

Waste Management Services

Review of Strategic Options for Metallic Waste

WMS-REP-NLWS/LLWR/25 – Issue 1 – June 2011

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Document Management

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Executive Summary

Purpose of this Report

The current strategic Best Practicable Environmental Option (BPEO) for metallic wastes suitable for disposal in the Low Level Waste Repository (LLWR) was developed in 2006. The BPEO identified in the study was, in the short-term, to export waste to overseas facilities and, in the long-term, to develop facilities in the UK. Since that time there have been a number of changes in policy and strategy by the UK Government, the Devolved Administrations and key Agencies.

This report has therefore been produced for the purpose of providing a review of the existing Strategic BPEO for Metallic Wastes to identify whether those conclusions are still valid.

Approach

The following aspects were reviewed to identify changes in the nuclear sector since 2006 potentially affecting management of metallic LLW:

- Changes to the policy, strategy and regulatory frameworks in which waste management decisions are made;
- Changes in the quantity and characteristics of the metallic LLW inventory; and
- Aspects of the 2006 strategic BPEO, including its conclusions, that are subject to interpretation, in particular the meaning of “short term” and “long term”.

Conclusions

The key conclusions from this work are:

- Changes to the LLW inventory indicate that there will be less metallic waste generated during the period 2011-2025. These changes do not, however, impact significantly on the findings of the 2006 strategic BPEO;
- Changes to drivers such as policy, legislation, regulation and strategy have not identified any issues that present a significant challenge to the findings of the 2006 strategic BPEO;
- Consideration of the changes to drivers such as policy, legislation, regulation and strategy indicates that the preferred option(s) identified in the 2006 strategic BPEO are further underpinned by these changes; and
- The key findings of the 2006 strategic BPEO study remain valid in the current context.

Recommendations

Following on from the above conclusions it is not considered that further detailed assessment or re-optioneering of the 2006 strategic BPEO is required.

It is recommended that the BPEO conclusions are reviewed in another 5 years or, as defined within LLWR Ltd management arrangements, if there are significant changes in the following areas:



- Anticipated and actual rates of metallic LLW generation;
- Supply chain capability and capacity, in particular the impact of market failure or contraction;
- Availability of waste treatment and disposal routes;
- Government strategy with regard to application of the waste hierarchy for LLW; and
- Funding for decommissioning and waste management programmes.

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1. Introduction

1.1. Purpose of this Report

In 2006 the NDA commissioned Studsvik UK to undertake an assessment of management techniques for low level radioactive metal waste. The findings and conclusions of the assessment were presented in a report entitled 'Strategic Best Practicable Environmental Option (BPEO) for Metallic Waste Management – Options Evaluation' [1]. The primary purpose of the report was to inform NDA's LLW strategy development activities. The report has been widely used by the NDA, the nuclear industry and its regulators since that time as a reference document to inform decision-making during the preparation of site-specific BPEO studies and development of Integrated Waste Strategies.

Since that time there have been a number of changes in policy and strategy by the UK Government and regulators as well as changes that might affect the strategic options that are considered.

This report has therefore been produced for Low Level Waste Repository Ltd (LLWR Ltd) by Entec UK Ltd (Entec) for the purpose of providing a strategic review of the existing BPEO for low level radioactive metal wastes to identify whether those conclusions are still valid.

1.2. Context

Capacity at the LLW Repository (LLWR) is limited. LLWR Ltd is developing a number of diversified waste routes that will allow wastes that would otherwise be disposed of in the repository to be disposed of by alternative means. Currently these waste routes include incineration, metal recycling and disposal. These routes will be augmented by the provision of characterisation and segregation services that will allow more waste to be disposed via the diversified waste routes.

Each of the diversified waste routes has been underpinned by a strategic BPEO [1, 2, 3] study that has explored the comparative benefits of a range of strategic options for that type of waste. The conclusions of these studies demonstrate that the options that have been selected perform well against a range of environmental, safety, social and economic criteria. The studies are available on the LLWR Ltd website at <http://llwrsite.com/llw-strategy/strategic-documentation>.

Recent discussions between LLWR Ltd and its key stakeholders have identified an appetite to revisit the assessment of options for metallic wastes. Key drivers for this exercise are:

- Potential to use techniques such as metal-melting as a pre-conditioning step prior to disposal where recycling cannot be achieved (i.e. for volume reduction only);
- Recent development of UK-based metal recycling facilities and potential for a UK-based metal-melter;
- Identification of potentially new waste feedstocks that were not specifically considered in the original BPEO study; and
- Regulatory discussions relating to applying the proximity principle and reducing the reliance on exporting waste under Trans-frontier Shipment (TFS) arrangements.



2. Background Information

2.1. Brief History of the LLW Repository

The LLWR has been in operation for over 50 years providing an essential service by managing the UK's solid low level radioactive waste (LLW). Originally disposal of LLW was based on landfill practices, with waste being tipped into clay-based trenches and covered with layers of stone and soil. Today the disposal trenches have been covered with a water resistant cap and a soil layer with planting of a mixture of grass and shrubs in keeping with the natural environment. In 1988 a new approach to the treatment and disposal of LLW in the UK saw the opening of Vault 8, an engineered facility for the long-term management of LLW. Under this new system, LLW was put into containers and grouted prior to disposal in Vault 8. The transformation of disposal procedures was completed in 1995 when the Waste Monitoring and Compaction Facility at Sellafield was opened. The new facilities meant that LLW could be compacted to reduce its volume and grouted within containers ready for disposal in Vault 8 improving the use of vault space. Planning permission for the development of Vault 9 at the LLWR was granted in January 2008 and construction commenced in September 2008.

One of the main objectives for LLWR Ltd now and in the future is to develop waste management services to support the national strategy for the management of LLW. Key objectives of the national strategy include rigorous application of the waste hierarchy and extending the life of the LLWR.

2.2. Current LLW Repository Operations

The operations currently undertaken at the LLWR include:

- Waste reception;
- Container grouting;
- Waste storage;
- Waste disposal;
- Site monitoring; and
- Facility maintenance.

LLW received onto site comes from various customers in the nuclear industry, the healthcare sector, research and educational establishments and other sources such as defence. Ultimately, the waste is grouted in containers, which are then stacked in engineered concrete disposal vaults. Treatment is also used to reduce the volume of waste where possible, before waste is containerised and brought to the LLWR.

LLWR Ltd currently offer a metallic waste treatment service, including techniques such as shot-blasting, size reduction and melting. The service is delivered using a network of supply chain facilities in the UK, Europe and the US. The aim of this service is to reduce the volume of low level waste by separating contamination from clean metal that can then be recycled. The secondary waste from the treatment process, such as slag from metal melting, can then be disposed of at the LLWR.

2.3. Sources of Metallic Wastes

The UK Radioactive Waste Inventory (UKRWI) 2010 [4] estimates that the total raw volume of LLW (including VLLW subcategory) is approximately 4.4 million m³. These wastes will be generated over a period of 110 years up to the end of the NDA's current decommissioning programme in 2120.

Contaminated metals represent about 17% or 780,000 tonnes of the LLW and VLLW expected to arise from operations and, more significantly, decommissioning in the nuclear sector [5]. Within the LLW category, metals represent over 41% (480,000 tonnes) of the inventory with the main types of metallic wastes being ferrous metals, primarily steels, with other metals including aluminium, copper and lead.

There are a diverse range of waste items that, in general, can be characterised as metallic, including building infrastructure, instruments, machinery and plant, components from nuclear processes, containers and tanks, protective sheeting and boilers. There is considerable variability in the type of contamination present that may be expected, both in terms of the radionuclides involved and also whether contamination is associated with activation products held within the metal crystalline structure, surface contamination or a combination of this.

2.4. Commentary on Current Strategic BPEO for Metallic Wastes

2.4.1. Objective and Approach

The current strategic BPEO for metallic wastes was developed in 2006 and looks at LLW from a national perspective. The objective of that study was:

“To provide [the] NDA with a full understanding of the technical and commercial arguments, justifications and issues relevant to the implementation of various management techniques on low level radioactive metals wastes in the UK. This will be achieved through the application of a BPEO assessment methodology to determine metal management options for significant aggregated waste streams in the UK.”

The approach to the 2006 BPEO took into account guidance from the environment agencies on BPEO [6] as well as the requirements of the Strategic Environmental Assessment (SEA) Directive [7], and involved the following phases:

- Options identification and screening, including a workshop, to identify options, screening criteria and 'route maps', which group a range of options into functional blocks, recognising that there are different options for different metallic wastes. The different route maps therefore identified generic functional blocks for short listed options as a means to aid the subsequent option evaluation exercise;
- Short listing the options, including a workshop, and agreement on the decision attributes and scoring methodology;
- Options characterisation;
- A workshop to score the options;
- Sensitivity analysis; and
- Selection of the BPEO.

2.4.2. Assessment of Strategic Options and Outcome

The short listed strategic options considered in 2006 are summarised in the table below.

Table 2.1 Short listed options in the 2006 BPEO for metallic LLW

Short-listed option	Description
National LLW facility	Waste would continue to be packed into ISO containers at source site and transported to the national LLW repository, where it would be compacted (if practical), grouted into half-height ISO containers (HHISO) or third-height ISO containers, and placed in concrete-lined trenches or vaults.
Engineered on-site LLW facility	Waste would be appropriately packaged and placed in an engineered LLW facility at the originating nuclear site and would eventually be closed off by engineered caps and landscaped. It was recognised that this approach is likely to be utilised at Dounreay to accommodate LLW waste arising from that site.
Overseas waste treatment using existing routes	Following removal of surface contamination, metals would be treated at existing sites overseas to reduce the volume and weight of the waste that has to be disposed of and recycle as much material as possible. The main technique used in countries such as Sweden, Germany and the United States is metal melting, which can allow up to 95% of the original metal to be free-released into the steel industry for recycling. Radioactive residues and secondary wastes (estimated at around 5% of the original waste material) are returned to the UK for disposal.
Regional waste treatment facilities	Following removal of surface contamination, metals would be treated at new regional sites in the UK to reduce the volume and weight of the waste that has to be disposed of and recycle as much material as possible.
National waste treatment facility	Following removal of surface contamination, metals would be treated at a new national site in the UK to reduce the volume and weight of the waste that has to be disposed of and recycle as much material as possible.

The outcome of that assessment was that in the **short term** the best option was **treatment in an overseas facility**. The key reasons for that decision were that the option was currently available; would not involve significant construction costs, would reduce solid waste generation and generation of long term contamination; allows a significant quantity of material to be recycled; and would be subject to strict licensing/permitting requirements.

The assessment concluded that in the **long term** waste treatment on a **national or regional scale** in the UK might be the favoured option. The key reasons for this were that it would align more closely with proximity, waste transport and self-sufficiency principles. Disposal of metallic wastes were considered the worst performing options in the short and long-term due to limited capacity at LLWR and other disposal facilities.

2.5. Implementation of the strategic BPEO for metallic wastes

Over past 3 years LLWR have been working with NDA, waste producers, regulators and stakeholder to develop a UK Strategy for Management of LLW from the Nuclear Industry [8]. This was subjected to public consultation and approved by Government in August 2010. In parallel to the development of the national LLW strategy, LLWR has been putting in place the enablers to implement the strategy. This includes the development of a suite of new waste services delivered through contracts with the supply chain. LLWR have established a competitive framework with a number of suppliers to ensure access to a wide range of UK and international facilities for the recycling of metal. This enables all waste producers to access these services via a convenient contractual model. This has

increased the size of the market available to the supply chain, leading to benefits in terms of lower costs through economies of scale, and has encouraged significant investment in UK facilities.

2.6. Responding to change

Since publication of the strategic BPEO for metallic wastes in 2006 there have been significant changes affecting the nuclear sector. Key examples of this include:

- Changes to Government policy and strategy on both higher activity and lower activity radioactive wastes to facilitate decommissioning and clean-up of nuclear sector legacies. Fundamental changes include the Government publishing their policy for the long term management of solid low level radioactive waste in March 2007 and the NDA publishing their UK nuclear industry low level waste strategy in August 2010. Key features of these documents include a move towards better implementation of the waste hierarchy and away from the past focus on disposal, using waste treatment assets as effectively as possible, and using the disposal capacity of the LLWR sparingly and as a last resort;
- A clear signal from Government in 2008 that new nuclear power stations should have a role to play in the UK's future energy mix and that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations. The Government also identified that active steps would be taken to facilitate this; and
- Implementation of the Government's better regulation programme which, amongst other things, aims to simplify and modernise existing legislation and change the attitudes and approaches adopted by regulators, so that regulation is transparent, accountable, proportionate, consistent and targeted. Major changes have included replacement of the requirements of the Radioactive Substances Act 1993 in England and Wales with the Environmental Permitting Regulations 2010 and replacement of the concepts of BPEO and best practical means (BPM) with best available techniques (BAT).

Section 4 considers whether the changes in the nuclear sector have the potential to change the conclusions of the 2006 strategic BPEO for metallic LLW.

3. Identification of Changes

This section identifies the changes in the nuclear sector since 2006 potentially affecting the strategic BPEO management of metallic LLW and considers the following:

- Changes to the policy, strategy and regulatory frameworks in which waste management decisions are made.
- Changes in the quantity and characteristics of the metallic LLW inventory.
- Aspects of the 2006 strategic BPEO, including its conclusions, that are subject to interpretation, in particular the meaning of “short term” and “long term”.

3.1. Policy, Strategy and Regulatory Framework

Figure 3.1 provides a summary of the main policy, strategy and regulatory requirements that have been considered to identify any changes since development of the original BPEO in 2006.

Table 3.1 considers the requirements of each of the five areas identified in Figure 3.1 and identifies whether they should be considered further as part of this review. The key findings of this exercise are:

- LLW policy has been changed to reflect the needs of large scale decommissioning;
- A strategy to support the implementation of the Government’s LLW policy has been published by the NDA and is being implemented;
- Additional radioactive wastes are expected from the development of new nuclear generating capacity in England and Wales;
- The current Government is committed to working towards a ‘zero-waste’ economy;
- A new permitting regime for radioactive waste disposal has been introduced in England and Wales; and
- The legal definition of radioactive material and radioactive waste is being amended.



Figure 3.1 Summary of Main Policy, Strategy and Regulatory Requirements since 2006

	International	Policy UK & Devolved Administrations	Regulation	Strategy	Implementation
England and Wales	<p>Article 37 & Commission Recommendations (1999/829/Euratom)</p>	<p>Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom (2007)</p> <p>Cm2919: Review of Radioactive Waste Management Policy: Final Conclusions (1995, amended 2004)</p> <p>Cm7124: Meeting the Energy Challenge: A White Paper on Energy (2007)</p> <p>Waste Strategy for England 2007</p> <p>Terms of Reference for a Review of Waste Policies (2010)</p> <p>National Policy Statements for Energy Infrastructure (draft)</p> <p>Forward policy from DECC</p>	<p>Environmental Permitting Regulations 2010</p> <p>Exemption Orders: Phosphatic Substances, Rare Earths etc Substances of Low Activity Review Programme (2011)</p> <p>Proposals for A Future Exemptions Regime under The Radioactive Substances Act 1993 and The Environmental Permitting Regulations 2010</p> <p>Nuclear Installations Act 1965 The licensing of nuclear installations</p> <p>Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008</p> <p>Regulations on the Transport of Radioactive Material</p> <p>Regulations and requirements under the Electricity Act 1989 as amended under the Energy Act 2004.</p>	<p>NDA Strategy (2006)</p> <p>Draft NDA Strategy (2010/2011)</p> <p>UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry (NDA, August 2010)</p> <p>Nuclear Sector Plan (Environment Agency, July 2009)</p> <p>LLWR Strategic Documentation VLLW Metallic waste Combustible waste</p> <p>Transport logistics</p> <p>Submarine dismantling project</p> <p>Integrated waste strategies Existing nuclear British Energy Defence</p>	<p>LLWR Company Requirements</p> <p>Environment Agency - Radioactive Substances Regulation Environmental Principles (REPs)</p> <p>HSE Safety Assessment Principles 2006 & Jan 2008</p>
Scotland*		<p>Scotland's Zero Waste Plan</p> <p>Higher Activity Radioactive Waste Policy</p>	<p>Radioactive Substances Act 1993</p>		

* where different from England and Wales

Table 3.1 considers the requirements of each of the five areas identified in Figure 3.1 and identifies whether they should be considered further as part of this review.

Table 3.1 Summary in the Changes in Policy, Strategy and Regulatory Framework since 2006

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
International treaties and conventions				
European Atomic Energy Community (EURATOM treaty) the Basis Safety Standards Directive (96/29/EURATOM).	European Union	1957	The treaty was one of the founding treaties of the EU. It was drafted to address issues relating to the field of nuclear power including the protection of the work force and general public from radiation. The Directive defines dose limits for workers stating that the limit shall be 100 millisieverts (mSv) in a consecutive five-year period, subject to a maximum effective dose of 50 mSv in any single year and Member States may decide an annual amount. For members of the public, the limit for effective dose shall be 1mSv in a year. However, in special circumstances, a higher effective dose may be authorised in a single year provided that the average over five consecutive years does not exceed 1mSv per year. There are also limits defined for apprentices and students and during pregnancy.	This change affects the assessment process and evidence generation rather than required standards of performance. At the strategic level it is not likely to have a significant affect on outcomes.
Commission Recommendation of 11 October 2010 on the application of Article 37 of the Euratom Treaty (2010/635/Euratom)	European Union	2010	<p>Article 37 of the Euratom Treaty requires Member States to provide information on any plan for the disposal of radioactive waste so that it can determine whether its implementation is liable to result in the contamination of another Member State. The European Commission must be provided with the information before the disposal is authorised by the competent authorities of the Member State concerned. A Commission Recommendation has been developed on the application of Article 37. 'Disposal of radioactive waste' is considered to cover planned disposal of waste or accidental releases from a range of activities that include:</p> <ul style="list-style-type: none"> ▪ nuclear fuel reprocessing; ▪ radioactive waste management; ▪ dismantling reactors and reprocessing plants; ▪ the emplacement of radioactive waste above or under the ground with no intention of retrieval <p>The Recommendation provides templates for the requirements of general data for each of the activities. Submissions to the Commission require a minimum of six months to process, however, this can take up to a year depending on the significance of the proposal or in cases where additional information is required.</p> <p>In summary, the revised Article 37 Recommendation has introduced some changes, of which the main change is that lower hazard sites no longer need to undertake long-range modelling if their local impacts are below stated thresholds.</p>	

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Waste Framework Directive (2008/98/EC replaces 2006/12/EC and 75/442/EEC)	European Commission	2008	<p>The 1975 framework Directive on waste revised by a number of amendments and a new codified version came into force in 2006. The Directive establishes a framework for the management of waste across the European Community. It requires Member States to:</p> <ul style="list-style-type: none"> ▪ Give priority to waste prevention and encourage re-use and recovery of waste; ▪ Prohibit the uncontrolled disposal of waste; ▪ Establish an integrated network of disposal installations; ▪ Prepare waste management plans; ▪ Ensure that the cost of disposal is borne by the waste holder; ▪ Ensure waste carriers are registered; ▪ Ensure that waste is recovered or disposed of without endangering human health. <p>The Directives overarching requirements are supplemented by other Directives for other waste streams.</p>	There have been no significant changes in requirements since 2006.

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Policy of the UK Government and devolved administrations				
Cm2919: Review of Radioactive Waste Management Policy: Final Conclusions	Produced by Defra Now the responsibility of DECC	1995; amended 2004	<p>Cm2919 sets out the conclusion of a review of radioactive waste management policy carried out by the Government.</p> <p>The main conclusions were that radioactive waste management policy should be based on the same basic principles that apply more generally to sustainable development. These are that:</p> <ul style="list-style-type: none"> ▪ decisions should be taken on the basis of the best possible scientific information; ▪ where there is uncertainty and potentially serious risks exist, precautionary action may be necessary; ▪ ecological impacts must be considered, particularly where resources are non-renewable or effects may be irreversible; ▪ cost implications should be brought home directly to the people responsible as expressed by the polluter pays principle; ▪ self-sufficiency is an important principle and countries should be encouraged to develop their own solutions to waste management problems. <p>Whilst many of the details of Cm2919 have now largely been superseded by Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom, the elements identified above still apply.</p>	<p>There have been no significant changes in the principles identified in the column to the left since 2006.</p> <p>However many of the details of Cm2919 have been superseded by the 2007 LLW policy statement and the MRWS programme.</p>

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom	<p>Produced by Defra, DTI and the Devolved Administrations.</p> <p>Now the responsibility of DECC and the Devolved Administrations.</p>	<p>2007</p>	<p>The policy statement replaces much of Cm2919, and covers all aspects of the generation, management and regulation of solid LLW. The document provides a high level framework within which individual LLW management decisions should be taken but emphasises that decisions should be made on a case by case basis whilst ensuring that the solutions are safe, environmentally-acceptable and cost-effective. The main changes brought about by the policy statement are:</p> <ul style="list-style-type: none"> ▪ The definition of low level waste (LLW) no longer refers to specific disposal sites. ▪ Waste is to be managed in accordance with the waste management hierarchy principles set out in waste strategy documents. ▪ Very low level radioactive waste (VLLW) can now be defined in two ways. Controls on disposals are not required for single items or volumes $\leq 0.1 \text{ m}^3$. Bulk disposals of high volume VLLW (HVVLLW) will require the regulator to put in place controls on disposal for the landfill site receiving the waste. ▪ All practicable options should be considered by operators for the long term management of LLW, and implementation of options should be subject to a satisfactory risk assessment and optimisation study, as required by relevant regulatory bodies. ▪ Disposal of LLW to an appropriately engineered facility (above or below ground) with no intent to retrieve the waste should be the end point for LLW following application of the waste hierarchy. Postponing final disposal to future generations is unjustified. ▪ Relevant options for disposal of LLW following application of the waste management hierarchy that can be considered include: <ul style="list-style-type: none"> - disposal to facilities that have yet to be constructed to take LLW (where this is deemed to be necessary); - disposal to near-surface facilities of the kind employed at the LLWR near Drigg, where disposal is by way of compaction, grouting and placement in a concrete vault; - disposal to specific areas of, or adjacent to, nuclear licensed sites (e.g. the current landfill-type disposal at Sellafield) or to disposal facilities that might, in future, be constructed at, or adjacent to, nuclear sites; - in-situ disposal; that is, burial at the point of arising; - disposal at specified landfill sites for LLW and high volume VLLW, including the practice of “controlled burial”, providing that this meets specified regulatory requirements; - general disposal of low volume VLLW to an unspecified destination, together with municipal, commercial or industry wastes. 	<p>There have been significant changes in the Government’s policy on solid LLW.</p> <p>The strategic BPEO for metallic wastes needs to be assessed in light of these changes.</p>

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
			<ul style="list-style-type: none"> ▪ Controlled disposal by burial of LLW and VLLW waste from nuclear sites in landfills should not be precluded, provided the necessary safety assessments can be carried out to the satisfaction of the environmental regulators. ▪ Presumption towards management solutions that can be implemented early rather than late noting that early solutions does not necessarily equate to early disposal. ▪ Consideration of the proximity principle during the development of waste management plans. ▪ The import and export of LLW to and from other OECD and EU countries can be authorised but only following an assessment of all practicable options, and should only be allowed for the recovery of re-useable materials or for treatment that will make its subsequent storage and disposal more manageable. Any secondary wastes arising from import / export for treatment should be returned to the country of origin. ▪ Communities should take greater responsibility for how they deal with non-nuclear industry LLW arisings, e.g. hospitals, universities. 	
Scotland's Higher Active Waste Policy	The Scottish Government	2011	The policy does not directly apply to LLW, but sets out the Scottish Government's position on higher active wastes, specifically that they do not support deep geological disposal of radioactive waste, and that the focus should be on long-term management of higher activity radioactive waste in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. Developers will need to demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved. All long-term waste management options will be subject to robust regulatory requirements.	The proximity principle is particularly important for radioactive waste management in Scotland. This should be taken into account in the review.

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
The Radioactive Substances Act 1993 (Application for an Authorisation to Dispose of Solid Low Level Radioactive Waste from Dounreay) (Scotland) Direction 2005	Scottish Executive (Now the Scottish Government)	2005	In 2005 the Scottish Executive directed the Scottish Environment Protection Agency (SEPA) not to authorise consignments of LLW from Dounreay to the national LLW repository in Cumbria. In the accompanying explanatory document, the Scottish Ministers stated their support for the long-term disposal of Dounreay LLW at Dounreay.	There have been no significant changes in the Scottish Government's position since 2006.
Cm7124: Meeting the Energy Challenge: A White Paper on Energy	Produced by DTI Now the responsibility of DECC	2007	In 2006 the Government's policy on nuclear new build had already been set out earlier in Cm5761 (2003), which stated that the economics at the time made nuclear new build an unattractive option for new, carbon-free generating capacity. Furthermore Cm5761 identified that important issues associated with managing current and potential future nuclear wastes needed to be resolved as part of any decision on nuclear new build. However, the policy also recognised that new nuclear build might be necessary if the UK was to meet carbon targets and that public consultation would be required before proceeding with the building of new nuclear power stations.	The NDA / LLWR will have to accommodate metallic LLW from nuclear new build.
Cm7296: Meeting the Energy Challenge – A White Paper on Nuclear Energy	Produced by BERR Now the responsibility of DECC	2008	In 2007 Cm7124 set out the revised overall policy for energy in the UK. The policy indicated that it was the Government's preliminary view that it is in the public interest to give the private sector the option of investing in new nuclear power stations. This policy was subject to the consultation along side Cm7124. However, if the Government also indicated that it would be for the private sector to fund, develop, and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs. In 2008 the Government published their current policy on nuclear energy (Cm7296), and stated that: "The Government believes it is in the public interest that new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to open up the way to the construction of new nuclear power stations. It will be for energy companies to fund, develop and build new nuclear power stations in the UK, including meeting the full costs of decommissioning and their full share of waste management costs." With respect to waste and decommissioning, the main focus of Cm7296 is on higher activity wastes. However, the paper also reinforces the responsibility of the NDA for developing and maintaining a national strategy for handling LLW from nuclear sites and for ensuring continued provision of the waste management and disposal facilities required.	This should be taken into account in the review.

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Revised Draft National Policy Statement for Nuclear Power Generation (EN-6) Volume I of II	DECC	2010	Between November 2009 and February 2010, the previous Government consulted on the six draft Energy NPSs and the Appraisals of Sustainability (AoS) that accompanied those NPSs. The Coalition Government made changes to the draft Energy NPSs and AoSs and ran a second consultation from 18 October 2010 to 24 January 2011. The main feature of the draft nuclear NPS relevant to this review is the acknowledgement that new nuclear power stations will produce low level waste and that the Government considers that arrangements already exist for the effective management and disposal of wastes in these categories, as demonstrated by the UK's experience of dealing with such wastes from existing nuclear power stations.	The NDA / LLWR will have to accommodate metallic LLW from nuclear new build. This should be taken into account in the review.
Revised Draft National Policy Statement for Nuclear Power Generation (EN-6) Volume II of II - Annexes	DECC	2010		
Cm7086 Waste Strategy for England 2007	Defra	2007	In 2006 the Government's overall strategy on waste in England and Wales had already been set out earlier in Cm4693 (2000), which required application of the waste hierarchy and set targets for recycling and recovery. The primary focus of the strategy was on municipal solid waste and discussion concentrated mainly on the different types of waste facility (i.e. landfill or waste management).	The move towards 'zero waste' and 'responsibility deals' might influence the assessment of options for on-site or local treatment of wastes.
Terms of Reference for a Review of Waste Policies	Defra	2010	In 2007, the Government published their current waste strategy for England. This again highlighted the importance of the waste hierarchy, but also shifted emphasis up the waste hierarchy to decouple waste growth from economic growth. Strategic aims included meeting and exceeding the Landfill Directive diversion targets for biodegradable municipal waste; increasing diversion from landfill and securing better integration of treatment for municipal and non-municipal waste; and securing investment in infrastructure whilst getting the most environmental benefit from that investment. The 2007 strategy also identified that the construction sector is the largest single source of waste arisings in England, reflected in a target to half the amount of construction and demolition (C&D) waste sent to landfill by 2012. This policy is therefore particularly relevant to nuclear sector decommissioning projects. The current waste strategy is being reviewed by the Coalition Government. The terms of reference of that review identify that the Government is committed to working towards a 'zero waste' economy (i.e. move towards zero waste to landfill.). Other themes include a focus on waste prevention, reuse and recycling, value for money, fiscal incentivisation to help individuals and businesses take action, resource efficiency, decentralised decision making and energy recovery.	
Scotland's Zero Waste Plan	The Scottish Government	2010	This strategy for Scotland emphasises an approach that makes the most effective use of all resources, and avoids wasting resources or making them unusable wherever possible. The strategy recognises that household waste only accounts for less than a fifth of all waste in Scotland, and will encourage waste prevention and increase the quantity and quality of resources recycled. The strategy also indicates that it gives clear signals that to allow for planning and investment decisions for the future.	

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Towards Zero Waste: The Overarching Waste Strategy Document for Wales	Welsh Assembly Government	2010	The Strategy for Wales also emphasises the move towards zero waste, with the key way of achieving this to be focussing on the most significant sectors to achieve this.	
Regulation				
Environmental Permitting Regulations 2010 (EP Regulations)	HM Government / Defra	2010	The EP Regulations were introduced on 6 April 2010, and replace RSA93 in England and Wales. It should be noted that in Scotland RSA93 still applies and in England and Wales the current radioactive substances Exemption Orders issued under RSA93 are still relevant. Theoretically there should be minimal differences in the legal requirement between the two sets of legislation, as the aim of the EP Regulations was to simplify and streamline the permitting process rather than to change how radioactive substances are regulated.	Implementation of Government policy rather than the legislation itself is more relevant for the strategic review.
Radioactive Substances Act 1993 (RSA93)	HM Government / Scottish Government	1993	Schedule 23 of the EP Regulations sets out the regulatory requirements in England and Wales. Although the language in Schedule 23 differs from that set out in RSA93 the main requirements are broadly similar and are summarised below. The keeping and use of radioactive materials requires a permit (or registration) from the environmental regulator. The disposal and accumulation of radioactive wastes requires a permit (or authorisation), although on nuclear sites the scope of that permit (or authorisation) does not include the accumulation of radioactive wastes. The environmental regulators are empowered to grant permits (or registrations/authorisations) and can include limitations and conditions as they see fit. During their determination of applications made for permissions at nuclear sites the environmental regulator consults with a range of bodies, including the general public, and takes accounts of all relevant factors in deciding whether to grant the permit/authorisation and which limitations or conditions it should apply. Government policy, international treaties and best practice are considered to be relevant factors.	
Environmental Permitting Guidance Radioactive Substances Regulation: For the Environmental Permitting (England and Wales) Regulations 2010: Version 1.1	Defra	2010	Some differences in approach between Defra and the Scottish Government and between the Environment Agency and SEPA are emerging. For example the EP Regulations no longer require permits in England and Wales to identify specific site(s) at which the waste will ultimately be disposed of. Instead waste can be treated or disposed at any site that is appropriately permitted to receive it. The Defra guidance on the EP Regulations for radioactive substances activities requires the Environment Agency to consider a range of factors when permitting nuclear sites for the disposal of radioactive waste, including: <ul style="list-style-type: none"> ▪ Basic Safety Standards Directive; ▪ Implementing Government policies, including those for the long term management of solid low level radioactive waste in the UK (2007) and decommissioning of the UK nuclear industry's facilities (2004). 	

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Exemption Orders review programme	DECC	2011	<p>DECC and the Scottish Government are reviewing the Exemption Orders under the EP Regulations and RSA93 to make them easier to use, while still ensuring they provide appropriate protection to human health and the environment. It is planned that the amended regulations and exemption orders will be enacted in October 2011 and will be made under the EP Regulations in England and Wales and RSA93 in Scotland. The schedules in the EP Regulations / RSA93 that define radioactive material and waste are also being amended to more accurately reflect the contents of the Basic Safety Standards Directive.</p> <p>The most significant changes is likely to involve the removal of unconditional exemptions provided in the Phosphatic Substances and Rare Earths etc. and Substances of Low Activity exemption orders, replacing them with the referenced schedule identified above. The current conditional exemption orders will be collated into a single exemption order. The new approach will also provide a clearer definition of what is and is not naturally occurring radioactive material (NORM) and a radioactive material or waste.</p>	<p>Some wastes are likely to be reclassified when the new Exclusion / Exemption regime becomes effective.</p> <p>This should be taken into account in the review.</p>
<p>Nuclear Installations Act 1965 (as amended) (NIA65)</p> <p>The licensing of nuclear installations</p>	HM Government / HSE	2007	<p>NIA65 controls certain nuclear installations and operations. It requires that licences be granted for those installations and operations covered by the act unless an exemption is granted by the appropriate minister. The licensing authority may attach to any licence granted such conditions as are considered necessary or desirable in the interest of safety.</p> <p>In terms of radioactive waste management any installation for <i>'the storage, processing or disposal of nuclear fuel or of bulk quantities of other radioactive matter, being matter which has been produced or irradiated in the course of the production or use of nuclear fuel'</i> is subject to the provisions of the Act.</p> <p>The HSE's Nuclear Safety Division is responsible for regulating against NIA65. It has produced 36 standard licence conditions that are applied to all premises licensed under the Act. Additional guidance has been produced to assist operators of licensed sites demonstrate compliance with the licence conditions.</p>	<p>There have been no significant changes since 2006 in the requirements nuclear site licences.</p>

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008	HM Government / Environment Agency	2008	<p>A Transfrontier Shipment (TFS) authorisation is required from the Environment Agency (in England and Wales) before any import or export can be made of radioactive waste or spent fuel. Before the Environment Agency can authorise any transfrontier shipment they must be certain that the country receiving the waste is capable of managing the waste safely and obtain the consent of the authorities of the countries directly involved, as well as the NII for nuclear sites. Before authorising any transfrontier shipment the Environment Agency considers other environmental issues such as carbon footprint and proximity principle.</p> <p>The Environment Agency has received an increasing number of applications for the export of low-level waste for treatment to the USA, Sweden and Germany. Transfrontier shipments that have been authorised include shipment of 2,500 tonnes of LLW scrap metals from Studsvik's MRF in West Cumbria to their melting treatment site in Sweden (TFS/2009/006).</p>	The review should take into account the relationship between TFS authorisations and the Policy for the Long Term Management of Solid LLW in the UK
The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009	HM Government / Department for Transport's Radioactive Materials Transport Team	2009	<p>The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 are concerned with the safety and security associated with the transport of radioactive material and implement International Atomic Energy Agency (IAEA) Regulations setting technical criteria and requirements. The regulatory responsibilities for this will be absorbed into the new Office for Nuclear Regulation (ONR).</p> <p>There have been a number of changes to these regulations since 2006, although these are primarily associated with security of the materials involved rather than changes that affect LLW waste management options.</p>	There have been no significant changes since 2006 in the requirements on transport of radioactive materials.
Energy Act 2004 – Part I	HM Government / NDA	2004	<p>Part I of the Energy Act 2004 created the Nuclear Decommissioning Authority (NDA) which is responsible for managing and discharging liabilities associated with the UK's civilian nuclear programme. The Act requires the NDA to fulfil its functions with regard to safety, security, value for money and protection of the environment. The NDA is also required to produce a strategy at least every five years which is subject to public consultation prior to approval by the Secretary of State for Energy and Climate Change and Scottish Ministers.</p> <p>The NDA requires its sites to produce integrated waste strategies (IWS) to help them inform the national waste strategy. For some nuclear sites, this requirement is reinforced through the radioactive substances permit / authorisation. Developing an integrated waste strategy also helps site operators demonstrate compliance with the nuclear site licence, in particular Condition 32.</p> <p>Whilst the NDA and the requirement for integrated waste strategies were in place in 2006, understanding of what it is trying to achieve has matured since that time.</p>	See discussion below under strategy.

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Development control and planning requirements under the Electricity Act 1989 as amended under the Energy Act 2004	HM Government / DECC	2004	DECC administers applications from developers seeking consent under Section 36 of the Electricity Act 1989 to build national energy infrastructure projects, including new nuclear power stations where the capacity is more than 50 MW. Applications for consent should include an Environmental Impact Assessment. In determining the application the Secretary of State must take account of relevant factors. These factors can vary from case to case but include Government Policy (both energy and other Government policies); planning considerations (including national, regional and local plans and guidance); environmental issues; local issues and the views of the relevant planning authorities and local people; Government statutory advisers; the applicant's arguments in favour of the proposal; and any other relevant representations received on the proposal.	See discussion above on the revised draft NPS for nuclear power generation (EN-6) .

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Strategy				
NDA Strategy	NDA	2006	In 2006, the NDA's first strategy set out a strategic approach for the sites for which they are accountable. At that time the Scottish Executive had recently directed SEPA not to authorise consignments of LLW from Dounreay to the LLWR (see discussion above under policy) and the Environment Agency was reviewing the radioactive substances authorisation for the LLWR. This uncertainty was recognised at that time and the preferred strategy for LLW was that, where possible, sites should host their own LLW facilities, in particular for HVLLW.	There have been significant changes in the overall strategy for managing radioactive waste since 2006. This should be taken into account in the review.
Draft NDA Strategy	NDA	2010	The NDA has recently consulted on their draft revised strategy. This emphasised application of the waste hierarchy for solid LLW to make the best use of the remaining LLWR capacity. The draft strategy identified that recycling of metallic LLW is the preferred way forward, that waste should be size reduced to ensure best use of disposal capacity; and that the disposal capacity should be used sparingly and as a last resort. Improved use of the waste hierarchy should reduce disposal volumes by waste prevention, reusing materials and recycling wherever possible. It was identified that ways of achieving this included better waste characterisation and inventory data. For waste that has to be disposed of the NDA would seek the use of the most appropriate (and proportionate) disposal option, including diverting waste away from the LLWR. The strategy also included a commitment to review available and projected capacity for the management of LLW in the UK.	
UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry	NDA	2010	This strategy clearly identifies that recycling is the preferred way forward for the treatment of metallic LLW, and also identifies a number of key activities to encourage this, specifically: <ul style="list-style-type: none"> ▪ Support to LLWR 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. ▪ Work with the supply chain and LLWR 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. ▪ Site licence companies must demonstrate that they are making best use of available metal treatment routes. ▪ Waste producers will be given support in demonstrating the value of metal recycling over disposal, beyond simple gate price cost comparisons. 	

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Nuclear Sector Plan	Environment Agency	2009	This strategy includes an object for operators to use the waste management hierarchy as much as possible and to minimise unnecessary use of LLWR as a national asset. Key performance indicators identified by the Environment Agency to assess this include the percent of LLW sent for reuse or recycling; disposal to routes other than LLWR (such as incineration and disposal as HV VLLW to landfill); and disposal to LLWR.	This plan mirrors the draft NDA strategy. Taking that strategy into account will also address this plan.
LLW Transport Hubs Assessment	LLWR	2010	The following key issues were identified for transport of LLW and implementation of the current strategic BPEO for metallic wastes: <ul style="list-style-type: none"> ▪ Historically there was no effective segregation of metallic and combustible LLW, reducing the transport and waste management options available for these wastes. ▪ Segregation efficiencies for solid LLW waste types are expected to increase from 25% in 2008 to 75% in 2015. ▪ Metal treatment and incineration of combustible wastes have lower transport costs and gate fees, compared with disposal at the LLWR. 	This assessment mirrors UK Strategy for the Management of Solid LLW from the Nuclear Industry . Taking that strategy into account will also address this assessment.
Submarine dismantling project	MOD	2010	The key underpinning principles and assumptions of the submarine dismantling project are that relevant to metallic LLW are that: <ul style="list-style-type: none"> ▪ For defence and security reasons, the UK's redundant submarines cannot be disposed of abroad; ▪ LLW will continue to have a disposal route via the NDA. 	These assumptions should be taken into account in the review

Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
Implementation				
Regulatory Guidance Series, No RSR 1: Radioactive Substances Regulation – Environmental Principles	Environment Agency	2010	<p>This guidance note identifies ten fundamental principles that the Environment Agency will apply in permitting and regulating operators. Three of these principles are of particular relevance, and they are summarised below.</p> <p>Integrated planning: All radioactive substances should be managed within integrated strategies that plan their complete lifecycle taking account of all interactions, dependencies and principles.</p> <p>Selecting and implementing management options: The best available techniques (BAT) for the management of radioactive substances should be used. These should be identified from systematic consideration of potential alternatives. Consideration should include human health, safety, the environment, waste prevention, minimisation and disposal and other likely costs and benefits. The term BAT is essentially the same as the existing concepts of best practicable environmental option and best practical means. BAT should be used to achieve a high degree of protection of the environment, taken as a whole and to meet the principle of optimisation. Where an operator uses BAT they will be taken to have reduced discharges and exposures to as low as reasonably achievable. This together with consideration of the local environmental conditions, the technical characteristics of the facility, and its location, provides the basis for permit conditions and limit values. The BAT approach involves consideration of costs and benefits to ensure that the cost of applying techniques is not grossly disproportionate in relation to the environmental protection they provide.</p> <p>Uncertainties and the precautionary principle: Decisions about radioactive substances should take into account uncertainties and where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost effective measures to prevent potential harm to people and the environment</p>	<p>These principles formalise regulatory principles that have been used by the Environment Agency since the late 1990s.</p> <p>There have been no significant changes since 2006.</p>

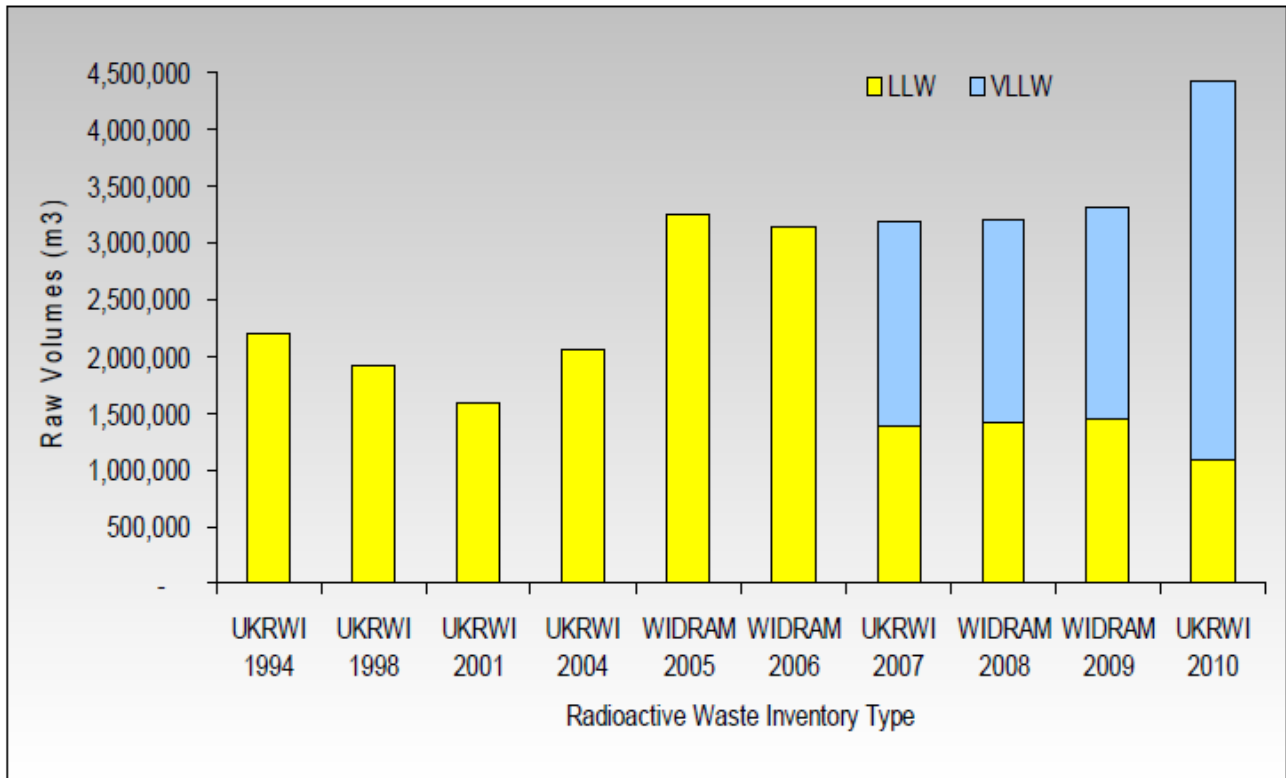
Relevant document	Owner	Date	Summary of requirements and changes since 2006	Implications
HSE Safety Assessment Principles	HSE	2006 & 2008	<p>This guidance note identifies seven fundamental principles that the HSE will apply in regulating waste management at nuclear sites, these are briefly summarised below:</p> <ul style="list-style-type: none"> ▪ A strategy should be produced and implemented for the management of radioactive waste on a site. ▪ The generation of radioactive waste should be prevented or, where this is not reasonably practicable, minimised in terms of quantity and activity. ▪ The accumulation of radioactive waste on site should be minimised. ▪ Radioactive waste should be characterised and segregated to facilitate subsequent safe and effective management. ▪ Radioactive waste should be stored in accordance with good engineering practice and in a passively safe condition. ▪ Radioactive waste should be processed into a passively safe state as soon as is reasonably practicable. ▪ Information that might be required now and in the future for the safe management of radioactive waste should be recorded and preserved. 	<p>These principles formalise regulatory principles that have been used by HSE since the late 1990s.</p> <p>There have been no significant changes since 2006.</p>



3.2. Changes in the metallic LLW inventory

A summary of the changes in inventory volumes since 1994 is shown in Figure 3.2 [5].

Figure 3.2 Trends in Inventory Volumes Since 1994



The Figure shows that inventory volumes have increased significantly over the last 15 years. Since 2007, the inventory has been segregated into fractions that are within the LLW and VLLW activity categories. In recent years, the increased overall volumes have been driven by increases in the VLLW fraction whilst the LLW proportion has decreased slightly.

The 2006 Strategic BPEO was based on information from the 2001 & 2004 Radioactive Waste Inventories and additional market intelligence. The analysis of these historic inventories indicated that bulk metallic LLW arisings in the UK were expected to be around 450,000 tonnes, of which over 90% would be ferrous metal. Metallic wastes therefore represented a significant proportion of the anticipated LLW arisings for which there was an urgent need to consider effective waste management options, resulting in the strategic BPEO assessment for metallic wastes in 2006.

As discussed in Section 2.3, contaminated metals represent about a 17% or 780,000 tonnes of the inventory. Within the LLW category, metals represent over 41% (480,000 tonnes) of the inventory with the main types of metallic wastes being ferrous metals, primarily steels, with other metals including aluminium, copper and lead.

It can be seen from the analysis above that total quantities of LLW and VLLW metal within the inventory have increased significantly, albeit the quantities classed specifically as LLW (i.e. excluding VLLW) have only increased marginally.

It should be noted that the actual arisings over the last few years have only been typically around 30% of those forecasted within the inventory. This is due to a number of reasons including better implementation of the waste hierarchy, conservatism within the original estimates, and the deferment of previously scheduled decommissioning work across the NDA estate.

3.2.1. Future changes to metallic waste inventory

There are a number of policy and regulatory changes which will change the future inventory of metallic wastes. Although it is not possible at this stage to quantify accurately how these changes will influence the total inventory of LLW and VLLW metals, the potential effects of these changes are briefly summarised in Table 3.2.

Table 3.2 Factors Influencing the Metallic Waste Inventory in the Future

Factor influencing metallic waste inventory		Potential effect
Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom	Changes to definition of LLW and HVVLLW.	Likely neutral effect on overall inventory, but may increase the proportion of VLLW compared to LLW.
Draft NDA Strategy	Improved used of the waste hierarchy.	Expected reduction in disposal volumes by waste prevention, reusing materials and recycling wherever possible.
Cm7124: Meeting the Energy Challenge: A White Paper on Energy	The NDA / LLWR will have to accommodate metallic LLW from nuclear new build.	Expected increase in disposal volumes associated with operations, but increase is likely to be small compared to the volumes of metallic wastes associated with decommissioning of existing facilities. Decommissioning metallic wastes from new build should be less than existing decommissioning wastes due to improvements in design and planning for decommissioning.
Exemption Orders review programme	Some wastes are likely to be reclassified when the new Exclusion / Exemption regime becomes effective.	Some wastes currently classed as LLW/VLLW may become exempt. Equally some exempt waste may become LLW/VLLW as some radionuclide limits are decreasing. The impact on the overall inventory volumes is therefore difficult to assess with certainty.

3.2.2. Use of the inventory in the 2006 strategic BPEO

The 2006 strategic BPEO recognised that the inventory at that time was largely based on estimates which might contain some inherent uncertainties and that site operators would likely hold more accurate and up to date information. For example minor discrepancies were identified regarding the weights presented for the Trawsfynydd boilers. Nevertheless, it was considered that at the national scale the impact of these uncertainties would be minor.

The main features of the interpretation and use of the inventory data in 2006 as follows:

- The overall inventory was based on long timescales for decommissioning with decay storage on-site to allow the short-lived radionuclides to decay below the LLW thresholds. However, decay storage might not be possible under the NDA's proposed accelerated decommissioning timetable, resulting in a potential increase in metallic waste volumes classified as LLW.
- Detailed arisings at any particular site would not unduly influence the selection of the BPEO.
- The largest opportunity for managing metallic wastes was associated with the ferrous metals that would arise from decommissioning and which could represent over 90% of all metallic LLW waste.
- The assessment attributes only used the inventory data on a qualitative basis:
 - The assessment attribute looking at the **short term flexibility** was designed to evaluate the ability of the option to cope with variation and uncertainty in the volumes and inventory of metallic LLW waste within a short-term timescale (i.e. up to 2008). It was recognised that there was the potential for significantly higher short-term LLW arisings than the historic assumptions and forecasts if the proposed NDA accelerated decommissioning strategy was implemented.
 - The long term flexibility attribute considered the influence of variations and uncertainty in the volumes and inventory of metallic LLW waste over the lifetime of the NDA's decommissioning programme.
- The assessment scoring only used the inventory data on a qualitative basis.
- The assessment weighting only used the inventory data on a qualitative basis:
 - The short term flexibility attribute was give a weighting score of 3, in recognition of the inherent uncertainties associated with current waste estimates arising from the decommissioning programme and the limited capacity at the LLWR.
 - The long term flexibility attribute was given a weighting score 1 as it was considered that there would be a reasonable amount of flexibility over the long-term for all options.

3.2.3. Implications of inventory changes for review of 2006 strategic BPEO

The 2006 strategic BPEO assumed that the accelerated decommissioning schedule presented in the NDA's Strategy might result in significantly higher short-term metallic LLW arisings than the historic assumptions and forecasts. This in turn influenced the long term and short term flexibility assessment criteria used for the 2006 strategic BPEO (see Section 3.3).

In reviewing the inventory data, this review has identified two ways in which this assumption is challenged. Firstly, there have been considerable changes in the estimated quantity of metallic wastes expected since 2006, as detailed in Sections 0 and 1.1.1. Overall, the data shows that the total inventory of metallic VLLW and LLW expected to be consigned has increased by approximately 60% from ~ 450,000te to 780,000te. Most of this increase is due to volumes from decommissioning activities post-2020.

Secondly, operational experience indicates that nuclear sites are currently only typically consigning 30% of their predicted annual waste (see Section 0).

Whilst the inventory is likely to evolve further in the future (see discussion in Section 3.2.4), the main implication of these differences is that demand for metallic LLW management services in the short to medium term is unlikely to be as high as that predicted in the 2006 strategic BPEO.

3.3. Review of Interpretation of the 2006 Strategic BPEO

One of the conclusions of the 2006 strategic BPEO was that in the **long term waste treatment on a national or regional scale** in the UK might be the favoured option. The key reasons for this were that it would align more closely with proximity, waste transport and self-sufficiency principles.

When analysing the 2006 study it is clear that there is some scope for the interpretation of what short-term and long-term actually mean. These criteria were used as part of the screening process to narrow down the option taken forward for full consideration. In other words, if an option was to be considered as a potential short-term solution it needed to be available within the next 2-3 years. For an option to be considered as a potential long-term solution, it needed to be available within the next 10 years.

These criteria are reasonable as a decade is a sensible planning timescale to consider the availability of waste management options. However, the implications of these constraints meant that options that might take more than 10 years to develop were screened out of the original BPEO study at an early stage.

As 5 years have elapsed since the original study was conducted the options that were screened out have been reviewed to see whether any of these now fall within the next 10 year time horizon. For example, the option to re-use metals within new nuclear build was screened out from the original study as new nuclear build was not envisioned at the time. The recent changes to Government energy policy now mean that this option could be considered, however, the scope to utilise this option is judged to be very limited in overall terms.

Despite the recent industry developments and changes in policy environment, no new significant options have emerged that would challenge the overall short-term and long-term options that were assessed in the original BPEO. This conclusion should be kept under review as new options may emerge over the coming years.

The meaning of 'short term' and 'long term' is implicit in the definition of the screening criteria used in the initial options assessment, which are repeated below:

Table 3.3 Definition of Long and Short Term based on the Screening Criteria in the 2006 Strategic BPEO

Screening criteria	Definition
Short term screening criteria	
ST1: Option must be within 2-3 years	The option must be capable of being operational on a significant scale within the next 2-3 years.
ST2: Technology must be available now	The technology or technique should be sufficiently developed to be considered 'available' now. This immediate availability is required to allow sufficient time for deployment (planning and regulatory approvals, construction, etc.) of the option within the 2-3 year timescale.
ST3: Technology must be proven	The option should be a tried, tested and be proven technology as a management option for metallic LLW. A technology should also be proven on a scale large enough to enable it to make a reasonable contribution to UK LLW waste volumes if implemented without significant further scale-up R&D.
ST4: Option must relieve short-term pressure on current LLWR capacity	Current practice is for most UK LLW to be disposed of at the LLW repository near Drigg in Cumbria. In the next few years (i.e. the short-term), capacity at LLWR may be extremely limited due to operational constraints.
Long term screening criteria	
LT1: Option must be available [...] within a 10 year development timetable.	<p>To be a viable long-term option it must be capable of being operational [within 10 years] at the latest to meet the NDA's current 'accelerated decommissioning' objectives.</p> <p>To enable newer technologies to be operating at full scale [within 10 years], it is considered that a new LLW management technology would have to be considered 'available' around 10 years prior to full operation to allow for activities such as pilot studies, scale-up, design, construction, commissioning, planning and regulatory approval.</p>
LT2: Technology must be available in 5 years	<p>For an option to be viable in the long-term, it should be sufficiently mature that the majority of the research and development required before the technology or technique is considered to be 'available' can be completed within the next 5 years.</p> <p>This is to allow sufficient time for testing, pilot studies, demonstrations, and operational deployment of new technologies within the [10 year] timescale.</p>

Screening criteria	Definition
LT3: Option must reduce LLW liabilities	<p>A key objective is to develop an appropriately balanced UK LLW strategy to deal with the wastes generated from decommissioning and clean-up of NDA licensed sites. This overall focus is aimed at reducing the overall liability passed on to future generations by use of effective waste management techniques and maximising value for money for the taxpayer. [...]. For an option to be viable in the long-term it should reduce the overall liability of metallic LLW management. For the purposes of this strategic BPEO assessment the 'liability' of metallic LLW can be defined in the following terms:</p> <ul style="list-style-type: none"> ▪ Amount/volume of waste that requires final disposal. ▪ UK financial and legal responsibility for managing the waste. ▪ Requirement for ongoing management, monitoring and maintenance over an extended period of time (i.e. intergenerational responsibility) with a preference for early waste management solutions. ▪ Finality of the disposal solution. <p>For an option to be considered viable it should reduce one or more of the aspects of LLW liability listed above.</p> <p>Options that temporarily hold or store the metallic waste, but do not reduce the eventual disposal volume or future management burden would therefore not be considered to reduce the overall liability of the waste in the long-term.</p>
LT4: Option must align with international conventions.	Self explanatory.

4. Implications of Changes on 2006 Study

A detailed assessment has been undertaken of the implications of the changes identified in Section 3 on the findings of the 2006 BPEO study. The outcomes of this assessment are presented in Table 4.1. Key findings are summarised as:

- A significant number of the changes identified in section 3 of this study do not present a potential challenge to the findings of the 2006 BPEO study and can, therefore, be disregarded from further consideration;
- A number of the changes identified in section 3 have the potential to change elements of the 2006 BPEO study, such as scorings or weightings, but none of these result in a significant changes to the conclusions of the 2006 BPEO study;
- Consideration of current throughput of metallic LLW indicates the potential to extend the 'short-term' options beyond that indicated in the 2006 BPEO study to, for example, 10 years;
- A reduction in demand for metallic LLW treatment services is likely to result in a more measured pace towards developing a business case to fulfil the 'long-term' options; and
- The conclusions of the 2006 BPEO study are not fundamentally altered as a result of the changes identified in section 3.

Table 4.1 Implications of Changes on the outcome of the 2006 strategic BPEO

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
1.	UK Solid LLW Policy	The definition of low level waste (LLW) no longer refers to specific disposal sites.	No	Due to the strategic nature of the 2006 BPEO the general definition of LLW (i.e. not referring to specific sites) was used. This change is unlikely to have a significant effect at a strategic level.
2.	UK Solid LLW Policy	Waste is to be managed in accordance with the waste management hierarchy principles	Yes	The waste hierarchy is implicitly examined under the 'Life-cycle materials and energy requirement (resource conservation)' attribute. The contents of the draft policy were also considered as an 'additional attribute' during the workshop. It was concluded by workshop attendees that the waste hierarchy was adequately addressed by other attributes and did not warrant independent evaluation. The 2006 strategic BPEO includes consideration of the waste hierarchy.
3.	UK Solid LLW Policy	Affect of changes in definition of VLLW, HVVLLW and LLW (including on inventory of metallic LLW.)	No	These changes could affect the types of treatment needed and the inventories of materials needing to be treated, although they do not affect the overall principles of seeking the BPEO. The change in inventories is unlikely to challenge the BPEO as the inventory data used in the 2006 assessment was used in a qualitative rather than quantitative basis.

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
4.	UK Solid LLW Policy	Options must be considered for long term management of LLW, with implementation subject to a satisfactory risk assessment and optimisation study.	Yes	The 2006 strategic BPEO facilitated consideration of options in accordance with this requirement. Implementation will be subject to robust processes that include risk assessment and optimisation (BAT/ALARP) studies.
5.	UK Solid LLW Policy	End point for LLW following waste hierarchy should be disposal with no intent to retrieve the waste.	No	One of the options identified for detailed assessment was disposal to LLWR. The waste hierarchy is implicitly considered under the 'Life-cycle materials and energy requirement (resource conservation)' attribute.
6.	UK Solid LLW Policy	Disposal to facilities that have yet to be constructed to take ILW (where this is deemed to be necessary);	No	The disposal of metallic waste to an ILW facility is not precluded by the 2006 strategic BPEO.
7.	UK Solid LLW Policy	Disposal to near-surface facilities of the kind employed at the LLWR near Drigg, where disposal is by way of compaction, grouting and placement in a concrete vault;	No	This is not specifically considered in the study. However disposal at LLWR (option 2.4) and disposal in an engineered near-surface facility (option 2.15) are assessed and performed relatively poorly. It is recognised that these options would only be selected if metallic wastes cannot be reused or recycled.
8.	UK Solid LLW Policy	Disposal to current or future facilities at or adjacent to nuclear sites.	No	This is option 2.15 in the 2006 strategic BPEO. It is rejected from the short-term options as it could not be ready within 3 years and from the long-term options as it does not reduce the liability of the waste as it is considered only as a stand-alone option, i.e. without prior treatment. However, it has been brought back into the short-listed options as a reference scenario.
9.	UK Solid LLW Policy	In-situ disposal (i.e. burial) at the point of arising.	Yes	This is option 2.8 in the 2006 strategic BPEO and was screened out from the short-term options as it would not meet regulator acceptance. As the Government policy now mentions this option, the outcome of the assessment could change. It is noted that this option is broadly similar to option 2.15 which performed poorly on weighted and unweighted scores. It is considered that inclusion of this option would not result in a change to the preferred options identified in the 2006 strategic BPEO study.

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
10.	UK Solid LLW Policy	Disposal at specified landfill sites for LLW and HVVLLW.	Yes	This is option 2.13 in the 2006 strategic BPEO - it was rejected after shortlisting as it may require a regulatory change. As the Government policy now mentions this option, the outcome of the assessment could change. Disposal of very low level wastes has been examined in a parallel study [3] which concluded that the BPEO for such waste was reuse and recycling. Disposal to specified landfill sites was the next best option. The findings of this study underpin the preferred option selected in the 2006 strategic BPEO study. Consideration of the findings of these two BPEO studies together suggests that this option should be pursued in preference to disposal in a heavily engineered facility for those metallic wastes that meet VLLW criteria. Inclusion of this option would not result in a change to the preferred options identified in the 2006 strategic BPEO study.
11.	UK Solid LLW Policy	General disposal of low volume VLLW to an unspecified destination, together with municipal, commercial or industry wastes.	Yes	These changes allow a more flexible approach to disposal of certain lower activity LLW - single items - see also row 2 and row 10. It is considered that this would apply to limited quantities of wastes and would be pursued in preference to disposal in a heavily engineered facility for those metallic wastes that meet VLLW criteria. Inclusion of this option would not result in a change to the preferred options identified in the 2006 strategic BPEO study.
12.	UK Solid LLW Policy	Controlled disposal by burial of LLW and VLLW waste from nuclear sites in landfills should not be precluded, provided the necessary safety assessments can be carried out to the satisfaction of the environmental regulators.	Yes	See row 10.
13.	UK Solid LLW Policy	Presumption towards management solutions that can be implemented early rather than late	No	The timing of solutions was examined in the 2006 strategic BPEO study. The workshop focussed on developing a solution that could be implemented early (within a 3 year time frame). However it was recognised that, subject to sufficient interest and investment, alternatives could be delivered in the longer term. The study concluded that, in the longer term, these alternatives could become preferred options. Recommendations for additional work included consideration of longer term issues.
14.	UK Solid LLW Policy	Consideration of the proximity principle during the development of waste management plans	Yes	The proximity principle is not explicitly examined in the 2006 strategic BPEO. However, a number of the attributes consider issues that are related to the proximity principle such as traffic, air quality and economic activity. Consideration of the NDA's LLW strategy indicates, that from a strategic perspective, issues related to the transportation of radioactive waste have only a marginal influence on the selection of waste management options. Inclusion of the proximity principle as a stand-alone attribute would provide slightly different scores to that generated for traffic-related environmental discharges and nuisance (which is the most relevant comparator) but would not result in a significant change to the findings of the BPEO study.

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
15.	UK Solid LLW Policy	The import and export of LLW to and from other OECD and EU countries can be authorised but only following an assessment of all practicable options, and should only be allowed for the recovery of re-useable materials or for treatment that will make its subsequent storage and disposal more manageable. Any secondary wastes arising from import / export for treatment should be returned to the country of origin.	No	The description of the option in the 2006 strategic BPEO for transporting waste to overseas facilities includes all the elements of this policy requirement. It is, therefore, considered that the process undertaken to produce the 2006 strategic BPEO and implementation of the preferred option accord fully with the revised LLW policy.
16.	UK Solid LLW Policy	Communities should take greater responsibility for how they deal with non-nuclear industry LLW arisings, e.g. hospitals, universities.	No	This is a strategic level BPEO and it is unlikely that communities taking more responsibility for non-nuclear LLW would have a significant affect on strategic level outcomes.
17.	Scottish Government policy	Importance of proximity principle for radioactive waste in Scotland, and Scottish Ministers' direction that LLW from Dounreay should not be disposed of to the LLWR.	Yes	The policy of the Scottish Government in relation to radioactive waste management places a greater emphasis on the proximity principle. The findings of the 2006 strategic BPEO recognise a desire to develop facilities closer to the point at which the waste generated in the longer term. Scottish Government policy is not considered to challenge the findings of the 2006 strategic BPEO but could influence the timescales over which the findings are implemented.
18.	Cm7296 (DECC white paper)	The NDA / LLWR will have to accommodate metallic LLW from nuclear new build.	No	The change in inventories is unlikely to challenge the BPEO as the inventory data used in the 2006 assessment was used in a qualitative rather than quantitative basis.

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
19.	Defra and the DAs' waste policy	Move towards 'zero waste' and 'responsibility deals' might influence the assessment of options for on-site or local treatment of wastes.	Yes	These factors may promote more refined decontamination and treatment in order to reduce further the amount for disposal and help towards the zero waste target, and responsibility deals could encourage local management over national management. The move towards 'zero waste' may also reduce the availability of conventional waste disposal routes. Introduction of this policy will place greater emphasis on reuse/recycling of wastes and is likely to underpin the selection of the preferred options in the 2006 strategic BPEO.
20.	Exemption orders review	Some radioactive wastes are likely to be reclassified when the new Exclusion /Exemption regime becomes effective.	No	The change in inventories is unlikely to challenge the BPEO as the inventory data used in the 2006 assessment was used in a qualitative rather than quantitative basis.
21.	TFS of radwaste regs 2008	Relationship between TFS authorisations and the Policy for the Long Term Management of Solid LLW in the UK.	No	There are no explicit policy, legal or strategic reasons for reducing use of TFS routes to enable treatment of metallic wastes.
22.	NDA strategy 2010	Support to LLWR 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.	Yes	The NDA strategy encourages the use of a wide range of waste management options with the principle goal of minimising the quantity of waste requiring disposal at LLWR. The 2006 strategic BPEO explores a range of technologies and locations related to metallic wastes. The preferred option(s) are being progressively implemented by LLWR Ltd, waste generators and the supply chain. The 2006 strategic BPEO identifies recommendations that will further support the implementation of the strategy.
23.	NDA strategy 2010	Work with the supply chain and LLWR Ltd to determine where future developments are best focussed to meet the needs of the nuclear industry.	No	The 2006 strategic BPEO does not make explicit reference to individual parties within the supply chain. However it is recognised that the facilities required to implement the preferred option(s) are owned and operated by parties within the supply chain.

Ref.	Source (abbreviated):	Change since 2006:	Potential to challenge 2006 strategic BPEO Findings	Comment
24.	NDA strategy 2010	Waste producers should make best use of available metal decontamination facilities.	No	All decontamination options (both specific processes and "local" and "central" - 15 options in all) were shortlisted equally as "part of all options" and were not screened out in the 2006 strategic BPEO. Decontamination facilities were assessed and are a feature of the preferred option that was identified in the study.
25.	NDA strategy 2010	Site licence companies must demonstrate that they are making best use of available metal treatment routes.	No	This requirement on sites to demonstrate 'best use' covers the obligations at a site-specific level and does not affect the strategic level BPEO. However, the production of a waste stream specific BPEO study which identifies a preferred option for that waste is expected to inform and support the development of site-specific strategies.
26.	NDA strategy 2010	Waste producers will be given support in demonstrating the value of metal recycling over disposal, beyond simple gate price cost comparisons.	Yes	The total costs associated with each option were not compared during the workshop because operating cost was not scored. However, those options which included recycling typically performed well in the 'economic' category. Assistance of the nature proposed by the NDA would further support the 'economic' scores of preferred option(s) and increase their overall performance. The preferred option(s) identified in the 2006 strategic BPEO are underpinned by this strategic initiative.
27.	Submarine dismantling project	For defence and security reasons, the UK's redundant submarines cannot be disposed of abroad; and the LLW arising from them will continue to have a disposal route via the NDA.	No	Submarine wastes only represent 0.3% of the total anticipated metals inventory and as such should be able to be managed within the existing UK infrastructure.
28.	Various influences on inventory	Inventory	Yes	There have been considerable changes in the qualitative inventory of metallic wastes since 2006, as. The inventory is expected to evolve further, reflecting the changes to the definition of LLW and HVVLLW, the new exclusion and exemption regime, improved used of the waste hierarchy and the generation of metallic wastes from the nuclear new build programme. However, it is considered that these changes would not significantly affect the findings of the 2006 strategic BPEO because the assessment used inventory data in a qualitative rather than quantitative manner and took account of this uncertainty.
29.	Need to reconsider short / long term	Definition of short term and long term	Yes	The definitions of 'short term' and 'long term' are particularly important in determining the commercial viability of options in the context of inventory changes and in establishing the timescales for implementing preferred option(s). Refined definitions of 'short term' and 'long term' are required to support the implementation of preferred option(s) from the 2006 strategic BPEO study.

5. Conclusions and Recommendations

This report has identified changes in key areas considered during the preparation of the 2006 strategic BPEO study for the management of metallic wastes. The BPEO study has been examined in the context of these changes to determine the degree to which the findings could be impacted by these changes and whether implementation of preferred options(s) should be reviewed.

5.1. Conclusions

Key conclusions from this work are summarised as follows:

- Changes to the LLW inventory indicate that there will be more metallic waste generated overall up to 2120, however, volumes during the 10 years are likely to be lower than currently forecast. These changes do not, however, impact significantly on the findings of the 2006 strategic BPEO;
- Changes to drivers such as policy, legislation, regulation and strategy have not identified any issues that present a significant challenge to the findings of the 2006 strategic BPEO;
- Consideration of the changes to drivers such as policy, legislation, regulation and strategy indicates that the preferred option(s) identified in the 2006 strategic BPEO are further underpinned by these changes; and
- The key findings of the 2006 strategic BPEO study remain valid in the current context.

5.2. Recommendations

Following on from the above conclusions it is not considered that further detailed assessment or re-optioneering of the 2006 strategic BPEO is required.

It is recommended that the BPEO conclusion are reviewed in another 5 years or, as defined within LLWR Ltd management arrangements, if there are significant changes in the following areas:

- Anticipated and actual rates of metallic LLW generation;
- Supply chain capability and capacity, in particular the impact of market failure or contraction;
- Availability of waste treatment and disposal routes;
- Government strategy with regard to application of the waste hierarchy for LLW; and
- Funding for decommissioning and waste management programmes.

Appendix 1: Glossary and References

Glossary

Basis Safety Standards Directive	96/29/EURATOM Directive: Laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation)
BIS	Department for Business, Innovation and Skills (supersedes parts of the DTI)
Cm2919	Command 2919
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
Devolved Administrations	Scottish Executive, Welsh Assembly Government and the Northern Ireland Executive
DoE-NI	Department of the Environment – Northern Ireland
DTI	Department of Trade and Industry – now replaced by BIS and DECC
EPR	Environmental Permitting Regulations 2010
EU	European Union
EURATOM	European Atomic Energy Community (and treaty)
HSE	Health and Safety Executive
HVVLLW	High volume very low level waste
LLW	Low level waste
LLWR	Low level waste repository
NDA	Nuclear Decommissioning Authority
NIA65	Nuclear Installations Act 1965
OECD	Organisation for Economic Co-operation and Development
REPs	Regulation environmental principles
RMTD	Radioactive Materials Transport Division, Department of Transport
RSA93	Radioactive Substances Act 1993

Scottish Government	Preferred name for the Scottish Executive
SOLA	Substances of Low Activity
TFS	Transfrontier Shipments (of waste)
VLLW	Very low level solid radioactive waste
WAG	Welsh Assembly Government

References

- 1 Nuclear Decommissioning Authority. [Strategic Best Practicable Environmental Option \(BPEO\) for Metallic Waste Management – Options Evaluation](#). April 2006.
- 2 LLWR Ltd. [Strategic BPEO Study into the Management of Combustible Low Level Radioactive Waste](#). October 2008.
- 3 LLWR Ltd. [Strategic BPEO Study for Very Low Level Waste Final Report – Volume 1](#). August 2009.
- 4 Nuclear Decommissioning Authority. [UK Radioactive Waste Inventory 2010](#). February 2011.
- 5 LLWR Ltd. [Low Level Waste Strategic Review](#). March 2011.
- 6 Environment Agency. Guidance for the Environment Agencies' Assessment of Best Practicable Environmental Option Studies (BPEO) at Nuclear Sites. February, 2004.
- 7 Office of Deputy Prime Minister. A Draft Practical Guide to the Strategic Environmental Assessment Directive. 2004.
- 8 Nuclear Decommissioning Authority. [UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry](#). August 2010.