Nuclear Free Local Authorities Secretariat

Plutonium Management Team
Department of Energy & Climate Change,
Third Floor Area D,
3 Whitehall Place,
London,
SW1A 2AW

27th July 2012

Emailed to: **plutonium@decc.gsi.gov.uk**

Dear DECC Plutonium Management Team,

NFLA SUBMISSION ON THE UK GOVERNMENT'S CONSULTATION ON THE PROPOSED JUSTIFICATION PROCESS FOR THE REUSE OF PLUTONIUM

I am writing to you to provide a formal submission to the Department of Energy & Climate Change from the UK and Ireland Nuclear Free Local Authorities Steering Committee (NFLA). The submission is in reference to the UK Government's consultation on the proposed justification process for the reuse of plutonium.

The NFLA is an organisation of local authorities from England, Scotland, Wales, Northern Ireland and the Republic of Ireland who raise legitimate concerns over the development of nuclear power, nuclear safety and radioactive waste management in the UK. The NFLA 'Terms of Reference' notes its aim is the long-term phasing out of nuclear power in favour of an alternative energy policy consisting primarily of a wide renewable energy mix, microgeneration and a more concerted programme of energy efficiency. For more details on the NFLA consult its website http://www.nuclearpolicy.info.

Along with the NFLA submission I also attach an annex which provides weblinks to the NFLA's submissions over recent years to the NDA and to DECC on the subject of what to do with the UK plutonium stockpile. As this submission also notes, the NFLA view has remained consistent – the plutonium should be immobilised, stored and managed safely.

1. Introduction

The Justification Process is an examination of the economic, social or other benefits of a practice which involves the release of radioactivity into the environment with the aim of showing that the benefits outweigh any health detriment of that class or type of practice.

The NFLA notes that the Department of Energy and Climate Change (DECC) is consulting on its proposed process for making applications, and the decision-making process for justification decisions concerning the reuse of plutonium as a means of long-term management of the UK's separated civil plutonium stockpile. The NFLA understands that, following the consultation, DECC will produce a 'Guidance for prospective applicants'. Applicants seeking a justification decision for the reuse of plutonium will need to satisfy the Justification Authority that the health detriments are offset by the benefits associated with the practice. As with previous justification consultations, the Justifying Authority is the Secretary of State for Energy and Climate Change and the three Devolved Administrations to the extent that they have competence in respect of the subject matter of a particular application.

The NFLA notes that the UK Government has already set out its preferred policy on the UK's stockpile of around 100 tonnes of 'weapons-useable' plutonium[1] – re-using it as Mixed Oxide (MoX) fuel – but says there is not yet sufficient information to decide whether to proceed with procuring a new MoX fuel fabrication plant. The NFLA understands the UK Government is now undertaking the next phase of work, which will provide the information required to make such a decision. The UK Government has publicly stated that, only when it is sure its preferred option can be implemented safely and securely, and is affordable, deliverable, and offers value for money; will it be in a position to proceed with a new MoX plant.

The NFLA also notes that the Nuclear Decommissioning Authority (NDA), which has responsibility for managing the UK's plutonium stocks, announced on 27th June 2012 that it is looking at the merits of two proposals to build new reactors – the PRISM fast reactor and the Enhanced CANDU 6 reactor – as a means of plutonium disposition - alongside plutonium reuse as MoX in Light Water Reactors. Discussions have taken place with General Electric-Hitachi (GEH) and Candu Energy inc. regarding their proposals. (1)

Earlier, on 13th April 2012, the NDA wrote to the DECC stating its intention to make an application under regulation 9 of the Justification of Practices Involving Ionising Radiation Regulations (2004) (for a new class or type of practice) in relation to retrieval and conversion of current plutonium stockpiles into MoX fuel; it's subsequent use in new EPR or AP1000 reactors, and the management of the spent MoX fuel. It was this letter which led to DECC launching the current consultation.

In the NFLA's view this consultation is pre-mature. The NDA is still investigating alternatives to the MoX fuel fabrication plant proposal. Whilst the NFLA would oppose the idea of building new reactors for the purpose of plutonium disposition, if the NDA is open to the investigation of reactor-based alternatives to the MoX fuel route, it should also re-examine the plutonium immobilisation concept as requested by the recently appointed Chair of the US Nuclear Regulatory Commission.

2. Consultation Questions

<u>Question One</u> – Do respondents agree with the Government's view that it is sensible to issue generic guidance for the reuse of plutonium? We welcome comments on this proposed approach.

Given that the Government remains unsure about its 'so-called' preferred option and the NDA is examining alternatives, producing a more generic guidance on a process for making applications and decisions on plutonium **management**, rather than just plutonium re-use, is the only way forward which makes sense. The guidance should cover applications for other plutonium management techniques. In particular it should leave the door open to future proposals on plutonium immobilisation.

For example on page 13 the proposed procedure should be to produce generic guidance for applicants wishing to justify techniques for the management of plutonium. The use of the word "re-use" appears to rule out techniques which involve treating plutonium as a waste.

<u>Question Two</u> – Are the proposed application and decision-making processes clear, appropriate and proportionate? If not, how can they be improved?

[1] Nuclear Weapons States such as the UK use weapons-grade plutonium for nuclear weapons. Generally – this type of plutonium is mostly the isotope plutonium-239 and it contains less than 7% plutonium-240. The plutonium in spent nuclear reactor fuel contains roughly 24% plutonium-240; such plutonium is often referred to as "reactor-grade". However, essentially all isotopic mixtures of plutonium—including reactor-grade plutonium—can be used for nuclear weapons, and are thus vulnerable to theft by terrorists. So here we use the term 'weapons useable' plutonium for reactor-grade plutonium. See Preventing Nuclear Terrorism, Union of Concerned Scientists Factsheet. http://www.ucsusa.org/assets/documents/nwgs/nuclear_terrorism-fissile_materials.pdf

NFLA notes that the Secretary of State for Energy and Climate Change is also the Justifying Authority. DECC needs to consider the obvious conflict of interest involved when it has already given its view. The Justifying Authority needs to be an unbiased neutral third party. As the Secretary of State has already made his mind up, this raises obvious questions about whether the Justification Decision can be legitimate if he remains as the Justifying Authority.

A new Justifying Authority should be appointed which has not yet expressed a view on plutonium management options.

<u>Question Three</u> – Is the indicative list of information in Table 3 sufficient and appropriate to assist in the making of justification applications and justification decisions? Does the indicative list omit any relevant information, or include any unnecessary information?

Plutonium management is very much a "*we-wouldn't-start-from-here*" issue. In other words, something is going to have to be done with the plutonium whether we like it or not. At some point a new class or type of practice with a health detriment, and security implications will have to be implemented. For this reason it would seem sensible for applicants to be asked to compare the chosen option with other credible options.

For example, members of the public across the UK, as well as stakeholders, will want to know the security implications of transporting MoX fuel containing 'weapons-useable' plutonium from Sellafield to Hinkley Point C compared with converting the plutonium into an immobilized waste form and storing this adjacent to irradiated spent fuel.

The section on Preparation of Separated Plutonium is written very specifically for an application for justification to build a new MoX fuel fabrication plant. There appears to be poor arguments for restricting applications to a single-type of plutonium management at this stage. Rather than talking about "fabrication into fuel", the guidance could use the phrase "plutonium management technique".

In the Fuel Fabrication section the use of the words "internal transport" is not clear. It should be noted that there is a big difference between moving plutonium materials internally within the Sellafield site and transporting them from, say, Sellafield to Hinkley Point C or Sizewell C.

A new section should be included on plutonium immobilization: The process of taking the prepared separated plutonium and immobilizing it as a waste form. To include any transports of the immobilized waste-form from its point of manufacture to its point of interim storage.

<u>Question Four</u> – Are there any other ways in which the draft justification process can be improved? If so how?

Much has changed since DECC's last consultation on plutonium management in February 2011. This consultation has missed a valuable opportunity to stimulate debate on this important subject which takes recent developments into account.

- On 11th March 2011 the Fukushima accident in Japan.
- On 3rd August 2011 the NDA announced that the Sellafield MoX Plant would close.
- On 23rd February 2012 the NDA announced it was seeking proposals on potential alternative approaches to the MoX route for managing the UK's plutonium stockpile.
- In May 2012 Prof. Allison Macfarlane, now confirmed as Chair of the US Nuclear Regulatory Commission called on the UK to look again at plutonium immobilization.
- On 27th June 2012 the NDA announced it is looking at the merits of both the GE-Hitachi PRISM reactor and the Enhanced CANDU 6 reactor as part of plutonium disposition strategy.
- Additionally, the Committee on Radioactive Waste Management highlighted concerns about the lack of work on the disposal of spent MoX fuel which may require cooling for up to 150 years at its plenary meeting in February 2011.

The Draft Justification Process Guidance could be improved by including sections on each of these points.

3. Fukushima and the implications for plutonium management.

The Government's December 2011 'Management of the UK's Plutonium Stocks' consultation response said in relation to Fukushima "*There will ... be time and opportunity for any significant relevant facts that might emerge to be considered as part of the longer term process*." (2)

According to the Government, the Office for Nuclear Regulation (ONR) report on the Japanese earthquake and tsunami and its implications for the UK nuclear industry (The Weightman Report) said there was no evidence to suggest that the presence of MOX fuel in reactor unit 3 significantly contributed to the health impact of the accident on or off the site.

However, it is clear from reading the Weightman report that this should not be taken as the all clear for MoX use in UK reactors. The report goes on to say:

"Questions have been raised about the possible use of MOX fuel in reactors in the UK. We have yet to see a safety case for such use and the information to date about Fukushima-1 does not add to knowledge about the safety of the use of MOX."

A 2001 study found that compared to a reactor fuelled with conventional nuclear fuel, the number of latent cancer fatalities resulting from an accident with core melt and early containment failure would be higher by 39%, 81% or 131% for full weapons-grade MOX cores, depending on the fraction of actinides released (0.3%, 1.5% or 6%). The population dose resulting from a beyond-design-basis accident involving a LWR using reactor-grade MOX fuel is two to three times greater than the dose resulting from the same accident if weapons-grade MOX is assumed. (3)

It would make sense to examine these health implications before proceeding with the construction of a MoX fuel fabrication plant, otherwise we could find that we have produced a fuel which cannot be licensed to use in UK reactors. Such an examination could take the form of, for example, a pre-licensing procedure and examination of the safety case for using MoX in an EPR and/or AP1000 reactor.

4. Sellafield MoX Plant Closure

The UK's Sellafield Mixed-Oxide (MoX) Fuel Fabrication Plant (SMP) is "*one of the most embarrassing failures in British industrial history*," according to a leaked US embassy cable. (4) It was built at a cost of £473 million, and despite repeated warnings that it would be uneconomic and could be a security risk, it has never worked properly. Even though the Government wrote off its capital cost, it was still haemorrhaging money. Though the annual loss is kept secret, the cable – released by Wiki Leaks – says it was "*costing taxpayers £90 million a year*".

The Government's preferred option is based on the assumption that we don't make the same mistakes with a second MoX fuel fabrication facility, especially if we bring in the French who already have a working Mox plant. But experience in the United States where Areva is building a Mox plant, which is reportedly costing five times as much as anticipated and is hopelessly behind schedule, does not bode well for the future. (5)

A Justification exercise based on underestimated costs will not give a reliable result. The Government should examine the reasons for the cost overruns of the American MoX programme.

5. Plutonium Immobilization

In an article in '*Nature*' by Prof. Allison Macfarlane, now confirmed as Chair of the US Nuclear Regulatory Commission, and others including Professor Frank Von Hippel, say the UK's proposals to covert plutonium stockpiles into MoX fuel are likely to run into technical and political difficulties, as well as escalating costs:

"*Britain should seriously evaluate the less costly and less risky method of direct plutonium disposal, and take the opportunity to lead the world towards a better solution for reducing stockpiles*."

The authors point out that the US had been planning to pursue both the MoX and immobilization routes, estimating in 1999 that it would cost about $4 billion to dispose of 34 tonnes of its 85-tonne stockpile of weapons-grade plutonium. But Russia, which had also committed to disposing 34 tonnes of its own weapons plutonium, objected to immobilization because the plutonium could be made into weapons if it were recovered. This, along with the cost of paying for two different programmes, led the United States to abandon the immobilization track. Instead, it commissioned an Areva-designed MoX plant. The cost of disposing of its 34 tonnes of plutonium has since soared to more than $13 billion, with the value of fuel produced likely to offset costs by only $1 billion to $2 billion. Britain should therefore give plutonium immobilization another look. (6)

The Government says the current cost estimates for the MoX option, including disposal, are comparable with the estimated costs of procuring and operating the necessary facilities for the immobilisation option, including disposal. Both options would cost around £3bn, but the costs of the MoX option would be reduced by the sale of MoX fuel. (7) This is disputed by the *Nature* authors who say immobilization should be easier and cheaper than MoX production. Converting 100 tonnes of plutonium into MoX fuel requires fabricating 100 million pellets of fuel, machined to exact dimensions to fit into long zirconium tubes. For disposal, however, the plutonium could be immobilized in fewer, less-precisely-sized 'pucks'. This immobilised plutonium could be packaged with spent fuel or solidified reprocessing waste, which emits gamma radiation that would ward off any thieves or terrorists for a century before we'd need to think about its disposal.

What concerns the Government is the lack of maturity of the immobilisation option. It does not want to pioneer new technology (although there is substantial literature on how to do it). Given the existence of the 'proven' MoX option, the Government says it doesn't need to bear such development risk. It points to the Areva MoX plant in France which it says has safely managed around 100 tonnes of plutonium. The failure of the UK MoX plant and the soaring costs of the Areva-designed MoX plant in the US' however, suggest that immobilization is a lower risk.

Nuclear physicist Dr Frank Barnaby says plutonium is such a dangerous material that the world stock of it should be immobilized. The best estimates made by the International Committee for Radiological Protection (ICRP) of the fatal cancer risks, arising from the inhalation and ingestion of plutonium, suggest that reactor-grade (i.e., civil) plutonium is very much more toxic than weapons-grade plutonium (i.e., plutonium best suited for the fabrication of nuclear weapons). If the individuals in a population inhale a total of a gram of typical reactor-grade plutonium, there will be about 20,000 extra deaths in the population. (8) So keeping this toxic material in circulation for longer by mixing it with uranium and using it as fuel in nuclear reactors poses an increased risk when compared with immobilizing the material on the site where it is currently stored.

6. Alternative Approaches

In its web announcement on the 27th June 2012 - 'Alternatives to re-use of plutonium as MoX fuel' - the NDA said it has engaged General Electric-Hitachi (GEH) and Candu Energy Inc. (a wholly-owned subsidiary of SNC-Lavalin Inc.) to provide further information regarding their respective proposals to use the PRISM Fast Reactor and the latest CANDU reactor. Whilst a CANDU reactor featured in the NDA's 2010 plutonium credible options paper, the PRISM fast reactor was not included and has not so far been subjected to any public consultation.

Candu Energy is proposing the use of its Enhanced CANDU6 reactor. This does not offer much of an alternative. The new 700MW EC6 reactor is designed to be fuelled with natural uranium fuel (i.e. not enriched) it can also use MoX fuel. It would therefore still require the construction of a MoX fuel fabrication plant. No application has been made by Candu Energy to the Office for Nuclear Regulation for a Generic Design Assessment to be made of the EC6 reactor - such an assessment would at best take between 3 and 4 years. (9)

In contrast the PRISM reactor would offer an alternative to building a MoX Plant. It would instead require the construction of at least a new conversion plant to convert Sellafield's existing stockpile of plutonium dioxide to a metal form for use in PRISM. GEH's claim that PRISM will also burn its own spent fuel suggests that some process or reprocessing plant will be needed if that is to be achieved.

After robust lobbying by GEH, a Memorandum of Understanding was signed by the NDA and GEH in early April 2012 under which the NDA agreed to pay an undisclosed sum for four months of further studies to be undertaken by GEH to demonstrate that PRISM was a '*credible alternative'* to the MOX option. No PRISM fast reactor is currently built or in operation and the costs of building and operating such a reactor have been estimated as being some 50% higher than a conventional reactor. (10)

PRISM is a small, 311MW, modular, sodium-cooled reactor. GEH wants to build two modules to form one PRISM power block of 600+ MWe. Under a 60-year plan this *'£multi-billion'* power block would be built at Sellafield within a timeframe of 10 years and *'would burn through the UK's huge stockpile of plutonium in about five years'*. During the remaining 55 years of its plan, GEH claims that the spent fuel arising from the first 5 years of operation (during which the plutonium stockpile is consumed) would itself then be used to fuel the fast reactor. (11)

According to e-mails received under Freedom of Information legislation, the NDA has repeatedly ruled the multi-billion pound 600 megawatt (MW) reactor out of the running on the grounds that the technology lacks credibility for the purposes of plutonium disposal. An email from Adrian Simper, the NDA's strategy and technology director, to GE Hitachi on November 29th 2011, which was obtained by Reuters, cited as a reason that "*the market did not expect to deploy them* (the plutonium reactor design) *commercially for several decades* (until 2050)." In that email, Simper also told an unidentified official at GE Hitachi that the NDA wanted to use "*market-provided reactors*" because the government "*was not prepared to take technology risk on a new reactor*." The email also referred to a joint meeting in which NDA set out "a hurdle for credibility" that GE Hitachi had thus far failed to meet. Hurdles included the safe management of recycling by-products as well as finding a British utility willing to own and operate the reactor. The NDA also demanded financial certainty that costs would be contained to about £2.5 billion and that the government would be insulated from technology deployment risks. The correspondence concluded with an admission that the two parties have "*struggled to reach a clear agreement on the work necessary to demonstrate credibility*," on which further progress depends. (12)

The GE-Hitachi Prism reactor came out of the US Department of Energy's integral fast reactor programme, which was itself abandoned by President Bill Clinton in 1994, just before Britain abandoned its own fast-reactor programme. Fast reactors have inherent nuclear proliferation problems as they help to keep weapons-useable plutonium in circulation and encourage other countries to separate plutonium from spent reactor fuel. (13)

Clearly something has persuaded the NDA to look further into this unproven plutonium management technique. If the NDA is prepared to do that it should also look again at plutonium immobilization.

7. Spent MoX Fuel Waste

The Committee on Radioactive Waste Management has questioned the value of deciding now on options for plutonium. (14) The lack of work on the disposal of spent MoX fuel was highlighted at its February 2011 meeting in Manchester. It was suggested that such spent fuel may require cooling for up to 150 years before it could be disposed of. Spent MoX fuel could, therefore have a very significant impact on the size of the Geological Disposal Facility footprint. According to '*The Independent*' the Massachusetts Institute of Technology has found that spent Mox fuel takes about seven times as much disposal space compared to spent uranium fuel. (15)

Even if most of the UK's stockpile of plutonium is fabricated into MoX fuel, there will still be plutonium left that cannot be used in that way which will require management. Spent MoX fuel is

much more radioactive because it contains on average five times more plutonium than spent uranium oxide fuel. After 10 years, the heat generation from spent MoX fuel is twice as high as that of spent uranium fuel. After 100 years, it is three times higher. Given the very long half-life of Pu-242 (380,000 years), and Neptunium-237 (2.14 million years), it is much more complicated to store MOX than normal spent fuel. Instead of partially solving our high level waste problem, using MoX as a reactor fuel creates even bigger waste problems: it needs more and longer cooling; it has to be stored much longer; it is more dangerous; and the costs are therefore higher.

The Government should not make any decisions on plutonium management without a full open and transparent investigation into the waste implications of each option.

8. Conclusions

In the NFLA's view:

- This consultation is premature while the NDA is looking at alternatives to the MoX route.
- If the NDA can investigate reactor-based alternatives to the MoX route, it should also re-examine plutonium immobilisation as requested by the Chair of the US Nuclear Regulatory Commission.
- There should be an examination of the health implications of using MoX fuel in conventional reactors, including during accidents, before proceeding with the construction of a MoX fuel fabrication plant, otherwise we could find that we have produced a fuel which cannot be licensed for use in UK reactors. Such an examination could take the form of a pre-licensing procedure and examination of the safety case for using MoX in an EPR and/or AP1000 reactor.
- A Justification exercise based on underestimated costs will not give a reliable result. The Government should examine the reasons for the cost overruns of the American MoX programme.
- The lack of maturity of the immobilisation option is a poor argument given that there is substantial literature on how to do it. The Government should be prepared to pioneer this new technology in any case for the benefit of global non-proliferation efforts.
- The Candu option offers no advantage over the MoX Fuel option and the PRISM option threatens to keep plutonium in circulation and encourage the spread of the plutonium fuel-cycle and hence nuclear proliferation around the globe.
- There has been a lack of research and development into the problems likely to be encountered in managing spent MoX Fuel. The waste implications of all plutonium management options should be examined.

If you have any queries with the content of this consultation please contact the NFLA Secretary, Sean Morris, using the details at the top of this letter.

Yours sincerely,

Chair of Nuclear Free Local Authorities

References follow on the next page.

9. References

(1) NDA Press Release 27th June 2012 https://www.nda.gov.uk/news/plutonium-management-alternatives.cfm

(2) Management of the UK's Plutonium Stocks: A consultation response on the long-term management of UK owned separated civil plutonium. DECC December 2011 http://www.decc.gov.uk/assets/decc/Consultations/plutonium-stocks/3694-govt-resp-mgmt-of-uk-plutonium-stocks.pdf

(3) E.S. Lyman, "Public Health Risks of Substituting Mixed-Oxide for Uranium Fuel in Pressurized-Water Reactors," Science and Global Security, Vol. 9, pp. 33-79, 2001 http://www.princeton.edu/sgs/publications/sgs/pdf/9_1lyman.pdf

(4) Daily Telegraph, 4th Feb 2011, http://www.telegraph.co.uk/news/wikileaks-files/london-wikileaks/8305283/UK-RAMPING-UP-ON-NUCLEAR-POWER-BUT-CHALLENGES-REMAIN.html

(5) Independent 6th May 2011 http://www.independent.co.uk/opinion/commentators/steve-connor-how-do-we-solvethe-plutonium-conundrum-2279634.html

(6) Von Hippel, Ewing, R. Garwin, R, Macfarlane, A. Time to Bury Plutonium, Nature, Vol 485, 10th May 2012. http://www.nature.com/nature/journal/v485/n7397/full/485167a.html (Abstract only on web)

(7) Management of the UK's Plutonium Stocks: A consultation response on the long-term management of UK-owned separated civil plutonium, DECC 1st December 2011 http://www.decc.gov.uk/assets/decc/Consultations/plutonium-stocks/3694-govt-resp-mgmt-of-uk-plutonium-stocks.pdf

(8) Barnaby, F. What to Do With Plutonium, Best Thinking website accessed 3rd July 2012 http://www.bestthinking.com/articles/energy/nuclear_power/nuclear_fuels/what-to-do-with-plutonium-

(9) Update on NDA plans for UK Plutonium Re-use, CORE, 3rd July 2012 http://www.corecumbria.co.uk/newsapp/pressreleases/pressmain.asp?StrNewsID=303
Also see i-Nuclear 27th June 2012 http://www.i-nuclear.com/2012/06/27/uk-in-talks-to-burn-plutonium-in-candu-reactor/

(10) i-Nuclear 3rd April 2012 http://www.i-nuclear.com/2012/04/03/uk-nda-signs-contract-with-ge-hitachi-for-study-on-prism-reactors-for-pu-disposition/

(11) i-Nuclear 14th March 2012 http://www.i-nuclear.com/2012/03/14/ge-hitachi-in-mou-with-costain-arup-poyry-to-build-2-prism-reactors-at-sellafield/

(12) Reuters 24th January 2012 http://www.reuters.com/article/2012/01/24/us-nuclear-waste-uk-idUSTRE80N1XR20120124
Guardian 24th January 2012 http://www.robedwards.com/2012/01/plutonium-reactor-plan-rejected.html (e-mails available on this website).

(13) Cochrane, T et al. Fast Breeder Reactor Programs History and Status. International Panel on Fissile Materials, February 2010. http://fissilematerials.org/library/rr08.pdf

(14) The author of this submission attended the Plenary Meeting of CoRWM 8th-9th February 2011 in Manchester.

(15) Independent 6th May 2011 http://www.independent.co.uk/opinion/commentators/steve-connor-how-do-we-solve-the-plutonium-conundrum-2279634.html

Annex A: Recent consultations and developments regarding plutonium options, and NFLA submissions to them.

1. In August 2008 the Nuclear Decommissioning Authority (NDA) published a consultation paper on Plutonium Options:
   http://www.nda.gov.uk/documents/upload/Plutonium-Options-for-Comment-August-2008.pdf

   NFLA Scotland responded this consultation:
   http://www.nuclearpolicy.info/docs/consultations/NFLAScot_PlutoniumOptions.pdf

   The NFLA response argued that the creation of further plutonium stocks should be stopped as quickly as possible, and that converting the existing stockpile to MoX fuel would not be an economic use of resources; would fail to meet non-proliferation objectives; involve unacceptable safety and security risks, and be a threat to civil liberties. Spent MoX fuel would be a much more hazardous waste form to deal with than conventional spent fuel. Instead it was argued that all plutonium immobilization options should be investigated further and tested against environmental principles, including in particular proliferation resistance, and other criteria such as cost, dose levels to the work force and so on.

2. In January 2009, the NDA published a revised Plutonium Credible Options Paper (Summary):
   http://www.nda.gov.uk/documents/upload/NDA-Plutonium-Topic-Strategy-Credible-Options-Summary-January-2009.pdf
   And a Technical Analysis Paper:
   http://www.nda.gov.uk/documents/upload/NDA-Plutonium-Topic-Strategy-Credible-Options-Technical-Analysis-January-2009.pdf
   And a Credible Options Technical Summary:
   http://www.nda.gov.uk/documents/upload/NDA-Plutonium-Topic-Strategy-Credible-Options-Technical-Summary-January-2009.pdf

   In March 2009 NFLA published a briefing on these Credible Options Papers:
   http://www.nuclearpolicy.info/docs/radwaste/RWB18.pdf

   The NDA paper noted that using the Sellafield MoX Plant (SMP) to manufacture MoX using the UK plutonium stockpile had been ruled out. SMP was built to manufacture MoX fuel for foreign customers only, at an original cost of £470m. But due to poor performance and technical problems SMP had cost the UK taxpayer around £2bn up to that point. The NDA concluded that the plant did not have the capacity or longevity to be used to manufacture MoX from the UK's plutonium stockpile. Therefore the recycle options which have been considered assumed that plutonium is either sold direct to another country or that MoX is fabricated in a new plant.

   It also noted that the NDA assumed fast reactors or speculative reactor technologies do not meet the definition of 'credible' at the moment as they are likely to take more than 25 years to deploy, and no MOD material is included in the inventory.

   The NFLA briefing argued that starting down the road of using plutonium as a fuel, whether at Sellafield or elsewhere, would be a step on the road to a plutonium economy which would bring with it much greater risks of nuclear proliferation, create terrorist targets and ultimately threaten civil liberties. As the plutonium-MoX economy grows, and transports proliferate, the risk of plutonium finding its way to a terrorist group or a clandestine state programme dramatically increases. A new generation of plutonium powered nuclear reactors would also increase the number of targets for a nuclear terrorist attack.

3. Following the publication of the above NDA plutonium credible options papers the Government met with some stakeholders to discuss the ways forward. Because of the many differing views expressed, it was decided that some of the key issues should be worked through in more detail and set out in publicly available discussion papers so that a wider audience can contribute to the development of Government thinking in this area, prior to the Government launching a public consultation autumn 2009. So in July 2009, the Department of Energy and Climate Change (DECC) issued a Pre-consultation discussion paper on the key factors that could be

used to compare one option for long term plutonium management with another. http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/energy%20mix/nuclear/plutoniummanagement/1_20090902105255_e_@@_preconsultationdiscussionpaperplutoniummanagement.pdf

NFLA responded to this in September 2009:
http://www.nuclearpolicy.info/docs/consultations/DECC_response_210909.pdf

This submission identified treating plutonium as a waste as the NFLA's preferred option.

4. In October 2009 DECC issued a Pre-consultation discussion paper covering decision methodology and timetable for decision making for long-term plutonium management strategy: http://www.dounreaystakeholdergroup.org/files/downloads/download1103.pdf

   In November 2009, NFLA responded to this second DECC pre-consultation discussion paper: http://www.nuclearpolicy.info/docs/consultations/DECC_plutonium2_response.pdf

   In its response NFLA argued that DECC should not be giving a preliminary view until all options – particularly treating plutonium as waste – are worked up into detailed proposals. This response also noted that DECC needs to consider the ongoing tension between the Secretary of State being the Justifying Authority when DECC has already given its view. This creates obvious issues about whether the Justification Decisions are neutral and legitimate.

5. In September 2010 the NDA published its Draft Strategy Document for consultation: http://www.nda.gov.uk/documents/upload/Draft-Strategy-published-September-2010-for-consultation-full-colour-version.pdf

   In November 2010, NFLA responded to this Strategy consultation:
   http://www.nuclearpolicy.info/docs/consultations/NFLA_NDA_Draft_Strategy.pdf

   In its response NFLA expressed concern that the Draft Strategy continues to promote the idea of transporting weapons-useable plutonium (as plutonium oxide or MoX) around the UK and around the world. The NFLA has consistently argued that plutonium at Sellafield and Dounreay should be immobilised as a waste form as it is an unacceptable and dangerous hazard. It is also at risk from a terrorist attack.

6. In February 2011 DECC issued a consultation on Long-Term Plutonium Management Policy: http://www.decc.gov.uk/assets/decc/Consultations/plutonium-stocks/1243-uk-plutonium-stocks.pdf

   In this document the Government says its preferred preliminary option is to convert the existing stockpile of UK plutonium to Mixed Oxide (MoX) Fuel. This would require the construction of a new MoX fuel fabrication plant. The Government concedes this would not have a positive economic benefit.

   Also published in February 2011 was an NDA "Current Position Paper" on Plutonium Strategy. http://www.nda.gov.uk/documents/upload/NDA-Plutonium-Current-Position-February-2011.pdf

   It also published an updated Credible Options Analysis (Gate A) dated 2010. https://www.nda.gov.uk/documents/upload/Plutonium-Credible-Options-Analysis-redacted-2010.pdf

   In May 2011 NFLA responded to this consultation:
   http://www.nuclearpolicy.info/docs/radwaste/Radioactive_Waste_Briefing_28_Plutonium_consultation.pdf

   This response noted in particular that moving forward with plans to build a new MoX plant at Sellafield would be unlikely to inspire public confidence. Given that some plutonium stocks will need to be immobilized as a waste form in any case, because they could not be converted to

MoX, the Government should move forward with research and development of this option before making any final decisions.

7. On 3rd August 2011 the NDA announced that the Sellafield MoX Plant would close (https://www.nda.gov.uk/news/smp-future.cfm). The plan, announced in May 2010, (https://www.nda.gov.uk/news/sellafield-mox-plant-future-2010.cfm) had been for Japanese customers to fund the renovation of the plant, but after the Fukushima accident this was no longer a viable option.

8. In December 2011 DECC issued a response to the responses it had received to its February 2011 consultation: http://www.decc.gov.uk/assets/decc/Consultations/plutonium-stocks/3694-govt-resp-mgmt-of-uk-plutonium-stocks.pdf

   This document concluded that the Government has identified the right preliminary view, but it does not yet have sufficient information to proceed with the procurement of a new MoX Fuel fabrication Plant, so the Government has not closed off alternative options. Disposal options will need to be worked up in any case to deal with small percentage of plutonium stocks that would not be re-useable.

   The Government concluded that we are potentially decades away from developing commercially viable fast reactor technology as a solution for plutonium management. The Government no longer believes that it is acceptable to store such large quantities of plutonium without having a deliverable policy in place for its long-term management. Keeping our plutonium in long-term storage until commercial fast reactors become available, before deciding what to do, is therefore not a realistic strategy.

   The Government has rejected the idea of transporting plutonium to MOX fabrication facilities overseas for security as well as practical reasons. Such an option would involve making several shipments of separated plutonium each year, for about 30 years.

   The Government does not want to pioneer new technology. Given the existence of the proven MOX option, the Government does not need to bear such development risk, although it remains open to such options if a commercial partner was prepared to bear the risk and if they can demonstrate a credible plan to deliver a solution within similar timeframes.

   The Government says the current cost estimates for the MoX option, including disposal, are comparable with the estimated costs of procuring and operating the necessary facilities for the immobilisation option, including disposal. Both options would cost around £3bn, but the costs of the MoX option would be reduced by the sale of MoX fuel. What concerns the Government is the lack of maturity of the immobilisation option.

   The Government does not consider plutonium to be a necessary resource to ensure security of energy supply.

9. On the 23 February 2012 the NDA announced we were seeking proposals on potential alternative approaches for managing the UK's plutonium stocks alongside providing support to the Government as it progresses its preferred policy of converting the material into Mixed Oxide fuel (MOX) for reactors. (NDA Press Release dated 23rd February 2012 https://www.nda.gov.uk/news/plutonium-management.cfm)

10. On 27th June 2012 the NDA announced that it had received four expressions of interest by the deadline of 31st March 2012. It considered that there was merit in progressing two of these alongside development of reuse as MOX in Light Water Reactors. Discussions have taken place with General Electric-Hitachi (GEH) and Candu regarding their proposals. The GEH proposal relates to a UK deployment of its PRISM reactor as part of an integral fuel fabrication/reactor plant solution for Plutonium disposition. The engagement is focused on assessing the technical and commercial credibility of the approach. The Candu proposal relates to a UK deployment of its Enhanced CANDU 6 reactor and associated facilities to

provide a solution for Plutonium disposition. The engagement is focused on assessing the commercial credibility of the approach and refreshing and refining technical studies undertaken previously. It is anticipated that the work on both proposals agreed at this stage will be concluded later this year. NDA will subsequently assess the information and consider how best to proceed with alternative proposals alongside the preferred option of reuse as MOX. (NDA Press Release 27th June 2012 https://www.nda.gov.uk/news/plutonium-management-alternatives.cfm)

11. The Government is currently consulting on a proposed justification process for the reuse of plutonium: http://www.decc.gov.uk/assets/decc/11/consultation/mgmt-plutonium-stocks/5376-mgmt-uk-plutonium-stock-cons.pdf