Safety Executive (HSE).

This licensing function is administered on HSE's behalf by its Nuclear Directorate. The Nuclear Directorate, sets out in conditions attached to a site licence the general safety requirements to deal with the risks on a nuclear site which Licensees must comply with. These licence conditions include specific requirements relating to the accumulation and storage of radioactive wastes on nuclear sites.

The nuclear licensing regime is complemented by the Ionising Radiations Regulations 1999 (IRR99) and other health and safety regulation which the HSE also enforces on nuclear sites as it does on any other sites. This general health and safety legislation will also apply to non-nuclear sites which treat or dispose of LLW.

### *Security*

The Nuclear Directorate's Office for Civil Nuclear Security (OCNS) is the security regulator for the UK's civil nuclear industry. It is responsible for approving security arrangements within the industry and enforcing compliance. The environmental agencies have responsibilities for the security of radioactive substances on non-nuclear sites.

### *Safeguards*

The UK Safeguards Office (UKSO) oversees the application of nuclear safeguards in the UK to ensure that the UK complies with its international safeguards obligations. Nuclear safeguards are measures to verify that States comply with their international obligations not to use nuclear materials (plutonium, uranium and thorium) for nuclear explosives purposes.

Further information on the regulation of radioactive waste is included in Appendix 2.

# 3 LLW arising from the nuclear industry

# 3 LLW arising from the nuclear industry

The UK LLW Strategic Review (Ref. 2) includes a baseline inventory of all LLW waste to be managed over the projected lifetime of the NDA's sites (between 2008 and 2129). This baseline has been developed using the 2007 UK National Inventory and Lifetime Plan (LTP) 08 Waste Accountancy Templates in consultation with waste producers. The estimated volumes include waste from NDA sites, British Energy sites and Ministry of Defence sites. It also includes information from non-nuclear industry LLW producers, for example the healthcare industry and research establishments. The review found that there will be approximately 3 million $m^3$ of LLW to be managed over this period. At present, approximately 60% of this waste has been designated as High Volume Very Low Level Waste (VLLW).

The review demonstrated the greatest generation of LLW (following current planned activities) occurs over the period from 2008 to 2031. There is also an increase in the generation of LLW around 2090 as a result of final site clearance activities at a number of NDA sites.

The strategic review document sets out the origins of the waste. Notably, it indicates that a significant proportion of the LLW (44%) and the VLLW (69%) to be generated originates from Sellafield. Other major producers of LLW include the Magnox operating sites and British Energy sites. The other notable producer of VLLW is Springfields, near Preston. It is worth noting that these figures are subject to change as waste producers refine their plans and waste forecasts accordingly.

The Strategic Review also provides an assessment of the types of waste to be managed. In terms of volume, the two LLW types that stand out are metal (37% of the inventory) and soil / rubble (33% of the inventory). For VLLW, the same two waste streams dominate; soil and rubble account for 63% of VLLW, metal accounts for 23%. The strategic review also documents when waste will arise. It determined that more of the metal waste is scheduled to be produced in the near term, (between now and 2030) Soil and rubble will be generated in both the near term and later on as part of final site clearance programme.

There are a range of options for the management of LLW. In the past, the majority of LLW has been disposed of at LLWR with little or no pre-treatment. Other options used to a limited extent in the past include disposal of certain wastes to landfill or to an incineration facility (either on-site or off-site), treatment of metallic wastes and the use of overseas waste treatment routes.

Analysis of this inventory shows that continuation of past approaches to LLW management will result in around 2.4 million $m^3$ of LLW requiring disposal at LLWR or a new national LLW repository. This can be compared to the scheduled capacity at LLWR of around 0.7 million $m^3$, which is subject to planning and regulatory approvals. The review demonstrates that if this is the case a new repository could be required by 2037, or possibly even earlier, if waste currently destined for other facilities had to be disposed to LLWR.

Further detail and analysis is included in the Strategic Review document:

http://www.llwrsite.com/llw-strategy-group/consultation-documents

The UK LLW Strategic Review baseline does not include:

- Low Level Waste associated with the operation and decommissioning of new nuclear power stations (see Section 6.3.3 for more information on new nuclear build)
- radioactively contaminated ground at nuclear sites that is not currently declared as waste (see Section 6.3.4 for more information on contaminated ground)

# 4 Strategic Environmental Assessment

# 4 Strategic Environmental Assessment (SEA)

The NDA is committed to safe and secure delivery of its missions and ensuring that its strategies take appropriate account of sustainability and environmental considerations. For this reason we have undertaken a SEA to inform the development of this strategy of such sustainability considerations and to assess the potential social, health, economic and environmental impact of the proposed strategy compared to a number of reasonable alternatives or options. Extracts are included from the Strategic Environmental Assessment in this consultation document (see pale green boxes) that set out the issues and considerations around the approaches proposed.

We have undertaken this SEA in accordance with the requirements of the European Union's SEA Directive (2001/42/EC) and transposing UK Regulations. The scope of the assessment has also been expanded to provide consideration of relevant potential environmental, social (including health and safety and hazard reduction) and economic effects ensuring that this assessment has the same scope as a sustainability appraisal.

The SEA process aims to:

- integrate environmental and relevant social and economic factors into the preparation of the Nuclear LLW Strategy and decision-making
- improve the Nuclear LLW Strategy, and enhance environmental protection
- facilitate public participation in decision-making
- facilitate openness and transparency of decision making

The consultation on this draft Strategy is therefore supported by an Environmental and Sustainability Report. This summarises the development of the Nuclear Industry LLW strategy, including consideration of reasonable alternatives, and presents the findings of the detailed assessment of the preferred options against a range of social, economic and environmental objectives. Where any significant adverse effects are identified, mitigating measures have been proposed, along with an indicative monitoring framework.

The Environmental and Sustainability Report aims to:

- provide information on the UK Nuclear Industry LLW Strategy
- provide a summary of relevant environmental information drawing on a review of relevant plans and programmes, baseline information and consultee views
- outline the process of assessment, the results of the scoping stage consultation and any difficulties encountered during the completion of the assessment
- identify, describe and evaluate the likely significant effects of the UK Nuclear Industry LLW Strategy and reasonable alternatives
- provide potential measures to avoid, reduce, mitigate or offset any potentially significant adverse effects on the environment and, where appropriate, to suggest potential measures to enhance the contribution of the UK Nuclear Industry LLW Strategy to the achievement of environmental and sustainability objectives
- provide an opportunity for the consultation authorities and the public to offer views on the findings of the assessment of the UK Nuclear Industry LLW Strategy

The Environmental and Sustainability Report was preceded by production of a Scoping Report which was issued for consultation in July 2008. This set out the proposed appraisal framework (expanded to include social and economic issues) and methodology to be used to assess both the revised NDA Strategy and the Nuclear LLW Strategy. The responses were used to revise the approach and update the information that has been incorporated into the report.

The Environmental and Sustainability Report and a Non-Technical Summary (which provides a high level summary of the findings) are available from www.nda.gov.uk/consultations/ to inform your reading and response to this draft Strategy. We welcome your feedback on the Environmental and Sustainability Report. Specific findings are included in the relevant sections of the strategy (see Section 5) to demonstrate the reasoning behind part of the strategy.

# 5 The UK strategy for the management of solid low level radioactive waste from the nuclear industry

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## 5.1 Vision

The UK strategy for the management of solid low level radioactive waste from the nuclear industry will facilitate continued hazard reduction and decommissioning through application of the waste management hierarchy. It will also provide continued capability and capacity for the safe, secure and environmentally responsible management and disposal of LLW in the UK, for both the nuclear and non-nuclear industries.

The strategy will provide value for money approaches to the management of LLW. It will take into account the technical, environmental and social factors, coupled with the most advantageous use of the UK Low Level Waste Repository.

We have set out below key principles that we consider appropriate for the management of LLW from the UK. They provide a framework in which the strategy should be implemented and also give guidance on Government expectations of NDA, nuclear waste producers, regulators and planning authorities to implement this strategy.

- Health, safety, security, environmental excellence and public acceptability is vital to the development of appropriate waste management plans and their implementation.
- Waste avoidance should be implemented by all producers of LLW.
- Effective characterisation and segregation of waste and material that will become waste is critical to flexible management of LLW.
- Given the diverse physical, chemical and radiological nature of LLW, it is important to have a variety of proportionately regulated waste management routes.
- The development of new waste routes or approaches to the management of LLW requires early and proactive engagement with local and national stakeholders.
- Availability of flexible waste management routes is essential for hazard reduction and decommissioning and the continued operation of the nuclear and non-nuclear industries.
- Waste management decisions should be supported by sound business cases and demonstrate the use of robust decision-making processes to identify the most advantageous option.
- This strategy does not aim to provide a single solution; different fit-for-purpose solutions will be required for different wastes.
- Where appropriate and practicable, we will make waste management facilities on NDA sites available for non-NDA producers of LLW on suitable commercial terms. Likewise, we would expect that non-NDA facilities are made widely available where this is appropriate.
- Integration of strategies for all wastes (both radioactive and conventional) is important nationally and at a site level; waste plans will be consistent with, and complement, national strategy and Government policy.

It is recognised that there are other policy and regulatory requirements and principles that apply to LLW management. Clearly, the implementation of this strategy will need to be undertaken in compliance with all relevant legal and regulatory requirements. More information on these requirements can be found on the websites of the Environment Agency, Health and Safety Executive and Scottish Environment Protection Agency and within the UK's reports to the Joint Convention on the Safety of Spent Fuel and Radioactive Waste.

## 5.2 Key themes

We propose that the UK nuclear industry LLW strategy comprises three strategic themes:

I. application of the waste management hierarchy to extend the life of LLWR and ensure waste is managed in a risk-based, fit-for-purpose manner

II. best use of existing assets

III. new fit-for-purpose waste management routes

Figure 2 sets out the proposed UK nuclear industry LLW strategy in summary.

Each theme is described below, setting out the issue or need, strategic direction and what the NDA and its partners will do to respond to that need. Discussion is then provided on how the strategy will be implemented, including information on the relationship between this strategy, LLW Repository Ltd, waste producers and the supply chain.

It should be recognised that managing LLW should not be separated from managing conventional waste on a nuclear licensed site. Implementation of this strategy will require an integrated waste management approach where a strategy is needed to manage all waste arisings.

## 5.3 Application of the waste management hierarchy to extend life of LLWR and ensure waste is managed in a risk based, fit for purpose manner

This section of the UK nuclear industry LLW strategy is focused on the waste management hierarchy. The waste management hierarchy was first introduced in 1975 in EU waste policy in the Framework Directive for non-radiological waste ('controlled waste'). It is an integral part of the development of integrated waste strategies at nuclear (and non-nuclear) sites. Application of the hierarchy is central to our approach for a number of reasons.

- The waste management hierarchy is recognised as good practice in waste management.
- Government's policy for the management of LLW tells us that waste should be dealt with at the highest practicable level in the hierarchy.
- The biggest challenge for the management of LLW in the UK is the availability of safe, secure and environmentally appropriate disposal capacity. There will be approximately 3 million $m^3$ of LLW generated in the UK once it has been packaged by waste producers for disposal (Ref. 2). Even with planned capacity for construction at LLWR (subject to relevant approvals) there would still be a requirement for 2.4 million $m^3$ elsewhere. We see the application of the waste management hierarchy and risk based approaches to the management of LLW as a critical part of addressing this challenge. Size reduction, change of physical form, reduction of waste volumes and more effective ways of handling LLW can be achieved at all levels of the hierarchy.

**Meeting regulatory requirements for the management of LLW, to ensure safety, security and protection of the environment, is the first priority for NDA and its operators. Implementation of the waste management hierarchy is mandated by policy, environmental regulation and is recognised as good practice in all aspects of radioactive and non-radioactive waste management. We believe it is an essential element for effectiv**499 817.10g15.3929(ep732(f)11.8058(f)11.84(i)11.4ep732(f)11.2499 Tf1(h)0.2921(i)11.4ep71(e)5.80

decisions about the management of this exempt waste.

Sorting and segregation of waste is essential to utilising different approaches to the management of waste. Historically the UK has separated LLW into compactable and non-compactable wastes, driven by the processes and disposal routes available. Further segregation into different waste types and categories (for example, separating out VLLW) is critical to successful application of the waste management hierarchy. Particularly in identifying more appropriate management routes for waste not necessarily requiring multi-barrier engineered containment, such as that provided by LLWR. Segregation of wastes at source, where practicable is the preferred option for this activity. It is recognised that this may require manual intervention and consequently, we recognise the need to balance handling of waste with the need to keep radioactive doses As Low As is Reasonably Achievable (ALARA) and other risks As Low As is Reasonably Practicable (ALARP).

In order to move forward in this area we will:

- develop programmes to improve characterisation of wastes on our sites and work with non-NDA sites to share good practice
- provide strategic direction to our sites, through the NDA Strategy and strategic specifications (see Section 6.1), to enhance avoidance of waste during operation and decommissioning.
- work with the Clearance and Exemption Working Group (CEWG)[2] to communicate, improve and implement the Nuclear Industry Code Of Practice on Clearance and Exemption as appropriate
- through LLW Repository Ltd, investigate the potential benefits of standardising characterisation, sorting and segregation of waste and develop standardised procedures as appropriate, for publication and dissemination
- look to our sites to determine appropriate LLW management routes, avoiding clean/exempt and VLLW being disposed of at LLWR
- look to LLW Repository Ltd to provide solutions that help sites to segregate waste more effectively (e.g. segregation at source, provision of appropriate containers etc)
- invest in research and development to improve the availability of equipment and techniques for characterisation
- develop guidance on good practices in this area
- provide incentives where appropriate for the segregation of waste through pricing strategies at LLWR and with NDA contracts where applicable.

**Question 1** – Do you agree with the proposed approach to avoidance and characterisation of waste? What are the most important areas for work and are there other actions that could be undertaken?

### 5.3.2 Minimise, Re-use and recycle

The next levels of the waste management hierarchy include minimising waste and the re-use and recycling of waste. It has previously been considered that opportunities to apply these principles to radioactive waste were limited; however, over recent years, there has been more success in realising these opportunities within and outside of the nuclear industry.

#### *Decontamination*

Decontamination of facilities and materials prior to decommissioning and consignment as waste has significant potential to minimise the amount of waste that needs to be managed as LLW. Typically, techniques in use at present are targeted at removing surface contamination of concrete and

[2] The Clearance and Exemption Working Group (CEWG) is a UK nuclear industry working group that aims to provide responsible and sustainable approaches to clearance and exemption issues and contribute to the development of legislation, standards and guidance as appropriate. More information is available at http://www.cewg.safety-directors-forum.org/

decontaminating metal. Examples include use of high pressure water jets, shot blasting, acid baths and machining and grinding equipment. These are all standard techniques used extensively in conventional waste management. There may be further opportunities to increase the use of techniques that could yield significant benefits in reducing waste volumes and activity. However, these benefits need to be considered in light of potential negative impacts such as generation of secondary waste and the costs of implementing these techniques. Additional decontamination innovations and applications may also need to be developed.

In order to achieve progress in this area:

- waste producers should ensure decontamination and minimisation techniques are included in their options assessments and decision making processes
- we will determine principles for the role of decontamination in decommissioning and investigate opportunities to improve the efficiency of decontamination facilities in use at the present time

*Re-use*

The LLW policy recognises the opportunities for appropriate re-use of soil and rubble; opportunities include void infill, construction and landscaping. There are examples of waste producers implementing this alternative to disposal (international examples do exist) although they are limited. In most cases authorisation for this activity would be required and there may be challenges in finding opportunities that combine the availability of appropriate material and projects that can receive the material. There may also be impacts on the site end state that would need to be considered.

Re-use of material is a significant opportunity to avoid inappropriate use of capacity at the LLWR and therefore more work is required to ensure that this opportunity is realised. In order to improve the implementation of these options we will:

- seek end users for soil, rubble and demolition products generated within the NDA and non-NDA estate using national networks such as the LLW Strategy Group
- work with regulators and waste producers to seek clarification of regulatory requirements and provide examples of UK and international good practice in re-use of waste

Metals wastes can be readily recycled following treatment, which is covered later in more detail.

**Question 2 –** Re-use and recycling of waste from the nuclear industry could yield significant benefits – do you agree with this approach and where do you see the significant opportunities for implementing the option?

*Decay storage*

A further opportunity to minimise the radioactivity of waste is decay storage of radioactive waste. Whilst decay storage of waste to exempt levels or levels suitable for alternative management options may have benefits, there are also significant challenges that need to be overcome, including rigorous characterisation before and after decay storage, availability of storage space, regulatory requirements, stakeholder acceptance and strategic fit with decommissioning strategies. It is our strategy that decay storage should only be considered on a case-by-case basis. Further study will be undertaken to better understand decay storage opportunities, which could include decay storage of short-lived ILW to LLW, and the limitations around them.

The **Strategic Environmental Assessment** that supports the development of this strategy considers decontamination, re-use and recycling. Conclusions of this assessment are presented below.

- 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 impacts of decontamination, such as energy use, resource use, discharges, secondary waste generation and the risk of exposure to workers involved in decontamination.
- The re-use 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. Re-use under appropriate control is also expected to result in limited environmental impacts. However, the scope of implementation will be limited by the practicability of identifying circumstances in which material can be re-used under appropriate regulatory oversight and the challenges of demonstrating the suitability of material for re-use.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

### 5.3.3 Waste Treatment

There are three waste treatment activities that will be key to success in achieving the vision for this strategy: waste compaction; treatment and recycling of metallic LLW; and, incineration[3].

It is our view that treatment routes for LLW should be utilised to ensure optimum use of the existing national disposal facility and where demonstrated as BPEO. Candidate waste should be cleaned, treated, recycled and / or exempted before disposal decisions are made. Metal decontamination/ smelting and incineration of candidate wastes should be pursued to the maximum extent. These opportunities are discussed in greater detail below.

#### *Waste compaction*

In recent years, compaction and high-force compaction of LLW have realised a significant amount of volume saving prior to disposal. On average, compaction of LLW achieves a 5:1 ratio of volume reduction. Compaction is a relatively simple process and technologies are mature. It is therefore considered to be an appropriate technology to maintain as part of our strategy. Improved waste packaging (e.g. 1 $m^3$ boxes rather than cylindrical drums) to maximise packing efficiency for compacted waste should also be pursued.

In order to optimise the use of compaction we will:

- determine whether there is a need for additional compaction capacity in the UK and ensure availability of compaction for LLW
- encourage the use of reusable containers for the transport of waste for compaction (for example Type-0075 containers) to reduce the amount of new packaging being compacted and also preserve space by generating a rectilinear waste form rather than the round waste form achieved with drummed waste
- expect suppliers of services to work with waste producers to provide innovative services as applicable

**Question 3 –** To what extent do you believe that compaction still has a key role to play in the optimisation of LLW management? What are the opportunities for improving the use of compaction?

[3] For the purpose of this strategy incineration is to be considered a treatment, rather than disposal process.

*Metal treatment and recycling*

Metallic waste represents approximately 27% of LLW in the UK. Metal decontamination and metal melting have been demonstrated as an effective way to manage these wastes and can achieve recycling rates of up to 95% of incoming material (Ref. 9). Consequently, treatment of metallic waste represents a significant opportunity for conservation of disposal capacity at LLWR whilst also enhancing the value of resources already within the nuclear estate.

Decontamination of metal wastes already takes place at a number of NDA and non-NDA sites, for example Winfrith and Sellafield. There are also a number of contractors in the supply chain who provide services in this area and a number of waste producers have initiated trials of these routes (e.g. Sellafield, Rosyth and Magnox South). We also recognise the investment by the supply chain in this area that has led to increased availability of this treatment opportunity. Whilst the current level of recycling is positive, there is significant scope for increasing the treatment of metallic waste in the future.

There are a number of key activities that are required to make this happen.

- We are supporting LLW Repository Ltd in developing a UK-wide metallic waste treatment service, which will open up the metallic waste treatment market and encourage further investment in this area allowing all waste producers access to treatment routes they may otherwise not be able to access.
- We will work with the supply chain and LLW Repository Ltd to determine where future developments are best focussed to meet the needs of the nuclear industry.
- Waste producers should make best use of available metal decontamination facilities.
- NDA SLCs must demonstrate that they are making best use of available metal treatment routes.

Further investigation is required to understand the optimal management approach for VLLW metal should alternative VLLW disposal routes open up (see below). At present, there is a reasonable financial and environmental case for treatment of LLW metal when compared to disposal. However, the cost of recycling of VLLW metals compared to alternative VLLW disposal routes is still somewhat uncertain. A strategic BPEO for VLLW management has recently been completed, which indicates that metal treatment is the preferred option for VLLW metal. The results will be published on the LLWR website when available.

- We will work with LLW Repository Ltd to better understand the opportunities for the recycling of VLLW.

The **Strategic Environmental Assessment** that supports the development of this strategy considers decontamination and metal recycling. A conclusion of this assessment is presented below.

- 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 both in the UK and through using overseas facilities. Through this assessment, at a national level, it has been demonstrated the benefits outweigh the potential negative impacts, however, specific circumstances will need to be considered to confirm this is the case at a site level.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

**Question 4 –** Do you agree that the benefits of metal treatment outweigh the detriments? If not, why not? If metal treatment costs more than disposal to implement, is this acceptable?

*Thermal treatment and energy recovery*

Thermal treatment of waste refers to the use of processes such as incineration or pyrolysis to significantly reduce the volume of waste and remove some of the volatile / hazardous components of the waste in the fly ash such that the final form of the waste is a more stable product. Waste forms from these processes are usually ash that is typically solidified in concrete. It has been demonstrated that thermal treatment is a viable and appropriate management option for LLW (Ref. 10). In particular, it is recognised that this is an effective treatment option for contaminated oils. It has been shown that for LLW considered alone, conventional incineration is likely to be the most appropriate thermal treatment technology. However, it has also been recognised that the benefits do not greatly outweigh those achieved by high-force compaction and it is often the case that those wastes amenable to incineration are also appropriate for high-force compaction.

We recognise that there may be opportunities for thermal treatment of LLW with other waste streams, for example ILW, graphite and asbestos. Energy recovery from thermal treatment of waste is also becoming a common practice in the conventional waste management industry. However, the size of incinerator that would be required to treat incinerable waste in the UK LLW inventory would be relatively small and would consequently limit any potential for major heat recovery. We believe that, at present, co-incineration of radioactive waste with conventional (municipal) waste for the purpose of energy recovery and driven by the primary need to manage LLW, does not provide a favourable option. This is due to provisions required for contamination control, the potential to generate significant amounts of LLW as ash and potential stakeholders concerns associated with waste movements (both conventional and radioactive waste) and dilution. (It is recognised that there may be opportunities for energy recovery where LLW is consigned to facilities that are already in place for the treatment conventional waste).

There are a number of incinerators operating in the UK that treat LLW from both the nuclear industry and the non-nuclear industry. However, the capacity of these facilities is limited. There are also facilities not currently in use that have potential for an increased role in the future, for example the incinerator at Capenhurst site, which is not currently operating. We want to see continued use of existing facilities where this represents the most appropriate management option and they can be shown to demonstrate value for money.

It is also recognised that thermal treatment of both radioactive and non-radioactive waste is an area of significant concern for stakeholders, particularly the communities that host thermal treatment facilities. Whist it is important that communities are engaged in developments for waste management, thermal treatment is an area where this deserves particular attention at an early stage. Clear and effective involvement of communities at an early stage when developments are planned is critical.

In order to make the most effective use of thermal treatment opportunities we will:

- support LLW Repository Ltd in development of existing supply-chain treatment routes for incinerable waste
- work with Sellafield Ltd to better understand opportunities for the Sellafield sites (Sellafield, Windscale and Capenhurst) in this area (in particular looking at opportunities for thermal treatment with other waste streams)
- expect waste producers to use incineration opportunities for contaminated oils where BPEO, which will contribute to the viability of incineration routes (contaminated oil is generally managed as a solid waste).
- further investigate opportunities for thermal

The **Strategic Environmental Assessment** that supports the development of this strategy considers thermal treatment and energy recovery (see Environment and Sustainability Report Non Technical Summary). Conclusions of this assessment are presented below.

- 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 both in the UK and using overseas facilities. Specific circumstances will need to be considered to ensure the benefits of this option outweigh the potential negative impacts of thermal treatment such as energy use, resource use, discharges, secondary waste generation, the risk 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, then 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 above.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

*Asbestos*

Thermal treatment offers potential opportunities for the management of asbestos, both radioactively-contaminated and clean. However, thermal treatment of asbestos has not yet been demonstrated as an economical option even though recognised as a beneficial opportunity for the environment. For the immediate future, LLW and VLLW asbestos should be characterised and despatched, via appropriate pre-conditioning (e.g. super-compaction), to an appropriate disposal route. For VLLW and exempt asbestos this may include appropriately authorised landfills. In the longer term we expect options and business cases to be developed as the opportunities for the application of alternative management technologies grow.

*Supply Chain approach*

To support this strategy, we want to see the establishment of a stable and competitive market for waste management services that will provide confidence for private investment. We believe that the existing waste management supply chain, given it's maturity and expert capabilities, has a key role in the delivery of this strategy and that the majority of waste management solutions that are required to implement this strategy are or will be available, either in the nuclear estate or through the supply chain. Therefore the supply chain should be used in preference to centralised investment in new infrastructure. Whilst use of the supply chain has been raised as an area for concern, it should be recognised that it has to operate within the same regulatory framework as existing site licence companies when operating these services and can often provide enhanced value.

There is potential for economies of scale to be achieved through centralised procurement and brokering for these services. It is our belief that this will maximise opportunities for all waste owners. Therefore:

- we are supporting LLW Repository Ltd in developing a diversified service offering to provide metal treatment and incineration services through the supply chain
- we will look to our sites and other waste producers to use services at LLWR or demonstrate sound reasoning for selecting an alternative treatment route should an alternative route be appropriate in specific circumstances
- we will support the supply chain in developing new management and disposal routes by explaining our role in the management of LLW and making available information on the wastes that need to be managed and when they will arise

Treatment of wastes prior to disposal may lead to increased waste movements, where treatment is undertaken at a separate location to the final disposal site. We believe that the relative impacts of these additional movements are small (see SEA text below). In some cases this may require international transport. International movements of LLW come under the Transfrontier Shipment of Waste Regulations 2008.

Flexibility is required for wastes to be sent to sites for treatment prior to their final disposal location when co-ordinated through a centralised body on behalf of NDA. As noted above, there is existing treatment infrastructure supporting the nuclear industry, although determining the viability and options for upgrading and / or expanding this existing waste infrastructure remains in progress. There may be opportunities for providing services to NDA and non-NDA waste owners. In order to develop this position we expect:

- those sites that have the potential for extending the life of existing assets to work with the NDA and LLW Repository Ltd to better understand the opportunities and, where appropriate develop business cases for any investment that may be required

**Question 6 –** We believe that the majority of waste management solutions that are required to implement this strategy are or will be available, either in the nuclear estate or through the supply chain and therefore should be used in preference to centralised investment in new infrastructure. To what extent do you agree with this statement?

The use of the supply chain involves using waste management infrastructure owned by commercial operators rather than the NDA commissioning its own new waste facilities. The difference between these options was not assessed in the **Strategic Environmental Assessment** as a single specific option; however, the assessment collectively allows the implications of this decision to be considered. The key outcomes from such a choice are the use of a mix of local, regional, national and international waste management facilities and consequent changes in transport. There are also implications that may result from the management of radioactive waste in facilities potentially distant from where waste arises or where it has historically been managed. On the basis of the SEA, conclusions of this assessment are presented below.

- Transport is a distinguishing factor in choices between waste management options and the transport of radioactive materials is an issue of potential 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 consideration. However, while transport is an issue of stakeholder interest, the actual impacts of LLW transport are small and so this issue is not a strong differentiator between options on a national scale. (This is expanded in Section 5.4.3).

- When considering disposal on or adjacent to nuclear sites there is need to consider net impact on transport holistically. It is possible that any benefit from avoiding LLW transport may be offset by additional construction traffic for new facilities.

- Some stakeholders have raised concern about the potential impacts on economy and society arising from the management of radioactive waste at sites away from existing nuclear sites, for example due to negative impact on property prices or inward investment. The SEA looks at information on the potential effects of non radioactive and radioactive waste facilities in this way. The conclusions of the assessment are presented below.

  ► Any impact on property prices of radioactive waste facilities is expected to be equivalent to those observed near non radioactive waste facilities and are expected to be both small and very localised. A study by the Department for Environment, Food and Rural Affairs (Defra) into these effects (Ref. 11) concludes there is little correlation between such impacts and the types of waste received and so we do not anticipate the co-disposal of radioactive and non radioactive wastes having significantly greater impacts on property prices than facilities taking only conventional wastes.

  ► The potential for the presence of nuclear sites to discourage non-nuclear companies from investing in areas near to such facilities has been suggested. However, the SEA did not identify conclusive evidence of significant negative impacts on local economies near major nuclear sites. As a result we have not been able to demonstrate significant negative impacts on local economies and indeed, where those options require new waste management facilities modest positive impacts are expected as a result of job creation.

- While we do not envisage widespread significant negative impacts on local communities, like other waste management infrastructure, such as municipal waste landfills and incinerators, the development of new radioactive waste management facilities is potentially contentious and will require effective and proactive engagement with local communities.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/

## 5.4 Best use of existing assets

The UK LLW Strategic Review (Ref. 2) identified the LLW management assets with the UK nuclear industry. In developing this strategy we have considered the value of using existing assets, in particular looking at the LLW Repository near Drigg in Cumbria. The assessment determined that there is inherent environmental, social and economic benefits in making the best use of existing infrastructure. In particular, there are benefits from the reduction in investment and resources required to construct new infrastructure at NDA sites. Optimised approaches to the management of assets align well with application of the waste management hierarchy, in particular, in re-use of resources that have already been expended.

### 5.4.1 The UK LLW Repository

LLWR is a key asset to the UK. LLW has been disposed of at LLWR since 1959. Waste streams are accepted for disposal at the LLWR based on the availability of sufficient volumetric and radiological capacity. LLW arrives at the LLWR in containers of varying sizes, either following processing mainly in the Waste Monitoring and Compaction (WAMAC) facility at Sellafield or directly from waste producers. Containerised wastes are then grouted and placed into engineered concrete vaults.

Making the best use of that asset is critical to the continued availability of LLW management capacity and capability. The LLWR provides a high level of safety, security and environmental protection for the disposal of LLW by offering a multi-barrier containment system. Capacity at the site is limited; continued use of the site and further extension and expansion is subject to planning and other regulatory requirements, such as the development of an acceptable Environmental Safety Case (see Section 6.4.1). The amount of LLW currently forecasted to be produced in the UK could never be disposed of at LLWR without significant treatment. Therefore, continuing to manage LLW as we have done in the past is not sustainable. In order to make best use of the facility it is important that only wastes that require engineered multi-barrier containment are consigned to the site. Other appropriate waste routes must be used for candidate wastes diverted from LLWR in the future.

In order to achieve this we will:

- ensure LLW Repository Ltd works with waste producers via its consignor support organisation to facilitate and coordinate waste routing appropriately in its role as NDA LLW implementation contractor
- apply contractual mechanisms to our sites to minimise waste arisings and avoid sending waste for direct disposal to LLWR unless necessary
- look to LLW Repository Ltd to use the Conditions for Acceptance (CFA) at LLWR to ensure that only those wastes that need enhanced safety, security and environmental protection through engineered vault disposal are consigned to the repository
- support LLW Repository Ltd in the implementation of alternative waste management routes for metallic and combustible wastes and for the management of VLLW

**Question 7 –** Do you agree with the approaches set out above for the development of an optimised approach to management of LLWR?

The **Strategic Environmental Assessment** which supports the development of this strategy considered a number of options around the future strategy for the use of the LLWR near Drigg including abandonment of the site and high level consideration of the impacts of retrieving waste already disposed of at the site, an important consideration when reviewing issues of site closure. Conclusions of this assessment are presented below.

- 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 resource used in the construction and capping of successor facilities.

- It is difficult to determine what the effects of early replacement of LLWR without retrieval of waste 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 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.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

### 5.4.2 Packaging

The majority of LLW disposed of in the UK is packaged in various types of freight containers, which are grouted prior to disposal to minimise void space and improve long-term waste performance. Typically, the container is also used for transporting the waste to its final destination; the containers are usually only licensed for a single transport. Although safe and reliable for waste transport and disposal, the use of this packaging system is resource and cost intensive and does not provide optimum use of the disposal capacity. It is recognised that any alternative approaches must continue to meet safety and compliance requirements in this area.

Improvement in this area represents a significant opportunity. In the past, the containers frequently had poor waste packing efficiency. In recent years this has improved somewhat, although often due to the filling of void space with VLLW material. Whilst this is recognised as an improvement, it results in valuable vault space being filled by VLLW. In the future we want to see improved packing efficiency, for LLW material requiring engineered vault disposal.

An alternative approach to packaging could have significant benefits in terms of cost, resource and disposal capacity at LLWR or other disposal sites, without compromising safety, security and environmental protection. Alternative packaging options are likely to include reusable transport containers and sacrificial disposal liners. Improvements to packaging need to measure benefits for treatment and the use of alternative disposal routes, not just the benefits that can be achieved at LLWR.

In order to achieve this we will:

- support LLW Repository Ltd in developing alternative packaging solutions, including reusable transport containers, approaches to achieve improved packing efficiency and development of lower cost disposal containers; LLW Repository Ltd already provide the national container supply service through its customer contracts
- look to waste producers and suppliers to work with LLW Repository Ltd in development of practical waste packaging solutions
- ensure that alternative packaging options do not prevent LLW Repository Ltd from making an acceptable Environmental Safety Case for its continued use

**Question 8 –** What are the key considerations that should influence the development of new packaging solutions for LLW management?

The **Strategic Environmental Assessment** that supports the development of this strategy considers alternative disposal packaging. A conclusion of this assessment is presented below.

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

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

### 5.4.3 Transport

The movement of radioactive waste in the UK is governed by the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 (Statutory Instrument 1573)[10] and regulated by the Department for Transport (DfT). These regulations have recently been introduced in the UK to provide a consistent approach within the EU for the safe transport of dangerous goods including radioactive materials.

The LLWR currently receives between 500 and 700 half height ISO (HHISO) containers per year in addition to occasional large items for disposal. Most of this waste (~80%) is delivered to LLWR by rail from Sellafield. Most consignor sites transport waste by road to Sellafield for compaction at WAMAC prior to despatch by rail to LLWR for disposal. The remainder of waste shipments are received at LLWR directly by road. Consignors organise their own transport using services provided by commercial carriers or other waste producers.

It is recognised that transport of LLW is a significant stakeholder concern, particularly for residents of the communities near facilities involved. Government's policy for the management of LLW recognises that, although the desire to avoid excessive transportation of materials is an important consideration, it must be balanced with all the other relevant factors on a case-by-case basis. The social and environmental impacts of waste transport are a function of the number of movements, the distance travelled and the mode of transport utilised. There may be a significant opportunity to move a portion of waste movements from road to rail and also utilise sea transport, where appropriate. We recognise these issues and want to work with our contractors and non-NDA waste producers to minimise the impact of transport as far as can be achieved.

In order to make the best use of these opportunities and in an effort to reduce the impact of waste transport:

- we have tasked LLW Repository Ltd with the co-ordination of waste transport and logistics between waste producers, treatment facilities and LLW disposal facilities
- we will work with LLW Repository Ltd and waste producers to develop a plan for the optimised and integrated transport of LLW, including an assessment of the costs and benefits from greater use of rail transport

It is recognised that transport is of concern to different people for different reasons. For waste producer decision making, appropriate mechanisms should be used to ensure dialogue, review and assessment of options for implementation of waste management that consider local and regional implications.

**Question 9 –** The impacts of the transport of LLW are limited when compared to transport of other materials, when considered at a national level. However, it is a very significant issue for local communities where the transport is taking place. How do you think this should be factored in to national strategy?

**Question 10 –** To what extent does a movement of waste from road to rail for transport represent a significant improvement? Do you see any disadvantages to this approach?

The **Strategic Environmental Assessment** that supports the development of this strategy considered throughout the potential issues associated with Traffic and Transport (see Environment and Sustainability Report Non-Technical Summary). Conclusions of this assessment are presented below.

- Transport is a distinguishing factor in choices between waste management options and the transport of radioactive materials is an issue of potential 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 an important factor. Despite being an important consideration, when considered on a national level, this issue is not a strong differentiator between options.

  ► The contribution of LLW to local transport at consigning nuclear sites is generally only a very small constituent of total transport associated with the operation of the site. We would expect the adequacy of local transport infrastructure and potential disturbance to local communities to be considered in the siting of any substantial waste management facility providing such a service.

  ► Transport of LLW to more distant waste management facilities does result in increased carbon emissions compared with management closer to the site where wastes arise. However, such emissions are relatively small on a national scale when compared with UK transport related emissions and such emissions are also not a significant contributor to the carbon emissions of the nuclear sector.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

## 5.5 New fit for purpose waste management routes

Implementation of this strategy will require new and / or expanded routes for the management and disposal of LLW.

Development of new routes has the potential to be controversial, in particular with the communities around which waste management operations will take place, as is often the case with conventional waste management developments. Development and use of these new routes should consider issues of public acceptability and the community vision for the area in which they are taking place.

Development of new sites for treatment or disposal of LLW should take place at strategically appropriate locations depending on the service being offered. This may include existing NDA estate, existing non-nuclear waste management facilities and new sites (local, regional or national).

The LLW policy recognises that for wastes that **cannot be prevented, further minimised, diverted for recycling or re-used**, final un-retrievable disposal is the end point for all LLW (Ref. 1). After all reasonable alternatives have been considered the following disposal options are available and should be considered on a case by case basis where regulatory requirements are demonstrated:

- in-situ disposal (e.g. contaminated ground)
- specified landfill or incineration, locally, regionally or nationally (e.g. VLLW)
- on-site or adjacent to site disposal (e.g. decommissioning rubble)
- other near surface facilities, locally, regionally or nationally (e.g. LLWR)

The Environment Agency, SEPA and the Environment Agency for Northern Ireland have jointly published Guidance on the Requirements for Authorisation for near surface disposal facilities (Ref. 12) to ensure doses to people and the environment are ALARA (as low as reasonably achievable) for these management options.

### 5.5.1 LLWR Segregated Waste Services

In response to a number of drivers, including the revised LLWR contract, Government policy, the development of this strategy and a recognition that alternative waste management options were needed for LLW in the UK, LLW Repository Ltd has set about expanding its service offering, as noted elsewhere in this document.

In the past LLWR services were comprised primarily of compaction, container supply and waste disposal. In order to improve availability of alternative waste management options LLW Repository Ltd is set to offer metal treatment, incineration and alternative VLLW disposal, in addition to its existing services. These services will encourage better segregation of waste and the application of the waste management hierarchy. In development of this strategy we have learnt that wastes are often not segregated because of the lack of alternative accessible waste management routes. Many waste producers have contracts with LLW Repository Ltd and these new services are being introduced as an extension to those existing contracts, making these alternative treatment routes readily available to all current and future waste producers, both NDA and non-NDA sites, large or small.

We are supporting LLW Repository Ltd in developing these services and see the implementation and use of them by NDA and non-NDA sites as critical to the success of this strategy. This is particularly the case for the near term as these services are likely to be available sooner than direct contracting with the supply chain by individual LLW producers.

In addition, as with container supply, the value of having a broker arrangement to leverage supply to existing and future waste management organisations (in the UK and overseas), through open and fair competition, offers the advantage of preferential rates as an alternative to disposal at LLWR, which is relatively expensive when lifetime costs are considered.

### 5.5.2 VLLW disposal and controlled burial

Government's policy for the management of solid LLW in the UK redefined a sub-category of LLW, called Very Low Level Waste (VLLW). It comprises two further sub-categories, high volume and low volume (see Glossary for more information). All VLLW from the nuclear industry is considered high volume VLLW by the Environment Agency; SEPA consider the first 50 $m^3$ of waste from a Nuclear Licensed Site as low volume VLLW. The policy promotes the use of a risk informed approach to the management of waste and also indicates that all options for the management and disposal of LLW should be considered. Following application of the waste management hierarchy, this includes consideration of disposal of VLLW to landfill, and where appropriate disposal of LLW to controlled burial sites, "provided the necessary safety assessments can be carried out to the satisfaction of the environmental regulators" (Ref. 1).

The use of alternative disposal routes needs to meet the relevant safety requirements, as noted above and be demonstrated to be the Best Practicable Environmental Option by the consignor site, this should include consideration of local community issues both at the consigning and receiving sites. As directed in Government's LLW policy, development of LLW management plans should consider all available solutions for management of LLW; the proximity principle should be considered as part of this. The Policy recognises that the desire to avoid excessive transportation of materials is an important consideration, however, noting that "it must be balanced with all the other relevant factors on a case by case basis" (Ref. 1).

The Environment Agency has produced initial guidance on how such activities will be regulated in England and Wales (Ref. 13), and the Scottish Environment Protection Agency (SEPA) will publish guidance in due course for such activities in Scotland. LLW Repository Ltd have undertaken a strategic BPEO study for VLLW management, to evaluate the potential options from a national strategic perspective. This has shown a preference for treatment of VLLW metal over disposal. It did not show a preference for any particular disposal option at a strategic national level. The outputs will be published on the LLW Repository Ltd website when they are available. Other waste management organisations are working to identify opportunities to assist the implementation of Government policy and provide viable waste management options to UK waste producers.

The use of alternative disposal routes for VLLW and suitable LLW through controlled burial, provides a significant opportunity for effectively managing suitable types of LLW and VLLW and extending the life of LLWR. In many cases, particularly for VLLW, the level of safety, security and environmental protection offered through engineered vaults goes well beyond that needed to demonstrate protection and meet regulatory requirements. Consequently, where the necessary safety assessments can be carried out to the satisfaction of the environmental regulators, diversion of VLLW away from LLWR is critical to implementing Government policy and extending the potential life of LLWR for waste that cannot be disposed of elsewhere.

In order to do this we will:

- support the supply chain in developing new management and disposal routes by explaining our role in the management of LLW and making available information on the wastes that need to be managed and when they will arise
- expect waste producers to make appropriate use of alternative waste management and disposal options for VLLW and controlled burial
- support LLW Repository Ltd in the development of an alternative waste disposal service for VLLW
- evaluate options for disposal on NDA sites on a case by case basis (see Section 5.5.4)

The **Strategic Environmental Assessment** that supports the development of this strategy considers alternative disposal options for VLLW and certain LLW waste. Conclusions of this assessment are presented below.

- As LLW encompasses a large range of radioactivity and a highly engineered facility such as LLWR is not necessarily required for lower activity waste and wastes containing short lived radioactivity, the use of conventional landfills presents potential benefits to the management of LLW. New disposal facilities will be required to demonstrate that disposal will meet the regulatory risk target prior to authorisation. The benefit of using landfill disposal options rather than vaulted disposal is achieved through reducing the raw materials used, ensuring the optimised use of the LLWR and improving the efficiency with which waste is packaged reducing the total volume of packaged waste requiring disposal.
- We do not believe that the use of landfill disposal for VLLW and suitable LLW will significantly affect remaining UK landfill capacity. Total estimated LLW arisings are 3 million $m^3$ over a period of 120 years with an average annual arising of approximately 30,000 $m^3$. This is a small amount compared with 335 million tonnes of non-radioactive waste arising each year (Ref. 7) and total remaining landfill capacity in England and Wales as of 2006 of 694 million $m^3$ (Ref. 14).

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations.

**Question 11 –** Government's policy for the management of LLW indicates that landfill disposal of LLW and VLLW should be considered when determining end points for these wastes. What do you think should be the key considerations when comparing landfill disposal with other options such as LLWR, new vaulted disposal routes, etc?

### 5.5.3 Dounreay LLW facility

Dounreay Site Restoration Limited (DSRL), the NDA's contractor at the Dounreay Site in Caithness, Scotland, has received planning consent from Highland Council for a new LLW disposal facility adjacent to the Dounreay site following a detailed BPEO process. The facility is planned to comprise a number of vaults for disposal of LLW and VLLW separately. The facility will accept waste from the Dounreay Site and the adjacent HMS Vulcan Naval Reactor Test Establishment, owned by the Ministry of Defence, for which Dounreay already provides a LLW disposal route. The development of the facility reflects the decision in 2005 by the Scottish Ministers to direct SEPA not to grant an authorisation under the Radioactive Substances Act 1993 to dispose of LLW from Dounreay to LLWR.

There are no plans at present to consider disposal in this facility of other suitable wastes from both the nuclear and non-nuclear industry.

The existence of a LLW facility at the Dounreay site will not remove the requirement to implement the waste management hierarchy and optimise management of LLW at Dounreay.

In order to make this happen we propose to:

- continue to develop and integrate plans for the new Dounreay LLW facility
- work with DSRL (and other stakeholders including SEPA) to ensure optimisation of waste management at the site, including appropriate implementation of the waste management hierarchy

### 5.5.4 Proposals for on-site disposal

A number of sites in the NDA estate are considering on-site disposal of LLW and VLLW following discussion with stakeholders and development of contingency plans for waste management to support their operations and decommissioning plans. On-site disposal may be a viable option for the management of LLW and should be considered amongst the alternatives. As with other options, robust business cases for implementing such options will be required. When considering them there are a number of issues that we consider critical to this assessment, these include consideration of:

- the appropriateness of the site for the purpose
- a comparison with other options available for the management of the waste
- environmental impact of constructing a new facility compared with using an existing facility
- consideration of the potential benefits in both a local and national context
- the ability to develop a robust Environmental Safety Case for waste management and disposal
- stakeholder interests, including public acceptability and supply chain involvement
- impacts on potential future uses of the site (referencing NDA property strategy)
- long term impacts on the site (de-licensing, end state and end use)

Due to the importance of local issues in developing these proposals, they need to be addressed on a case-by-case basis. This may include consideration of all reactor decommissioning wastes.

On-site disposal could also include in-situ disposal , which is included in the 2007 LLW policy amongst the disposal options available for consideration. It may provide a risk based approach to the management of certain contaminated land wastes where it can be demonstrated to meet regulatory requirements and can be shown to represent the Best Practical Environmental Option. Again, this would need to be considered on a case-by-case basis given the influence of site specific issues in such an approach.

The **Strategic Environmental Assessment** which supports the development of this strategy considered on-site disposal. Conclusions of this assessment are presented below.

- One of the benefits often 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 net impact 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 transport to construct an on site facility.
- The widespread use of on-site disposal involves a larger number of relatively small facilities compared to other options and so may be less efficient in terms of raw material and resource use when 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.

More detailed information is available in the Environment and Sustainability Report which supports this consultation and is available from www.nda.gov.uk/consultations/.

**Question 12 –** To what extent do you agree with the key considerations set out above for on-site disposal proposals?

### 5.5.5 Orphan wastes

Certain LLW wastes are not currently suitable for disposal at LLWR, for example because they do not meet the CFA, and at the present time do not have a defined route for either treatment or disposal. These waste are often described as orphan wastes.

Because of the diverse nature of these wastes, determining the most appropriate management option for these wastes will in some circumstances require a waste stream specific assessment. There may however, be opportunities for determining a single approach for similar wastes that arise on a number of sites. One of the initiatives implemented through the National LLW Management Plan (Section 7.2) will be to consolidate research and development on these waste streams across the NDA estate with the aim of determining the most effective management option for these wastes on behalf of all sites. In some cases new treatment and disposal routes may be required for specific waste streams.

# 6 Implementation of the strategy

# 6 Implementation of the strategy

During the development of this proposed strategy a number of synergies, opportunities and initiatives to implement the strategy were identified.

As noted previously the implementation of this strategy will need to be undertaken in compliance with all relevant legal and regulatory requirements. More information on these requirements can be found on the websites of the Environment Agency, Health and Safety Executive and Scottish Environment Protection Agency and within the UK's reports to the Joint Convention on the Safety of Spent Fuel and Radioactive Waste.

We have set out below some of the key aspects of implementing the strategy within the regulatory regime, some of the key issues that affect the implementation and how organisations will need to work together in order to deliver the strategy. In Section 7 we have included information on the National LLW Management Plan, the detailed plan for implementation of the strategy.

## 6.1 Encouraging the right behaviour

This LLW Strategy is intended to bring a change in how LLW is managed in the UK nuclear industry, recognising that many consignor sites have already made significant progress in bringing about this change. In response to Government's policy we want to build on this by improving consideration and use of alternatives to the disposal of LLW, ensure the best use of the UK's assets for the management and disposal of LLW and open new routes such that waste producers have viable options to consider in making effective waste management decisions. This aims to provide overall flexibility and mitigate risk of constraining provision of continued capability and capacity for the management of LLW, a critical enabling process to achieve our overall mission. In addition, this strategy aims to facilitate waste prevention and reduction via application of the waste management hierarchy.

We recognise that waste producers, both those within and outwith the NDA estate, are the legally responsible entities for the management of the waste they produce. This means that whilst NDA can provide high-level strategic direction, NDA cannot directly instruct a waste producer to behave in any particular way. There are key areas where this strategy and the NDA can actively encourage the right behaviour.

- *Waste producers will align with this strategy* – This strategy responds to Government commitments in policy. Following consultation, it will be endorsed by ministers and will feed into the overall NDA strategy. We will also work with all stakeholders to demonstrate the value of the approaches outlined in this strategy, noting that in certain circumstances other approaches may be appropriate on a case-by-case basis.
- *Communication and provision of information* – we will proactively communicate with stakeholders and where appropriate share information to support the waste management decision-making process.
- *Changing the business case* – this strategy and the underpinning information available, now enable consignor sites to better understand the national implications of their waste management decisions – we would expect these benefits and detriments to be included in consignor site decision-making processes and inform the development of business cases for the management of LLW presented to NDA by its delivery partners, recognising that site based decision making may lead to diverse outcomes.
- *Feeding into environmental decision making* - the findings in the development of the strategy will provide information that may influence environmental decision making at the site level.
- *Incentivising* – in some circumstances we may deem it appropriate to use financial or other contractual incentives to influence the behaviour of NDA contractors; we will also work with LLW Repository Ltd to develop pricing strategies for its services which support implementation of the LLW strategy. One way to instigate change in waste management could be to set targets for reuse, recycling, using alternative management routes for LLW.
- *Strategic direction* – we provide strategic direction to NDA sites through specifications and guidance; implementation of this strategy will be incorporated into these specifications.
- *Opening new routes* – we are working with LLW Repository Ltd to make alternative routes for the management of LLW available to all UK waste producers. We are also working with our

other site licence companies, waste producers and suppliers to provide win-win solutions and realise opportunities for efficiencies.

- *Supporting the supply chain* – we will support the supply chain in the development of alternative waste management services, this may include support to their stakeholder engagement activities in explaining our role and the benefits to UK as a whole of alternative waste management options.
- *Sharing good practice* – we will work with waste producers, the supply chain and Regulators to ensure that good practice in the management of LLW is communicated to enhance performance at NDA and other waste producing sites.

**Question 13 –** Do you agree with the approaches set out for encouraging the right behaviour? To what extent do you think that waste recycling targets could have benefit to the national strategy? What potential benefits and difficulties would you envisage from implementing such approaches?

## 6.2 Working with others, consultation and public acceptability

Success of this strategy will rely on implementation of the strategy by all parties involved in the management of LLW. To ensure commitment to effective and efficient implementation, organisations will need to work closely to achieve the best results for all parties involved. The parties directly involved in the implementation include:

- Nuclear industry LLW producers
- Non-nuclear industry LLW producers
- LLW Repository Ltd
- Regulators (EA, SEPA, NII, OCNS, DfT)
- Planning Authorities
- NDA
- Waste management supply chain
- Government

The strategy has been developed to deliver national benefits across the UK. It is however recognised that this strategy has an impact at every level, including regional, local and within communities.

The Strategic Environmental Assessment has been structured to incorporate all relevant facets of sustainability appraisal. It has provided insight and information on potential impacts at a national level, whilst drawing out aspects where particular regional and local concerns need to recognised.

At a national strategic level, due to the nature of LLW and VLLW within the nuclear industry, it appears that impacts of LLW management and transport on the environment, people and society are low. However, it is recognised that radioactive waste, even LLW and VLLW, raises particular concerns for the public and local communities. Perceptions associated with the radioactive nature of these operations also has the potential to create negative economic impacts and negative feeling amongst the communities involved.

In light of the above it will be essential to undertake careful and considered engagement with local communities where the implementation of this strategy leads to proposals for new waste management facilities or changes in approach to LLW management. Such engagement needs to be open and transparent and should demonstrate why a particular management option for low level waste has benefits over other options. In some cases, those benefits may operate at a national level in addition to more local considerations. It is important to recognise that LLW management decisions and facilities have, like municipal waste management, the potential to be highly contentious.

As per paragraph 31 of the UK LLW Policy (Ref. 1), the final strategy will provide guidance for national, regional, and local planning authorities as necessary in the preparation of planning strategies and their appraisal.

## 6.3 Key Issues

There are a number of key issues that have the potential to impact on the management of LLW in the UK and consequently the success of this strategy. These issues are outlined below.

### 6.3.1 LLWR Environmental Safety Case

LLW Repository Ltd is in the process of updating the Environmental Safety Case (formerly Post-Closure and Operational Environmental Safety Case) in line with the requirements of their Radioactive Substances Act Authorisation to dispose of radioactive waste. The Environmental Safety Case sets out to demonstrate that the facility will properly protect people and the environment. In order to do this LLW Repository Ltd needs to show that the location, design, construction, operation and closure of the site meet a series of principles and requirements (see Appendix 2). This involves an extensive programme of work and regular discussion with the Environment Agency. The Environmental Safety Case is due for submission to the Environment Agency by 1 May 2011. The Environment Agency will then review the safety case and determine whether it is appropriate to continue to dispose of waste at the LLWR. They will also define types and quantities of waste.

The safety case plays an important role, not just in gaining authorisation to continue disposal at the site, but also how it is operated. This may have implications for what waste can be consigned to the site; this may include limits on the radiological nature of waste suitable for disposal, the chemo-toxic nature of wastes and also how it is packaged. The safety case will also establish the safe capacity of the site for waste.

Over the development of the safety case we will work closely with LLW Repository Ltd to understand the implications of the developing safety case for implementation of the strategy and also the implications of the LLW strategy for the safety case. Specifically, over the next year, LLW Repository Ltd will be undertaking a process of optimisation during which they will assess the impacts of this proposed strategy. This process, as part of the consultation on the strategy, will be used to inform the final version of the strategy.

### 6.3.2 Development of legislation

There are a number of ongoing activities related to regulation of LLW and conventional waste that will affect how LLW and VLLW are managed.

*Guidance on authorisation and licensing issues associated to new disposal routes*

The Environment Agency has published guidance on how they will regulate radioactive waste being consigned to landfill in line with the UK LLW Policy. SEPA is expected to publish equivalent guidance for Scottish landfills later this year. Given that diversion of VLLW away from LLWR to other fit-for-purpose routes is a key part of this proposed strategy, availability of these routes will have a significant influence on the success of the strategy, particularly in the near term.

*Review of Exemption Orders under the Radioactive Substances Act*

Government is currently in the process of reviewing the suite of exemption orders made under the Radioactive Substances Act 1993 across the UK. This is driven by Government's Better Regulation agenda and aims to simplify regulations on those using exemptions whilst maintaining appropriate protection to human health and the environment. The programme will ensure that the future suite of Exemption Orders:

- are easier to follow and interpret
- meet current legislative standards in terms of modern legal drafting requirements
- are transparent and easier to use

Current proposals suggest that the revised exemption orders will be risk informed and may use other existing standards in their formulation, for example BSS and ICRP (International Commission on Radiological Protection) levels. The proposals are radionuclide specific and will allow wastes with higher levels of lower hazard radionuclides to be excluded from regulation than is currently the case. More restrictive limits would be imposed for the

clearance of wastes containing more hazardous radionuclides. The review of exemption orders should not change the volume of waste to be managed, but may:

- result in some wastes currently designated 'radioactive' to be changed to 'not-radioactive' and vice versa
- change the permitting requirements for some wastes

*Phase II of the Environmental Permitting Programme*

In England and Wales the Government has just completed a consultation on Phase II of the Environmental Permitting Programme (EPP) including the expansion of the Environmental Permitting Regime to the regulation of radioactive substances. The EPP is a major Defra, DECC, Environment Agency and Welsh Assembly Government initiative that has created a single more user-friendly and modern permitting and compliance system for Waste Management Licensing and Pollution Prevention and Control, while maintaining standards of environmental protection. The current proposals for expanding this regime to include radioactive substances regulation have the potential to streamline administrative arrangements for the regulation of radioactive wastes and make such arrangements more consistent with conventional waste management regulation. The proposals also have the potential to streamline the transfer of radioactive wastes between sites, facilitating multi-site approaches to waste management.

### 6.3.3 New Nuclear Build

In Section 2.1 we set out our definition of the nuclear industry for the purpose of this strategy. In January 2008 the UK Government published a White Paper on Nuclear Power in which it set out its view that new nuclear build should have a role to play in the UK's future energy mix. As such, there is potential for the nuclear industry to change significantly in the foreseeable future. There are two ways in which this strategy will have interactions with nuclear new build.

- Firstly, the development of new nuclear power stations will increase the amount of LLW that will need to be managed. Prospective vendors of nuclear reactors indicate that the volume of waste generated by both operating and decommissioning new build reactors will not be substantial when compared to the waste already in the inventory. This will, of course, depend on how many new stations are built and as this becomes better understood the LLW strategy will need to be reviewed in light of this.
- Secondly, an operator of a new nuclear power station will be required to have a Funded Decommissioning Programme (FDP), approved by the Secretary of State for the Department of Energy and Climate Change, in place before construction of the power station begins. Potential new nuclear operators will therefore need to engage with NDA, LLW Repository Ltd and other LLW management providers on specific issues, in order to develop their FDPs.

### 6.3.4 Contaminated ground

A number of sites in the UK (both NDA and non-NDA) either have, or may have, land contaminated by radioactive materials. Remediation of these sites may require the management of substantial quantities of material. Whilst the management of radioactively contaminated ground does not have to result in the generation of waste, it is likely that some ground (typically soil and rubble) will be consigned as LLW. Indeed some sites already declare a volume of ground-derived material as LLW in their waste inventory. At the present time contaminated ground declared as waste amounts to around 0.5 million $m^3$, which is equivalent to approximately 17% of the LLW inventory. There is a significant amount of potentially contaminated ground that has not yet been declared as waste because it is not yet well characterised and / or a management option has not yet been selected. This quantity of material is in excess of the total inventory of LLW (estimates suggest there could be 13 million $m^3$ (Ref. 6)) and presents a significant risk to this strategy (see Section 7) because of the impact that this material could have on the inventory of waste to be managed.

In order to address this issue, in the immediate term we are working with the regulators to fully understand the requirements on sites which have ground contaminated and/or ground potentially

contaminated with radioactive material (and non-radioactive contamination). We are also working with the regulator community and sites to fully understand the options available for land quality management.

In the longer term, this will allow more focussed characterisation of sites and an improved understanding of the situation, including a better knowledge of what volumes of material will require management as waste and where opportunities exist for the management of contaminated ground in-situ. The desired end state and end use for a given site will be critical to this understanding. As this understanding improves we will be able to determine the impact on the LLW strategy and develop it as required.

## 6.4 Classification of waste and the importance of a robust inventory

The UK Government, via NDA, periodically publish an inventory of radioactive waste in the UK in compliance with EU requirements. The most recent version of this is the 2007 UK Radioactive Waste Inventory (Ref. 6). This inventory provides a reference source of information for Government and its agencies, and others with a role or interest in the management of radioactive waste. Its publication is one facet of the continuing commitment of the UK Government and the organisations responsible for radioactive wastes to openness and transparency in matters relating to the management of these wastes.

An inventory of wastes to be managed is also essential to effective waste management planning, both in the near term and in the long term. In developing this strategy we have used the information supplied for the 2007 Inventory combined with information on LLW submitted with the 2008 lifetime plans for NDA sites. The information was collated in the UK LLW Strategic Review and has informed the development of this strategy. Inventory collation and refinement is an iterative process and the maturity of estimates and forecast is strongly linked to the phase of operation or decommissioning a particular site or organisation is in.

Moving forward we need continued improvement in waste inventory data to continue to plan effectively and also to monitor the implementation of this strategy. A number of initiatives are planned to improve our understanding of wastes that need to be managed, particularly in respect to the amounts of VLLW and exempt waste in waste inventory forecasts.

The National LLW Management Plan (see Section 7.2) includes a number of projects that also support the development and improvement of the inventory of LLW in the UK. This will examine waste stream characterisation and consignment processes, improve quality assurance and waste forecasting and implement archiving of records.

Classification of wastes has been raised earlier in this document. For example, the Government review of Exemption Orders under the Radioactive Substances Act (see Section 6.2.2), which may have an influence on the inventory. This could then influence the performance of the strategy in terms of the quantities of waste that will require management.

Alternative approaches to the classification of wastes are also considered at times by various other organisations. Such alternative approaches, for example classifying wastes in line with approaches adopted in other countries, may have benefits to how we manage LLW. At present Government is not considering any change in approach to the classification of LLW, however, should this situation change it would be critical to understand the impact on the inventory and on this strategy.

## 6.5 Research and Development

The NDA carries out research and development (R&D) through provision of funding for the R&D needs of its sites and also directly where considered appropriate, as directed in the Energy Act 2004. At NDA sites, site-based R&D is captured in Technical Baseline and Underpinning Research and Development documents (TBURDs). These are collectively used to information the directly funded R&D work. Direct funding includes work related to the decommissioning of nuclear installations, the cleaning-up of nuclear sites and other NDA functions. This is achieved through a portfolio of work managed through the NDA and also through funding of various academic, university based research programmes. With particular reference to the university programme, there is therefore a close link with skills development in the nuclear industry.

In general, the management of LLW is not a particularly high-tech process and therefore research and development in the area is unlikely to require a major programme of innovations. However, there are key areas where further R&D has the potential to yield significant gains in the management of LLW and the implementation of this strategy. These areas include:

- advancing techniques for effective sentencing of waste, especially bulk waste
- further developing of existing techniques for the management of waste
- bringing techniques from outside the nuclear industry (conventional waste management) into the management of LLW
- better understanding opportunities for co-treatment with other wastes (for example ILW and non-radiological hazardous waste)
- exploring opportunities for alternative approaches to disposal for certain materials (short lived ILW, long lived LLW etc) and other specifically challenging waste types, such as organics and Ra-contaminated luminescent materials from the non-nuclear industry

In order to ensure that there is progress in these areas the NDA will continue to fund work through the Direct Research Portfolio, our programme of Concepts Projects (which cover small packages of work) and through the Technology Demonstration programme, which covers larger projects demonstrating the value of specific technologies.

## 6.6 Sharing good practice

The Energy Act 2004 instructs the NDA in carrying out its duties to ensure the adoption of what it considers to be good practice at its sites. In the development of this strategy, including discussions with waste producers and the supply chain and at site visits it is clearly evident that there is much good practice already in place in the management of LLW in the nuclear industry. Dissemination of this good practice and wider take up will enhance delivery of the strategy and generate new opportunities and benefits, such as greater value for money, in addition to meeting the requirements of the Energy Act. In many parts of the industry good practice is already shared, particularly through multi-site site licence companies and through topic specific working groups. However, there remain opportunities for improving the sharing of good practice.

Whilst practices throughout the management of LLW offer potential for sharing of good practice, four areas have been recognised for specific attention through the National LLW Management Plan:

- minimisation
- characterisation
- segregation
- recycling

For each of these areas a specific project has been determined, more details about which can be found in the National LLW Management Plan. In addition, the LLW Strategy Group, which has membership from across the industry, will continue to meet and provide the key vehicle for sharing good practice and collation of information and opportunities in LLW management. To date, the LLW Strategy Group has focused on development of this strategy; in the future, sharing of good practice, tracking progress and planning will become the mainstay of the meetings.

# 7 Risks, contingency plans and opportunity

# 7 Risks, opportunities and contingency plans

During the development of this proposed strategy we have identified a number of key risks that may affect the implementation of the strategy. These have been identified through technical assessment of the proposed strategy, through the SEA and through dialogue with stakeholders. Conversely, implementation of the strategy represents a significant opportunity, which can be recognised at a number of levels.

We have presented key risks below, including a high level indication of what we will do to mitigate the potential affects of risks (Section 7.1). In addition to mitigation of risks it is important to plan for implementation of the strategy to realise the significant opportunity presented. Section 7.2 provides information on the National LLW Management Plan, which sets an initial 54 key initiatives designed to make this happen. Further initiatives may be required as the strategy implementation evolves.

Whilst we believe that this strategy will be effective and can be implemented we also recognise that there is a need for a certain level of preparedness, in the unlikely event that the strategy fails, i.e. contingency planning. This is also covered later in this section (Section 7.3).

**Question 14 –** To what extent do you agree with the risks and mitigation set out here?

## 7.1 Risks

| Risk | Comment / Impact | Mitigation |
|---|---|---|
| LLW Repository Ltd unable to make Environmental Safety Case to continue use of LLWR for disposal. | LLW Repository Ltd is to submit a revised Environmental Safety Case to the Environment Agency in 2011. Given the central role of LLWR in the proposed strategy, this eventuality would require a review of the strategy and the approach to the management of LLW in the UK (see contingency planning below). | LLW Repository Ltd has a significant programme of work ongoing to deliver the revised Environmental Safety Case. During the consultation period for this strategy, LLW Repository Ltd will be considering the implications of the strategy and innovations at LLWR for making the required safety case. This will enable them to respond to the consultation with a detailed assessment of the impact of the strategy on the site. The proposed LLW strategy will be reviewed in light of this response and amended should a significant impact on the Environmental Safety Case project result from the proposed strategy. |

| Risk | Comment / Impact | Mitigation |
|---|---|---|
| Uncertainties in the LLW inventory mean that more, less or different wastes need to be managed than the proposed strategy has been designed to address. | The future inventory of LLW, including quantity, type and timing of arising has uncertainty associated with it. This is because much of the waste has to be estimated, particularly for the latter years of the decommissioning programme. This uncertainty is a well recognised feature of the exercise of producing a forecast of waste arisings and carries with it a certain amount of risk. In addition to the uncertainty, the inventory of waste could change for a number of reasons such as legislative change defining what is considered LLW, change in decommissioning programmes, waste from new nuclear build and new wastes being identified. The impact of change in the inventory could, for example, be an inability to meet demand for waste management services should volumes of waste increase significantly at a given time. It is worth noting that, in general, changes in the inventory are associated with conservative/ precautionary approaches to estimating, meaning that volumes and levels of radioactivity tend to go down. This cannot however be relied upon. | All major producers of LLW (NDA and non-NDA) contributed to the UK radioactive waste inventory, which is completed every three years. In addition, NDA sites are required to submit forecasts of waste annually as part of their Lifetime Plan/ Integrated Waste Strategy. This regular update to the inventory of LLW provides an opportunity to review the impact on the LLW strategy and prepare for any major change. In general we would expect a few years between the change in the inventory forecast and the actual change in waste arising.<br>In addition to annual review of inventory, together with LLW Repository Ltd and waste producers we are reviewing particular waste streams that have an impact on the LLW strategy and the LLWR Environmental Safety Case to improve confidence in our understanding. This approach has already brought useful information to light that has brought particular benefit to the Environmental Safety Case. We are also investigating standardisation of characterisation procedures which may benefit the collation of the waste inventory.<br>Thirdly, inventory management is also required by regulators and other specific inventory improvement projects are underway. |
| Very large quantity of contaminated ground needs to be managed as waste. | This risk has the potential to impact in the same way as the inventory risk. We have separated this issue as it covers material that at the present time has not been identified as waste. Contaminated ground at some sites has been characterised and management solutions identified, even if only at a high level. In some cases this has also led to identifying what material will be managed as waste. However, significant areas of ground potentially contaminated with radioactivity have not yet been characterised in detail and management approaches determined. This means that there could be a need for contaminated ground to be managed as waste. The amount of material to be managed could be greater than the total inventory of LLW as we understand it at present. | In order to address this issue, we are working with the regulators to fully understand the requirements on sites that have contaminated and potentially contaminated ground. We are also working with the regulator community and sites to fully understand the options available for land quality management.<br>In the longer term, this will allow more focussed characterisation of sites and an improved understanding of the situation, including a better knowledge of what volumes of material will require management as waste. Linkages with the desired end states and uses for a given site will be critical to this understanding. As this understanding improves we will be able to determine the impact on the LLW strategy and develop it as required. |

| Risk | Comment / Impact | Mitigation |
|---|---|---|
| Difficulties in segregating waste at consignor sites impede implementation of the strategy. | Central to delivery of this strategy is the requirement for waste producers to segregate waste into waste types, such that the most appropriate management option can be employed in dealing with that waste type. There is potential that waste producers may not be able to implement effective segregation due to a number of issues, including availability of space, unsuitable levels of waste generated and other technical issues. Failure to segregate waste would lead to more waste than is strictly necessary being disposed of at LLWR, reducing the potential for extending its life. | In order to address this risk we will work with LLW Repository Ltd to investigate the benefits of standardising sorting and segregation of waste and develop standard procedures if appropriate. We will also work with LLW Repository Ltd and waste producers to share good practice in the segregation of waste. There is also an opportunity to provide incentives for the segregation of waste through pricing strategies at LLWR. Finally, we will look to LLW Repository Ltd to provide solutions that help sites segregate more (i.e. appropriate containers etc) |
| Alternative disposal routes for VLLW (and certain LLW) are not available. | In accordance with UK policy, which was subject to several rounds of public consultation, significant gains can be made in the management of LLW in the UK by a proportionate approach to the disposal of low level waste, in particular VLLW. However, there are issues associated with implementation of this element of the strategy, not least of which is public acceptability of disposal of VLLW at conventional landfill sites. Disposal of VLLW to landfill is in accordance with Government policy and has been demonstrated to be safe; however, it remains an issue of concern for certain stakeholders. | Before a landfill site can receive VLLW or LLW it will have to obtain an authorisation from the Environment Agency or SEPA (depending on where it is located). In order to obtain this authorisation the operator of the landfill will have to demonstrate to the relevant agency that its operations will meet regulatory risk targets and may, for higher activity LLW, be required to develop a more detailed Environmental Safety Case to demonstrate this fact. More information can be found at: http://www.environment-agency.gov.uk/business/sectors/100241.aspx<br>Prospective operators of such facilities will need to engage in effective and open dialogue with local communities to explain the operations and the issues associated with it.<br>NDA has a role in demonstrating the benefits to the UK of adopting this approach to the management of VLLW. |

## 7.2 Opportunity: National LLW Management Plan

In response to Government's policy, we recognised that strategy in some areas would require greater focus on tactical solutions to fully address our policy commitments. As such, LLW Repository Ltd, supporting NDA has been tasked with developing a National LLW Management Plan (Ref. 3), which is intended to sit alongside the UK nuclear industry LLW strategy and provide the detailed initiatives that will help to realise the significant opportunity presented by the proposed strategy. This plan was published in draft form in February 2009 and is available for review on the LLWR website:

http://www.llwrsite.com/llw-strategy-group/consultation-documents

The plan details a number of initiatives developed as part of LLW Repository Ltd's programme to support the NDA strategy. The plan includes details of the need, scope, priority, deliverables and a schedule for each initiative. The plan also proposes owners for these initiatives and assesses the current availability of funding to support the initiatives. summary of the current plan contents is provided in Table 1 below

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**Table 1** – Summary of the content of the National LLW Management Plan

| No. | Initiative | Potential Mechanism |
|---|---|---|
| **Waste Avoidance / Minimisation (WAM)** | | |
| 1 | Standardise waste avoidance and minimisation programmes | Waste Management Hierarchy guidance document |
| 2 | Improve consistency of application of Nuclear Industry Code of Practice (NICoP) | Formal NICoP programme on LLW Management |
| 3 | Incentivise waste minimisation | Performance-based incentives for waste management hierarchy implementation |
| 4 | Identify and share waste avoidance and minimisation best practices | Website on waste minimisation practices |
| **Waste Characterisation (WC)** | | |
| 5 | Standardise characterisation programmes | Guidance document on waste characterisation |
| 6 | Consolidate R&D on characterisation | Website on waste characterisation R&D |
| 7 | Identify and share characterisation best practices | Website on good practices in LLW management |
| 8 | Centralised provision of characterisation equipment and/or SQEP resource | Waste characterisation services |
| 9 | Re-estimate wastestream characterisation | Evaluation and re-characterisation of waste streams |
| **Waste Segregation / Categorisation (SC)** | | |
| 10 | Develop guidance on segregation best practices | Guidance document on waste segregation practices |
| 11 | Incentivise segregation of wastes | Performance-based incentives on waste segregation implementation |
| 12 | Standardise design of waste segregation facilities | Published design concept for segregated wastes |
| **Waste Treatment (WT)** | | |
| 13 | Incentivise treatment of wastes | Performance-based incentives; contract and CFA modifications for LLW treatment |

| No. | Initiative | Potential Mechanism |
|---|---|---|
| 14 | Develop metal treatment routes | Metal treatment services |
| 15 | Develop incineration routes | Combustible waste treatment services |
| 16 | Supply chain provide new treatment facilities, capacity and capabilities. | Waste treatment services |
| 17 | Improve efficiency and utilisation of existing incinerators at nuclear sites | Independent incineration study |
| 18 | Improve efficiency of existing NDA metal decontamination facilities | Independent metal decontamination study |
| 19 | Consolidate R&D on orphan and hazardous wastestreams | Consolidated R&D recommendations for hazardous and orphan wastes |
| **Recycle / Re-use and Exempt Waste (RR)** | | |
| 20 | Identify and share re-use and recycling best practices | Website for sharing re-use and recycling good practices |
| 21 | Develop mechanism for co-ordination of supply and demand for materials | Enhanced material trading platform for waste |
| 22 | Re-use/recycle waste in new construction projects in nuclear industry | Performance-based incentives on waste re-use |
| 23 | Re-use/recycle in new construction projects outside nuclear industry | Communication of re-use and recycle projects |
| **Waste Disposal (WD)** | | |
| 24 | Develop alternative routes for exempt waste disposal | Communication of initiative results |
| 25 | Develop alternative routes for VLLW disposal | Segregated waste treatment service at LLWR |
| 26 | On-site/Near-Site disposal of VLLW on existing NDA sites | Alternative VLLW disposal routes |
| 27 | On-site/Near-Site disposal of LLW on existing NDA sites | Strategic BPEO for on-site/near-site facilities |
| 28 | Disposal of some LLW to Deep Geological Repository (e.g. long-lived isotopes) | Study on Environmental Safety Case (ESC) implications for disposal of long-lived radionuclides |
| 29 | Disposal of short-lived ILW in near-surface facilities | Study on disposal options for ILW containing short- lived radionuclides |
| 30 | Alternative Vault Designs | Vault 9 Post-project design review and recommendations |
| 31 | Optimise closure of LLWR | ESC submittal to EA |
| 32 | Disposal of NORM to alternative facilities | Non-Nuclear Industry LLW Strategy |
| 33 | Decay storage of short-lived LLW | Study on disposal options for LLW containing short- lived radionuclides |
| 34 | In-situ management of contaminated ground | NDA Strategy for Land Quality Management |
| **Waste Packaging (WP)** | | |
| 35 | Develop methods and tools for improving waste packaging efficiency. | Guidance document on LLW packaging |
| 36 | Use of reusable containers for transport of LLW | Technical report on re-usable LLW containers |
| 37 | Introduce inner disposal liners for non-compactable waste | Design specification for LLW disposal liner |

| No. | Initiative | Potential Mechanism |
|---|---|---|
| 38 | Introduce puck overpacks for compacted waste | Design Specification for 1-$m^3$ box liner |
| 39 | Introduce small modular containers for segregated wastes | Design specification for modular inner-packaging container liners |
| 40 | Introduce reinforced bags for VLLW | Design specifications for VLLW Packages |
| | **Waste Transportation (TRAN)** | |
| 41 | Use of transport hubs | Transport feasibility study |
| 42 | Increased use of rail transport | Transport feasibility study |
| 43 | Integration of LLW and spent fuel rail shipments | Transport feasibility study |
| 44 | Transport of large components whole | Transport feasibility study |
| | **Waste Tracking / Inventory Management (TIM)** | |
| 45 | Simplify waste consignment processes | Web-based LLW management and shipping tracking systems |
| 46 | Improved waste quality assurance processes | Quality Assurance guidance document for LLW |
| 47 | LLW records consolidation and archiving | National LLW Records Archive |
| 48 | Improve waste forecasting | Web-based inventory management system |
| | **Other (OTHER)** | |
| 49 | Development of UK LLW Strategy | National LLW Strategy and National LLW Management Plan |
| 50 | Preparation of national strategic option assessments | Strategic Option and Opportunity Studies |
| 51 | Enhance communications within LLW management community | Implementation of the National LLW Strategy Group |
| 52 | Establish Principles for Decontamination and Decommissioning | Formal NICoP programme on LLW management |
| 53 | Develop strategy to optimise use of current/future NDA assets | Strategic Environmental Assessment for National LLW Strategy |
| 54 | Introduce risk-based classification of radioactive substances and waste | Environmental Safety Case for LLWR |

The National LLW Management Plan will be further developed through 2009, where it will be informed by stakeholder input through the National LLW Strategy Group and through this consultation on the UK nuclear industry LLW strategy. The management plan is planned to be published in full for the first time in 2010 and revised annually thereafter.

LLW Repository Ltd has also, under contract, produced Initial and Preliminary Operational Strategies, that set out how they will provide the required LLW storage and disposal capacity at LLWR to meet the needs of UK LLW producers present and future, subject to an accepted Environmental Safety Case. The objectives of the LLWR Operational Strategy are to transform the LLWR from a storage and waste handling site to a fully integrated waste management operation, providing a full service across the broad spectrum of waste management activities in support of NDA, LLWR and consignor initiatives. The LLWR Operational Strategy was developed around the driving principles that recognise the need for:

- disciplined and integrated implementation of the waste hierarchy at the site of waste arising
- minimising the burden on the environment from disposal of radioactive wastes by minimising volumes of waste destined for the LLWR through consignor support
- emplacing into LLWR vaults only those wastes that require multi-barrier containment for human health and environmental protection ensuring the best use of engineered disposal at LLWR

Implementing the LLWR Operational Strategy is intended to provide the required storage and disposal capacity for waste arisings until 2070. A Developed Operational Strategy will be issued by LLW Repository Ltd by March 2010, embedding learning from the strategy.

## 7.3 Contingency planning

Whilst we believe that this proposed strategy can be implemented and has a good chance of success it is important to have some understanding of what may be required in the unlikely event that the proposed strategy should not fully meet its objectives. The following sets out the contingency options available in this case. Firstly, should supply chain approach be unsuccessful, then we may need to consider development of facilities by the NDA to support the implementation of the strategy (either directly or through NDA SLCs). Secondly, should the strategy fail completely we may need to develop a successor facility to LLWR.

If the strategy is unsuccessful the implications could be significant. The proposed strategy, if implemented fully, has the potential to extend the life of LLWR to 2070. Without adoption of this strategy and a consequent change in current practices for LLW management in the UK, LLWR could be full as soon as 2037 or earlier. As set out below, we believe that the (lifetime) costs associated with a new facility would be in the region of £2 billion and such a facility would require a minimum lead in time of 11 years (Ref. 15).

### 7.3.1 Contingency 1 – development of facilities by NDA

This draft LLW strategy looks towards the supply chain for provision of alternative treatment and disposal options to assist in implementation of the waste management hierarchy. The supply chain may include waste producers themselves. For NDA sites, developments in this area will be driven by the aspirations of the site and robust business cases will be required to demonstrate the value of investment by NDA in such projects. An example is the inclusion in the LLWR lifetime plan of VLLW disposal at the site and consideration of this option for certain wastes at other sites.

In the near term, this strategy does not propose centrally driven investment to deliver alternative waste management solutions. However, should solutions not be forthcoming we will need to consider whether central investment will be required to deliver the strategy. A detailed assessment of the new strategy options, costs and benefits would be required before taking such an

# 8 Next steps

# 8 Next steps

The next steps for development and implementation of the UK Nuclear Industry LLW Strategy are set out below.

- Formal public consultation of this Draft LLW Strategy and Strategic Environmental Assessment (SEA) from May to August 2009
- Following consultation, the LLW Strategy will be updated and recommended to Government for approval in early 2010
- Ongoing dialogue on the LLW strategy and plans for implementation through active participation and engagement at the National LLW Strategy Group and other stakeholder forums
- Development and performance of implementation plans and strategic business cases on early strategic initiatives as set forth in the LLW Management Plan

The collective implementation of the LLW Strategy and management plan initiatives could produce a step-change improvement in LLW management practices across the UK. Improved safety and environmental benefits as well as significant savings to the current LLW baseline could result. Extension of the operational lifetime for the LLW Repository could also sustain long-term decommissioning and cleanup for the NDA estate.

A summary of the consultation questions for the UK nuclear industry LLW strategy is provided below.

## 8.1 Summary of consultation questions

**Question 1** – Do you agree with the proposed approach to avoidance and characterisation of waste? What are the most important areas for work and are there other actions that could be undertaken?

**Question 2 –** Re-use and recycling of waste from the nuclear industry could yield significant benefits – do you agree with this approach and where do you see the significant opportunities for implementing the option?

**Question 3 –** To what extent do you believe that compaction still has a key role to play in the optimisation of LLW management? What are the opportunities for improving the use of compaction?

**Question 4 –** Do you agree that the benefits of metal treatment outweigh the detriments? If not, why not? If metal treatment costs more than disposal to implement, is this acceptable?

**Question 5 –** Do you agree with the proposals set out for thermal treatment? If not, why not? As incineration is often a controversial approach, what should be the key message if the LLW strategy were to actively promote the use of this technology?

**Question 6 –** We believe that the majority of waste management solutions that are required to implement this strategy are or will be available, either in the nuclear estate or through the supply chain and therefore should be used in preference to centralised investment in new infrastructure. To what extent do you agree with this statement?

**Question 7 –** Do you agree with the approaches set out above for the development of an optimised approach to management of LLWR?

**Question 8 –** What are the key considerations that should influence the development of new packaging solutions for LLW management?

**Question 9 –** The impacts of the transport of LLW are limited when compared to transport of other materials, when considered at a national level. However, it is a very significant issue for local communities where the transport is taking place. How do you think this should be factored in to national strategy?

**Question 10 –** To what extent does a movement of waste from road to rail for transport represent a significant improvement? Do you see any disadvantages to this approach?

**Question 11 –** Government's policy for the management of LLW indicates that landfill disposal of LLW and VLLW should be considered when determining end points for these wastes. What do you think should be the key considerations when comparing landfill disposal with other options such as LLWR, new vaulted disposal routes, etc?

**Question 12 –** To what extent do you agree with the key considerations set out above for on-site disposal proposals?

**Question 13 –** Do you agree with the approaches set out for encouraging the right behaviour? To what extent do you think that waste recycling targets could have benefit to the national strategy? What potential benefits and difficulties would you envisage from implementing such approaches?

**Question 14 –** To what extent do you agree with the risks and mitigation set out here?

Nuclear Decommissioning Authority

# APPENDICES

# Appendices

## Appendix 1 - The National LLW Strategy Group

The National Low Level Waste Strategy Group (LSG) has been established to develop a working partnership between the Nuclear Decommissioning Authority, LLW Repository Ltd, Regulators, Stakeholders and LLW Waste producers to promote innovation, value for money, and implementation of the waste hierarchy by planning for effective waste disposal solutions. This initiative will support ongoing nuclear operations, the nuclear site decommissioning and remediation programme and LLW management needs of 'non-NDA' commercial organisations. The National Low Level Waste Strategy Group shall serve as a primary point of contact for integration and engagement on LLW innovations, issues, and strategy development.

Membership of the Low Level Waste Strategy Group includes senior representatives from the Nuclear Decommissioning Authority, Regulators, Stakeholder groups, and LLW Consignor sites that are actively generating low level waste. The nuclear industry supply chain is represented on the LLW Strategy Group by the Nuclear Industry Association. Each member is responsible for representing the views and interests of their parent organisation and for promulgating the business of the Strategy Group back into their parent organisation.

In addition to the formal membership of the Strategy Group, other participants and organisational representatives will be invited to attend Strategy Group meetings at the Chair's discretion. Corresponding participants will also be notified of future meetings and topics of discussion and / or review.

The following organisations are represented either as members or corresponding members of the LLW Strategy Group:

| Organisation | |
|---|---|
| Nuclear Decommissioning Authority | Sellafield Site Ltd (including Capenhurst) |
| Environment Agency | Dounreay Site Restoration Ltd |
| Scottish Environment Protection Agency | Magnox North Sites |
| Health and Safety Executive<br>(Nuclear Installations Inspectorate) | Magnox South Sites |
| Health and Safety Executive<br>(Office for Civil Nuclear Security) | Research Sites Restoration Ltd |
| Department of Energy and Climate Change | Springfields Fuels Ltd |
| Department for Environment, Food and Rural Affairs | Low Level Waste Repository Ltd |
| Scottish Government | Ministry of Defence |
| Welsh Assembly | AWE (Atomic Weapons Establishment) |
| Northern Ireland Assembly | British Energy |
| NuLeAF (Nuclear Legacy Advisory Forum) | GE Healthcare |
| Cumbria County Council | Nuclear Industry Association |
| Scottish Councils Committee on Radioactive Substances | |
| Department for Transport | |

## Appendix 2 - Regulation of LLW

In the UK, the Radioactive Substances Act 1993 (RSA93) provides the framework for controlling the management of radioactive material and wastes so as to protect the public and the environment, and for regulatory functions in relation to RSA93, the BSS Directive 96/29/Euratom has been implemented in the UK by country-specific regulations.

Defra and the Environment Agency are at the time of writing consulting on the extension of the Environmental Permitting Regime to encompass radioactive substances regulation. If this proposal is pursued following consultation this would replace the Radioactive Substances Act in England and Wales although it would not change the expected regulatory standards and outcomes for radioactive substances. In Scotland, RSA 93 would remain.

### Exemptions from regulation

All materials are radioactive to some extent, and there is some waste which is not required to be subject to specific regulatory control, because the levels of radioactivity contained within it are either not possible to control, or are so low that regulation is not warranted. Such radioactive wastes can be disposed of in the same manner as other municipal, commercial and industrial wastes i.e. to landfill or incineration, without authorisations under the Radioactive Substances Act 1993.

UK Government is undertaking a review of Schedule 1 of RSA93, and the entire suite of exemption orders. The purpose of the review is to simplify and rationalise the exemptions and to demonstrate clearer compliance with the BSS Directive 96/29/Euratom.

### Regulatory guidance on requirements for authorisation

The developers and operators of facilities for solid radioactive waste disposal (i.e. low level waste repositories or landfill sites that could take LLW and VLLW) have to demonstrate to the regulators that the facilities will adequately protect people and the environment. To do this, they will need to show their approach to developing and operating the facilities, and also demonstrate that the location, design, construction, operation and closure of the facilities, will meet a series of principles and requirements. The regulators have just published new guidance (called Near-surface Disposal Facilities on Land for Solid Radioactive Wastes - Guidance on Requirements for Authorisation, GRA (Ref. 12)) which sets out these principles and requirements, and which indicates how they are likely to be interpreted. The guidance also provides information about the associated framework of legislation, government policy and international obligations.

The Environment Agency has also published further guidance on how they will regulate the disposal of low level radioactive waste to landfill sites. Further details can be accessed here:

http://www.environment-agency.gov.uk/business/sectors/100241.aspx

### Role of the NII in LLW management

Under UK law (the Health and Safety at Work etc. Act 1974) employers are responsible for ensuring the safety of their workers and the public, and this is just as true for a nuclear site as for any other.

This responsibility is reinforced for nuclear installations by the Nuclear Installations Act 1965 (NIA65), as amended. Under the relevant statutory provisions of the NIA a site cannot carry out certain activities prescribed in the Act unless the user has been granted a site licence by the Health and Safety Executive (HSE).

This licensing function is administered on HSE's behalf by its Nuclear Directorate. Nuclear Directorate, sets out in conditions attached to a site licence the general safety requirements to deal with the risks on a nuclear site which Licensees must comply with. These licence conditions include specific requirements relating to the accumulation and storage of radioactive wastes on nuclear sites.

The nuclear licensing regime is complemented by the Ionising Radiations Regulations 1999 (IRR99) and other health and safety regulation which the HSE also enforces on nuclear sites as it does on any other sites. This general health and safety legislation will also apply to non-nuclear sites which treat or dispose of LLW.

Specifically any LLW treatment or disposal activities not carried out on nuclear sites will continue to be regulated under the IRR99 by the HSE. These regulations place requirements on any employers

whose practices involve work with ionising radiations to monitor exposure to ionising radiations and apply necessary controls in order to keep such exposure as low as is reasonably practicable. These regulations also include legal limits on worker exposure to radiation.

Under the terms of relevant Memoranda of Understanding (MoU), HSE consults with the Environment Agency or SEPA regarding environmental issues relating to its regulation of nuclear sites.'

**Basic Safety Standards Directive - BSS**

Legislation on radiation protection in the European Union is governed by the Euratom Treaty and the Directives. The Basic Safety Standards Directive (96/29/Euratom) of 13 May 1996 is the framework directive for radiation protection in the European Union.

It deals with radiation protection of exposed workers and the public. Member States are required to implement the BSS Directive. The main aim of theses Standards is to ensure that exposures are kept as low as reasonably achievable/practicable and that individual dose limits are not exceeded.

The Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000 implements the EU Directive 96/29/Euratom, where applicable, which lays down Basic Safety Standards (BSS). A similar Direction from Scottish Ministers was issued to SEPA. Essentially the RS Direction 2000 requires:

- individual and collective doses to be ALARA
- annual dose constraints to be 0.3 mSv for any new source, 0.5 mSv for any single site and 1.0 mSv dose limit
- undertakings to appoint Qualified Experts

**International Commission on Radiological Protection - ICRP**

The International Commission on Radiological Protection (ICRP) is an independent international body of experts set up to provide guidance on a range of topics relating to the protection of man from the harmful effects of ionising radiation.

For practices involving the use of radioactive substances the system of radiological protection is based on the three principles of justification of practices, optimisation of protection and dose limitation as set out in ICRP60. These principles are reflected in UK legislation and policy for the regulation of LLW management activities.

**ARTICLE 37**

As a Member State of the European Union, UK activities involving radioactive substances are governed by legislation set down under the Euratom Treaty. Article 37 of the Euratom Treaty states:

Each Member State shall provide the Commission with such general data relating to any plan for the disposal of radioactive waste in whatever form as will make it possible to determine whether the implementation of such plans is liable to result in the radioactive contamination of the water, soil or airspace of another Member State.

The 'disposal of radioactive waste' within the meaning of Article 37 of the Treaty should cover any planned disposal or accidental release of radioactive substance, in gaseous, liquid or solid form in or to the environment, associated with the processing or storage of radioactive waste arising from operations and dismantling of nuclear reactors and reprocessing plants.

## Appendix 3 - References

| No. | Reference |
|---|---|
| 1. | Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom, By Defra, DTI and the Devolved Administrations, March 2007 |
| 2. | LLW Strategic Review, LLW Repository Ltd, 2008 |
| 3. | National LLW Management Plan, LLW Repository Ltd, 2009 |
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| 5. | LLWR consolidated technical briefs, LLWR, 2009 |
| 6. | UK Radioactive Waste Inventory as at 1 April 2007, NDA and Defra, March 2008 |
| 7. | Defra, e-Digest Statistics about: Waste and Recycling |
| 8. | United Kingdom, Parliament 1993. Radioactive Substances Act , 1993. HMSO, London |
| 9. | Strategic BPEO for metal waste management, Studsvik, April 2006 |
| 10. | Preliminary Strategic Assessment Report to Consider Thermal Processing for the Management of Suitable Low-Level Radioactive Waste in the UK, 722500202/R403/Issue 1, Nuclear Technologies, November 2008 |
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| 12. | Near-surface Disposal Facilities on Land for Solid Radioactive Wastes Guidance on Requirements for Authorisation, Environment Agency, SEPA, Northern Ireland Environment Agency, February 2009 |
| 13. | Guidance note: Disposing of radioactive waste to landfill, Environment Agency, 2009 |
| 14. | Environment Agency landfill capacity statistics: http://www.environment-agency.gov.uk/static/documents/Research/ew_landfill_cap_06_1958423.xls |
| 15. | A Cost Estimate for the Successor Facility to the Low Level waste Repository (LLWR), Nuvia, March 2009 |

## Appendix 4 - Glossary

**Activity**

The number of atoms of a radioactive substance which decay by nuclear disintegration each second. The unit of activity is the Becquerel, which is equivalent to one disintegration per second.

**As Low As Reasonably Achievable (ALARA)**

The ALARA principle is contained in the Euratom Basic Safety Standards Directive 96/29, which is transposed into UK law. Essentially, it means that all reasonable steps should be taken to protect people. In making this judgement, factors such as the costs involved in taking protection measures are weighed against benefits obtained, including the reduction in risks to people and the environment.

**Becquerel (Bq)**

The standard international unit of radioactivity equal to one radioactive transformation per second. Becquerels are abbreviated to Bq. LLW is classified according to its radioactivity content per unit mass of waste (Bq per gram, or per tonne). Multiples of becquerels commonly used to define radioactive waste are: kilobecquerels (kBq) equal to one thousand Bq; megabecquerels (MBq) equal to one million Bq; gigabecquerels (GBq) equal to one thousand million Bq.

**Best Practicable Environmental Option (BPEO)**

In the context of authorisations under RSA93, for nuclear sites, the options' assessment method currently used is Best Practicable Environmental Option (BPEO). BPEO was described by the Royal Commission on Environmental Pollution, Twelfth Report (Cm 210) 1988 as "…. the outcome of a systematic and consultative decision-making procedure which emphasises the protection and conservation of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long-term as well as in the short term". A BPEO study is usually carried out by or on behalf of the waste producer and assessed by the relevant environment agency as a basis for its regulatory decision-making.

**Best Practicable Means (BPM)**

BPM is a term used by the environment agencies (EA and SEPA) in authorisations issued under the RSA93. Essentially, it requires operators to take all reasonably practicable measures in the design and operational management of their facilities to minimise discharges and disposal of radioactive waste, so as to achieve a high standard of protection for the public and the environment. BPM is applied to such aspects as minimising waste creation, abating discharges, and monitoring plant discharges and the environment. It takes account of such factors as the availability and cost of relevant measures, operator safety and the benefits of reduced discharges and disposals. If the operator is using BPM, radiation risks to the public and the environment will be ALARA.

**Clean-up**

The decontamination and decommissioning of a nuclear licensed site.

**Command 2919 (Cm2919)**

The Review of Radioactive Waste Management Policy: Final Conclusions White Paper published in July 1995. This was the last comprehensive UK Government radioactive waste policy statement. Areas of this statement have been superseded by the decisions and actions of subsequent UK Government administrations.

**Controlled burial**

Also known as "special precautions burial". A process of 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 ordinary refuse 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 ordinary waste.

**Decay storage**

The process of allowing material containing short-lived radionuclides to decay so that the final waste is easier to dispose of as radioactive waste, or until the point where the waste becomes exempt from specific regulatory requirements. Used extensively in hospitals and research establishments, and to some extent by the nuclear industry.

**Decommissioning**

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**European Union (EU)**

The European Union of countries of which the United Kingdom is a member. The EU issues its own legislation which the UK, as a member state, is obliged to follow.

**Exemption Order (EO)**

RSA93 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.

**Fit for purpose**

In the context of this document, a term applied to waste management activities which are engineered to a degree that is commensurate with the types of wastes they will receive. For example, for disposal, LLW towards the higher end of its definition would go to a facility that has a greater degree of engineering than those towards the bottom end of the definition. In all cases, the intention is that facilities will provide adequate protection of people and the environment, and would meet all regulatory requirements.

**Health and Safety Executive (HSE)**

A statutory body whose role is the enforcement of work related health and safety law under the general direction of the Health and Safety Commission established by the Health and Safety at Work Act 1974. HSE is the licensing authority for nuclear installations. The Nuclear Safety Directorate of HSE exercises this delegated authority through the Nuclear Installations Inspectorate (NII) who are responsible for regulating the nuclear, radiological and industrial safety of nuclear installations UK wide.

**Integrated Waste Strategies (IWS)**

An integrated waste strategy is not a legal requirement but is required of contractors working under the auspices of the NDA. It covers solid radioactive waste in all waste categories (i.e. LLW, ILW, HLW). For example, during an options' assessment, one option could be to store ILW until it decays to LLW.

**Intermediate level waste (ILW)**

Radioactive wastes exceeding the upper activity boundaries for LLW but which do not need heat to be taken into account in the design of storage or disposal facilities.

**International Commission on Radiological Protection (ICRP)**

An advisory body founded in 1928 providing recommendations and guidance on radiation protection. ICRP recommendations normally form the basis for EU and UK radiation protection standards.

**Ionising Radiations Regulations 1999 (IRR99)**

The main legal requirements, enforced by the HSE, concerning the control of exposure to radiation arising from the use of radioactive materials and radiation generators in work activities in the nuclear industry; medical and dental practice; manufacturing; construction; engineering; paper; offshore drilling; education (colleges, schools) and non-destructive testing.

**Landfill**

The disposal of waste by shallow burial. Modern landfills are lined to reduce seepage of material from the site into the environment, and once full, are capped to reduce rainfall entering the site. The EU Directive on the landfill of waste (Council Directive 99/31/EC) set targets for the reduction of biodegradable municipal waste sent to landfill.

**Licensed nuclear sites**

A site given a licence by the NII under the Nuclear Installations Act.

**Low Level Waste (LLW)**

Includes metals, soil, building rubble and organic materials, which arise principally as lightly contaminated miscellaneous scrap. Metals are mostly in the form of redundant equipment. Organic materials 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. LLW contains radioactive materials other than those acceptable for disposal with municipal and general commercial or industrial waste. It is now defined as "radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma radioactivity".

**Low Level Waste Repository (LLWR) near Drigg**

The LLWR is in Cumbria and 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 NDA and currently operated by a consortium of companies called UKNWM.

**Local community**

In the context of this document, those communities which may be impacted by waste management plans, including any host community in the vicinity of a waste treatment or disposal facility, and the local authorities concerned.

**Luminising**

The process of using a radionuclide with a material that emits light when irradiated, for example, radium was used in old watches and instrument dials so their numbers could be seen as a green glow in the dark.

**Ministry of Defence (MoD)**

MoD sites producing radioactive waste are mainly those producing and handling nuclear fuel for submarines and those producing and handling radioactive materials for nuclear weapons.

**Nuclear Decommissioning Authority (NDA)**

The NDA was set up on 1 April 2005, under the Energy Act 2004. It is a non-departmental public body with designated responsibility for managing the liabilities at specific sites. These sites are operated under contract by site licensee companies. The NDA has a statutory requirement under the Energy Act 2004, to publish and consult on its Strategy and Annual Plans, which have to be agreed by the Secretary of State and the Scottish Ministers.

**Nuclear Installations Act 1965 (NIA65)**

UK legislation which provides for the operation and regulation of nuclear installations within the UK.

**Nuclear Installations Inspectorate (NII)**

See Health & Safety Executive

**Office for Civil Nuclear Security (OCNS)**

The independent security regulator for the UK civil nuclear industry.

**Optimisation**

Optimisation is the process of ensuring that all radiation exposures of the public are as low as reasonably achievable (see ALARA). Optimisation is achieved by employing best practicable means (BPM). Optimisation, justification and limitation are the three key principles of radiation protection recommended by the International Commission on Radiological Protection in 1990 and which form the basis of European Community and UK legislation.

**Planning authorities**

A general term for those regional planning bodies and local authorities throughout the UK who are responsible for the preparation of planning strategies and for determining applications for construction and operation of waste treatment and disposal facilities that may be sited in their area of responsibility.

**Proximity principle**

The Proximity Principle is a key element of EU environmental and municipal waste management policy. It was introduced in Article 5 of the Waste Framework Directive (75/442/EEC as amended by Directive 91/156/EEC), and is incorporated into UK waste strategy documents.

**Radioactive waste**

Any material contaminated by or incorporating radioactivity above certain thresholds defined in legislation, and for which no further use is envisaged, is known as radioactive waste. (See RSA93 and NIA65.)

**Regulators**

In the context of this document, principally those bodies responsible for the regulation of the nuclear industry and non-nuclear industry LLW producers and treatment and disposal suppliers (See Environment Agency, SEPA, HSE, Department for Transport and the Office for Civil Nuclear Security.)

**Risk**

The chance that someone or something that is valued will be adversely affected by a hazard, where a hazard is the potential for harm that might arise, for example, from ionising radiation.

**Radioactive Substances Act 1993 (RSA93)**

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: this function for licensed nuclear sites being provided by the NIA65.

**Scottish Environment Protection Agency (SEPA)**

The environmental regulator for Scotland. SEPA's role is the enforcement of specified laws and regulations aimed at protecting the environment, in the context of sustainable development, predominantly by authorising and controlling radioactive discharges and waste disposal to air, water (surface water, groundwater) and land. In addition to authorisations issued under the RSA93, SEPA also regulates nuclear sites under the Pollution Prevention and Control Regulations and issues consents for non-radioactive discharges.

**Sentencing**

The step of the waste management process at which the decision is made that an article or substance is clean, excluded, exempt or radioactive.

**Stakeholders**

People or organisations, having a particular knowledge of, interest in, or be affected by, radioactive waste, examples being the waste producers and owners, waste regulators, non-Governmental organisations concerned with radioactive waste and local communities and authorities.

**Storage**

The emplacement of waste in a suitable facility with the intent to retrieve it at a later date.

**Strategic Environmental Assessment (SEA)**

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.

**Sustainability appraisal (SA)**

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. SA's fully incorporating the requirements of the SEA Directive (2001/42/EC) are mandatory for a range of regional and local planning documents under the Planning and Compulsory Purchase Act 2004.

**Very low level waste (VLLW)**

Covers waste with very low concentrations of radioactivity. It arises from a variety of sources, including hospitals and the wider non-nuclear industry. Because VLLW contains little total radioactivity, it has been safely treated by various means, such as disposal with municipal and general commercial and industrial waste directly at landfill sites or indirectly after incineration. Its formal definition is:

(a) in the case of low volumes ('dustbin loads') of VLLW "Radioactive waste which can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste ("dustbin" disposal), each 0.1m3 of waste containing less than 400 kilobecquerels (kBq) of total activity or single items containing less than 40 kBq of total activity. For wastes containing carbon-14 or hydrogen-3 (tritium):

- in each 0.1m3, the activity limit is 4,000 kBq for carbon-14 and hydrogen-3 (tritium) taken together
- for any single item, the activity limit is 400 kBq for carbon-14 and hydrogen-3 (tritium) taken together

Controls on disposal of this material, after removal from the premises where the wastes arose, are not necessary."

Or (b) in the case of high volumes of VLLW "Radioactive waste with maximum concentrations of four megabecquerels per tonne (MBq/te) of total activity which can be disposed of to specified landfill sites. For waste containing hydrogen-3 (tritium), the concentration limit for tritium is 40MBq/te. Controls on disposal of this material, after removal from the premises where the wastes arose, will be necessary in a manner specified by the environmental regulators".

**Waste producer**

The organisation that produced radioactive waste in the first instance. The waste producer may or may not equate to the current waste manager, as responsibility for the waste may have been passed to another organisation in the interim.