# Nuclear Free Local Authorities RADIOACTIVE WASTE POLICY Briefing No.64 – NDA Higher Activity Waste Strategy

**Prepared for NFLA member authorities, June 2016**

## NFLA response to the Nuclear Decommissioning Authority's (NDA) proposed Higher Activity Radioactive Waste Strategy.

### i. Preamble

The Nuclear Decommissioning Authority (NDA) is seeking views on its recently published Higher Activity Waste (HAW) strategy. At a recent meeting of the LGA Nuclear Legacy Advisory Forum, the Chief Executive of the NDA confirmed that the organisation is seeking initial views on the strategy. A more formalised consultation on the strategy is expected later in the year and will reflect upon comments to this draft strategy. The NFLA Secretariat has developed a response to the consultation, which is attached below. If NFLA member authorities wish to submit their own responses to the consultation they are encouraged to do so by emailing the NDA directly - strategy@nda.gov.uk. There appears to be no closing date for responses, so local authorities are encouraged to submit views as soon as possible. This response was formally endorsed at the NFLA Steering Committee meeting on the 24th June.

### 1. Introduction

Higher Activity Waste (HAW) is a category of radioactive waste which includes High Level Waste (HLW), Intermediate Level Waste (ILW) and a small volume of Low Level Waste (LLW) that is not deemed suitable for disposal at the Low Level Waste Repository (LLWR) near Drigg or the LLW facility at Dounreay.

UK government policy for the long-term management of Highly Active Waste (HAW) is to package and hold wastes in secure interim storage until they can be transferred to a deep underground Geological Disposal Facility (GDF), apart from in Scotland where the policy is for long-term management in near-surface facilities. A GDF is currently expected to be available to receive some HAW from around 2040. It is not expected to be ready to start receiving High Level Waste (HLW) and Spent Fuel (SF) until 2075.

This new Nuclear Decommissioning Authority (NDA) HAW Strategy, like previous LLW Strategies, looks at management strategies through the prism of the waste hierarchy. In the NFLA view, the waste hierarchy is used as a way to justify transporting waste to other facilities and even other countries in order to carry out so-called "processing" or treatment. This results in unnecessary discharges of radioactive substances into the environment and spreading radioactive waste around in alternative 'disposal' facilities - all of which result in dilution and dispersal of radioactive substances throughout the environment.

The HAW Strategy proposes using a so-called 'risk-based approach' to divert waste which was previously destined for 'disposal' in the GDF to LLW disposal facilities or new near surface 'disposal' facilities; processing more waste, including by thermal treatment, and transporting more waste between sites. In the NFLA view, the NDA's HAW Strategy places too much emphasis on '*a risk-based approach to waste management'* where actually the calculation of risk is subject to huge uncertainty. Instead the emphasis should be placed on a clear set of environmental principles and a '*precautionary approach*.' Such an approach would argue for the management of waste on the site where it is produced (or as near as possible to the site) in a facility that allows monitoring and retrieval of the wastes.

## 2. NFLA's Environmental Principles

NFLA advocates a waste management strategy based on a set of sound environmental principles.

The NFLA Steering Committee agreed a set of clear environmental principles which should be used for the management of nuclear waste in October 2004 at its Annual General Meeting in Hull.

These are:

- **The idea that radioactive waste can be "disposed" of be rejected in favour of radioactive waste management;**
- **Any process or activity that involves new or additional radioactive discharges into the environment be opposed, as this is potentially harmful to the human and natural environment;**
- **The policy of 'dilute and disperse' as a form of radioactive waste management (i.e. discharges into the sea or atmosphere) be rejected in favour of a policy of 'concentrate and contain' (i.e. store safely on-site);**
- **The principle of waste minimisation be supported;**
- **The unnecessary transport of radioactive and other hazardous wastes be opposed;**
- **Wastes should ideally be managed on-site where produced (or as near as possible to the site) in a facility that allows monitoring and retrieval of the wastes.**

The above principles are echoed in a Department for Environment Food and Rural Affairs (DEFRA) document published in 2000 "*Statutory Guidance on the Regulation of Radioactive Discharges into the Environment from Nuclear Licensed Sites: Consultation Paper*."

This states that:

"*Radioactive waste management policy should be based on the same basic principles that apply more generally to environmental policy, and in particular to that of sustainable development*."

The document discusses the '*concentrate and contain approach*' and compares it with a '*dilute and disperse'* approach, and concludes that where possible '*concentrate and contain' should be the preferred option*.'

The document stressed that "*Where there is uncertainty and potentially serious risks exists, precautionary action may be necessary*".

It is the NFLA view that 'disposal' of radioactive waste, whether in a deep underground geological disposal facility or a near surface facility is basically another method of '*dilute and disperse'*. And that the NDA HAW Strategy places too much emphasis on '*a risk-based approach to waste management'* where actually the calculation of risk is subject to huge uncertainty. Instead the emphasis should be placed on a '*precautionary approach*.'

Such an approach would not, for instance, view transport of HAW as "*a particularly significant enabling step within the waste management lifecycle*" nor would it support 'disposal' of waste. Rather it would support the management of waste on the site where it is produced (or as near as possible to the site) in a facility that allows monitoring and retrieval of the wastes.

NFLA has in general, however, been more supportive of the Scottish Government's policy of near-surface 'disposal' because it states that: *"…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."*

It is the monitorability and retrievability which are crucial here.

## 3. Waste Hierarchy

The Waste Hierarchy is described in the NDA Strategy as a "*central theme of the NDA HAW strategy*. [It] *provides a framework for waste management decision making throughout the lifecycle and enables an effective balance of priorities*." The NDA says the waste hierarchy principle applies just as much to HAW as it does to LLW, especially if its application can reduce the number of stores to be built and the number of disposal vaults to be constructed in a disposal facility.

In the NFLA view, however, the "*waste hierarchy*" is used as a way to justify transporting waste to other facilities and even other countries in order to carry out so-called "processing", and diluting and dispersing waste through the unnecessary discharge of radioactive substances into the environment and spreading waste around in landfill sites and by the use of incineration. In other words, NFLA does not believe that the "*waste hierarchy*" gives sufficient priority to environmental issues.

## 4. HAW Inventory

In November 2015 the NDA published an overview of the HAW it is responsible for. The total lifetime packaged volume of UK HAW is 463,000 $m^3$ of which the NDA owns 404,000 $m^3$ (~87% of all UK HAW). The remaining 59,000 $m^3$ is mostly Intermediate Level Waste owned by EDF Energy and the Ministry of Defence, with the balance split between GE Healthcare, Urenco, UKAEA and a few minor producers.

About 75% of all the NDA's HAW is from the Sellafield site and about 20% from the Magnox sites. Although the NDA HAW strategy is only applicable to the HAW within the NDA estate, this is by far the majority of the total amount of HAW arising across the whole of the UK including 100% of the HLW inventory.

**HAW Management Lifecycle**

First the waste has to be extracted or **retrieved** from its current location. **Retrieved waste** is then **conditioned**. This typically involves **immobilising** waste in a suitable **encapsulating** material such as cement, to give a solid and stable **wasteform**.

The **wasteform** can then go for **packaging**. The **waste package** is a container that is suitable for handling, long-term storage, transport, and potentially for 'disposal'. Sometimes the waste requires more shielding than can be provided by the packaging alone so there may be a requirement for over-packaging if the waste is to be transported.

Waste packages are then **stored** in a robust engineered facility with a design life of typically 100 years that is resistant to foreseeable incidents such as seismic events and severe weather. The **interim storage facility** should provide protection from potential external corrosion caused by ambient conditions including atmospheric salts, temperature and humidity levels which could have a long-term impact on the integrity of the package.

Monitoring and inspection of waste packages is a key measure of the performance of these multi-barriers.

The final stage is intended to be **emplacement** or 'disposal' in a deep geological disposal facility, or as in the case of Scotland, a near surface facility. Some waste packages have not been designed specifically for disposal and may require additional packaging before they can be considered suitable for disposal.

The HAW inventory managed by the NDA can be divided into four main types of waste:

a. **Wet ILW – potentially mobile waste.**

Often heterogeneous waste streams stored in historical facilities that in some circumstances require urgent attention in particular legacy wastes on the Sellafield site. This waste often needs to be immobilised to reduce hazard as quickly as possible.

**b. Solid ILW.**

There are significant volumes of solid ILW, which includes concrete, rubble and activated steel, at the lower end of the ILW radioactive spectrum. So, although these wastes are currently expected to be disposed of in the GDA, the NDA's risk-based approach could see them disposed of in near surface facilities.

**c. Graphite.**

Within the UK there are large quantities of irradiated graphite present in AGR, Magnox and test/prototype reactors. Currently this is mostly destined for the GDF or near surface facilities in Scotland. Alternative waste treatment solutions could substantially reduce the volume of graphitic wastes that are currently planned to go to a GDF.

At the moment old Magnox reactors are not expected to be dismantled until towards the end of this century so developing alternative methods to treat graphite has not been a priority, but the NDA is re-visiting this strategy.

**d. High Level Waste.**

Highly active liquors (HAL) – or high level liquid wastes - arise at Sellafield through the reprocessing of spent nuclear fuel. This is then "vitrified" or turned into glass blocks. Reprocessing is expected to end at Sellafield around 2020.

## 5. New Management Opportunities

Previously HAW management involved site specific retrieval, treatment, conditioning and packaging almost exclusively involving encapsulation in cement, followed by interim storage until disposal in a GDF or a near-surface facility for wastes arising in Scotland. Since the NDA's inception it has sought to take a more flexible approach.

There are five different management techniques discussed in the NDA Strategy Document, all designed to reduce the amount of waste requiring 'disposal'.

### *a) Effective waste characterisation*

Characterisation and segregation of waste can allow more appropriate management. For instance, if LLW is mixed with ILW it would normally have to be disposed of as ILW. But if the two types of waste can be segregated the LLW can follow the normal LLW route thus reducing the volume which has to be expensively emplaced in a GDF,

For example, the NDA recently announced that it had retrieved mixed waste from underground chambers at the decommissioned Berkeley nuclear power plant. Although it was originally anticipated that all this material would be intermediate-level waste (ILW), a "*campaign of innovative retrieval techniques and segregation*" enabled some of it to be disposed of as low-level waste and very low-level waste, diverting over 50 tonnes away from the site's interim storage facility and saving millions of pounds. (1)

***To NFLA, this seems to be eminently sensible where it does not lead to any further doses to workers or discharges to the environment than would otherwise have been the case.***

### *b) HAW/LLW boundary wastes*

At the lower end of the HAW spectrum, according to the Low Level Waste Repository Ltd (LLWR), there is approximately 150,000$m^3$ of anticipated waste arisings which are predominantly concrete,

mixed waste and metals. A significant proportion of these wastes (approximately 50%) may be classifiable as LLW and the vast majority (over 90%) is expected to arise from the NDA estate.

Waste which does not require heating to be taken into account in the design of storage facilities and which contains radioactive materials exceeding 4 gigabecquerels per tonne of alpha or 12 GBq/te of beta/gamma is classified as ILW, which currently usually means that the waste is destined to be consigned to the GDF, apart from in Scotland. However, the NDA now wants to use a more 'risk based approach' to allow some of this waste to be consigned to new near surface facilities.

It can be assumed that this means that provided the radiological risk to the most exposed member of the public is less than a risk guidance level of $10^{-6}$ per year (that is, a risk of death of 1 in a million per year due to exposure to ionising radiation) then near surface disposal could be deemed to be acceptable.

The environment agencies Guidance on Requirements for Authorisation (GRA) on Near Surface Disposal Facilities for Solid Radioactive Waste (Near Surface GRA) says that a risk level of $10^{-6}$ per year is equivalent to a calculated dose of around 0.02mSv/yr, where the probability of receiving the dose is one. 0.02 mSv is the Basic Safety Objective set as a target for new nuclear installations, or waste facilities by the Office for Nuclear Regulation. But the GRA also says that in situations where the probability of receiving a dose is less than one, doses could be greater. (2)

In other words, based on modelling of the likely behaviour of radioactive substances in this "boundary waste", a potential dose much higher than 0.02mSv could be deemed to be acceptable.

***NFLA believes this level of flexibility in the permitted dose from near surface 'disposal' sites is unacceptable.***

The NDA says the fact that near-surface facilities could accommodate wastes categorised as ILW is reflected in the Scottish government's long-term HAW policy, which recognises that near-surface disposal is a possible management option for some wastes arising in Scotland.

But the Scottish Government's policy of near-surface 'disposal' requires that: *"Developers … demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved."*

***For NFLA, this caveat should also be reflected in the NDA Strategy.***

Decontamination techniques could be used to treat waste, particularly surface-contaminated material, in order to allow the leftover bulk of the material to be managed as LLW.

NFLA believes that decontamination techniques are unacceptable if they lead to increased discharges of radioactive substances into the environment.

### *c) Reuse/recycle*

The HAW Strategy says some radioactive wastes may be deemed suitable for reuse or recycling. Some waste materials may be decontaminated or decay stored to allow for recycle/reuse opportunities now or in the future within the industry. There are also large numbers of ILW interim packages across the estate where the container could be reused or even recycled, *e.g.* 200 litre drums.

***For NFLA, any recycling should be carried out on-site and only if there are no increases in discharges to the environment.*** Any materials recycled should only be used on site to manufacture new waste packages.

### *d) Waste volume reduction*

Various techniques for waste volume reduction are mentioned in the HAW Strategy including mechanical methods such as super-compaction, and chemical methods and high temperature processing.

The NDA says it will continue to support collaborative working in order to drive forward the implementation of thermal treatment technologies for the treatment of HAW and these may require some form of aerial discharge abatement.

***For NFLA, in line with its environmental principles noted above, any method which requires further discharges of radioactive substances into the environment would be seen as unacceptable.***

### e) Storage and disposal

The NDA says it will continue to encourage industry to investigate the sharing of storage solutions and in particular, maximise the utilisation of storage capacity in existing stores.

The need to use existing space efficiently needs to be balanced against the increased risk of transporting waste between sites and the likely objection from the public living around nuclear sites to waste being brought in from outside. ***In the NFLA view, waste should be managed on the site where it is produced wherever possible.***

## 6. Conclusion

The NDA HAW Strategy makes changes to the current strategy in an apparent attempt to reduce the volume of waste which will eventually need to be emplaced in a deep Geological Disposal Facility.

Some of these measures involve diverting waste to near surface disposal facilities by using a so-called 'risk-based approach'. Rather than using a precautionary approach to make sure that doses of radiation to exposed members of the public are never above a certain level, this approach will allow the possibility of higher doses provided the probability of such a higher dose is assessed to be sufficiently low. ***NFLA believes introducing this level of flexibility is unacceptable.***

Other methods of volume reduction such as recycling, heat treatment or chemical treatment, are likely to involve increases in discharges of radioactive substances into the environment and are also unacceptable.

Where volume reductions can be made without increased discharges to the environment or increases in doses to the workforce this is welcomed.

It seems strange to NFLA that as a society we are contemplating techniques by the NDA to reduce volumes of legacy nuclear waste, without proper consideration of environmental principles, whilst another section of the nuclear industry is busy planning to start generating yet more nuclear waste.

## 7. References


(1) World Nuclear News 14th June 2016 http://www.world-nuclear-news.org/WR-Clearance-continues-of-Berkeley-waste-vaults-1406165.html

(2) Near-surface Disposal Facilities on Land for Solid Radioactive Wastes Guidance on Requirements for Authorisation, Environment Agencies, February 2009 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296507/geho0209bpjl-e-e.pdf