



Radioactive waste, its disposal and the long term solution

For the UK, delivering a safe, long term storage/disposal solution for radioactive waste is a central and important issue spanning both decommissioning and new build markets. For the legacy wastes the issue is pressing, not least to address public confidence in the next phase of new build. Before embarking on the new build programme robust, tried and tested arrangements need to be in place and a solution engineered to deal conclusively not only with historic material but also the waste that is certain to arise from future planned activities.

This article will examine some of the key issues facing the industry in respect of waste management, and touch on responsibility for funding and delivering appropriate solutions.

In England and Wales, the key provisions governing the accumulation and disposal of radioactive waste are now to be found in Schedule 23 to the Environmental Permitting (England and Wales) Regulations 2010, which repeal and replace most of the Radioactive Substances Act 1993. For this article defining the different types of radioactive waste, albeit fairly simplistically, will be the starting point. In its various forms, waste arises from past, current and future programmes of fission-derived power generation, military and maritime uses, and from civil uses of radioactive material including the less innocuous activities of universities, research facilities and hospitals.

The most commonly used categorisation refers to high, intermediate and low level (and very low level) waste, with each category defined predominantly by reference to the level of the materials' radioactivity and consequently the level of hazard associated with it.

Low level waste can consist of everyday materials, such as discarded gloves and protective equipment which have

come into contact with, and hence been contaminated by radioactivity. Whilst activity levels may not be particularly high, they may be sufficient to constitute radioactive waste. Low level waste sits at the lower end of the contamination spectrum, and accounts for the large proportion (by volume) of waste in storage.

Storage facilities for low level waste could broadly be described as highly engineered surface landfill sites, requiring no particularly complicated engineering solutions for long term safe management. Intermediate and high level waste on the other hand, sit at the other end of the spectrum, containing significantly more radioactivity and presenting far greater intrinsic risks to health and to the environment. The difference in activity levels between high and intermediate level waste creates an added complication. The former requires cooling (in cooled tanks or canisters stored in ponds, or underground) and shielding. These factors severely limit its mobility and transportability.

Of the UK's radioactive waste between 80-90% is low level, emanating predominantly from decommissioning activities, with around 2% high level, and the remainder intermediate level. Future increases in low level waste volumes will continue in line with the legacy reactor fleet decommissioning programme. It should be noted that radioactive waste does not include un-reprocessed spent fuel, which is treated as a potential future resource.

During the nuclear industry's period of 'state ownership' in the latter half of the last century, the Nuclear Industry Radioactive Waste Executive ('NIREX') was established to manage both the UK's existing radioactive waste inventory and to promote waste management optioneering for the anticipated increases in waste volumes.

Safety is fundamental to any storage/disposal strategies and methodologies, as is the requirement for the management of safety over the long periods, sometimes centuries, that the waste may remain radioactive and thus harmful.

Equally fundamental is the issue of control of the material, for example depositing waste in reinforced concrete blocks deep in the ocean. The concern this presents, despite the ocean providing an effective buffer, is that the waste is then beyond inspection or being retrieved, and should the concrete encapsulation decay, an unmanaged risk of radioactivity being released into the environment could follow.

In addressing the storage issue, international consensus appears to favour the same solution; placing the waste in deep, stable geological strata, sufficiently below ground to reduce the risks of both accidental and groundwater intrusion.

NIREX's early plans to pursue an underground storage facility, led to an application in 1994 to build a 'Rock Characterisation Facility' - a proposed twenty year programme to sink a shaft 1000 metres into bedrock underneath Sellafield monitoring movement and groundwater in anticipation of the data gathered supporting a second application for a Deep Waste Repository. The scheme however faced significant opposition, from the anti-nuclear lobby, local communities and councils, despite nuclear development being familiar in the area. This planning refusal started a five year hiatus in identifying a waste management solution.

The Committee on Radioactive Waste Management ('CoRWM') followed and during 2004/2005 undertook extensive public consultations and engagement with industry and academia both in the UK and abroad.

Its independent report concluded that deep geological containment was the optimum solution, coupled with recognition that local community support was an important issue along with the engineering and safety considerations. CoRWM pressed for a high level of community engagement and the inclusion of voluntarism as a concept in site identification and selection. The 2006 CoRWM report emerged shortly after the Energy Act 2004 took effect and the Nuclear Decommissioning Authority ('NDA') was established.

The Government transferred the bulk of the UK's historic nuclear assets into the NDA along with responsibility for delivering long term waste management solutions, by also transferring ownership of the then UK Nirex Limited to the NDA.

Shortly afterwards the NDA recognising the need for independence from its own waste generating activities (as operator of the still functioning Magnox stations), transferred its waste management responsibilities to a stand alone Radioactive Waste Management Directorate ('RWMD') within its organisation.

Meanwhile the European Commission in 2003 proposed a Radioactive Waste Directive which expressed a clear preference for deep geological disposal facilities to be constructed by a set date. As originally drafted, this proposal risked inconsistency with EU Directives on environmental assessment and public consultation. This proposal was withdrawn, but has now been replaced by a revised proposal from the European Commission published in November 2010.

The Government's 'Managing Radioactive Waste Safely' ('MRWS') programme is now the cornerstone of the UK strategy. Development of further work on geological disposal as an option led to the White

Paper 'MRWS - A Framework for Implementing Geological Disposal' ('White Paper'). It encapsulated the Government's response to the CoRWM report and set out several key propositions:

- Long term geological disposal for 'higher' activity waste
- Robust interim storage programme
- Voluntarism to be encouraged
- NDA (incorporating NIREX) to deliver a repository
- Independent scrutiny by regulators
- Pending a permanent facility, reliance on interim stores and transportation links between existing waste locations to rationalise interim storage

With NIREX's skills incorporated into the NDA, and the NDA having set up within itself the RWMD, the latter will progress the geological repository. The RWMD is expected to operate as a 'prospective Site Licence Company' and regulators such as the Nuclear Installations Inspectorate ('NII') and the Environment Agency ('EA') will look for clear independence in its decision-making away from any NDA influence - itself an owner and generator of waste.

With support from the Waste Management Steering Group ('WMSG') and the Geological Disposal Implementation Board ('GDIB'), these are perhaps the strongest indicators that a geological disposal facility ('GDF') is a reality, rather than theoretical. Linking the GDF and new build, the Government has accepted 'being held to account' on delivering a GDF. This status is consistent with the Government's position on waste and new nuclear (i.e. the cost of waste management from new build will be borne by the developers themselves) that significant progress needs to be made in finding waste management solutions to allow new build to take place.

Key to success is local community support. The Government defines voluntarism as communities expressing an interest and willingness to participate at different stages of the planning process. At present three volunteer communities in Cumbria have expressed interest, with a five-stage process now underway:

- Interest expressed at local level
- De-selection of unsuitable sites (geological screening by the British Geological Survey has commenced)
- Desk-based studies at candidate sites - to be commenced
- Surface-based investigations - including intrusive boreholes - to be commenced
- Preferred site selection

Whilst responsibility for the costs for legacy waste management lies squarely with the NDA and the public purse, it is less clear exactly how new build developers will discharge their responsibilities to meet future waste management costs. Although it is broadly accepted those costs would be secured through funded decommissioning plans required by the Energy Act 2008 - a prerequisite for any new nuclear build - the detail is far from settled.

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