



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

Low Level Waste Strategic Review

March 2011

Document History

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Executive Summary

The first Low Level Waste (LLW) Strategic Review, published in January 2009, represented a major milestone in development of the LLW strategy. The Strategic Review included the Nuclear Decommissioning Authority's (NDA) first comprehensive national LLW baseline, integrating LLW strategies, infrastructure, volumes, and costs to inform NDA's strategic decision-making and the development of the UK Nuclear Industry LLW Strategy and the associated UK LLW Management Plan. The UK LLW Strategy was approved by Government in August 2010. The objectives of this 2010 Strategic Review document is to update the previous 2008 baseline for 2010, focusing on current site LLW strategies, costs, and the available assets and infrastructure (existing and planned) for LLW management. This will inform identification of synergies and opportunities to improve LLW management across the estate as part of ongoing national strategy implementation.

The NDA LLW baseline can be described in terms of several interrelated aspects; current site LLW management strategies, waste volumes, costs and liabilities, and the assets and infrastructure (existing and planned) available for LLW management. For Magnox, Dounreay, and Research Sites, information from Lifetime Plan 10 (LTP10) (submitted March 2010) has been utilised. As Sellafield are currently in the process of establishing a new LTP10 baseline, the latest available 'provisional' May 2010 LTP data has been used in this review, noting that some aspects may not have yet been officially approved by NDA. The Sellafield baseline may therefore be subject to change.

The NDA requires all sites to produce an Integrated Waste Strategy (IWS) in accordance with NDA Specification ENG01. These IWSs articulate the site's LLW management strategy. The current site strategies have been reviewed against the strategic principles outlined within the recently published UK LLW strategy to understand the current level of alignment across the estate with the national strategy. These strategic principles for the management of LLW throughout the UK provide expectations for the implementation of LLW strategy for waste producers, regulatory bodies, and stakeholders. The review of site strategies indicates that, with few exceptions, the IWS documents largely meet the NDA specification. However, there are often weaknesses in describing how the site's LLW strategy is being implemented in practical terms and demonstration of the linkage with the costs within the LTP baseline. All NDA sites reference application of the waste hierarchy principles as a core part of their waste strategy. However, there appears to be significant variation in the practical application of these principles between sites. It is evident that many of the IWS documents identify similar actions in terms of a requirement to establish the same type of waste route (e.g. Very Low Level Waste (VLLW) disposal to landfill or optimise characterisation). It is notable that waste disposal to LLWR is often still the default strategy, and this may be reflective of the immaturity of alternative waste routes. This is an area that is being developed by LLWR and sites, and perhaps as new waste routes become established, waste disposal will cease to be the default strategy and implementation of the waste hierarchy will be substituted in future site strategies.

A review of the UK's LLW inventory shows that information on the sites LLW is developing to better identify waste streams and to incorporate new waste disposal routes. The total forecast LLW volume is 4.4 million m³ which arises during 2010 to 2120. This consists of 3.3 million m³ of VLLW and 1.1 million m³ of LLW. Sellafield is the dominant LLW waste generator for the UK, producing roughly 3.3 million m³ of waste (LLW and VLLW) accounting for 76% of the UK's total waste. Volumes are dominated by VLLW wastes with soil and rubble identified as the main waste stream.

Comparison with previous inventories shows that sites are re-characterising wastes as VLLW leading to a reduction of 0.4 million m³ of LLW between the Waste Inventory Disposition Assessment Model (WIDRAM) 2008 and UK Radioactive Waste Inventory (UKRWI) 2010 figures. The inventory review has also highlighted several areas of improvement that would greatly improve the information generated and allow for a better understanding of the future LLW waste arisings. These areas include consistency of waste reporting tools, reporting of actual waste treatment and disposal routes and improved consistency in characterisation practices.

The costs and liabilities faced by NDA for LLW management include the full lifecycle costs for management and disposal of solid LLW and VLLW generated by operations and decommissioning of NDA's sites. This includes

the design, construction, operation and decommissioning of any solid LLW management facilities required in addition to the cost of treatment (characterisation, packaging, conditioning, etc), transport, and waste disposal. The cost baseline is used to define a Nuclear Provision (NP) (previously referred to as the Nuclear Liability Estimate (NLE)) which is included within NDA's Annual Report and Accounts (ARAC). The review of cost information shows that the provisional 2010 cost baseline is around £8.9Bn. This has decreased by £0.96Bn from the previous 2008 baseline of £9.86Bn. Since 2008, some projects have been removed from the LTPs (notably the Soil Treatment Plant at Sellafield) and there have been increases and decreases in the cost of other individual elements reflecting changes in scope, unit rate assumptions, and underpinning inventory numbers. In some cases, costs have moved to different categories, for example, the proposed new-build LLW treatment facilities at Sellafield (metal recycling, smelter, thermal treatment) have been removed from the Sellafield LTP. Corresponding supply chain treatment costs are now included within the Sellafield off-site disposal category instead. Magnox Final Site Clearance LLW costs have increased significantly since March 2008, following a fundamental re-estimation of the cost of these activities. There remain several areas where site baselines are not fully aligned with the UK LLW strategy or utilise very conservative assumptions regarding waste volumes and categorisation. It should be noted that the 2010 baseline may be subject to change following finalisation of the Sellafield LTP10 and receipt of Springfield's data for 2010.

The assets and infrastructure available to manage LLW and VLLW from the UK nuclear industry has been reviewed, including key facilities which are at the planning and development stage. The review highlights that there have been some changes to the facilities that are available to nuclear sites since 2008. Sites have increasing access to metal recycling and thermal treatment facilities. The Studsvik Metal Recycling Facility in West Cumbria has now been successfully operating for over a year and has treated waste from a number of nuclear sites. LLWR have introduced segregated waste services for metallic and combustible waste which will expand options available to waste producers. A number of commercial landfill operators across the UK are seeking authorisations under the Environmental Permitting Regulations 2010 for LLW and VLLW disposal ranging from expansion of existing sites to new dedicated facilities. To facilitate implementation of the waste hierarchy, LLWR are in the process of developing a suite of new packages which are more cost effective and provide more flexibility for treatment purposes. The aim is to reduce reliance on disposal at the LLWR near Drigg in Cumbria.

Within the baseline, there are a number of opportunities for optimisation going forward as the LLW strategy is implemented. The UK LLW Management plan sets out the scope, schedule and approach to delivering these opportunities. These management plan initiatives contribute towards NDA's strategic objectives for LLW.

The scope of the ACCELS (Acceleration of Element 2 Strategy) programme includes the identification and evaluation of 42 specific opportunities to reduce the cost of LTP baselines across the NDA estate. These opportunities include improved inventory and waste forecasts, use of consistent waste routing assumptions and cost factors, and targeted reductions in capital spend through best use of onsite resources, the supply chain, and economies of scale across the estate. LLWR has worked with each Site Licence Company (SLC) to gather the required underpinning data and review the opportunities. Integrated Project Teams (IPT) comprised of LLWR, NDA, and SLC managers, have been formed to review the largest NDA opportunities at Sellafield and Magnox and develop the forward plan for implementation. This review of the 2010 cost baseline informs how these opportunities are taken forward. The ACCELS programme has identified a further reduction of £1.5 billion saving from the NP and identified several other key areas where the approach will deliver savings. The savings come from a detailed study of the wastes generated during decommissioning and will result in a new NP of £7.4Bn following incorporation of the savings in to the NDA's ARAC.

The ultimate goal of the programme is to see opportunities formally reflected within a modified LTP. However, NDA can consider whether sufficient confidence exists in the validity of an opportunity to make an adjustment to the annual LLW NP ARAC estimate in advance of any formal change to SLC baselines.

This Strategic Review takes into account potential inventory and NP reductions that have been evaluated as part of the ACCELS programme. This review informs the ongoing implementation of the NDA's LLW Waste Programme which incorporates the outstanding actions from the LLW Management Plan and the ACCELS programme. This programme sets out the framework for the delivery of work packages identified to optimise LLW management in the UK.

Tables 5 and 6 below, show the total LLW and VLLW raw volumes arising by UK region during the periods 2010-2020 and 2010-2120.

TABLE 5 – 10 YEAR UK REGIONAL DISTRIBUTION OF LLW AND VLLW RAW VOLUMES BETWEEN 2010-2020 (M³)

UK Region	LLW Volume	VLLW Volume	Total Waste Volume	Percentage of Total Waste
North West	125,177	91,593	216,770	43.3%
North East	7,103	-	7,103	1.4%
West Midlands	62	-	62	0.0%
East Midlands	730	-	730	0.1%
East	6,599	-	6,599	1.3%
South West	15,396	9,375	24,771	5.0%
South East	35,766	58,038	93,804	18.7%
Wales	5,935	2,677	8,612	1.7%
Scotland	104,035	36,228	140,263	28.0%
Other	1,675	-	1,675	0.3%
	302,488	197,912	500,400	

TABLE 6 – 110 YEAR UK REGIONAL DISTRIBUTION OF LLW AND VLLW RAW VOLUMES BETWEEN 2010-2120 (M³)

UK Region	LLW Volume	VLLW Volume	Total Waste Volume	Percentage of Total Waste
North West	439,264	3,170,443	3,609,707	81.5%
North East	14,051	-	14,051	0.3%
West Midlands	100	-	100	0.0%
East Midlands	730	-	730	0.0%
East	83,166	2,992	86,158	1.9%
South West	116,599	18,204	134,803	3.0%
South East	101,986	88,786	190,772	4.3%
Wales	95,626	10,500	106,126	2.4%
Scotland	232,747	44,551	277,298	6.3%
Other	7,841	-	7,841	0.2%
	1,092,110	3,335,476	4,427,586	

For a further breakdown of LLW and VLLW volumes by UK County Council area during the periods 2010-2020 and 2010-2120, see Appendix C.

4.6.8 Onsite Disposal (OSD)

In addition to the national facility at LLWR, there have also been some limited historic disposals to pits and trenches on other UK nuclear sites such as Harwell, Dounreay, Springfields and Sellafield. Some of these facilities may require remediation prior to site closure potentially generating LLW, though the current intention on these sites is for final disposal.

Historically Sellafield have disposed of VLLW/HVLA excavated soil to the on-site South Landfill and Calder Landfill. Both facilities are now non-operational. The Calder Landfill Extension Segregated Area (CLESAs) which has a capacity of 100,000m³ is currently being used for disposal of inert wastes from decommissioning and site clearance activities. Sellafields LTP10 included £56m for operations and maintenance of the CLESAs and a further £4.5m for the construction of a second facility between 2026 and 2031. This facility would not however, be able to accommodate all of Sellafields waste.

Some nuclear licensed sites, such as Harwell and Dounreay have plans for VLLW/HVLA disposal facilities on their sites. A new facility on the Dounreay site, currently under construction, similar to that of the LLWR in Cumbria, is planned to dispose of all remaining LLW at Dounreay. The LTP10 for Dounreay has a budget of £104m identified for the construction and operation of their LLW management facility. RSRL has identified £12m for the construction of a facility for the management of HVLA at Harwell. This facility may also fulfil the requirements of the Winfrith site. This proposal is a contingent facility in case routes to the supply chain do not open up.

Other nuclear licensed sites are also investigating the potential to locate disposal facilities on their sites following appropriate optioneering studies. Magnox South carried out preliminary work to investigate the feasibility of OSD at Hinkley Point A. This proposal is currently on hold.

A summary of the status of OSD proposals within LTPs is shown in Table 10.