NFLA Radioactive Waste Policy Briefing Number 73: UK Government consultation on the future regulation of nuclear sites as they reach their 'end' states

Prepared for NFLA member authorities, September 2018

The NDA's Draft Radioactive Waste Strategy July 2018

i. Overview of Policy Briefing

This edition of the NFLA Radioactive Waste Policy provides members with a model response to a Nuclear Decommissioning Authority (NDA) consultation on developing a single radioactive waste strategy to cover all levels of waste they manage across its estate. This includes all existing waste, and materials that may become waste at some point in the future. NFLA has consistently responded to all NDA waste strategy consultations since the NDA was constituted. This response has been developed for the NFLA by the NFLA Scotland Policy Advisor. It is the NFLA's understanding that the strategy covers NDA waste in England, Scotland and Wales.

This consultation closes at midday on 31 October 2018

If you wish to submit a response to the consultation then email it to: iwm@nda.gov.uk

Or send it by post to the following address:
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1. Introduction

The Nuclear Decommissioning Authority (NDA) Radioactive Waste Strategy Document begins by pointing out that the UK has been producing and managing radioactive waste for many decades, implying that there are no problems associated with current policies. ***Yet no country in the world has implemented a long-term solution for higher level waste.***

To illustrate the problem it is worth remembering that the UK built 26 Magnox reactors at 11 sites between 1956 and 1971. These reactors are now all closed and the job of decommissioning them has fallen to the NDA. One of these Magnox stations (with two reactors) at Bradwell in Essex is currently in the final stages of preparing the site for an 80 year period of care and maintenance. The power station stopped generating electricity in March 2002, after running for 40 years. So, to put this issue into context, a baby born today in the maternity ward at Colchester Hospital could well end up with grand-children or even great grand-children who work on the job of final decommissioning and packaging the waste generated by dismantling the plant.

Radioactive Waste Management Ltd. (RWM Ltd.) says the proposed new nuclear reactors for England and Wales will use high burn-up fuel (65 GW/tU) which will require a cooling period of up to 140 years before being emplaced in an underground repository – which could mean spent fuel stored on new reactor sites for up to 200 years (i.e. 140 years after the reactor closes). However by the judicious mixing of long-cooled and short-cooled 'Spent Fuel' it is possible the duration of storage after the end of power station operation could be reduced to the order of 60 years before disposal.

This means waste could be stored on the reactor site until around the year 2150. (1) Again to provide some context, the grandchildren and great grandchildren of those people who carried out the final dismantling of Bradwell could be expected to load spent fuel from Bradwell B to be transported to some future geological disposal site.

In the NFLA's view, the NDA should not be promoting the use of volume as a comparator for different types of waste, as it does in the introduction to this consultation document. The use of volume as a measure of the impact of radioactive waste is ***highly misleading***. Volume is not the best measure to use to assess the likely impact of wastes and spent fuel from a new reactor programme, in terms of its management and disposal. For instance, the nuclear industry and government repeatedly claim that the volume of nuclear waste produced by new reactors will be small, approximately 10% of the volume of existing wastes; implying this additional amount will not make a significant difference to finding an underground dump for the wastes the UK's nuclear industry has already created. (2) By looking at the amount of radioactivity in the waste instead, it can be seen from RWM Ltd figures that ***Hinkley Point C alone will produce waste which will contain 3,800,000TBq by the year 2200 or about 80% of the radioactivity in existing waste.*** (3)

According to the consultation document over 90% of the UK Radioactive Waste Inventory by volume is generated by the NDA estate. This invites the conclusion that continuing to operate the UK's ageing nuclear reactors for as long as possible won't make much difference to the radioactive waste inventory. In fact, by looking instead at waste in terms of activity rather than volume, it can be seen that in the 2010 Derived Inventory 1,920,000TBq out of a total of 4,770,000TBq is accounted for by legacy spent fuel mostly produced by EDF Energy's AGR stations and Sizewell B, i.e. ***at least 40% is not the result of the NDA's activities***. (4)

2. NDA Strategy

In January 2016 the NDA consulted on a Draft Strategy for 2016-21. (5) The final strategy was published in March 2016. (6) In its response (7) the NFLA said:

"…*a worrying picture is emerging … of an evolving strategy for the NDA which is straying even further from important environmental principles. NFLA notes that across the UK there has already been increasing quantities of radioactive waste "diluted and dispersed" around the environment by diverting it to landfill, discharging into estuaries, seas and atmosphere using dissolution plants, metal recycling plants and incinerators – masquerading as the environmentally-friendly sounding "waste hierarchy*".

Regrettably, since then, these fears have only been confirmed. According to NuLEAF (The Nuclear Legacy Advisory Forum) much material (up to 90%) has been diverted from disposal at the Low Level Waste Repository at Drigg in Cumbria (LLWR). Much of the Very Low Level Waste (VLLW) is sent to specialist landfill sites at King's Cliffe in Northamptonshire, Lillyhall in Cumbria and Clifton Marsh in Lancashire. (8) Other types of facility include radioactive metal recycling plant and incinerators. (9) The 2016 NDA Radioactive Waste Inventory makes great play of the fact that "*over 85% of LLW is diverted away from the LLWR by using more sustainable waste management routes*." (10)

It continues:

"*The waste hierarchy encourages new approaches for managing LLW in a more sustainable way. It sets out the priority order for managing waste materials based on their environmental impacts. The preference is to avoid producing waste or minimise the amount of waste that is generated in the first place. Where practicable, waste material is then considered for re-use or recycling following decontamination. If suitable, some waste may be incinerated. Disposal is the least preferred option*."

The concern is that these so-called "*more sustainable routes*" amount to spreading the waste around the country and thus diluting and dispersing radioactivity around the environment.

3. Principles and Ethics

In May 2018, the US National Council on Radiation Protection and Measurements (NCRP) published Commentary No. 27, Implications of Recent Epidemiologic Studies for the Linear-No threshold Model and Radiation Protection. NCRP concludes that "*the recent epidemiologic studies support the continued use of the LNT model for radiation protection. This is in accord with judgments by other national and international scientific committees, based on somewhat older data, that no alternative dose-response relationship appears more pragmatic or prudent for radiation protection purposes than the LNT model.*" (11)

This model says that the relationship between cancer risk and radiation dose is linear, so that even at low doses of radiation there is still a small cancer risk. In short – there is a scientific consensus that there is no safe level of radiation.[1]

It follows, therefore, that it is unethical and immoral to knowingly increase releases of radioactivity into the environment, no matter how small, when this can be avoided. It was with this in mind that the NFLA developed a series of environmental principles which it believes should be followed when deciding how to manage nuclear waste (see box).

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.

4. Strategy Objectives

Key objectives for the Waste Management Strategy should therefore be:

- Encourage nuclear operators to end the production of new nuclear waste (including spent fuel) as soon as practicable;
- Existing radioactive wastes should be concentrated and contained to avoid wherever possible further radioactive discharges into the environment. The use of the waste hierarchy under these circumstances is not appropriate;
- Waste Management infrastructure needs to be developed to facilitate the long-term, passively safe storage of radioactive waste near or on the surface and as near as possible

[1] There are many uncertainties in current estimates of radiation doses and risks: larger uncertainties exist with internal radiation. These arise mainly from the many steps used to derive doses, and partly from lack of statistical precision in deriving risks from epidemiology studies. The size of these uncertainties has been estimated by a number of expert dosimetrists: for some nuclides these are very large. The report by the CERRIE committee recommended that uncertainties should be acknowledged and dealt with by the government. Its parent committee, COMARE, backed these findings. See Fairlie, I. *Uncertainties in Doses and Risks from Internal Radiation,* Medicine, Conflict and Survival 2005 https://www.tandfonline.com/doi/abs/10.1080/13623690500073414

to where the waste was produced in a way which facilitates monitoring and retrieval and protects from malicious attack;
- Existing wastes, including spent fuel and plutonium, should be immobilised and placed in long-term passively safe storage as quickly as possible;
- The collective radiation dose to the UK and global population should be reduced to an absolute minimum.

5. Planning and Preparation

NFLA agrees that understanding the inventory of waste and materials that need to be managed throughout the decommissioning and waste management processes is essential to successful planning and preparation.

NFLA also agrees that characterisation plays an important role in the decommissioning of nuclear facilities; forming the basis for planning, identification of the extent and nature of contamination, assessment of potential risk impacts, cost estimation, implementation of decommissioning and waste management, radiation protection, protection of the environment. This is why it is important not to use volume as the main comparator for different stocks of nuclear waste, but instead to list the radionuclide constituents. We also agree that an understanding of non-radioactive characteristics such as chemotoxic and hazardous components is essential to support waste management decisions.

Integrated Waste Management plans should include a strategy, where appropriate, for the waste producer to end the production of new nuclear waste (including spent fuel).

6. Treatment and Packaging

The consultation document says the aim of waste treatment and packaging is to process raw waste into a form that is suitable for 'disposal', where routes are readily available, or for long-term storage pending the development of suitable disposal routes.

NFLA agrees with former CoRWM member Professor Andy Blowers who says that:

"The search for a disposal site diverts attention from the real solution for the foreseeable future, which is to ensure the safe and secure management of the unavoidable legacy wastes that have to be managed." (12)

The primary objective of treatment and packaging should be to produce a waste-form which is most suitable for long-term storage. Treatment should be a process which does not disperse further radioactivity into the environment. Treatments like incineration or so-called decontamination involve discharges of radioactivity into the environment and should therefore be avoided.

NFLA sees the idea of 'disposal' as a misnomer. It is simply placing nuclear waste in a medium from which there is no intention to retrieve. However this does not preclude further discharges into the environment. Indeed these are usually allowed for, and attempts are made to keep them to 'acceptable' levels. But these attempts are not necessarily successful, and the public does not have a great deal of say on what is deemed 'acceptable'.

7. Storage

The consultation document defines storage as "*the holding of radioactive waste or material in a facility that provides for its containment, with the intention of retrieval*." It goes on to say that "*storage facilities are required … until a disposal route becomes available*."

Another way of phrasing this might be that waste is kept in a facility where it can be contained and monitored until it can be moved into a medium where eventual dilution and dispersal have been authorised. (Of course there will have been some radioactive decay in the meantime.)

The consultation says the strategy allows for safe and secure storage for a period of at least 100 years. This period of time needs to be revisited. A Geological Disposal Facility (GDF) is not expected to be ready to receive waste until at least 2040. It is expected to take around 90 years – until around 2130 to emplace all existing waste. Even assuming that a GDF is the agreed way forward, and it is delivered in 12 years' time, 100 years of storage does not leave much leeway for some waste.

The consultation document mentions "*investigating store consolidation opportunities where they are available have the potential to provide cost and/or schedule benefits*." The downside of this, of course is that it means unnecessarily moving waste around the country and increasing the risks to those living on transport routes.

Table 1 on Radioactive Waste Storage does not seem to take into account the need for heat generating wastes to cool down. Logically spent fuel should be declared waste when reprocessing at Sellafield ends. With THORP due to close this year and Magnox by 2020 it would seem sensible to include spent fuel in the discussion about future strategy.

8. Disposal

As set out in the Environmental Principles above, the NFLA rejects the idea that radioactive waste can be "disposed" of. The dictionary definition of "dispose" is "to get rid of something". Even those in favour of disposal don't believe that disposal gets rid of waste. They agree that radionuclides in waste will eventually return to the surface or disperse in the environment, but they seek to show that radiation doses to the public will be at an acceptably low-level. The NDA consultation document says deep disposal will "*ensure that no harmful quantities of radioactivity ever reach the surface environment*." Given that the Linear No Threshold Model of radiation protection shows that there is no safe level of radioactivity, this is a scientifically inaccurate statement. What it should say is that radiation which reaches the surface should only increase the risk of cancer and other health problems by an "acceptable" level. And it should define what an acceptable level is considered to be.

NFLA believes it is currently impossible to demonstrate with any scientific credibility that the resultant radiation dose to people from a nuclear waste repository would be at an acceptably low level into the far distant future.

Those in favour of 'disposal' generally argue that we have a responsibility to future generations to deal with the issue of nuclear waste we have created now, rather than leaving it for them to clean up. On the other hand the NFLA would argue that it would be better to leave future generations with a choice about what to do with nuclear waste rather than bequeathing a fait accompli which could turn out to be a leaking repository.

Risk based approach = releasing radioactivity into the environment to reduce costs

The NDA Consultation Document says "*disposal of radioactive waste should follow a risk-based approach*". The document also talks about "*making best use of capacity and capabilities that either exist now or could be developed in the future*".

This *modus operandi* is virtually the opposite of concentrating and containing radionuclides, as advocated in the NFLA environmental principles. It means permitting this disposal of radioactive waste in various ways to save money provided it can be shown that the increased risk to the public is '*acceptably*' low.

The NDA consultation document is proposing to support (indeed the NDA already does support)

1. Leaving waste in situ or dumping it on decommissioned nuclear sites;
2. Sending waste to commercial landfill sites;
3. Continuing to send Low Level Waste to the LLWR facility at Drigg and the LLW disposal site at Dounreay;
4. The possibility of near surface disposal of ILW in England and Wales, not just in Scotland.
5. Deep Geological Disposal.

Along with several 'treatment' methods mentioned, such as incineration and so-called 'decontamination' and 'recycling' many of these 'disposal' methods will have the effect of increasing the collective radiation dose to the UK population.

9. Radioactive Waste Strategy Implementation

UK Low Level Waste Policy, originally published in 2010 has already diverted 88% by volume of waste which would have gone to the Low Level Waste Repository near Drigg. The question which must be asked is '*where has it gone'* and '*what are the collective dose implications of such a change*'. New disposal routes have included: a range of alternative waste treatment processes; and alternative VLLW disposal routes (landfill and in-situ disposal). The NDA claims this has saved approximately £150 million between 2009 and 2017.

10. Conclusions from the NFLA

In 2003, the Government said that about 2 million cubic metres (m^3) of LLW could arise from existing nuclear and non-nuclear activities over the next century, including that which will arise from the decommissioning and clean-up of the UK's older, publicly owned, civil nuclear sites, by the Nuclear Decommissioning Authority (NDA). This compared with a remaining capacity for the currently authorised LLW repository (LLWR) site near the village of Drigg which was estimated to be about 0.8 million m^3. (13)

The NFLA expressed concern at the time that some options for LLW management could result in increased dilution and dispersal, increasing the potential for public exposures, and adding to the burden of radiological risk that is carried by society. (14)

Clearly, something needed to be done. You can't fit 2 million m^3 into a space large enough for only 0.8m^3. In 2009, the NFLA concluded that:

"*There is a legacy of public mistrust in the industry which …can only be overcome by underpinning any proposed strategy with a clear set of environmental principles; setting a boundary on the amount of waste to be dealt with – in other words cancelling proposals for new reactors; and extensive consultation in an open and transparent manner.*"

The NFLA has consistently argued that developing radioactive waste management policy needs to be underpinned by a clear set of environment principles. The most important of these principles is that we should stop producing more waste as soon as possible.

These principles also mean that waste policy should be about limiting and restricting discharges and dispersal of radioactivity into the environment, and aiming for a goal of zero discharges. If there are cases where, as the Government claims, complete containment is not a 'practical proposition' because of practices which have been carried out in the past and legacy wastes which have been stockpiled, then the waste producers need to make the case for an exception to be made.

11. References

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(2) Nuclear Industry Association website (accessed) 9th July 2018 https://www.niauk.org/industry-issues/waste-management/

(3) An overview of the differences between the 2013 Derived Inventory and the 2010 Derived Inventory, RWM Ltd, July 2015 https://rwm.nda.gov.uk/publication/differences-between-2013-and-2010-derived-inventory/

(4) As above

(5) NDA Draft Strategy, September 2015 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/459520/NDA_Draft_Strategy_-_Sept_2015.pdf

(6) NDA Strategy Effective April 2016 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/518669/Nuclear_Decommissioning_Authority_Strategy_effective_from_April_2016.pdf
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(13) RWMAC "The Radioactive Waste Management Advisory Committee's: advice to Ministers on the management of low activity, solid radioactive wastes within the UK" Defra, 2003.
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