

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

August 2010



Executive Summary

The UK strategy for the management of solid low level radioactive waste from the nuclear industry has been developed to reflect and implement Government Policy. The aim is to provide a high level framework within which low level radioactive waste (LLW) management decisions can be taken flexibly to ensure safe, environmentally acceptable and cost-effective management solutions that reflect the nature of the LLW concerned.

To deliver this aim, three strategic themes have guided the development of this strategy:

- I. the waste hierarchy;
- II. the best use of existing LLW management assets;
- III. and the need for new fit-for-purpose waste management routes.

The strategy is to apply the waste hierarchy more effectively to the management of LLW. We have set out the preference for managing LLW at higher levels of the hierarchy, which will mean a move away from the past focus on disposal. In turn, this will make the best use of the Low Level Waste Repository (LLWR) and ensure the UK's capacity for the management of LLW. Being able to manage the UK's LLW is vital for the nuclear industry, plant operation, decommissioning, power generation (existing and new) and also for other LLW producers, such as hospitals and universities.

Where the preference for higher levels of the waste hierarchy cannot be met and disposal is necessary, it must be optimised to minimise the overall impact of LLW management on people and the environment. We believe that:

- Waste prevention is a fundamental principle for the operation and decommissioning of nuclear facilities
- There are resource and cost benefits in minimising the amount of LLW we have to manage
- Reuse defers waste production and extends the life of resources
- Recycling is the preferred way forward for the treatment of metallic LLW
- Volume reduction ensures best use of disposal capacity
- Disposal capacity is a precious resource and it must be used sparingly and as a last resort

The LLW Strategy requires that managing LLW should not be separated from managing other radioactive wastes and non-radioactive wastes (Controlled wastes) and implementation will require an integrated waste management approach.

LLW producers and managers should develop plans for the management of LLW that are informed by the waste hierarchy, the proximity principle and the need for early solutions. Affordability will be a key consideration in the implementation of the strategy. It will be crucial that lifecycle environmental and social benefits of managing waste at higher levels of the waste hierarchy are compared with direct disposal. Decision making should be supported by sound business cases to identify the most advantageous option and should be completed in an open and transparent manner.

To make suitable arrangements in the determination of treatment and disposal routes, robust decision making and early dialogue with communities affected by waste management activities are needed and should consider all viable options. This may include in-situ disposal; development of new facilities on or adjacent to sites to manage waste from that site; or extended to manage waste from a number of sites; or the development of facilities away from nuclear sites.

There is considered to be sufficient capability in the nuclear estate (including the supply chain) for the provision of waste management, treatment and disposal services and the strategy proposes continued utilisation of this capability rather than investment in centralised facilities in the near term. However, the strategy does report the need for robust information to underpin these assessments (i.e. volume and radioactivity content and forecast arisings). The strategy presents the drivers for continual improvement in quality of information, principally the need to continually assess the availability of capacity for managing the waste.

The amounts of waste we think will arise in the future mean that we need to change the way we manage it. The consultation on this strategy told us that people want to reduce the environmental impact of LLW management, which means closer alignment with the way other industry manages its wastes and moving away from relying on disposal. The strategy sets out how we will ensure the UK's continued capability and capacity through avoiding generating waste, reusing materials and recycling LLW based on robust information and transparent decision making processes. The LLW Repository, where the majority of UK LLW waste is disposed, is central to the strategy and it is important that we preserve the capacity at the site and use it wisely. All disposal capacity is a precious resource; it should be used sparingly and as a last resort.

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1 Background and Scope

1 Background and Scope

This document sets out the UK strategy for the management of solid low level radioactive wastes arising from the nuclear industry. Central to the strategy is the implementation of the waste hierarchy in the management of LLW, which will support the provision of continued capability and capacity for managing LLW in the UK. The strategy has been prepared for the UK Government and devolved administrations by the Nuclear Decommissioning Authority (NDA) in response to the Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom (Ref. 1). We, the NDA, are responsible for the decommissioning and clean-up of the UK's civil public sector nuclear sites.

This strategy 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 potentially affected by Low Level Waste (LLW) management, for example communities where waste is managed.

1.1 Background

In March 2007 the UK Government and devolved administrations (for Scotland, Wales and Northern Ireland, from hereon referred to as 'Government') published the policy for the long term management of solid low level radioactive waste in the UK ('the Policy'). This 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 volume)
- 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 development of a UK nuclear industry LLW strategy, developing a plan for the optimum use of LLWR and making NDA LLW management facilities available to other nuclear and non-nuclear managers of radioactive waste.

We have developed this strategy working with our LLW strategic partner, LLW Repository Ltd, and other stakeholders. The UK's only management route for certain LLW, and the only facility in the UK that can accept a wide range of LLW from numerous waste producers, is the Low Level Waste Repository (LLWR). Its continued availability is considered vital by both nuclear industry and non-nuclear industry LLW producers.

The majority of LLW continues to be consigned to LLWR, therefore, this strategic asset has a strong influence on both this strategy and how LLW waste is managed in the UK. The UK will generate significantly more LLW than the potential disposal capacity at LLWR, which means there is a need for alternative ways to manage LLW, including treatment and where necessary, the use of alternative disposal routes. The Policy also asked us to assess the need for other disposal options and at what point a replacement for LLWR might be required.

In parallel with the development of this strategy, Government is developing a strategy for the management of LLW from the non-nuclear industry. These strategies will be suitably integrated in order to operate effectively together.

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 the Environment and Sustainability Report which accompanied the consultation on this strategy 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.

The majority of UK LLW (by volume) arises at nuclear sites undertaking the following activities: fuel fabrication and uranium enrichment; nuclear power generation; spent fuel reprocessing; decommissioning; nuclear energy research and development; Ministry of Defence activities; manufacture of radioactive medical products.

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.

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

1.2 Scope

Government's LLW Policy requires a strategy for the management of solid LLW from the nuclear industry. For the purposes of this strategy the nuclear industry is defined as sites that hold a nuclear site licence. This includes NDA Site Licence Companies (SLCs), existing commercial nuclear power stations, and certain Ministry of Defence and other defence related 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 to take account of this strategy and the strategy for the management of LLW from the non-nuclear industry.

The UK Government has committed to facilitating new nuclear power generation. In addition to existing sites, this strategy applies to new nuclear sites as they are developed. The design, construction and operation of these sites must consider how best to incorporate this strategy into their waste management activities. Indeed, new sites are best placed to incorporate key elements of this strategy, such as those steps higher in the waste hierarchy, the prevention and minimisation of waste.

A number of nuclear industry sites in the UK have, to a varying extent, some contamination of ground and groundwater. This strategy will be relevant to such material once a decision is made on whether it requires management as LLW. At the current time, the UK inventory of LLW includes a quantity of contaminated ground that has been characterised and determined as LLW. However, there is a greater quantity of material yet to be sufficiently characterised to determine the appropriate management option. There is clearly an opportunity to reduce the arisings of LLW by managing contaminated ground and groundwater in such a way that it need not be managed as LLW.

NDA sites are expected to generate approximately 80% of all LLW from the nuclear industry (by volume) and the largest NDA site, Sellafield, is expected to generate approximately 60% of the total LLW arisings (Ref. 2). This means that NDA sites, in particular Sellafield, have an important role in the implementation of this strategy.

This is a UK-wide strategy and therefore does not attempt to address site-specific issues. It is recognised that appropriate waste management solutions at one site may be different to those at another site. For example, economies of scale may mean that a particular solution at a large site will not be appropriate for a smaller site. As such, this strategy is not prescriptive about which management solutions should be used in specific circumstances.

In line with Government policy, this strategy sets the strategic direction for producers and managers of LLW. It's implementation will ensure flexibility of options and continued capability and capacity for management of the UK's LLW.

1.3 Development of strategy

This strategy has been developed in response to Government's LLW Policy. A number of projects and initiatives were undertaken to ensure development of a robust strategy. These included: development of a strategic partnership between NDA and LLW Repository Ltd focussed on delivery and implementation of the strategy; a review of the current situation of LLW management in the UK (Ref. 2) and numerous topic specific studies (Ref. 3); a Strategic Environmental Assessment to assess the impact of a number of options that the strategy could undertake (Ref. 4); and extensive stakeholder engagement, focussed on a broad ranging stakeholder group and full public consultation. This strategy forms the solid LLW element of the NDA strategy, under the integrated waste theme recognising the majority of UK LLW is produced at our sites.

Key stakeholders involved in the development of the strategy include LLW waste producers, the NDA, LLW Repository Ltd, representatives from Government, regulators and planning authorities. The interests of the nuclear industry supply chain, along with nuclear site operators, were represented by the Nuclear Industry Association.

To support strategy development we established a UK-wide LLW Strategy Group to promote innovation and implementation of the waste hierarchy and develop value for money solutions. The group provided significant review and feedback on the emerging strategy and their input was essential to its development. Particularly, input from nuclear site regulators ensured appropriate consideration of Health, Safety, Security and Environmental issues in developing this strategy.

A draft version of this strategy was formally consulted on from June to November 2009 along with the Environment and Sustainability Report, which captured the outputs of the Strategic Environmental Assessment. The consultation period was extended to ensure that all relevant stakeholders were aware of the consultation and had an opportunity to respond.

In general the response to the consultation was supportive of the proposed strategy, particularly around the need to apply the waste hierarchy to the management of LLW and the need to make the best use of the UK LLW repository. The consultation response also provided extensive insight into key issues around the implementation of the strategy, particularly interaction with communities affected by LLW management and the role of the supply chain in delivering the strategy.

A digest of the consultation responses and how they have been addressed in developing this final strategy is included in the Post Adoption Statement (Ref. 5). This document also describes how the output of the Strategic Environmental Assessment and consultation influenced the final strategy. It includes proposals for monitoring criteria for implementation of the strategy.

Moving forward this strategy will be reviewed periodically, at least in line with the NDA Strategy review cycle.

2 UK Nuclear Industry LLW Strategy

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Three strategic themes have guided the development of this strategy:

- I. application of the Waste Hierarchy
- II. the best use of existing LLW management assets
- III. the need for new fit-for-purpose waste management routes

The strategy will provide a framework for 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. LLW producers have already started to implement change in the way their LLW is managed. These efforts are recognised and will need to be built upon as part of an integrated programme to deliver this strategy.

The strategy does not set out to develop a range of new techniques and technologies for the management of LLW. We believe the capability is largely available, with many of the tools readily available in the management of Directive wastes. Innovation may be required in applying them within the nuclear industry or at individual sites where they have not previously been used.

This strategy includes a number of management actions and initiatives, many of which are being managed by the NDA in partnership with LLW Repository Ltd and waste producers. LLW Repository Ltd have been given the role by the NDA of UK integrator for LLW management and will play a central role in the implementation of this strategy. In many cases, there will be benefits where waste producers work collaboratively with LLW Repository Ltd to achieve the aims of the waste producer and the aims of this UK wide strategy.

To support implementation of the strategy the UK Nuclear Industry LLW Management Plan (Ref. 6) has been developed. This plan is a programme of initiatives and opportunities to ensure timely delivery of the strategy in the most cost-effective way. The UK Nuclear Industry LLW Management Plan is available on the LLW Repository Ltd website (www.llwrsite.com).

The following sections of this document set out the UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry (main text). We have also included actions that will support implementation of the strategy (white boxes with a green outline) and additional information on some specific projects and issues (green boxes). Figure 1 (below) provides an overview of the strategy.

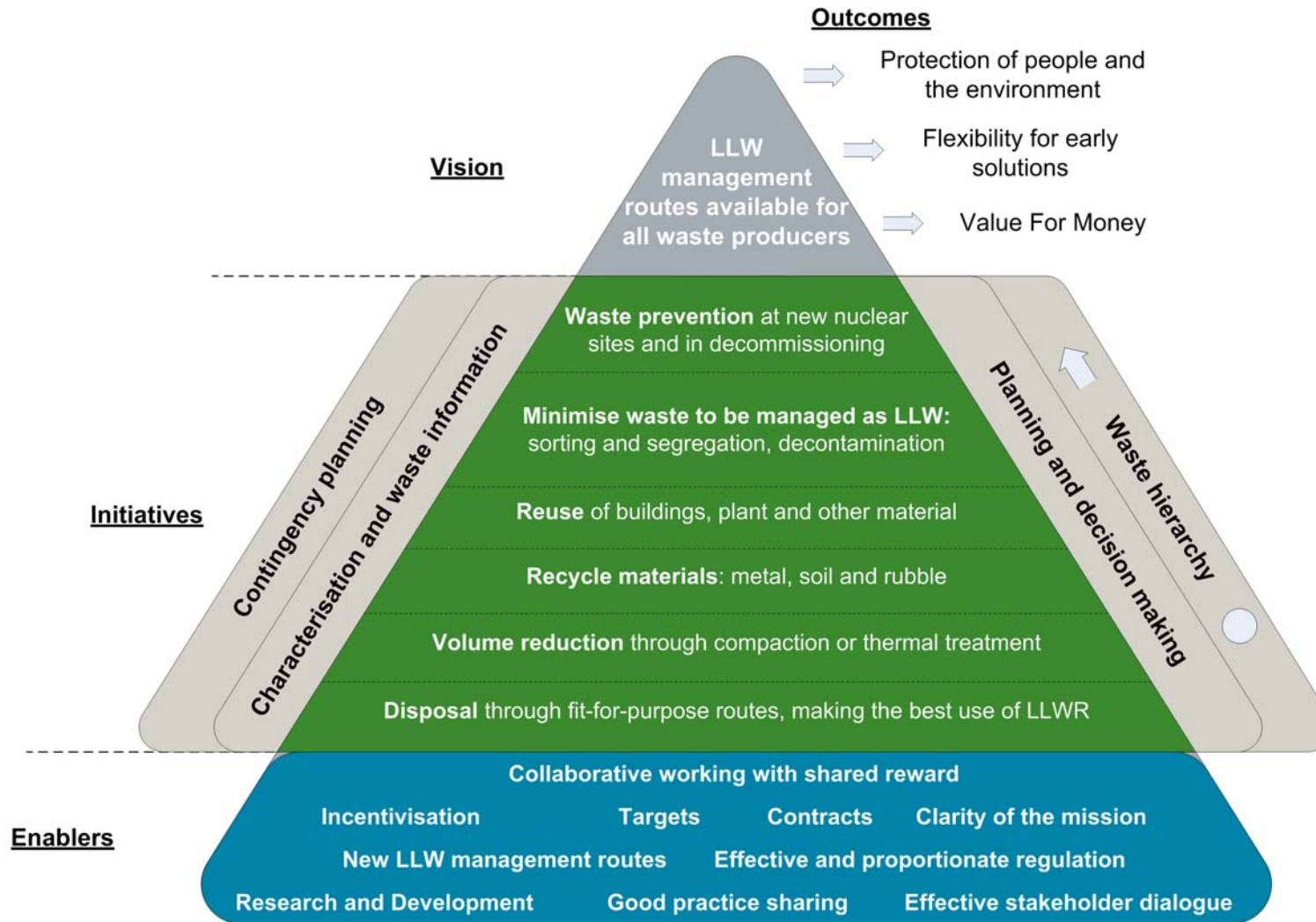


Figure 1 - UK nuclear industry LLW strategy in summary

2.1 Principles

We have set out below key principles appropriate for the management of LLW throughout the UK. They provide overarching expectations for implementation of the strategy for waste producers, planning authorities, regulators, NDA and the supply chain.

- High standards of health, safety, security, environmental protection and public acceptability are central to the development of appropriate waste management plans and their implementation.
- Waste prevention should be implemented by all producers of LLW wherever practicable.
- 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, the availability of proportionately regulated waste management routes is essential.
- The development of new waste options or approaches to the management of LLW requires early and proactive engagement with local and national stakeholders.
- Availability of flexible waste management options 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.
- 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, availability of non-NDA facilities to waste producers will support implementation of the strategy.
- Integration of strategies for all wastes (both radioactive and non-radioactive, Directive waste) 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. Implementation of this strategy must 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, Scottish Environment Protection Agency and the Health and Safety Executive's Nuclear Installations Inspectorate and within the UK's reports to the IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

2.2 Integrated Waste Management

Managing LLW should not be separated from managing other radioactive wastes and Directive wastes on a nuclear industry site (solid, liquid and gaseous). Implementation of this strategy reinforces the requirement for an integrated waste management approach to manage all waste arisings.

This strategy recognises that some of the initiatives to reduce the amount of waste managed as LLW have implications for other wastes. For example, decontamination of LLW such that it can be managed as exempt waste results in increases in waste to be managed elsewhere. There is an expectation that the principles and approaches set out in this strategy apply to those wastes as well; in particular application of the waste hierarchy.

Conversely, it is recognised that these opportunities apply to other radioactive wastes. For example, some Intermediate Level Wastes may be treated such that they can be suitably managed as LLW or in the same manner as LLW. Whilst such activities would result in more LLW to manage there may be benefits for early remediation and realising opportunities that outweigh this issue. This strategy therefore needs to be flexible in order to manage such opportunities as they arise.

2.3 Planning and decision making

Planning for the management of LLW occurs at a number of levels and is affected by a wide range of factors. Critical to choosing the best approach for managing LLW is the availability of robust information (Section 2.4).

The NDA has a significant role in the lifecycle management of LLW. We will need to monitor the implementation of this strategy and consider how best to respond to a changing environment. Our role involves continually reviewing available and projected capacity for the management of LLW in the UK and taking appropriate action should it be required. This may include additional investment and provision of LLW management infrastructure (such as new waste treatment and disposal facilities) should they be unavailable through the supply chain.

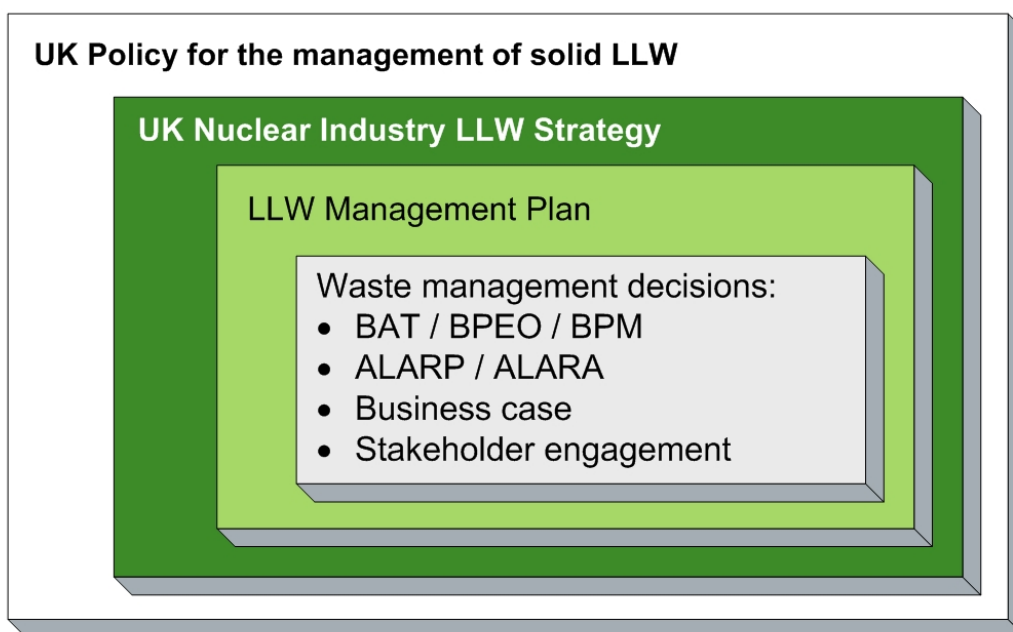


Figure 2 – Policy, strategy planning and decision making

LLW Management Plans

Waste management decisions should not be taken on an ad-hoc basis. Indeed, the Policy for the management of LLW requires waste managers to develop a LLW Management Plan taking account of current and future arisings of LLW. This requirement can be met through the development of an Integrated Waste Strategy, in which all wastes are considered, with particular emphasis on how the waste hierarchy has been addressed. The Policy sets out the key requirements of LLW Management Plans noting the need for appropriate engagement with stakeholders. It also states that the plans are required to meet the needs of regulators, who will exercise their powers to ensure that LLW is managed appropriately.

Decision making

Waste management decisions within the overall framework of the LLW Management Plan should be supported by the use of robust decision-making processes to identify the most advantageous option. There are regulatory requirements on waste managers to demonstrate that they are applying Best Available Techniques (in England and Wales) or Best Practicable Environmental Option / Best Practicable Means (in Scotland and Northern Ireland) for ensuring the most appropriate LLW management approach. Other strategic optioneering processes may also contribute to a waste management decision.

The process for deciding the best means and techniques for managing LLW in specific cases is important to the implementation of this strategy and should be made in an open and transparent manner. These decisions should be taken as part of an integrated waste management approach as described above and should take account of the whole range of relevant considerations, including safety, security, sustainability and economic factors. A full range of realistic available options should be considered. Decision-making processes will also need to be informed by community interests, the waste hierarchy, the proximity principle and the need for early waste management solutions.

A key consideration in any decision will be choosing to use, or invest in, facilities close to site, or use facilities further away. The proximity principle proposes that waste should be managed in the nearest appropriate installations (see the text box for more information). Whilst 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. In the case of radioactive wastes, as with some hazardous wastes, the number of appropriate facilities may mean that the nearest appropriate facility is a considerable distance from where waste is generated.

Decision-making processes will vary with the significance, complexity, and sensitivity of the decision ranging from demonstrating that an established good practice is appropriate to initiating a full optioneering process involving bespoke stakeholder engagement. It is ultimately the responsibility of the waste producer to satisfy themselves that their choices represent the most appropriate decision. This strategy provides an overall framework in which these decisions can be made.

Business Cases and Affordability

Implementation of the waste hierarchy and avoiding disposal is the preferred approach for managing LLW. All options need to be considered to demonstrate the appropriate approach on a case-by-case basis to respond to different challenges in managing LLW. Guidance is available on how to include wider issues in environmental decision-making and also in developing business cases to demonstrate the overall value of decisions (see HM Treasury's Five Case Model, Ref. 7).

Affordability will be a key consideration in the implementation of the strategy. In many cases managing waste at a higher level in the waste hierarchy appears to cost more than disposal. However, this is often because the true lifecycle costs of disposal are not easily recognised. Consideration of affordability should include the balance between the lifecycle environmental and social benefits of managing waste at higher levels of the waste hierarchy and the lifecycle cost of different management options, including disposal. These future costs may include new replacement facilities as required.

Use of supply chain

In some cases, waste producers will be deciding between using the supply chain and undertaking to manage waste themselves. Such a choice will also need to consider the broader influences on the decision, such as considerations of safety, security, sustainability and affordability, and where appropriate should include dialogue with relevant stakeholders. Waste producers also have a duty of care to ensure that their waste is managed responsibly through the whole of its lifecycle, even after the waste has left their direct control.

Proximity principle

The proximity principle is an important consideration for the management of waste. The proximity principle, is described in Planning Policy Statement 10 (England) (Ref. 8) and suggests that waste planning should “enable waste to be disposed of in one of the nearest appropriate installations”. The proximity principle is also captured in the planning guidance of the devolved administrations. The UK LLW Policy recognises the importance of this consideration, indeed transport is a very sensitive issue for communities affected by LLW management. However, the Policy also notes 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 proximity principle is often compared against the economies of scale that can be achieved through reducing the number of sites managing waste. The disparity in amount and location of LLW and High Volume VLLW arisings in the UK is a key issue. For example, consideration of these factors will be different in Cumbria, where a significant proportion of LLW is located at one site, to other parts of the country, where smaller arisings are generated over a much wider area.

This is a matter that is appropriately considered as part of the BAT or BPEO/BPM assessment undertaken by the waste producer as part of their application for an authorisation to send waste off site for treatment or disposal.

2.4 Characterisation and waste information

Obtaining good quality (i.e. accurate and up-to-date) waste management information involves the characterisation of waste and materials located at each site; maintaining inventories for waste volumes, packages, and waste content; and the real-time use and archiving of records. Robust and appropriate data and information are critical to effective decision making.

In order to obtain good quality information, waste producers need to undertake effective characterisation programmes to determine what waste will arise and when. Characterisation at all stages of the waste management cycle is important; it can yield most benefit before materials become waste, which supports good decision-making so as not to foreclose options. As new nuclear sites are developed it will be important to incorporate relevant data from these sites into LLW forecasts, this includes requirements for the operation and decommissioning of those sites.

Radioactive waste information is collated in the UK Radioactive Waste Inventory (Ref. 9), to meet European Union (EU) requirements. The inventory provides a reference for Government and its agencies, and others with a role or interest in the management of radioactive waste, for example the supply chain. 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.



Waste characterisation

In many cases, the inventory provides an upper limit for the amount of radioactive wastes to be managed. This is useful information in order to understand the potential scope of the issue. However, for strategic planning purposes, there is also a need for estimates that reflect the most likely levels of waste arising. A number of initiatives are planned to improve inventory data and our understanding of wastes that need to be managed, particularly in respect to the amounts of High Volume VLLW and exempt waste in waste inventory forecasts. The UK Nuclear Industry LLW Management Plan, developed to implement this strategy, includes a number of projects that also support the development and improvement of the inventory of LLW in the UK. The Management Plan can be found on the LLWR website.

In addition to waste volumes and types, other waste management data are important to effective planning. In particular, there is a need for alignment in the data used to make business cases to allow equitable comparison of LLW management decisions.

In order to move forward in this area we will:

- through LLW Repository Ltd, provide guidance on characterisation of waste and develop standardised procedures as appropriate, with a view to aligning the processes and procedures used within the industry
- develop programmes to improve characterisation of wastes on our sites and work with non-NDA sites to share good practice
- where needed, invest in research and development to improve the availability of equipment and techniques for characterisation
- through LLWR, provide standardised cost parameters that properly reflect the true and complete costs for LLW management options such that comparable business cases can be developed throughout the industry.

Classification of radioactive waste is also important to the LLW inventory. In some cases there may be changes to how wastes are classified. The current Government review of Exemption Orders under radioactive waste regulations¹ is likely to have an influence on the overall waste inventory. This could affect the strategy in terms of the quantities of LLW 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.

¹ In England and Wales disposals of radioactive waste are regulated under the Environmental Permitting Regulations 2010 (EPR2010). In Scotland and Northern Ireland regulation is under the Radioactive Substances Act 1993 (RSA93).

2.5 The Waste Hierarchy

The waste hierarchy (otherwise known as the Waste Management Hierarchy) was first introduced in 1975 in EU waste policy in the Waste Framework Directive for non-radioactive waste (Directive waste). It is an integral part of the development of integrated waste strategies at nuclear (and non-nuclear) sites. Application of the waste hierarchy is central to our approach for a number of reasons.

- The waste hierarchy is recognised as good practice in waste management and reduced the overall environmental impact.
- Government's policy for the management of LLW tells us that waste should be dealt with at the highest practicable level in the hierarchy.
- Disposal capacity is a precious resource; we need to move away from reliance on disposal of LLW to reduce the impact of LLW management.
- Managing waste in ways other than disposal will extend the life of the UK LLW Repository.

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 hierarchy is mandated by policy and environmental regulation, and is recognised as good practice in all aspects of radioactive and non-radioactive waste management. It is an essential element for effective management of LLW.

2.5.1 Waste prevention

There is a significant opportunity to avoid the generation of LLW (and other wastes) both on NDA and non-NDA sites. Waste prevention is the highest level of the waste hierarchy and potentially yields the greatest benefit. At decommissioning sites, much LLW may effectively have already been generated and therefore cannot be prevented. However, there are opportunities to prevent waste (both LLW and non-radioactive waste) during operational activities and new construction (e.g. power generation, construction to support decommissioning etc). This strategy recognises a hierarchy for waste prevention specific to LLW management that should be implemented within the nuclear industry:

- I. Avoid creating any waste
- II. Avoid creating any radioactive waste
- III. Avoid creating any radioactive waste with activity above defined exempt levels

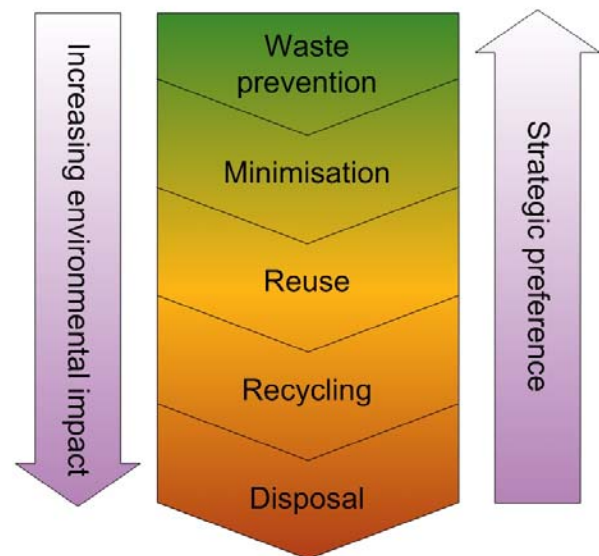


Figure 3 - The waste hierarchy

Waste prevention is a fundamental principle for the operation and decommissioning of nuclear facilities

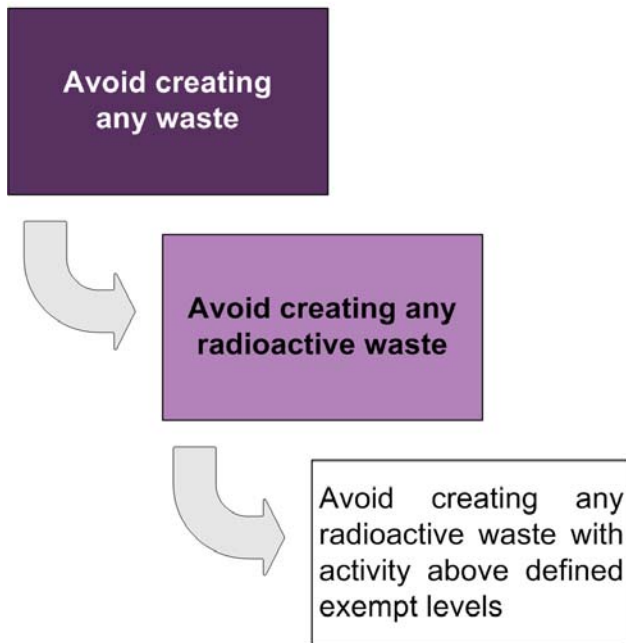


Figure 4 – A hierarchy for waste avoidance

This hierarchy reflects the increased level of resource use and cost of the management of radioactive waste over Directive waste.

There are fundamental approaches and principles that need to be undertaken in order to make the most of this opportunity to prevent waste. These include:

- waste prevention as a fundamental principle of design and operation of all new nuclear facilities, including new nuclear power stations as they are developed.
- waste prevention as a fundamental principle for the operation of nuclear facilities and for planning decommissioning
- recognising that, where waste generation cannot be prevented, there remain benefits in not having to manage that waste as LLW
- avoiding taking materials into a radioactively contaminated area unless entirely necessary.

In order to move forward in this area we will:

- provide guidance through LLW Repository Ltd on opportunities for waste prevention and application of good practice
- provide strategic direction to our sites, through the NDA Strategy and strategic specifications to enhance prevention of waste during operation and decommissioning.

2.5.2 Minimisation of waste to be managed as LLW

As noted above, where wastes cannot be prevented there are advantages in not having to manage waste as radioactive waste. Whilst in some cases the generation of radioactive waste cannot be prevented, practical approaches can be used such that wastes can be managed in ways that have lower resource use and costs associated with them (e.g. as High Volume VLLW or exempt waste). LLW minimisation can be divided into three approaches:

- Separating out wastes where they are mixed or before they can become mixed
- Reducing the activity levels of waste through decontamination
- Characterise waste such that it can be sentenced appropriately

There are resource and cost benefits in minimising the amount of LLW we have to manage

Minimising the amount of waste being managed as LLW should not be undertaken in a way that negates good waste management decision-making. Conventional waste management issues still apply to the management of this waste and the waste hierarchy must remain key to decisions about the management of High Volume VLLW and exempt waste.



LLW sorting facility at Oldbury site

Sorting and segregation

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 metals or High Volume VLLW) is critical to successful application of the waste hierarchy and identifying more appropriate management routes for waste not necessarily requiring multi-barrier engineered containment, such as those facilities provided at LLWR. Segregation of wastes at source, where practicable, is the preferred option for this activity in order to reduce reworking of the waste. It is recognised that this may require manual intervention and consequently, we recognise the need to balance handling of waste with requirements to keep doses from ionising radiation and other risks As Low As is Reasonably Practicable (ALARP).

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 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 waste management. There may be further opportunities to increase the use of techniques that could yield significant benefits in reducing the amount of waste managed as LLW. These benefits need to be considered in the light of potential impacts such as the generation of liquid and gaseous discharges and other secondary wastes and the costs of implementing these techniques. Additional decontamination innovations and applications may also need to be developed.

Decay storage

A further opportunity to minimise the radioactivity of waste is decay storage. 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 storage, availability of space, regulatory requirements, stakeholder acceptance and strategic fit with decommissioning strategies. Decay storage is however, particularly useful for those wastes containing radionuclides with a short half-life. It is our strategy that decay storage should 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.

Use of Exemption Orders

The UK regulatory framework includes exemption orders which can be used to remove the requirement for registration or authorisation of some radioactive wastes, if it can be demonstrated that specific requirements are met. With respect to LLW from the nuclear industry, these requirements broadly relate to demonstrating that the waste does not present a significant hazard because of its very low levels of activity. Clearly the use of exemption orders has benefits in terms of resource use and costs and in many circumstances is the end point for the approaches described above. Effective use of exemption orders requires quality assured characterisation of waste to provide confidence in regulators and stakeholders and ensure that wastes are sentenced appropriately.

This strategy aims to make the maximum possible use of exemption orders. As noted above, this does not take away the need to manage waste responsibly and should not be done in a way that compromises safety, security and environmental protection.

In order to move forward in this area we will:

- work with the Clearance and Exemption Working Group (CEWG, part of the Safety Directors Forum) to broaden communication of the Nuclear Industry Code Of Practice on Clearance and Exemption (Ref. 10) and update it as appropriate in line with changes to legislation (for example revisions to exemption orders)
- provide incentives where appropriate for the segregation of waste through pricing strategies at LLWR and with NDA contracts where applicable
- through LLW Repository Ltd, provide guidance on sorting and segregation of waste and develop standardised procedures as appropriate, for publication and dissemination with a view to aligning the processes and procedures used within the industry
- determine principles for the role of decontamination in decommissioning and investigate opportunities to improve the efficiency of decontamination facilities in use.

Waste producers should ensure decontamination and minimisation techniques are included in their options assessments and decision making processes.

2.5.3 Reuse

The LLW policy recognises the opportunities for appropriate re-use of materials before they become waste. Opportunities for re-use exist well before a material becomes a waste, for example plant, equipment and buildings, which have reached the end of their original intended purpose but may continue to have value elsewhere.

Other materials that provide opportunity for re-use include soil and rubble. (With regard to rubble there is often overlap between re-use and recycling). With all of these opportunities, the key to realising them is making potential users aware of these materials. It is also recognised that these opportunities exist largely within the nuclear industry for radioactively contaminated materials and there is a general preference for this over re-use outside the nuclear estate.

For plant and equipment, the NDA operates an Asset Transfer Website which enables potential users to identify equipment that has come to the end of its original intended use. Already this system has seen significant amount of plant and equipment re-used within the NDA estate at considerable cost saving.

Reuse defers waste production and extends the life of resources

For soil and rubble, there are UK and international examples of waste producers implementing alternatives to disposal, 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 with projects that can receive the material. There may also be impacts on the site end state that would need to be considered. Guidance is required on how these opportunities can be identified and implemented at a practical level.

In order to improve the implementation of these options we will:

- determine whether the scope of the NDA's Asset Transfer Website can be expanded to the whole of the nuclear industry
- seek end users for soil, rubble and demolition products generated within the NDA and non-NDA estate using UK wide networks such as the UK LLW Strategy Group
- work with regulators and waste managers to seek clarification of regulatory requirements and provide examples of UK and international good practice in re-use of waste and provide guidance on implementation of these opportunities
- consider opportunities for re-use of LLW transport containers (see Section 2.6)

2.5.4 Recycling

Recycling materials for a second (or further) use presents a significant opportunity to the nuclear industry. Specifically, this strategy recognises metal treatment and recycling as the main opportunity in this area, although it should be recognised that there are other opportunities such as recycling of concrete and rubble for an alternative use as noted in the re-use section above.

Recycling is the preferred way forward for the treatment of metallic LLW

Metallic waste accounts for approximately a third 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. 11). In practice, this process broadly involves the removal of surface contamination, often by conventional metal cleaning processes such as dry grit blasting, followed by a clearance process to release the clean material to the recycling market. In some cases an additional stage of melting is required to remove all contamination from the metal. Quality assured clearance of material before it is released is critical to demonstration of regulatory compliance and also for the confidence of stakeholders at all levels.

Decontamination of metal wastes already takes place at a number of NDA and non-NDA sites, for example Winfrith and Sellafield. In addition, there are also a number of contractors in the supply chain who provide services in this area. Whilst current levels of recycling are encouraging, there is scope for increasing the treatment of metallic waste. This strategy aims to increase the application of metal treatment in a way that demonstrates best value for money. We believe that, at the current time, use of the supply chain will provide the capacity required for this increase and should be a primary consideration over development of and investment in new metal treatment facilities at waste producing sites.

A strategic BPEO for VLLW management was undertaken (Ref. 12) and for metallic VLLW, metal treatment has been demonstrated to be the preferred option at UK strategic level when resource preservation, best use of disposal capacity, environmental responsibility as well as cost are considered. We believe that recycling should be the preferred way forward for the treatment of this waste and indeed this material has a role to play in ensuring the viability of this waste route.

LLW contaminated drums consigned for metal treatment



These photos show contaminated LLW drums that have been treated at a metal recycling facility. The pictures show the drums before and after decontamination using grit blasting.

After this process the metal was monitored and confirmed as exempt and then subsequently recycled.

There are a number of key activities that will drive an increase in metal recycling:

- 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.
- We will support waste producers in demonstrating the value of metal recycling over disposal, beyond simple gate price cost comparisons.

2.5.5 Waste volume reduction

Whilst volume reduction is not formally a step in the waste hierarchy, it has an important role to play in the provision of optimised disposal. For those wastes that are not amenable to higher levels in the hierarchy, and therefore require disposal, it is vital that the best use is made of the disposal capacity used. Reducing the volume of the waste being disposed of is an effective way of achieving this.

Volume reduction ensures best use of disposal capacity



Compacted waste pucks being placed in LLW package.

Compaction

Compaction and high-force compaction are already a regular part of LLW management and have realised a significant amount of volume saving prior to disposal. Compaction of LLW typically achieves volume reduction ratios of 4:1 to 10:1 (Ref. 2). Compaction is a relatively simple process and technologies are mature and we therefore expect compaction to continue to be used where appropriate. There is however, still room for improvement, for example, by changing the packaging, using 1 m³ boxes rather than cylindrical drums to increase packing efficiency when the waste is disposed of. Also there may be need for further innovation, for example in situ compaction to reduce transport need and series compaction, where compaction is used in succession with another waste treatment process.

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
- encourage suppliers of services to work with waste producers to provide innovative services as applicable

Thermal Treatment

Thermal treatment of waste refers to the use of heat to stabilise and reduce the volume of waste. The most common example of this is incineration, but other approaches exist such as pyrolysis and plasma arc processes. These processes significantly reduce the volume of waste and remove some of the volatile and hazardous components of the waste. The resulting waste ash is also 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. 13) and is indeed already in use at a number of UK nuclear industry sites, in addition to a number of supply chain organisations that provide thermal treatment services for LLW.

Thermal treatment of low level waste has a key role to play in the optimisation of the management of LLW, given the significant benefits that are achieved in terms of volume reduction. Due to the practical difficulties arising from the small volume of combustible LLW expected to be generated we do not believe that energy recovery is a key driver for treatment of LLW. However, where supply chain organisations offer thermal treatment with energy recovery this has potential for additional benefit.

Existing incinerator capacity within the nuclear industry will continue to be used where it is demonstrated as the BAT / BPM for the waste and offers value for money. In the near term, we do not consider that there is a need for investment in new thermal treatment capacity solely for use within the nuclear industry. Where further capacity is required, such as where existing facilities cannot meet demand or do not provide value for money, it should be obtained through the supply chain.

Thermal treatment of both radioactive and non-radioactive waste, particularly incineration, is an area of significant concern for stakeholders, particularly the communities that host thermal treatment facilities. Whilst 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 important. Open and transparent discussions on the thermal treatment of radioactive waste are important to securing and maintaining the confidence of stakeholders.

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

- support LLW Repository Ltd in development of existing supply-chain thermal treatment routes for combustible LLW
- work with waste producers and the supply chain to better understand the need and capacity for thermal treatment of LLW and determine where and when additional infrastructure may be required
- investigate opportunities for thermal treatment of LLW with other waste streams (ILW, graphite etc)

2.5.6 Waste disposal

The aim of the strategy is to ensure continued capability and capacity for the management of LLW. Whilst the strategy wants to significantly reduce the reliance on disposal for the management of LLW, it recognises that there are some wastes that are not amenable to being managed at higher levels in the waste hierarchy. Where waste does require disposal, this should be achieved in the most optimised way in order to minimise the impact of those disposal activities.

Disposal capacity is a precious resource and it must be used sparingly and as a last resort

This will mean making the best use of the LLWR and only disposing of suitable wastes at that site. It should be recognised that avoiding disposal at LLWR should not automatically mean disposing of waste elsewhere. Disposal capacity for all wastes is a precious resource and must be used sparingly; as such every effort should be made to avoid the use of disposal wherever possible.



Waste emplacement in a vault at LLWR

UK LLW Repository

LLWR is a key asset to the UK. LLW has been disposed of at LLWR since 1959. Continued availability of this facility is central to this strategy, ensuring that the UK is able to effectively manage LLW. The strategy looks to extend the life of this facility to ensure capacity for the long term.

LLW is 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.

The LLWR provides a high level of safety, security and environmental protection for the disposal of LLW by offering a multi-barrier containment system. However, capacity at the site is limited, both volumetrically and radiologically. Continuing to manage LLW as we have done in the past, with a focus on disposal, is not sustainable and therefore 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 for disposal. Appropriate alternative waste management routes must be used for 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's UK integrator for LLW management
- 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 High Volume VLLW

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 permit 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. 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, part of the safety case development involves a process of optimisation during which LLW Repository Ltd will assess the impacts of this strategy and the opportunities for implementing the strategy.

Other Disposal Options

Government policy for the management of solid LLW in the UK defined a sub-category of LLW, called Very Low Level Waste (VLLW), including a “Low Volume” and “High Volume” division. The policy promotes the use of a risk-informed approach to the management of LLW and also indicates that all options for the management and disposal of LLW should be considered.

For LLW that still requires disposal following application of the waste hierarchy, this includes consideration of disposal of High Volume VLLW to landfill type facilities. Where appropriate, disposal of LLW to landfill by means of controlled burial may also be considered, “provided the necessary safety assessments can be carried out to the satisfaction of the environmental regulators”.

Alternative disposal options include: 1) the use of existing landfill sites; 2) development of new facilities on or adjacent to sites to dispose of waste from that site; 3) development of new facilities on or adjacent to sites to dispose of waste from a number of sites; 4) use of new facilities away from nuclear sites to dispose of wastes from one or a number of sites on a regional or national basis. Provision of these services could be achieved either through the supply chain or through nuclear site licence companies, or a combination of the two. Whichever approach is used, it should be implemented to high standards, both technical and management, to minimise the impact of this activity and ensure public confidence. The Environment Agency and SEPA provide guidance on their websites describing how they will regulate such sites.

Provision of new facilities, both on and off site, will require consideration of a number of factors. The NDA has a role in reviewing available and projected capacity and providing information that supports decisions as to whether new capacity is required at a given time. As with other LLW management developments, clear and effective involvement of communities at an early stage when developments are planned is important. Open and transparent discussions are important to securing and maintaining the confidence of stakeholders. Provision of new facilities at nuclear sites will require consideration of a number of additional factors linked to the future of the site, such as sustainability, the suitability of the site for disposal purposes, long-term impacts of disposal for de-licensing, and achieving a desired end state and potentially end use.

This strategy recognises the opportunity provided by the use of alternative sites for disposal of LLW. However, it does not set out to prescribe which of the above is preferred or where these activities should take place because of the inherently local issues that accompany such decisions.

The use of alternative disposal options needs to meet the relevant safety and planning requirements and be demonstrated to be the BAT or BPEO/BPM by the consignor. This should include consideration of local community issues both at the consigning and receiving sites. As noted above, disposal capacity is a precious resource and every effort should be made to avoid disposal where practicable.

In order to support the development of a risk-informed approach to the disposal of LLW we will:

- where required, explain our role in the management of LLW and make available information on the wastes that need to be managed and when they will arise
- expect consignors to make appropriate use of alternative waste management and disposal options for High Volume 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

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.



Illustration of how the Dounreay LLW Facility will look after construction

The existence of a LLW facility at the Dounreay site will not remove the preference to implement the waste hierarchy and optimise management of LLW at Dounreay. There are no plans at present to consider disposal in this facility of other suitable wastes from both the nuclear and non-nuclear industry.

2.6 Packaging and transport

2.6.1 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.

This strategy recognises the significant opportunity that would result from improvements in LLW packaging. As such, LLW Repository Ltd will look to provide an optimised packaging approach for LLW, for both transport and disposal. LLWR already provides the national container supply service through its customer contracts.

Improved packaging also needs optimised packing into the containers by the waste producers. Recently there have been improvements in packing efficiency of containers consigned to LLWR and this should continue. However, effort should be made to achieve this through the better packing of LLW and not by infilling void space with VLLW or potentially exempt material.

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. It is recognised that any alternative approaches must continue to meet safety and compliance requirements in this area.

In order to achieve better packaging 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
- 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.

2.6.2 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 and regulated by the Department for Transport (DfT).

It is recognised that transport of LLW is a significant stakeholder concern, particularly for residents of the communities with facilities nearby (see “Proximity Principle” in Section 2.3). 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 an opportunity to transfer a portion of waste movements from road to rail and also utilise sea transport, where appropriate. However, the desire to alleviate concerns over transport needs to be balanced with the practicability of alternatives and relatively low risk presented by the transport of LLW.



LLW package arriving by rail at LLWR

This strategy aims to put in place actions to review what constitutes an optimised approach to the transport of LLW and will determine the appropriate balance of criteria. 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.

In order 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.

3 Key Influences on Strategy Implementation

3 Key Influences on Strategy Implementation

This document does not aim to provide plans for the implementation of the strategy. However, key implementation issues are discussed below to provide clarity and future expectations on the path forward. Plans and projects to support the implementation of the strategy are included in the UK Nuclear Industry LLW Management Plan, revised annually and posted on the LLWR website.

3.1 Community involvement and stakeholder engagement

The success of this strategy will rely on action 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: LLW producers; LLW Repository Ltd; regulators (EA, SEPA, NII, OCNS, DfT); planning authorities; NDA; the waste management supply chain; Government. Forums for engagement will be required, such as the LLW Strategy Group, to provide the opportunity to work together and focus on the delivery of the strategy.

The strategy has been developed to deliver benefits across the UK. It is however recognised that this strategy has an impact at every level, including regional, local and within communities. Radioactive waste, even LLW and VLLW, raises particular concerns for the public and local communities. Perceptions associated with the radioactive nature of these operations, not the actual hazard or risk presented by them, has the potential to create negative feeling and possibly also economic impacts, amongst the communities involved.

In light of the above, it will be essential to undertake careful and considered engagement with local communities early in the waste management planning and decision making process, particularly 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 in order to build confidence and credibility. There is no single organisation responsible for ensuring that this dialogue takes place. The responsibility is shared between all organisations involved in the implementation of this strategy.

In order to provide support in this area, a sub group of the UK LLW Strategy Group developed pointers to good practice document on stakeholder engagement around LLW projects, which provides guidance in this area (Ref. 14). This can be downloaded from the LLW Strategy Group section of the LLWR website: (<http://www.llwrsite.com/llw-strategy/national-llw-strategy-group>).

3.1.1 Interaction with Planning Authorities

As stated in UK LLW Policy, this strategy should be used as guidance by national, regional and local planning authorities when preparing and reviewing their planning strategies for waste management.

Waste managers and facility operators should recognise the importance of early dialogue with local government decision makers (e.g. waste planning authorities in England) to help inform (a) the preparation of local waste development documents and (b) the handling of planning applications. It is important to work in constructive partnership with local government decision makers as delays can arise if a proposed development is not adequately conceived or does not pay due regard to local planning policies. In contrast, where proposals reflect those policies and their preferred locations for waste management facilities, applicants should expect expeditious and informed consideration of planning applications.

UK planning policies also highlight the complementary nature of planning and pollution control regimes. Where waste management authorisations for disposal to existing facilities are sought, the operator should enter into discussion with local government decision makers to take advice on whether planning permission might also be required. This should be considered on a case-by-case basis, taking into account the original permissions and conditions for operation of the site.

We recognise that planning authorities will require a sufficient evidence base, with data about the volumes and types of LLW and High Volume VLLW arisings on a region by region basis, an indication of the timing of such arisings, and information about existing and reasonably foreseeable facilities for managing LLW and High Volume VLLW in each region, as noted in Section 2.5.

In order to support local government decision makers we will make available information on LLW forecasts on a region by region basis.

It is recognised that waste management facilities of all kinds are often a matter of concern for communities. In the development of a new facility, discussions will take place between the developer and the local authority in line with the planning regime for England, Wales and Scotland, and will include engagement with local communities. It is for the developer and the local authority to reach appropriate agreement on the acceptability of any new proposals.

3.2 The role of the supply chain

As noted elsewhere, we believe that the capability and techniques needed to implement this strategy already exist. Some of this will need to be accessed through the waste management supply chain given its maturity and expert capabilities. Enabling the supply chain to take part in the delivery of the strategy, which we believe is essential, will require a stable and competitive market for low level waste management. Supply chain organisations operate within the same regulatory framework as existing site licence companies and can often provide enhanced value through bringing in their experiences from outside the nuclear industry. In some circumstances there may be all round benefits for organisations new to radioactive waste management from working in partnership with organisations that have a longer history in this area.

A key enabler for working with the supply chain will be provision of good quality information on opportunities, particularly with respect to waste arisings. Options for providing this information including working with trade associations, attendance at key events and provision of information on relevant websites. In particular, organisations more used to Directive waste management will need clarity on the requirements for working with LLW.

The need for effective stakeholder dialogue is essential for supply chain organisations entering the LLW management area, particularly where there is no existing relationship with stakeholders or where stakeholders are new to issues of LLW management.

3.3 Low Level Waste issues that require further consideration

This strategy captures the management of all LLW. In some areas however there are other further considerations that are required due to the specific nature of certain wastes or cross over with other areas of strategic management. Some of the most significant are captured below.

3.3.1 Contaminated ground

A number of sites in the UK (both NDA and non-NDA) either have, or may have, ground and groundwater contaminated by radioactive substances. 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 m³, 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 characterised sufficiently and / or a management option has not yet been selected. This quantity of material is in excess of the total inventory of LLW.

In order to address this issue, in the short 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 and non-radioactive substances. 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 central to this understanding. As this understanding improves we will be able to determine the impact on the LLW strategy and develop it as required. Alignment with the waste hierarchy should be part of determining the way forward, indeed, the management of contaminated ground includes significant opportunities to manage material at levels higher in the waste hierarchy.

3.3.2 Trans-boundary wastes

As noted in Section 2.2, the management of LLW is one part of the wider integrated waste management that takes place within the nuclear industry. In some circumstances there may be benefits to addressing LLW and other wastes at the same time, for example ILW and reactor decommissioning wastes have all been suggested as areas for further consideration. There may also be benefits for addressing certain waste types which cross radioactive waste categories, for example graphite, as a whole rather than addressing waste categories separately. This strategy does not preclude the investigation and implementation of such options. In addition, this strategy needs to recognise the potential for decontamination of ILW bringing it into the LLW management regime. Whilst this has potential to increase the amount of LLW to be managed, there is overall benefit with respect to resources and cost in avoiding managing waste as ILW.

3.3.3 LLW not suitable for disposal at LLWR

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.

Because of the diverse nature of these wastes, determining the most appropriate management option for them 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 UK Nuclear Industry LLW Management Plan 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.

3.3.4 Legacy wastes

Legacy LLW is defined as existing contained or unpackaged wastes that are placed in interim storage awaiting waste treatment and/or disposal. In accordance with the presumption towards early solutions within the LLW Policy, legacy LLW should be cleared from the site of generation, as soon as practicable, via an appropriate treatment or disposal route. We believe that dealing with legacy wastes early is a key part of NDA's mission of site remediation and contributes to minimising environmental and safety risks.

Sellafield

The largest NDA site is Sellafield, in Cumbria. A significant amount of LLW (approximately 60%) is expected to come 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.

Due to the large quantities of LLW and High Volume VLLW that will be generated from decommissioning and remediation activities at the Sellafield site, Sellafield Ltd, NDA and LLW Repository Ltd will together evaluate the potential for disposal of these wastes on or adjacent to the site. This specific onsite option is viewed as a medium to long-term disposal solution for a significant portion of the waste to be generated from Sellafield.



Decommissioning at Sellafield

Sellafield Ltd has developed their own strategy for the management of LLW at the Sellafield site (Ref. 15). We worked closely to ensure that the Sellafield strategy was compatible with the emerging UK nuclear industry LLW strategy. Sellafield Ltd will consider whether there is a need to alter their strategy in the light of this strategy. This is also the case for other sites with respect to their integrated waste strategies.

3.4 Innovation

3.4.1 R&D

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.

Areas of research that we will endeavour to look at include:

- advancing techniques for effective sentencing of waste, especially bulk wastes
- development of existing techniques, such as characterisation, handling, volume reduction, and packaging
- bringing techniques from outside the nuclear industry (Directive waste management) into LLW management
- better understanding of opportunities for co-treatment with other wastes (e.g. ILW, Directive waste)
- exploring opportunities for alternative approaches to disposal for certain materials (short lived ILW, long lived LLW etc) and other specific wastes, such as organics and radium contaminated luminescent materials

Much R&D work associated with LLW management is undertaken by waste producers driven by a particular need at that site. The NDA does however undertake direct research where there is a multi-site or cross industry need. Where there is a technology gap along these lines we will determine how best the need can be addressed, either through R&D driven by waste producers or centrally through directly funded work for example, as part of NDA's R&D portfolio and strategy.

3.4.2 Sharing of 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. 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 there is potential throughout the management of LLW for sharing good practice, four areas have been recognised for specific attention:

- minimisation
- characterisation
- segregation
- recycling

This strategy recognises a number of resources available for dissemination of good practice in waste management, including LLW, for example the Waste and Resources Action Programme (WRAP) (<http://www.wrap.org.uk/>) and the Environment Agencies Requirements Working Group (EARWG) database (<http://www.rwbestpractice.co.uk/>). For each of the areas above a specific project has been included in the UK Nuclear Industry LLW Management Plan focusing on how to build on the resources already available and further improve the sharing of good practice.

The UK LLW Strategy Group, which has membership from across the industry, will continue to meet and provide a key role for sharing good practice and for the collation of information and opportunities in LLW management.

3.5 Monitoring strategy implementation

Section 2.4 of this document recognises the importance of information about LLW management. One area where robust data is particularly important is in monitoring the success of the strategy. Changes in the practices of LLW management, particularly increased use of the higher levels of the waste hierarchy, can only be demonstrated through quality data.

Encouraging the right behaviours can be achieved in a number of ways: provision of information, strategic targets, financial incentives (including reward), and maintaining flexibility for waste producers. All of these will be required to some extent in the implementation of the strategy.

Many waste management strategies set out targets for specific parts of the strategy. In order for such approaches to add real value, they must be based on reliable metrics and be fully within the control of the organisations who are asked to meet them. The management of LLW is affected by a broad range of impacts where this is not entirely within the waste producers' control.

However, the concept of waste recycling targets remains popular with stakeholders. In recognition of this, we will undertake a programme of work to determine effective targets that extract maximum benefit and encourage the application of the waste hierarchy and encourage right behaviours, for example good performance in safety and environmental management of LLW. Such targets will need to recognise that sites are at different stages of maturity and as such there may need to be some flexibility in targets or different targets may be appropriate for different sites. Initial monitoring of site progress may be required before targets can be encouraged or set.

In some circumstances it may be 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.

As noted above, the Post Adoption Statement published alongside this document also includes proposals for monitoring the impact of the strategy on the criteria used in the Strategic Environmental Assessment.

3.6 Risks, opportunities and contingency planning

During the development of this strategy a number of key risks that may affect its implementation were identified through technical work, the SEA, dialogue with stakeholders and the formal consultation. Conversely, implementation of the strategy represents a significant opportunity, which can be recognised at a number of levels. Risk and opportunity management are an ongoing processes and it is therefore not appropriate to include risks and opportunities here.

Moving forward, risks associated with the strategy from the NDA point of view will be captured in our risk management process at the appropriate level. Actions will be undertaken to mitigate those risks and contribute to ensuring continued capability and capacity for the management of LLW in the UK. Other organisations involved in the implementation of the strategy should also manage relevant risks accordingly.

In addition to mitigation of risks, it is important to plan for implementation of the strategy and to realise the significant opportunity presented. As noted above, LLW Repository Ltd have captured actions in a UK Nuclear Industry LLW Management Plan, which sets out key initiatives designed to support implementation of the strategy and realise this opportunity. Further initiatives will be required as the strategy implementation evolves.

Dependent on any nuclear new build programme (and any other nuclear sector developments), a successor disposal facility to LLWR is likely to be required, predominantly for decommissioning wastes. Some operational wastes may need accommodating, dependant on the lifetime of facilities. Although the timing is difficult to predict at present, such a facility may be required before the end of the current century. Some contingency work has been undertaken and has considered potential costs and the likely timing required for site selection, authorising and building of a new repository (which may be of the order of 15-20y).

Assuming successful implementation of this strategy, new repository capacity is unlikely to be required for very many decades. This does however underpin the strategic need to enable waste producers to continually determine waste forecasts that enable a robust review of capacity required for both legacy and new build wastes.

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 could include a need to consider development of facilities by the NDA and at some point could require the need to develop a successor facility to LLWR. These alternatives are considered in the development of business cases at the strategic level and we have developed a reasonable level of understanding of the impacts that these contingencies represent. Understanding the alternatives and impacts clearly influences the implementation of this strategy.

4 Supporting Information

4 Supporting Information

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.

4.1 Regulatory framework

Environment

In England and Wales disposals of radioactive waste are regulated under the Environmental Permitting Regulations 2010 (EPR2010). In Scotland and Northern Ireland regulation is under the Radioactive Substances Act 1993 (RSA93). Radioactive waste regulation 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 regulations empower the appropriate environment agency to attach conditions and limitations to any permit that it issues.

Authorisations under RSA 93 require operators to demonstrate that they are applying Best Practicable Means (BPM), ensuring doses to people and the environment are ALARA. This incorporates where appropriate demonstration that the Best Practicable Environmental Option (BPEO) has been adopted to manage radioactive wastes. Under EPR2010 the equivalent is achieved through demonstration of BAT.

Exemption Orders

All materials are radioactive to some extent, however 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 waste regulations.

Government is currently undertaking a review 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 High Volume 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 published guidance (called Near-surface Disposal Facilities on Land for Solid Radioactive Wastes - Guidance on Requirements for Authorisation, GRA) 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 and SEPA have also published further guidance on how they will regulate the disposal of low level radioactive waste to landfill sites.

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 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. 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.

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.'

Planning

Land use planning in England and Wales is the subject of the Town and Country Planning Act 1990 and associated regulations as amended. The main planning law in Scotland is The Town and Country Planning Act (Scotland) 1997. The Planning etc. (Scotland) Act 2006 amends the 1997 Act with regard to Development Planning and Development Management (including appeals, local reviews and enforcement). Planning operates through two interlinked processes: the provision of policy frameworks in spatial plans or Local development plans in Wales, and the control of development. The policy adopted in plans is the predominant "material consideration" in determining a planning application for a specific development. For this reason, land use planning in the UK is often said to be 'plan-led'.

In England, national planning policy is set out in Planning Policy Statements (PPS) and in Wales, Planning Policy Wales and Technical Advice Notes. PPS10 and Planning Policy Wales and TAN21 sets out Government policy on Sustainable Waste Management. Scotland's policy on waste management is reflected in Scottish Planning Policy 10 (Planning for Waste Management). These explain the objectives and principles that regional planning bodies and waste planning authorities should meet in preparing and delivering their planning strategies for waste management.

This 28 page document can be accessed by the following link:

<http://www.scotland.gov.uk/Resource/Doc/196433/0052646.pdf>

Policy Framework Annex - part 11 specifically refers to the Long Term Management of Solid Low Level Radioactive Waste.

The primary focus of plan making is then at regional and local levels, and at the local level in Wales:

- Regional Spatial Strategies in England set out a spatial plan for the region that must conform with Government policy.
- Minerals and Waste Development Frameworks in England (and where still applicable local waste plans) or Local Development Plans in Wales, cover local authority planning policy for waste, and must accord with national planning policy and, in England, the relevant Regional Spatial Strategy.

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 it complies with 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.

International Issues

Basic Safety Standards Directive - BSS

Legislation on radiation protection in the European Union is governed by the Euratom Treaty and its Directives. The Basic Safety Standards Directive (96/29/Euratom) of 13 May 1996 is the framework directive for radiation protection in the European Union. This deals with radiation protection of exposed workers and the public. Member States are required to implement the BSS Directive. The main aim of these 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.

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. Before constructing a new facility, waste managers should discuss with Government and the regulators the need to compile an Article 37 submission.

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4.3 Glossary

Activity

The number of atoms of a radioactive substance which decay by nuclear disintegration each second. The unit of activity is the Becquerel (Bq), 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 requires that all reasonable steps should be taken to protect people and the environment. 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.

Best Available Technique (BAT)

"BAT" is defined (using the definition in article 2 of the PPC Directive) as the most effective and advanced stage in the development of activities and their methods of operation, which indicates the practical suitability of particular techniques for providing, in principle, the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and impact on the environment as a whole.

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.

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. Parts of Cm 2919 were superseded by Government's revised LLW Policy (March, 2007).

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. Typically, 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

The process whereby a nuclear facility, at the end of its economic life, is taken permanently out of service and its site made available for other purposes.

Decontamination

Removal or reduction of radioactive contamination.

Directive waste

Directive waste is the term used in national legislation to describe waste which (a) falls within the definition in Article 1(1)(a) of the WFD and (b) is not excluded from the scope of the WFD under Article 2(1)(b)."

Disposal

In the context of solid waste, disposal is the emplacement of waste in a suitable facility without intent to retrieve it at a later date; retrieval may be possible but, if intended, the appropriate term is storage. Disposal may also refer to the release of airborne or liquid wastes to the environment (i.e. emissions and discharges).

Dose

A general term used as a measure of the dose absorbed by man from radiation, measured in sieverts, and its sub-multiples (millisieverts – mSv - equal to one thousandth of a sievert, or microsieverts, equal to one millionth of a sievert). Radiation dose is received from many sources – of the average annual dose of 2.6 mSv, 85 per cent comes from natural background radiation, 14 per cent from medical sources and the remaining one per cent from miscellaneous man-made sources.

Environment Agency (or EA)

The environmental regulator for England and Wales. The Environment Agency'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, the EA also regulates nuclear sites under the Pollution Prevention and Control Regulations and issues consents for non-radioactive discharges.

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.

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 categories (i.e. LLW, ILW, HLW) and non-radioactive and hazardous wastes. 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.

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.

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.

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.

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 Waste Regulations

In England and Wales disposals of radioactive waste are regulated under the Environmental Permitting Regulations 2010 (EPR2010). In Scotland and Northern Ireland regulation is under the Radioactive Substances Act 1993 (RSA93).

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.

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):
 - (i) in each 0.1m³, the activity limit is 4,000 kBq for carbon-14 and hydrogen-3 (tritium) taken together
 - (ii) for any single item, the activity limit is 400 kBq for carbon-14 and hydrogen-3 (tritium) taken togetherControls on disposal of this material, after removal from the premises where the wastes arose, are not necessary.
- (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 manager

Any organisation that currently has responsibility for the safe and environmentally responsible disposition of specific radioactive wastes in accordance with regulatory requirements, and the funding thereof. The organisation may or may not equate to the waste producer, who generated the waste in the first instance, as the responsibilities listed above may have passed to another organisation in the interim.

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.

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