

The Role of Specified Landfill in the Implementation of the Sellafield Low Level Waste Strategy - 10023

David Loudon
Sellafield Ltd, Sellafield, Seascale, Cumbria, CA20 1PG UK

ABSTRACT

In March 2007 the UK Government issued a new policy for the management of solid low level waste. This document, 'Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom', sets out a framework for the flexible management of low level wastes, recognising that prior policy and strategies were not written with large scale nuclear decommissioning and site restoration in mind.

One aspect of the policy is the introduction of a new waste classification, High Volume Very Low Level Waste. This waste classification typically consists of construction or demolition type wastes including contaminated soils containing up to 4 Bq/g of activity. This classification of wastes can be disposed to a specified landfill. A specified landfill is a landfill site which is authorised by the Environment Agency under the Radioactive Substances Act to receive High Volume Very Low Level Wastes up to a volume limit specified by the authorisation. Specified landfills can be either developed on or adjacent to the nuclear licensed site or they can be commercially operated conventional landfill sites remote from the site licence company.

This method of disposal is novel to the UK nuclear industry, and currently there are a limited number of companies in the process of obtaining authorisations for specified landfill disposal. There is considerable stakeholder interest in the development of specified landfill sites and the reaction to initial applications or expressions of interest with regard to the development of such facilities, remote from the nuclear licensed sites has received mixed responses from regulators, local councils and members of the public

INTRODUCTION

Sellafield site is one of the most complex nuclear decommissioning challenges in the world. The decommissioning of the facilities located at Sellafield will generate significant volumes of wastes which will require safe, sustainable and cost effective management options.

Within the UK radioactive wastes are classified into three main categories, reflecting the radiological hazard associated with each waste classification:

Low Level Wastes (LLW) – Radioactive waste having a radioactive content not exceeding 4 GBq/te alpha or 12 GBq/te beta/gamma

Intermediate Level Wastes (ILW) – Radioactive wastes containing radioactivity above the LLW threshold, but not significantly heat generating

High Level Wastes (HLW) – Radioactive wastes containing radioactivity above the LLW threshold which generate a significant heat output

LLW accounts for 90 % of the volumes of radioactive wastes but only 0.0003 % of the activity. The largest waste volumes arising from the decommissioning of the Sellafield site are classified as LLW. Sellafield is expected to account for approximately 70 % of the UK LLW inventory of 3 million m³. Currently almost all LLW is disposed to the national Low Level Waste Repository (LLWR); however this facility does not have sufficient capacity for the future decommissioning waste arisings. This is a key driver in the development of revised UK policy and subsequent waste management strategies.

The revised UK policy introduced a sub-category of LLW, High Volume Very Low Level Wastes, HVVLLW. This waste category is defined below and a key aspect of this waste category is that it can be disposed to a specified landfill site.

The decommissioning of the Sellafield site is expected to generate significant quantise of HVVLLW. The profile of the anticipated arisings is shown in Fig. 1 below:

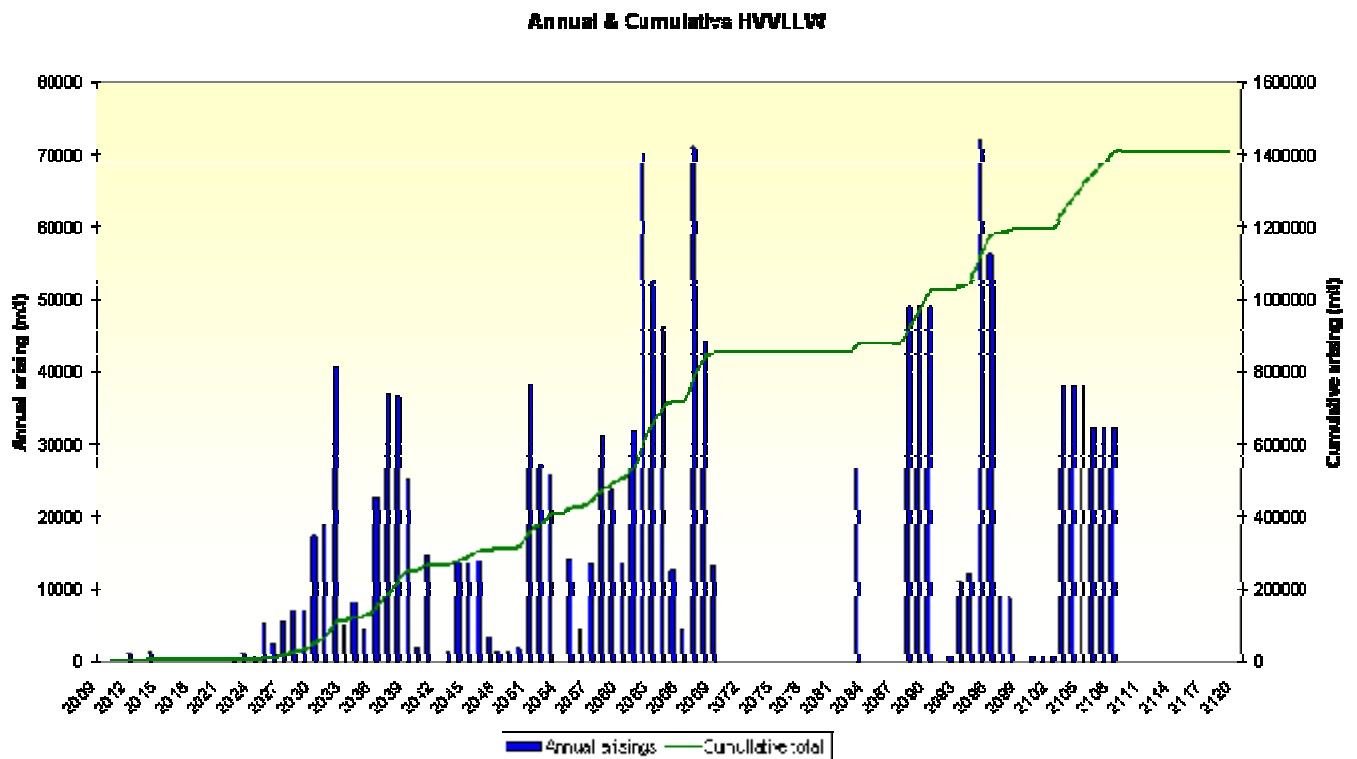


Fig. 1 Anticipated Annual and Cumulative HVVLLW Arisings at Sellafield.

REGULATORY FRAMEWORK

In March 2007 the UK Government published a document entitled ‘Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom [1]’. This document amended or replaced earlier waste management policy embodied within ‘Review of Radioactive Waste Management Policy: Final Conclusions (Cm2919) White Paper’ published in July 1995 [2]. The new policy does not aim to be prescriptive in its approach and introduced greater flexibility into the scope of management options for LLW with a key aim of providing a high level framework within which individual LLW management decisions can be taken to ensure safe, environmentally acceptable and cost effective management solutions that appropriately reflect the nature of the LLW concerned.

The policy introduced a sub-category of LLW, High Volume Very Low Level Waste, HVVLLW. This category of waste is defined as:

“Radioactive waste with maximum concentration of 4 MBq/te of total activity which can be disposed of to specified landfill sites. For waste containing tritium the concentration limit for tritium is 40 MBq/te. Controls on disposal of this material, after removal from the premises where the waste arose, will be necessary in a manner specified by the environmental regulators.”

The Government Policy states that disposal of HVVLLW can be to a specified landfill. The definition of specified landfill is a landfill site that has specific controls placed upon it to limit the total volumes of HVVLLW being deposited at any one particular site. Within the UK commercial landfill sites are classified into one of three categories, inert, municipal or hazardous with the categories reflecting both the types of wastes which may be disposed and the engineering and containment criteria which need to be achieved during the site design phase. These criteria are defined in the European Landfill Directive which is implemented in the UK by The Landfill (England & Wales) Regulations 2002 and subsequent amendments in 2004 and 2005.

All current operational landfill sites within the UK comply with the requirements of the landfill directive. These sites are regulated by the Environment Agency, (EA) in England and Wales and by the Scottish Environmental Protection Agency, (SEPA) in Scotland. The requirements for operation of landfill sites are covered in a detailed environmental permit which defines the operational control of the facilities during the design, operational and aftercare phases. All landfill site operators must demonstrate technical competence to defined levels in order to obtain a permit to operate and also must demonstrate financial competence and provide assurance usually in the form of a bond or insurance that funding will be available in the event of an operator being unable to complete the operational and aftercare phases.

Environmental Permits are enforced for a period of aftercare and monitoring which is typically between 30 and 60 years after the operational phase is complete.

For an existing landfill site, or a new dedicated landfill site to be able to accept HVVLLW the site would need to apply for a disposal authorisation under the Radioactive Substances Act 1993 (RSA). This application is made to the EA and must be supported by a radiological impact

assessment for the site. The EA, SEPA and the Northern Ireland Environment Agency (NIEA) published a guidance document, 'Near-surface Disposal Facilities on Land for Solid Radioactive Wastes – Guidance on Requirements for Authorisation' [3] in February 2009 which sets out the requirements expected to be achieved to satisfy an application for RSA. The development of any facilities must ensure that environmental and public protection standards are maintained. The guidance document lists a number of principles which provide the underlying basis for the technical assessment made when regulating radioactive substances. These principals are outlined in Fig 2 below:

The principals outlined below establish the requirements which must be satisfied when applying for a RSA disposal authorisation for a specified landfill or other near surface disposal facility for solid radioactive wastes. The requirements cover aspects such as:

- Environmental Safety Case
- Environmental Safety Culture & Management System
- Dose constraints during period of authorisation
- Risk guidance level after the period of authorisation
- Human intrusion after the period of authorisation
- Optimisation
- Environmental radioactivity
- Protection against non-radiological hazards
- Site investigation
- Use of site, facility design, construction, operation and closure
- Waste acceptance criteria
- Monitoring
- Dialogue with potential host community and others

Once a specified landfill is authorised to dispose of HVVLLW, the consigning site would require a transfer authorisation under RSA to allow the transfer of waste from the site of production to the disposal facility. This application is made to the relevant environment agency and would typically be supported by an optioneering study to demonstrate that this disposal route is the most suitable route for the waste in question. Optioneering studies to date have been in the form of a Best Practicable Environmental Options assessment

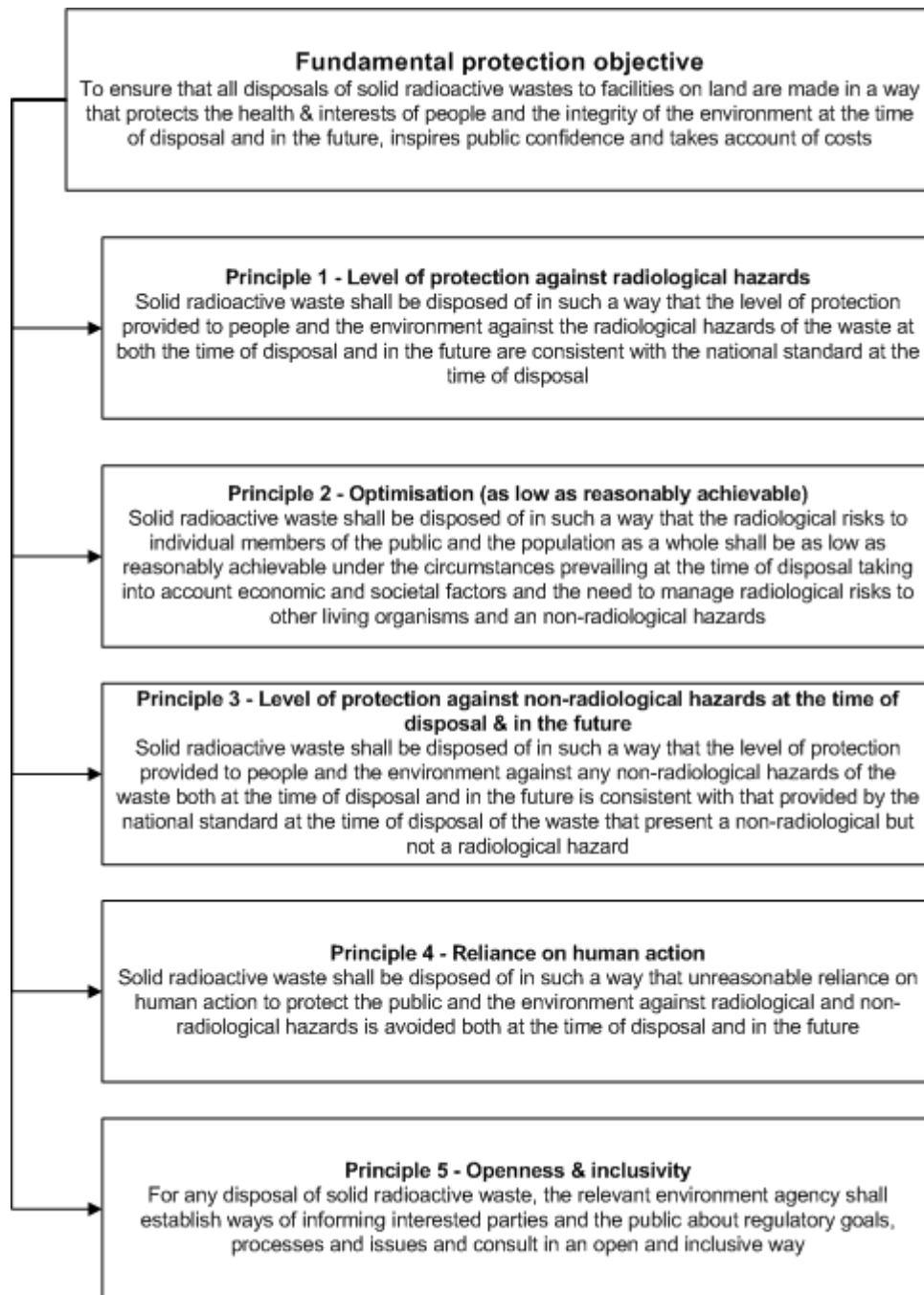


Fig 2. Near Surface Disposal Guidance – key principles

STAKEHOLDER DIALOGUE & OPTIONEERING

Sellafield Ltd recognised that current methodologies for handling LLW were not sustainable in the longer term and alternative waste management technologies are required to implement the waste management hierarchy and reduce the disposal burden on the national LLWR. A process was initiated whereby supply chain companies were invited by means of an Expression of Interest (EOI) to submit proposals on how alternative waste management technologies could be

applied to the waste arising on the Sellafield site. This review process identified several technologies which could be applied to waste management practices on the Sellafield site with a view to reducing the quantities of wastes requiring disposal to LLWR.

The output of this review was used to form the basis of a series of stakeholder dialogue sessions as part of a strategic optioneering process. The process consisted of a number of day long sessions which were open to members of the public, supply chain representatives, regulators and stakeholders each focussing on specific key waste management areas, namely Metals, Asbestos, Combustible Wastes, Oils & Solvents and High Volume Low Activity Wastes. Each session had a similar format whereby the key issues surrounding each waste type were discussed and potential alternative waste management processes identified and debated with an open discussion on the merits or otherwise of alternative techniques. The sessions were managed by independent facilitators and the output recorded and published. Details of the process and the individual sessions are available on the Sellafield Ltd website;

<http://www.sellafieldsites.com/page/corporate-responsibility/stakeholder-engagement/consultations/low-level-wastes-on-the-sellafield-site>

The output of the stakeholder dialogue and optioneering process was used to develop the Sellafield Low Level Waste Strategy.

STRATEGIC POSITION

Sellafield Ltd had a requirement placed upon it by the Environment Agency to develop and publish a Low Level Waste Strategy for the Sellafield site. The strategy document, Sellafield Site Low Level Waste Strategy IWSS(08)01 was published in December 2008 [4]. The document outlined the forward strategy for managing current and future LLW arising from the Sellafield site. The key principles of the strategy are:

- Ensure the waste management hierarchy is applied without compromising safe operations or hazard reduction principles
- Avoid and minimise unnecessary generation of radioactive wastes
- Reduce the burden of waste routed to current disposal facilities
- Reduce lifetime waste management costs to stakeholders
- Manage all wastes in such a manner as to minimise the impact on human health, safety and the environment
- Standardise best practice in management of LLW and embed across the Sellafield Site

The strategy document addressed specified landfill and on site disposal issues and identified a forward plan for the short, medium and longer term. The forward plan looks at utilisation of supply chain specified landfill in the short term with a review on the potential for application of on or near site specified landfill in the longer term.

The Nuclear Decommissioning Authority (NDA) has developed a National LLW Strategy in response to the Government policy. This strategy document, UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry [5], was issued for consultation in

June 2009 and is expected to be formally issued in March 2010. The NDA has a remit to ensure a continued LLW disposal capacity is in place to meet the needs of the nuclear industry. The draft strategy document outlines key themes to extend the life of the existing LLWR. These themes are listed below:

- application of the waste management hierarchy to extend the life of LLWR and ensure waste is managed in a risk-based, fit-for-purpose manner
- best use of existing assets
- new fit-for-purpose waste management routes

The NDA strategy identifies that should a replacement for the current LLWR be required it is anticipated to cost somewhere in the region of £2 Billion and take 11 years to site, licence and become operational.

Clearly there is the potential for significant cost benefit if a replacement LLWR can be avoided. As the VLLW inventory is a significant percentage of the total LLW inventory alternative disposal routes will play a key role in minimising the volumes of LLW disposed to LLWR. A key theme of the NDA draft strategy is the development of new fit for purpose waste management routes. This includes the development of specified landfill capability.

The draft national strategy and the Sellafield strategy are closely aligned and the Sellafield strategy will be reviewed once the National Strategy is formally issued. Currently the Sellafield strategy identifies utilisation of off-site specified landfill, existing on site disposal and potential new on site disposal options as being viable for the management of VLLW.

In August 2009 LLW Repository Ltd published a report on ‘Strategic Best Practicable Environmental Option (BPEO) Study for Very Low Level Wastes’ [6]. This study was carried out with representation from LLWR, NDA, Regulators and Site Licence companies to evaluate the relative merits of a number of options to allow a long term solution(s) for the management of this waste to be determined. The output of this study showed that continued disposal to LLWR for VLLW was the least favoured option and that the use of existing off site facilities and the development of new on site facilities were the more favoured options.

The output of this study was used, along with the output of the earlier stakeholder dialogue to produce a Sellafield specific BPEO [7]. This BPEO identified that in the short term particularly whilst decommissioning waste volumes were low that supply chain specified landfill routes are probably the favoured option and that as decommissioning waste volumes increase the development of an on or near site option should be investigated.

RISKS & ISSUES

There are three main issues/risks discussed here covering liability for VLLW disposed in specified landfill sites, the views of stakeholders and the cost/affordability of specified landfills.

The use of specified landfill represents a step change in the way in which radioactive wastes from the nuclear industry are managed. Whilst it is expected that the radiological risks associated with specified landfill are very low there are still some uncertainties which need to be addressed. As discussed above, specified landfills will be required to hold a RSA authorisation for disposal. Consignors sending VLLW to specified landfill will be required to hold a transfer authorisation under RSA to allow the consignment of wastes to the relevant facility. Sellafield is also licensed under the Nuclear Installations Act (NIA), and section 7 of this act places a duty on the licensee to ensure that during the licensee's period of responsibility no ionising radiation emitted from any waste discharged (in whatever form) on or from the site causes injury to any person or damage to any property. The issue of any residual liability remaining with the nuclear site licence company under the NIA following disposal needs to be determined.

At the time of writing this paper there are three supply chain companies that have submitted RSA authorisation applications to the Environment Agency to seek authorisation for existing landfills to accept VLLW. There is also at least one other company looking to develop a new dedicated VLLW facility. The reception of local stakeholders to these proposals has been mixed ranging from general acceptance to vocal opposition to proposed developments. The views of local stakeholders will play an important part in the decision making criteria on utilising a specified landfill.

As no specified landfills are operational at the time of writing this paper the costs associated with these facilities is unknown. It is expected that the costs will be significantly lower than LLWR disposal costs due to the lower risk and associated lower site engineering requirements. However it is likely that market forces may result in the disposal prices being higher than may have been expected due largely to issues associated with risk, perception and scarcity of service. This may bring into question issues over value for money and affordability of off site supply chain services over the development of dedicated on or adjacent to site facilities.

The decision to utilise specified landfill disposal will require a careful consideration of a range of factors.

CONCLUSIONS

It is clear that the use of specified landfill has a significant potential to reduce the volumes of wastes disposed to LLWR and in turn realise significant cost savings both in terms of reduced disposal costs and contributing to offsetting future repository design, build and operational costs. The decommissioning of the Sellafield site will generate significant volumes of LLW of which approximately 60% could be classified as HVVLLW. The use of specified landfill will therefore play key role in the implementation of the Sellafield Low Level Waste Strategy. The decision on whether to utilise an off-site specified landfill as opposed to developing a site on or adjacent to the nuclear licensed site will require a detailed assessment of a range of criteria.

At this stage it is likely that off site specified landfill has a role to play in the implementation of the Sellafield Low Level Waste Strategy, particularly in the short to medium term whilst the volumes of VLLW generated are relatively low. As the major decommissioning programmes are

accelerated, with the resultant increase of VLLW production the development of an on or adjacent to site specified landfill may be more beneficial.

REFERENCES

- 1 Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom 26th March 2007
- 2 Review of Radioactive Waste Management Policy: Final Conclusions (Cm2919) White Paper July 1995
- 3 Near-surface Disposal Facilities on Land for Solid Radioactive Wastes – Guidance on Requirements for Authorisation February 2009
- 4 Sellafield Site Low Level Waste Strategy IWSS(08)01 December 2008
- 5 UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry consultation document June 2009
- 6 Strategic Best Practicable Environmental Option Study for very Low Level Wastes August 2009
- 7 Sellafield VLLW Options Study TC(09)17

GLOSSARY

BPEO	Best Practicable Environmental Option
Bq/g	Bequerels per gramme
EA	Environment Agency
EOI	Expressions of Interest
HLW	High Level Wastes
HVVLLW	High Volume Very Low Level Wastes
ILW	Intermediate Level Wastes
LLW	Low Level Wastes
LLWR	Low Level Waste Repository
MBq/te	Mega Bequerels per metric tonne
NDA	Nuclear Decommissioning Authority
NIA	Nuclear Installations Act 1965
NIEA	Northern Ireland Environmental Agency
RSA	Radioactive Substances Act 1993
SEPA	Scottish Environmental Protection Agency