

Nuclear Free Local Authorities **RADIOACTIVE WASTE POLICY**

Briefing No. 29– Dounreay fast reactor credible options

Prepared for NFLA member authorities, 24th August 2011

Exotic Fuels - Dounreay Fast Reactor Credible & Preferred Options, Public ConsultatJuly 2011

NFLA Model Response to NDA Consultation

Background to this briefing

This briefing has been prepared for NFLA member authorities in Scotland and the north of England in order for them to receive a copy of the NFLA's model response to the Nuclear Decommissioning Authority's (NDA) consultation on the credible and preferred options for dealing with exotic fuels remaining from the Dounreay Fast Reactor Programme (which ended in 1977). A consultation has also been announced for similar radioactive materials arising from the Harwell nuclear facility in Oxfordshire and the NFLA will seek to provide a model response for this separate consultation next month. The briefing has been prepared by the NFLA Scotland Policy Advisor Pete Roche.

If NFLA member local authorities wish to respond to the Dounreay consultation directly using the NFLA model response then it should be sent to strategy@nda.gov.uk for the attention of the NDA Strategy for Spent Fuel Group. It needs to be sent to the NDA by the end of August 2011.

The NDA mentions in its press release of 8th July 2011 that it would like comments on its credible options paper before the end of August 2011.¹ It is a struggle to find any other public mention elsewhere – in the media or the document itself - of the fact that the NDA's document is a consultation. The document does say:

“In preparing the final business case, the SLCs [Site Licence Companies] and NDA will need to engage with regulators, stakeholders and local communities to gain their view of the proposed strategy for management of this material.”

But the Business Case is expected to be presented in the early autumn and a decision made two months after that, with transports beginning in 2012 if approved. This gives very little time for further public consultations on this important issue, in particular with local authorities and emergency planning officials and emergency services between the Highlands and Cumbria. This is one of eight major conclusions the NFLA makes about this consultation, which are summarised in section 7 of its submission below.

At its Annual General Meeting in Hull in October 2004, the Nuclear Free Local Authorities Steering Committee agreed a set of clear environmental principles which should be used for the management of nuclear waste. These are:

- the idea that radioactive waste can be "disposed" or 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.

1. Introduction

A sustainable decommissioning policy must be based on a clear set of environmental principles, in particular: the polluter pays principle; the concentrate and contain principle and the proximity principle.

The recently published Scottish Government Policy is that the long-term management of higher activity radioactive waste should be in near-surface facilities located as near to the site where the waste was produced as possible.ⁱⁱ Obviously the NDA does not define the "breeder material" in question as waste. But nor does the NDA define the material as spent fuel (despite the fact that it was described as "breeder fuel" in the 2000 Dounreay Site Restoration Plan.ⁱⁱⁱ) No explanation is given as to why the material is not defined as waste – consultees are expected to accept the NDA's opinion on the matter.^{iv} This is presumably on the same basis that spent fuel from ordinary nuclear reactors is not defined as "waste" – because it supposedly contains "useful" plutonium and unused uranium. With the demise of the Sellafield MoX Plant – the only civilian facility in the UK making use of plutonium, albeit foreign-owned plutonium - in the NFLA's view it is high time that spent fuel and "breeder material" is defined as waste.

The NDA's proposal to transport the "breeder material" to Sellafield for reprocessing in the Magnox reprocessing plant is, therefore, breaching at least two important environmental principles. Firstly, the waste (breeder material) is not being managed as close to the site where it was produced as possible, so it is breaching the proximity principle. Secondly, by dissolving the material in nitric acid in order to extract plutonium in the Magnox reprocessing plant the process will be adding to the discharges of radioactivity from the Sellafield site – diluting and dispersing radioactivity throughout the environment and thus breaching the concentrate and contain principle.^v

2. Security Concerns

The Dounreay Fast Reactor operated from 1959 to 1977. It used an inner reactor core operating at high temperature and an outer ring (known as breeder material) of uranium metal which captured neutrons from the inner core and produced plutonium – the idea being that this would be removed, and the plutonium extracted and used to produce new fuel. With fast neutrons some of the absorptions in U-238 will lead to fission and the rest

will lead to the production of Pu-239. It is likely that any plutonium separated from the waste “breeder material” would be weapons-grade plutonium (predominantly Pu-239 with less than 7% Pu-240)

The breeder material is radioactive, but, according to the consultation document, much less so than fuel since it does not contain large amounts of fission products and it has also been cooled since 1977.

Paragraph 2.3 describes this material as 'Category A' material for security purposes without further explanation. It is assumed that this refers to Category 1 of the IAEA guidelines on Physical Protection of Nuclear Material and Nuclear Facilities. Category 1 material requires provision of a 24 hour guard service – probably armed. Where guards are not armed, the guidelines say that ‘compensating measures’ should be applied and that the objective should be the arrival of adequately armed response forces in time to counter armed attacks and prevent the unauthorized removal of nuclear material.^{vi}

On the other hand, the table on page 11 claims that “*criticality constraints mean that shipments are at reduced security category*”.

Clearly this requires much more explanation and discussion. The prospect of 50 armed rail movements travelling the length of Scotland to Cumbria will be of great concern to local authority emergency planning departments and the emergency services.

3. Other Category A materials

Paragraph 2.4 points out that reducing long-term security costs at Dounreay will be dependent on other materials being removed from the site as well.

According to the Parliamentary Office of Science and Technology:

“...there are around 109 tonnes of fuel at Dounreay [including the 44 tonnes of DFR breeder material]. About a quarter of this comes from the PFR [Prototype Fast Reactor] – it has been removed from the reactor vessel and is in interim storage. This fuel contains significant quantities of plutonium.”^{vii}

So, once the precedent has been set by transferring DFR breeder material to Sellafield, it is likely there will be further shipments of material containing “*significant quantities of plutonium*”. This extra material may not be in the “reduced security category” claimed for the DFR material.

4. “Breeder Material” Stuck

It should be noted that of the 44 tonnes of “breeder material”, 32 tonnes is stuck inside the reactor. This, in theory, consists of intact elements which have retained their original form.^{viii} Paragraph 2.4 states that this ‘in-reactor’ material cannot be accessed until the bulk of the Sodium/Potassium mix (NaK - being used to cool the breeder material) has been removed from the reactor. Removal of the bulk NaK is programmed to be complete by March 2013.

There must be some serious doubts about whether this timetable can be met. The December 1998 UKAEA report “Dounreay: The Way Ahead” stated that:

“Contract documents are being prepared to allow a contract to be placed for the removal of the fuel. This work is being given priority and full-scale demonstration trials of

alternative methods of recovering the fuel are scheduled to be complete by September 2002.” ix

And yet 13 years later the “breeder material” is still stuck inside the reactor.

The 1998 Safety Audit by the Health and Safety Executive (HSE) and Scottish Environment Protection Agency (SEPA) stated that the NaK removal and treatment plant “*was in the final stages of commissioning, but ... the project has suffered delays such that there has been no progress for approximately four years.*”

In its response UKAEA said the removal of the NaK was expected to be complete by March 2005. It is now programmed to be complete some 8 years later.^x

The HSE/SEPA Final Report on the Safety Audit states that breeder fuel removal operations will occur between 2007 and 2012. Clearly this has not happened.^{xi}

In the consultation document we are now told there is a detailed plan being implemented for the extraction of the fuel from the core and cleaning off of any excess NaK, which is scheduled to be complete around 2015/16. Even if this date is achieved it leaves a very limited window to transport the material to Sellafield and reprocess it before the Magnox reprocessing plant closes in 2016/17.

The remaining 12 tonnes of “breeder material” which was removed from the reactor in late 1965 was stored in steel cans, and then repackaged between 1989 and 1995. Unlike the material stuck inside the reactor this material is in the form of cut fuel elements, fuel pieces and debris. According to the Site Restoration Plan there is evidence that some of this material has suffered deterioration, but stabilisation is possible “*using proven technology*”.^{xii}

Clearly it is quite likely that transports of material to Sellafield may begin in 2012 with the 12 tonnes of material stored outside the reactor, but if it then proves impossible to remove the stuck “breeder material” in time to be reprocessed before the closure of the Magnox reprocessing plant in 2016/7 there will have been no security or environmental gains at Dounreay and the risks associated with these transports will have been undertaken for nothing.

5. Magnox Reprocessing

As highlighted by the ‘John O’Groat Journal’ there is no appraisal of the litany of problems that have beset reprocessing at Sellafield, the NDA simply concludes that the “opportunity” of sending DFR material for reprocessing in Cumbria is just “*a reversion to the original plan*”.^{xiii} It is treated as a happy consequence of the fact that the Magnox reprocessing plant has failed to meet its international obligations to close by the end of 2012.

The Magnox reprocessing plant had been scheduled to close at the end of 2012 as part of the UK’s strategy to meet its OSPAR¹ commitments, but due to poor plant performance is now not expected to close until 2016/17. As a consequence, although radioactive discharges into the Irish Sea from the Sellafield site are low at the moment, they are likely

¹ The Convention for the Protection of the Marine Environment of the North-East Atlantic, known as OSPAR, has a strategic objective is to prevent pollution of the maritime area from ionising radiation through progressive and substantial reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances. OSPAR will ensure that by the year 2020 discharges, emissions and losses of radioactive substances are reduced to levels where the additional concentrations in the marine environment above historic levels, resulting from such discharges, emissions and losses, are close to zero.

to peak again between 2013 and 2016. It is also worth noting that there is likely to be a lag of around 5 years after reprocessing ends before discharges are reduced, so the UK cannot possibly meet its commitments to achieve 'close to zero' concentrations by 2020.

It is usually argued that there is no other proven method for managing spent Magnox fuel other than reprocessing. Given that the Magnox reactors are nearly all closed there is a finite quantity of spent fuel which will need to be reprocessed. If that is spread over a longer period of time due to reduced throughput because of technical problems, this should not make too much difference to the total volume of radioactive discharges going into the Irish Sea. Recent life extensions to the remaining two Magnox reactors are likely to add to the discharges expected to enter the Irish Sea, as will the plan to reprocess DFR breeder material. In the NFLA's view this course of action runs counter to the UK Government's commitments to this international treaty organisation and represents a failure to implement Best Available Techniques for spent fuel management. A detailed break-down and justification for predicted increases in discharges of radioactive substances as a consequence of these reprocessing plans should be provided to the OSPAR Commission before any transports are undertaken.

6. The Alternative Option

According to paragraph 2.5 of the consultation document, the immaturity of the immobilisation option indicates that an extensive R&D programme would be required to underpin the alternative option of immobilising the material in grout or polymer and storing it at Dounreay. It continues:

"The nuclear sector has historically found it difficult to develop immobilisation options for bulk quantities of uranium metal, but there may be value in maintaining a watching brief on these activities and continuing some development work as a contingency."

Yet in 1998 we were told:

*"An alternative method of treating the fuel (which contains much lower levels of plutonium than PFR fuel) prior to storage and eventual disposal as ILW **is available** as a fallback option which would be discussed with the regulators if required".* (emphasis added)

By 2006 this was no longer the fallback option, but THE option. The Dounreay lifetime plan which the NDA inherited assumed the DFR breeder material would be encapsulated, probably using grout, mainly because the anticipated end date of Magnox Reprocessing at Sellafield was 2012.

It is difficult to understand why after 13 years the immobilisation option is still described as "immature".^{xiv}

It is hard not to agree with the anonymous "industry experts" quoted in *The Guardian* who believe that the NDA has an interest in continuing to insist that plutonium will have some future use. If the NDA admits that it does not then not only will this breeder material have to be reclassified as a waste but the NDA and Government will be forced to acknowledge that the hundreds of millions of pounds worth of plutonium stored at Sellafield will have to be recognised as a liability on government balance sheets. Maintaining the pretence that plutonium might be useful allows it to be classified as a zero-value asset.^{xv}

7. NFLA Conclusions to the NDA Dounreay consultation

- This consultation exercise has been very poorly executed. It is not clear whether a further consultation exercise is planned once the business case has been published in the early autumn. In any case this will be of limited value as it will be apparent that a decision has already been made.
- With the demise of the Sellafield MoX Plant it is high time that spent fuel and “breeder material” is classified as waste.
- The NDA’s proposals will breach at least two environmental principles – the proximity principle and the concentrate and contain principle.
- The NDA’s proposal to reprocess this “breeder material” in the Magnox reprocessing plant at Sellafield will mean an increase in discharges from Sellafield at a time when it is already failing to make progressive a substantial reductions in discharges and achieving close to zero by 2020, in accordance with to the UK international commitments.
- It appears likely that the 50 or so shipments from Dounreay to Sellafield would need to be accompanied by armed police for security reasons.
- Once the precedent has been set further plutonium containing material requiring armed escort will probably be transported to Sellafield.
- There must be serious question marks over whether the “breeder material” stuck inside DFR can be removed, cleaned and despatched to Sellafield in time to be reprocessed before 2016/17.
- It appears that the NDA is putting forward these proposals as part of its campaign to maintain the pretence that plutonium is useful in order to avoid the UK plutonium stockpile being declared a waste and therefore becoming a liability on the Treasury’s books.

Therefore NFLA strongly opposes these proposals on both security and environmental grounds.

References:

ⁱ NDA Press Release 8th July 2011 <http://www.nda.gov.uk/news/dfr-exotic-fuel-options.cfm>

ⁱⁱ Scotland’s Higher Activity Radioactive Waste Policy 2011
<http://www.scotland.gov.uk/Publications/2011/01/20114928/0>

ⁱⁱⁱ Dounreay Site Restoration Plan Volume 6 Dounreay Nuclear Fuels Inventory and Management Plan para 5.6 page 19. It is presumed that Paragraph 5.6 is discussing the same material as there are 44 tonnes of “DFR Fuels” discussed in the Site Restoration Plan and 44 tonnes of “breeder material” discussed in the current consultation. The Site Restoration Plan says:

“Although the fuel burn-up is low it is considered as irradiated (spent) fuel since it originated from a power producing reactor”.

^{iv} See “Not fuel and not waste – so what is it?” John O’Groat Journal 5th August 2011

<http://www.johnogroat-journal.co.uk/Features/The-Free-Press/Not-fuel-and-not-waste-so-what-is-it-03082011.htm>

^v For further discussion see NFLA Scotland’s Response to the Dounreay Site End State Consultation, January 2007

http://www.nuclearpolicy.info/docs/consultations/NFLA_Dounreay_End_State.pdf

^{vi} Assessing the Risk of Terrorist Attacks on Nuclear Facilities, POST Report 222, Parliamentary Office of Science and Technology, July 2004 See Box 3.2

<http://www.parliament.uk/documents/post/postpr222.pdf>

^{vii} Assessing the Risk of Terrorist Attacks on Nuclear Facilities, POST Report 222, Parliamentary Office of Science and Technology, July 2004 Para 9.9 page 86

<http://www.parliament.uk/documents/post/postpr222.pdf>

^{viii} Dounreay Site Restoration Plan Volume 6 Dounreay Nuclear Fuels Inventory and Management Plan para 5.6 page 19.

-
- ^{ix} Dounreay - the Way Ahead: UKAEA response to the 1998 HSE/SEPA Audit of Dounreay. Recommendation 50 page 35.
- ^x Ibid Recommendation 51 page 35
- ^{xi} Safety Audit of Dounreay 1998: Final Report 2001, HSE and SEPA, Jan 2002 Page 67
<http://www.hse.gov.uk/nuclear/auditfin.pdf>
- ^{xii} Dounreay Site Restoration Plan Volume 6 Dounreay Nuclear Fuels Inventory and Management Plan para 5.6 page 19.
- ^{xiii} "Not fuel and not waste – so what is it?" John O’Groat Journal, 5th August 2011
<http://www.johnogroat-journal.co.uk/Features/The-Free-Press/Not-fuel-and-not-waste-so-what-is-it-03082011.htm>
- ^{xiv} Dounreay - the Way Ahead: UKAEA response to the 1998 HSE/SEPA Audit of Dounreay. Recommendation 50 page 35.
- ^{xv} Guardian 3rd August 2011 <http://www.guardian.co.uk/environment/2011/aug/03/sellafield-mox-plant-close>