Briefing Paper 4

A Briefing for Local Authority Planners on Radioactive Waste Management

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nuleaf
nuclear legacy advisory forum

1: Introduction

Developments in radioactive waste management – covering nuclear and non-nuclear industries – are likely to impact on all counties of England and Wales, suggesting that all waste planning authorities should address relevant developments in their Local Plans and Waste Plans.

To assist Local Planning Authorities, this Briefing Paper provides a high-level overview of radioactive waste management in the UK and references to where more detailed information can be found. It covers:

This paper should be read in conjunction with **Nuleaf Briefing Paper 11 – Nuleaf Advice on Approaches to Radioactive Waste Management in Local Plans** – which provides detailed guidance on the current planning and waste framework and NDA strategy. It also includes specific advice on policies on radioactive waste that local authorities may wish to adopt, and examples of actual policies from relevant authorities across England and Wales.

2: National Responsibilities

National responsibilities are allocated in the following way:

- Government maintains and develops policy and the regulatory framework;
- Regulators have the duty to ensure that the policy and regulatory framework is properly implemented; and
- The producers and owners of radioactive waste are responsible for developing their own waste management strategies to implement policy and regulatory requirements.

Within Government, the **Department of Business, Energy and Industrial Strategy (BEIS)** and the **Devolved Administrations** have overall responsibility for policy and legislation. However, **DEFRA** and the **Department for Levelling**

Up, Housing and Communities also have some responsibilities around radioactive waste management. The **Ministry of Defence** is accountable for radioactive wastes kept or stored at military related nuclear licensed sites.

The **owners and producers** of radioactive waste are:

- Civil public sector nuclear sites are owned by the **Nuclear Decommissioning Authority (NDA),** a non-departmental public body established under the Energy Act 2004. **Nuclear Waste Services (NWS)**, a wholly owned subsidiary of NDA, is responsible for the management of all types of radioactive and non-radioactive waste generated by the NDA Group. Its key responsibilities are to deliver the NDA's **Integrated Waste Management Programme (IWMP)**, manage the operations of the **Low-Level Waste Repository (LLWR)** and identify and develop a suitable site for a **Geological Disposal Facility (GDF).**
- Private sector nuclear sites are owned and operated by **EDF Energy**. The Advanced Gas Cooled Reactors (AGRs) operated by EDF have either ceased generation or are due to do so by 2028. It has been agreed that, following defueling by EDF, the decommissioning and waste management for the AGR stations will pass to Magnox, part of the NDA Group;
- Defence-related sites are usually owned by the **Ministry of Defence**, and operated by private sector companies;
- **URENCO UK** (from production of enriched uranium for nuclear fuel); and
- **GE Healthcare** and other non-nuclear users of radioactive material (i.e. universities and hospitals).

3: Categories of Radioactive Wastes and Materials

Radioactive waste is any material that is either radioactive itself, or is contaminated by radioactivity, for which no further use is envisaged. Most radioactive waste is produced by nuclear power station operators and associated fuel-cycle facilities. A substantial amount arises from nuclear research and development sites. Some also arises from Ministry of Defence sites, and small amounts are produced by medical, industrial and educational establishments.

In the UK, radioactive waste is classified under the following broad categories:

High Level Wastes (HLW)

These are highly radioactive and generate substantial amounts of heat. HLW is a product from reprocessing spent nuclear fuel at Sellafield in Cumbria. It arises as highly radioactive nitric acid, which is converted into glass within stainless steel

containers ('vitrification') at the Sellafield site. If declared a waste, spent fuel would also be categorised as HLW.

Intermediate Level Wastes (ILW)

These are wastes where the radioactivity levels are higher than for Low Level Waste, but which do not require heat to be taken into account in the design of management facilities. ILW is sufficiently radioactive to require shielding and containment. It arises mainly from the reprocessing of spent fuel and from operations and maintenance at nuclear sites, including fuel casing and reactor components, moderator graphite from reactor cores, and sludges from the treatment of radioactive effluents.

Low Level Waste (LLW)

These are radioactive wastes other than that suitable for disposal with ordinary refuse, but not exceeding 4 gigabecquerels per tonne of alpha activity, or 12 gigabecquerels per tonne of beta or gamma activity. Unlike HLW and ILW, LLW does not normally require shielding during handling or transport. Currently, LLW consists largely of paper, plastics and scrap metal items that have been used in hospitals, research establishments and the nuclear industry. In future there will be large volumes in the form of soil, concrete and steel, as nuclear plants are decommissioned. LLW represents about 90% by volume of UK radioactive wastes but contains less than 0.0003% of the radioactivity.

Government is moving towards a change in legislation that will enable some LLW (particularly VLLW and LALLW – see below) to be disposed of on site where this is seen as the best option. If this legislative change is approved, it could lead to significant changes in the management and disposal of the lowest level radioactive material generated by decommissioning.

Very Low-Level Waste (VLLW)

This is a sub-category of LLW, consisting of the same sorts of materials, and divided into Low Volume ('dustbin loads') and High Volume ('bulk disposal'). Low volume VLLW can be disposed of to unspecified destinations along with municipal, commercial or industrial waste. High volume VLLW can be disposed of in specified landfill sites and controls are necessary as specified by the environmental regulators.

Low Activity Low Level Waste (LALLW)

A sub-set of LLW which is below a certain threshold of radioactivity.

Out of scope wastes

Material that is so low in radioactivity that the risks to humans and the environment can be classed as negligible.

Non-nuclear LLW

A range of processes and industries outside the nuclear industry produce LLW. These include hospitals, research facilities, military uses and certain industries. There is a separate Government strategy to manage non-nuclear LLW.

Naturally Occurring Radioactive Material (NORM)

NORM consists of materials, usually industrial wastes or by-products, which contain naturally occurring radioactive materials which have been concentrated by the nature of certain industrial processes. Within the UK a range of industries including oil and gas, produce such NORM wastes. There is a separate Government strategy for the management of NORM.

A national inventory of radioactive wastes is updated about every three years. It describes all stocks of radioactive wastes held in the UK, together with predictions of future arisings. The most recent version of the inventory was published in 2019[1].

Finally, it should be noted that the NDA has adopted a risk-based approach to the management of radioactive wastes, so that decisions on treatment and disposal are made based on the best management option rather than simply on their classification.

4: Main Steps in the Management of Radioactive Wastes

Radioactive waste will undergo some or all of the following steps depending on the type of waste and strategy for its management:

- Pre-treatment – the aim is to segregate waste into streams that will be managed in similar ways.
- Treatment – involves changing the characteristics of the waste by volume reduction, radionuclide removal or change of composition.
- Conditioning – involves transforming wastes into a form suitable for handling, transport, storage and disposal, usually by immobilisation and packaging.

[1] https://ukinventory.nda.gov.uk/

- Storage – involves emplacement of waste in a facility with an intention to retrieve for another step in the management process.
- Retrieval – involves removing wastes from storage for inspection, further storage or disposal.
- Disposal – occurs when packages of radioactive waste are emplaced in a facility with no intention of retrieval. Disposal can also include discharging liquid and gaseous effluent into the environment.

Strategies and plans for managing radioactive wastes need to address all the steps that are relevant to a particular waste.

5: Government Policies for Radioactive Waste Management

These can be summarised as follows:

Higher Activity Wastes (mainly High-Level Waste and Intermediate Level Waste)

Policy in England and Wales is for Higher Activity Wastes (HAW) to be stored on NDA sites before being disposed of in a Geological Disposal Facility (GDF). This is a highly engineered repository located deep underground in suitable geology.

In December 2018 (England) and January 2019 (Wales), Government launched a new siting process for a GDF. Nuclear Waste Services (NWS) is a subsidiary of the NDA that has been tasked by Government with finding a suitable location for a GDF. Policy requires that such a development can only take place within a consenting local community, and both local authorities and communities have been given a significant role in the siting process.

The GDF has been designated a **Nationally Significant Infrastructure Project (NSIP)** and a **National Policy Statement (NPS)** governing the planning aspects of the process, was laid before Parliament in July 2019. More information on the current process can be found in Nuleaf **Briefing Paper 14**, while background information on geological disposal can be found in **Briefing Papers 5, 16** and **17**.

The NDA is also considering the scope for disposing of some of the UK's HAW inventory in a **Near Surface Disposal** site or sites. Near Surface Disposal would be limited in scope and would not negate the need for a GDF. Further announcements on this issue are anticipated.

Radioactive waste management is a devolved policy issue. Therefore, the Welsh Government, Northern Ireland Executive and Scottish Government each have responsibility for this issue in respect of their areas.

The Welsh Government and the Northern Ireland Executive supports the implementation of geological disposal. Scottish Government policy is that long term management of Higher Activity Waste should be in near-surface facilities located as near to the site waste originates as possible. It does not sponsor the programme for implementing geological disposal.

Low Level Wastes

The UK Government published a **Policy statement on Low Level Waste management**[2] in March 2007. The most recent **Strategy for the management of solid Low-Level Waste (LLW) from the nuclear industry** was published in February 2016[3]. At its heart are commitments to:

- Apply the waste hierarchy and move away from the past focus on disposal;
- Make best use of existing LLW management assets, particularly the LLW Repository (LLWR) in Cumbria; and
- Identify new fit-for-purpose management routes.

Nuleaf's **Briefing Paper 8** provides more detail on LLW policy. Strategies for the management of NORM (Naturally Occurring Radioactive Material) and for non-nuclear industry radioactive waste have also been published (see Section 6).

Spent Fuel (SF) and Plutonium

Government policy is that the question of whether to reprocess spent fuel (a chemical process for separating uranium and plutonium), or hold it in storage, is a matter for the commercial judgement of the owner of the spent fuel, subject to meeting the necessary regulatory requirements.

Government has confirmed its view that in the absence of any proposals from industry, new nuclear power stations built in the UK should proceed on the basis that spent fuel will not be reprocessed. The **THORP (Thermal Oxide Reprocessing Plant)** at Sellafield closed in 2018, while the **Magnox Reprocessing Plant** shut down in 2022, ending all reprocessing operations.

UK Government's preferred policy for the long-term management of plutonium is that it should be reused in the form of mixed oxide fuel (MOX), with any

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[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/254393/Low_level_waste_policy.pdf
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/497114/NI_LLW_Strategy_Final.pdf

remaining plutonium unsuitable for conversion into MOX immobilised and treated as waste for disposal. UK Government has also stated that it would be open to consider alternative options if they offered better value to the UK taxpayer. It should be noted that at present, there are no plans to build a facility to produce MOX, nor, at present, are any of the new build reactor designs capable of burning it.

A Government progress report on Plutonium consolidation, storage and disposition was published in March 2019[4].

Liquid and Gaseous Waste Discharges

Under the terms of the **Radioactive Substances Act 1993 (RSA 93),** disposal includes the discharge of liquid and gaseous wastes to the environment. Such disposals are made as part of normal operations from hospitals, research establishments and the nuclear industry, and are controlled by means of authorisations issued under RSA 93. The Government is committed to progressive and substantial reductions in radioactive discharges. In June 2009 the UK Government published its revised strategy for radioactive discharges to inform decision making by industry and regulators. This strategy is currently under review.

Decommissioning

This is the process whereby a nuclear facility is taken permanently out of service, dismantled and its site made available for other purposes. Current Government policy dates from 2004. This states that decommissioning should be carried out as soon as reasonably practicable, taking all relevant factors into account, including the availability of waste disposal routes. Government states that the relevant factors, and their respective importance, can only be determined on a case-by-case approach.

A process of reviewing and updating decommissioning policy is underway and is expected that a new policy will be finalised in 2023. The NDA is also currently reviewing its approach to the decommissioning of the Magnox sites, which will result in the timelines for decommissioning of some sites being brought forward.

As noted earlier, responsibility for the decommissioning of the UK's AGR stations now sits with the NDA, with Magnox taking on this task following defueling by EDF.

[4] https://www.gov.uk/government/publications/progress-on-plutonium-consolidation-storage-and-disposition

Contaminated Land

Part 2A of the Environmental Protection Act 1990 addresses radioactively contaminated land. Annexes 4 and 5 of DEFRA Circular 01/2006 explain how.

Import and Export

Government policy is that radioactive waste should not be imported or exported from the UK, except for the recovery of reusable materials and, in specific cases, for treatment that will make its subsequent storage and disposal more manageable. Where such processes would add materially to the wastes needing to be disposed in the UK, the presumption should be that they will be returned to the country of origin. However, waste may be imported for treatment and disposal in the UK if it is in the form of spent sources that were manufactured in the UK or, in certain cases, if the waste is from small users such as hospitals.

6: Advisory Bodies, International Guidelines and Regulations

Government and others are advised by a number of different bodies:

- **Committee on Radioactive Waste Management (CoRWM)** – provides scrutiny and advice on the long-term management of radioactive wastes
- **Nuclear Safety Advisory Committee (NuSAC)** – advises the Health and Safety Commission on nuclear safety policy and its implementation
- **Committee on Medical Aspects of Radiation in the Environment (COMARE**) – provides assessments and advice on the health effects of radiation in the environment.
- **Public Health England** – provides advice, research, laboratory services and training courses.

Government policies are framed within the context of international guidelines and regulations, involving the following:

- International Commission on Radiological Protection
- International Atomic Energy Agency
- Nuclear Energy Agency of the OECD

Following the UK's exit from the European Union, the UK is no longer a member of EURATOM. Post Brexit, the **Nuclear Safeguards Act 2018** makes provisions for the government to pass regulations on, and implement agreements relating to, nuclear safeguarding. The Act also extended the role of the UK-wide Office for Nuclear Regulation to oversee the application of the new domestic regime.

7: Regulators

Regulators have the duty to ensure that the policy and regulatory framework is properly implemented. The primary regulators are:

Office for Nuclear Regulation (ONR) – ONR independently regulates nuclear safety and security at 37 nuclear licensed sites in the UK. They also regulate transport and the safeguarding of nuclear and radioactive materials. Their duty is to ensure that the nuclear industry controls its hazards effectively, has a culture of continuous improvement and maintains high standards. More information on how ONR regulates is available here[5].

The Environment Agency – regulates any disposal, discharge or off-site transfer of radioactive waste through authorisations issued under the Radioactive Substances Act 1993 (RSA93). It advises ONR on the long-term disposability of conditioned waste and scrutinises plans for disposal. The role of the EA in managing radioactive waste is set out here.

Natural Resource Wales - is responsible for regulating the nuclear industry in Wales on disposals and discharges of radioactive waste, discharges of cooling water and operation of standby generators.

Other regulators include: the Office for Civil Nuclear Security (OCNS) – responsible for regulating security arrangements; and the Radioactive Materials Transport Division (RMTD) of the Department of Transport – responsible for regulating the transport of radioactive materials.

8: Strategies for Implementing Policy

NDA Strategy

The NDA is responsible for producing a strategy for managing civil public sector nuclear liabilities which must be updated every 5 years. The latest Strategy was published in April 2021[6]. The Strategy is broken down into a series of themes: site decommissioning and remediation, spent fuels, nuclear materials, integrated waste management and critical enablers.

Site Decommissioning and Remediation – NDA's objective is to decommission and remediate designated sites and release them for other uses, in consultation with local authorities and communities. The aim is to complete this as

[5] https://www.onr.org.uk/
[6] https://www.gov.uk/government/publications/nuclear-decommissioning-authority-strategy-effective-from-march-2021

soon as reasonably practical and to progressively reduce risk and hazard. Each site will be treated individually and the benefits and detriments of clean up, in terms of safety, desired next use, environmental impact and cost assessed.

Spent Fuel – NDA's strategy is to ensure safe, secure and cost-effective lifecycle management of spent fuels. There is a commitment to engage with government, regulators and stakeholders in reaching strategic decisions.

Nuclear Materials – Strategy is to ensure safe, secure and cost-effective lifecycle management of nuclear materials. Nuclear materials are being consolidated at sites which are considered to be best suited to their safe long-term management.

Integrated Waste Management – The objective of Strategy is to ensure that wastes are managed in a manner that protects people and the environment, now and in the future, and in ways that comply with government policies and provide value for money. Strategic decisions about waste management are informed by the following principles:

- Supporting key risk and hazard reduction by enabling and delivering a flexible approach to long term waste management.
- Consider the entire waste management lifecycle.
- Apply the waste hierarchy.
- Promote timely characterisation and segregation of waste.
- Provide leadership giving greater integration across the estate and supply chain.
- Support and promote the use of robust decision-making processes.
- Enable the availability of sustainable, robust infrastructure for continued operations, hazard reduction and decommissioning.

This work is also supported by the NDA's **Radioactive Waste Strategy**[7], published in 2019.

Critical Enablers – NDA has identified a range of critical enablers which it must address in order for it to deliver its strategy effectively. They are:

- Health, safety, environment and well-being
- Sustainability
- Security and Resilience
- Cyber Security
- Research, Development and Innovation
- People
- Asset management

[7] https://www.gov.uk/government/consultations/nda-radioactive-waste-management-strategy

- Supply Chain
- Information Governance
- Socio-economics
- Public and stakeholder engagement
- Transport and logistics
- International Relations.

The overarching strategy is supported by the **NDA Business Plan**, which sets out operations plans over a rolling three-year period.

UK Strategies for Low Level Waste Management

As noted earlier, the most recent **Strategy for the management of solid Low-Level Waste (LLW) from the nuclear industry** was published in February 2016[8].

UK Government published the first part of its **strategy for the management of solid Low-Level Waste from the non-nuclear industry** in March 2012[9]. This deals with radioactive waste which is generated on non-nuclear licensed sites such as hospitals, pharmaceutical industries, and research and educational establishments.

The Strategy for **Naturally Occurring Radioactive Materials (NORM)** wastes was published in 2014[10]. NORM wastes are generated in industries such as production of titanium oxide and Oil and Gas exploration and production, including the process known as fracking.

EDF Energy Strategy

EDF Energy is the operator of the current fleet of energy generating nuclear power stations in the UK.

It was announced on the 7th of June 2021[11] that an agreement had been reached for the defueling and decommissioning of the UK's 7 Advanced Gas Cooled (AGR) reactors. Under the agreement, the AGR's will be defueled by EDF before being transferred to the NDA to complete the decommissioning process, with Magnox as the Site Licence Company (SLC). In advance of the transfer a decommissioning plan for each station will be developed. The NDA and Magnox will engage with

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[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/497114/NI_LLW_Strategy_Final.pdf

[9] https://www.gov.uk/government/publications/strategy-for-the-management-of-solid-low-level-radioactive-waste-from-the-non-nuclear-industry-part-1-anthropogenic-radionuclides

[10] https://www.gov.uk/government/consultations/strategy-for-the-management-of-naturally-occurring-radioactive-material-norm-waste-in-the-united-kingdom

[11] https://www.gov.uk/government/news/decommissioning-agreement-reached-on-advanced-gas-cool-reactor-agr-nuclear-power-stations

EDF to ensure that the plan reflects NDA Strategy, public procurement regulation and the learning that Magnox have acquired from their work on the first-generation stations.

EDF's costs of defueling and decommissioning will be met from the Nuclear Liabilities Fund (NLF) **Segregated Decommissioning Fund**. The NLF[12] was originally established in 1996 as the Nuclear Generation Decommissioning Fund to provide finance for the decommissioning of the 8 stations now operated by EDF and some other nuclear liabilities. The Fund is a limited company and is owned by the Nuclear Trust, which has five trustees, three appointed by BEIS and two by EDF.

Low Level Waste produced in operating the power stations is sent for treatment and/or disposal. Intermediate Level Waste is stored on site in tanks or vaults pending disposal to the Geological Disposal Facility when it becomes available, or in Scotland stored long term in near surface facilities. Spent fuel from the Advance Gas Cooled Reactors (AGR) is sent to Sellafield for storage or reprocessing, whilst spent fuel from Sizewell B which is a Pressurised Water Reactor (PWR) is stored on site until a final decision is made on how it will be disposed of.

EDF Energy is constructing a new nuclear power station at Hinkley Point in Somerset, with another planned for Sizewell in Suffolk. Decommissioning is a factor included in the design of the new reactors, the intention being to minimise the amount of radioactive waste produced. Current plans are that spent fuel from new nuclear power stations will be sent directly to the Geological Disposal Facility for disposal and will not be reprocessed.

Ministry of Defence Strategy

The MoD is committed to complying with legislation and 'so far as is reasonably practicable' with national policy relating to the management of radioactive wastes and decommissioning. MoD's approach includes sending Low Level Waste to the Low-Level Waste Repository near Drigg and interim storage of Intermediate Level Waste at the sites where it arises. The intention is that ILW will be disposed of in the Geological Disposal Facility.

The MoD's Submarine Dismantling Project (formerly known as ISOLUS) concluded in 2016. This identified Capenhurst in Cheshire as the site for the storage of ILW from decommissioned submarines which are currently being stored at Rosyth and Devonport (Plymouth) dockyards. Following storage, these wastes will be sent to the Geological Disposal Facility when it is operational.

[12] https://www.nlf.uk.net/