Management of the UK's Plutonium Stock: consultation on the proposed justification process for the reuse of plutonium: Greenpeace Response

General

Greenpeace has commented on the UK Government's policy process on plutonium management for over 30 years, including more recently having a representative at the NDA's Nuclear Materials Issues Group meetings and providing responses to relevant consultations.

Last year the Government carried out a consultation exercise on its 'preferred option' for plutonium to be processed into MOX (mixed oxide) fuel for reuse in electricity generation. It subsequently 'confirmed' reuse as the policy option it would take forward. It did so, on its own admission, on the basis of incomplete information, *and* without taking proper account of the emerging findings from the Fukushima nuclear disaster. The present consultation seeks to take its favoured option a step forward, and in doing so risks locking in a poor policy decision, in producing Guidance for the 'Justification' of plutonium reuse. Greenpeace views the present consultation as premature and unduly restrictive of the UK's options for managing its plutonium waste stocks.

Greenpeace is opposed to all forms of nuclear power, which poses an unacceptable risk to the environment and to humanity. It cannot be a 'solution' to the UK's legacy nuclear waste to reuse wastes which result in something dangerous and more difficult to manage than the original material.[1] The Government should take forward options that

- end the generation of new radioactive waste forms
- secure existing waste and nuclear materials in the UK in the least vulnerable form and most secure place possible
- serve global non-proliferation aims.

Greenpeace is concerned, despite the Government's claim that it is not closing off alternatives that the focus of the present consultation on Guidance for the Justification of Plutonium reuse does not allow for on-site immobilization of plutonium.

The Government is reminded that its most recent decisions on new nuclear power have not justified MOX fuel use in the 'conventional' reactors designs being assessed for use in the UK.

Economics

Justification[2] is an assessment of the economic, social or other benefits in relation to the health detriment of the class or type of practice. No practice involving exposure to ionising radiation should be

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[1] The lack of substantial work on the disposal of spent MOX fuel was highlighted at the February 2011 meeting of the Committee on Radioactive Waste Management in Manchester. It was suggested that such spent fuel may require cooling for up to 150 years before it could be disposed of. The NDA has undertaken a 'rep-conceptual' assessment of MOX spent fuel disposal, but this work is not yet finalised http://www.nda.gov.uk/documents/upload/Executive-Summary-Letter-of-Compliance-Assessment-Report-Options-for-disposal-of-Plutonium-stocks-in-a-GDF-August-2010.pdf

[2] Justification of Practices Involving Ionising Radiation Regulations 2004 (Justification Regulations) http://www.legislation.gov.uk/uksi/2004/1769/contents/made

adopted unless it produces sufficient benefits to the exposed individuals or to society in general to offset the health detriment it may cause.

According to DECC's February 2011 consultation on the "*Management of the UK's Plutonium Stocks*" the undiscounted cost of building and operating a new MOX plant over 30 years is estimated to be roughly £5bn - £6bn, and the resulting MOX fuel is estimated to have an undiscounted value of £2bn. In other words "...**it is unlikely that the value of the fuel will reach a point where it covers the full cost of its manufacture**". [3]

An immobilisation and disposal option was estimated to have undiscounted lifetime costs of around £5bn - £7bn. [4]

The consultation does not explore the problems raised, in terms of the economics of the reuse option, of the role of the Government, as the owner of the main part of the plutonium stockpile. Decisions on reuse of plutonium (versus not reusing it) are not subject to ordinary market forces (subsidies for conventional new build notwithstanding). The issue of EDF/British Energy owned plutonium and any further plutonium added to the UK holdings through renegotiation of contracts with overseas utilities also needs to be factored into justification applications.[5] Any reuse option would also have to be shown to meet the requirements of bi-lateral agreements and inter-company contracts.

Before procuring a MOX fuel fabrication plant - one stage of the Government's favoured option – it says the net-benefits associated with the practice must be *shown* to outweigh the health detriments (emphasis added).[6]

Clearly Plutonium Disposition, in whatever form it takes ('direct' disposal or reuse), will lead to a cost to the taxpayer, and will not be a money-making enterprise. Given this, the Government needs to explain what factors it will use in deciding on whether or not the potential benefits of reuse, in the justification equation, outweigh the potential detriments.

Quantifying the benefits

It is not at all clear what the key objective of Government Plutonium policy is and quite why reuse is *the* preferred option.

Table 2 of the consultation document gives a list of the information an applicant will need to provide, but gives no indication of the weighting which will be given by the Government to each factor. How will jobs, for example, be weighed against health detriments? How will proliferation resistance be weighed against cost to the taxpayer? How can an applicant show that a certain number of jobs plus a certain

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[3] Management of the UK's Plutonium Stocks: A consultation on the long-term management of UK owned separated civil plutonium, DECC February 2011. http://www.decc.gov.uk/assets/decc/Consultations/plutonium-stocks/1243-uk-plutonium-stocks.pdf Para 3.12 page 17-18

[4] ibid Para 3.35 page 22

[5] See Sellafield's German plutonium cut and pasted to France by UK Government. CORE Briefing 15th July 2012 http://www.corecumbria.co.uk/newsapp/briefings/briefsmain.asp?StrNewsID=305

[6] Consultation document Para 5, page 7

level of proliferation resistance and CO_2 savings outweigh the financial costs, waste management problems and health detriment? Further, there are different elements of 'delivery risk' associated with different elements of a proposed Plutonium management policy. For example, it may be possible to estimate what the costs of a new MoX plant are, but given the history of cost over-runs on previous major projects at Sellafield, any economic benefits assumed on the basis of early costings should be seen as potentially risky. There is also the possibility of greater health detriments arising from accidents and unforeseen incidents outside design spec of envisaged operations.The best way forward in the face of this requirement, to compare apples with oranges, is for the Government to be completely open about its objectives.

It should be clear, for example, whether such issues as the following are to be included in its consideration:-

- Employment levels at Sellafield;
- The opposition of West Cumbrian councils to direct disposal of Plutonium in a repository;
- Whether new facilities and reactors for plutonium reuse at Sellafield would be part of an overall benefits package should West Cumbria decide to proceed with the search for a national nuclear dump site in the area?

The best option?

Given that something has to be done with plutonium, and given that none of the options will provide any overall financial benefit, demonstrating that the chosen option is the best option in terms of meeting the Government's policy objectives and international treaty obligations, would seem to be the only acceptable way to show that an option is justified.

However, the consultation document says it is not necessary to show that the class or type of practice is the best of all the available options. The Government appears to view the justification exercise as not one which shows that the chosen option is the least costly way of meeting policy objectives, or one which shows that positive benefits are maximised over detriments.

The Government needs to say why it is not necessary for the applicant to show the proposed option is the best - environmentally, for health protection, financially, for proliferation resistance and so on. Any justification guidance needs to explain how an option which is not the best option overall can still meet, in full, the policy aims.

Given that the Government remains unsure about its 'so-called' preferred option and the NDA is still examining alternatives,[7] a generic guidance on a process for making applications and decisions on plutonium management, rather than just plutonium re-use, is a more sensible way forward.

Such guidance should cover applications for all plutonium management techniques. In particular it should leave the door open to future proposals on plutonium immobilisation. The use of the word "reuse" throughout the consultation document rules out techniques for plutonium management which exclude reuse. This surely leaves the Government in a quandary, for earlier justification proposals for

[7] NDA Press Release 27th June 2012 https://www.nda.gov.uk/news/plutonium-managementalternatives.cfm

nuclear plants 'justified' new build against other options e.g. relying solely on wind or gas for electricity generation and as a means of reducing CO2 emissions. Any justification of plutonium reuse as MOX would need a comparison of alternative options - not just other reactor use options (e.g. PRISM, which would not involve MOX use itself) but also non-reuse.

A consultation based on the re-use of plutonium as MOX fuel is premature. The NDA says it intends 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; its subsequent use in new EPR or AP1000 reactors, and the management of the spent MOX fuel. Yet it is still investigating alternatives to the MOX fuel fabrication plant proposal. If the NDA is open to the investigation of other reactor-based alternatives to the MOX fuel route, it must surely also re-examine the plutonium immobilisation options as proposed by Prof Allison Macfarlane (now Chair of the US Nuclear Regulatory Commission) and other international experts who, earlier this year wrote:

"*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*." [8]

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. It is claimed, the overall costs of the MOX option could however be reduced by the sale of MOX fuel.[9] This too is disputed by Prof Macfarlane and her co-authors who say immobilization would be easier and cheaper than MOX production.

The Government also says the immobilisation option lacks maturity - it does not want to pioneer new technology. Again, Macfarlane et al. say there is substantial literature on how immoblisation can be done. The Government describes the MOX route as a 'proven' option and as an example of this has pointed 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 immobilisation is a lower risk. As a part of any justification for the reuse option MOX spent fuel disposal would have to be 'proven', yet no facilities exist which can demonstrate this material can be safely disposed of.

Finances and Subsidies

DECC says the additional cost of disposing of the spent MOX fuel, compared with conventional fuel, would be borne by the commercial nuclear operator, and this would be reflected in the value of the MOX as fuel.

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[8] 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)

[9] 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-ukplutonium-stocks.pdf

Under current re-use options, it is assumed that any MOX produced would be used as fuel in the new nuclear reactor designs currently under consideration in the UK – either the EPR or AP1000.[10] Neither of these reactors have been built or operated anywhere in the world. In the justification applications for these designs, the potential for MOX use was referred to. However, the SoS's justification decision of December 2010 did not allow for MOX use in these reactor designs.

New nuclear operators in the UK (of the EPR or AP1000) will need to have had several years operating experience for the reactors before switching to MOX fuel. Yet, the relevant DECC documents note that MOX use in these reactors would have to undergo the justification decision process. Presumably the justification process to be covered by the proposed guidance is the start of that justification process.

If so then the timing of any reuse option is vital. The EPR has yet to complete the Generic Design Assessment (GDA) process and the AP1000 GDA is currently 'paused' awaiting a utility to choose it before the GDA process will restart. The other reactors mentioned in the media as possible plutonium-using designs, CANDU 6 and PRISM, are not yet even before the ONR for consideration under the GDA process. [11] Just when the reactors would be available to burn plutonium is crucial issue as it involves other factors which will have to be taken into account and which will have financial, environmental and worker health implications e.g. the 'in-growth' of Americium-241 in plutonium stocks.[12] Anyone applying to justify the use of plutonium would have to demonstrate how they have included this into the 'justification equation.'

The UK's plutonium stockpile has been produced by taxpayer subsidised spent fuel reprocessing operations. If MOX fuel were to be offered to new nuclear operators at the same price as conventional uranium fuel (which it is assumed would be more expensive because it is not subsidised) it would still raise significant taxpayer subsidy issues.

More likely, new nuclear operators would need to be offered some sort of incentive to be persuaded to use MOX fuel as it is likely to be more technically problematic than conventional uranium fuel. Offering such an incentive could also raise subsidy issues. Questions arise over which party would pay for the possible 150 years storage, packaging and disposal of any resulting MOX spent fuel - particularly if a private company had used the plutonium as part of a Government disposition programme.

Depending on the proposer of the justification, there may be other subsidy matters to be addressed. The NDA has previously suggested (among a range of options) that MOX fuel could be used in UK state-owned reactors and the resulting electricity sold, again raising subsidy issues.[13] The Government needs to say how it would deal with these subsidy issues and whether or not it would support a state-owned reactor selling electricity into the UK's electricity market and how the price of this electricity would be regulated.

Overseas Options

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[10] Consultation document Para 6

[11] See Update on NDA plans for UK plutonium re-use, CORE Briefing, 3rd July 2012 http://www.corecumbria.co.uk/newsapp/briefings/briefsmain.asp?StrNewsID=303

[12] http://www.nda.gov.uk/documents/upload/Plutonium-Options-for-Comment-August-2008.pdf Appendix 1

[13] http://www.nda.gov.uk/documents/upload/Plutonium-Credible-Options-Analysis-redacted-2010.pdf

Although the NDA letter to DECC (discussed in the consultation document) said the authority intended to apply for a justification decision on the construction of a MOX fuel fabrication facility and the subsequent irradiation of the MOX fuel in UK-based EPR and AP1000 reactors, the Government consultation says its intention is to issue generic guidance for the reuse of plutonium.

It needs to be clear whether this generic guidance will cover options which include overseas options mentioned in the NDA's 2010 Credible Options paper, or whether these options have now been completely ruled out. The earlier options included:

- Selling or leasing plutonium powders directly to a 3rd party country;
- Contracting for MOX fabrication abroad;
- Selling MOX fuel to overseas nuclear operators.

Response to specific questions

1. *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.*

Greenpeace is opposed to the reuse of plutonium as nuclear fuel in any type of reactor.

We note that the Government has not foreclosed other options in relation to different reuse technologies (Consultation Para 25) that 'may be found to be credible in appropriate timescales'. If so, why should it not keep open the option immobilization, especially since it is accepted that further research on immobilization will be required in any event, to deal with that portion of the plutonium stocks not suitable for re-use[14]?

2. *Is the proposed application and decision-making process clear, appropriate and proportionate? If not, how can they be improved?*

Greenpeace is concerned that the Justification process contains an inherent conflict of interest, in that the Justifying Authority is the Secretary of State for Energy and Climate Change, the same person who has now taken a policy decision in favour of MOX reuse. Greenpeace is aware of the permission decision in *Walker* but believes that the arrangement is unsatisfactory.

3. *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?*

We assume this question is linked to the information in table 2. On that we note that 'terrorism' is not listed (page 17) under radiological health detriments, but is mentioned under environmental issues. It must be included under radiological health detriments.

[14] *Management of the UK's Plutonium Stocks: A consultation response on the long-term management of UK-owned separated civil plutonium*, DECC, December 2011, Para 3.56

In our view the recommendation in Paragraph 41 of the Consultation Document (that this information to be applied to each phase of the reuse process, as well as the practice overall) has to be a requirement. Table 3 does not list all the major facilities/processes necessary for every stage of a plutonium reuse programme e.g. spent fuel encapsulation (packaging) is missing. Yet the technology - and location - would have major management and financial implications for any applicant. Similarly, the possibility of 'reprocessing' MOX spent fuel, as already advocated by some, should be required to be listed as a separate stage if an applicant proposed it was part of a plutonium-reuse programme.[15]

4. *Are there any other ways in which the draft justification process can be improved? If so, how?*

We do not agree that the methodology for comparing the benefits and detriments of proposals should be at the discretion of the applicant (Consultation Document, Para. 41). In the interests of a fair, transparent and acceptable Justification process (for public and Parliament), there must be a universal set of criteria and methodology - which must also be open to independent scrutiny. The approach proposed confirms our concern that the options have not been properly assessed and compared by the Government, and will not be done by applicants. The Government's Response to its earlier consultation on managing the UK's plutonium stocks conceded that it did not yet have enough information on the options to carry out a full appraisal:

> 3.32 At this point in the programme, there is no additional relevant information that could be published either as a separate document or via a re-run of the consultation. We believe that we have enough information available to allow UK Government to take a strategic view of the way forward now. However taking a strategic sift of the options now does not mean we will proceed to implementation without obtaining any further evidence. The sift allows us to focus efforts and resources on the option that looks to be the most promising in terms of being able to deliver a solution. We will have to gather sufficient evidence to be satisfied that our proposal remains credible and is in line with Treasury Green Book rules before we can decide on implementing a solution.

The consultation also misses out the essential point of the Green Book guidance on appraisal, which is that competing options should be tested against each other:

> 2.3 Appraisals should provide an assessment of whether a proposal is worthwhile, and clearly communicate conclusions and recommendations. The essential technique is option appraisal, whereby government intervention is validated, objectives are set, **and options are created and reviewed, by analysing their costs and benefits.**[16]

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[15] The Royal Society noted this would not be a practical option, http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/projects/nuclear-non-proliferation/FuelCycleStewardshipNuclearRenaissance.pdf

[16] The Green Book: Appraisal and Evaluation in Central Government, HM Treasury 2003, Para 2.3, emphasis added

Nor will applicants be required to carry out comparative analysis: Para. 10 of the Consultation Document states that 'It is not necessary to show as part of justification that the class or type of practice is the best of all the available options.'

It is hard to see how, given the lack of any robust comparison of options, the Government can select a policy that delivers the best value for taxpayers' money and maximises the potential benefits and minimises the potential detriments. It is also difficult to see how it can be fulfilling its legal requirement to keep radiation exposure '*as low as reasonably practicable*' by allowing for the building of a MOX fabrication plant, the operation of plutonium-using reactors and the creation of MOX spent fuel. Taking plutonium and converting or incorporating it into intensely hot and radioactive spent fuel cannot properly meet the ALARP principle, a requirement noted in the Consultation Document, Para 22 as :

> 22. The law requires, not only for activities involving ionising radiation to be justified, but also that exposure to ionising radiation is kept below stringent legal levels, and are further reduced to as low as is reasonably practicable (the ALARP principle).

The requirement is derived from Article 6 of the Directive, which states that:

> (3) In addition each Member State shall ensure that:
> (a) in the context of optimization all exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account;

This requirement cannot be met under the reuse option, even if the exposures and social/economic aspects of each of the options been weighed and compared, unless those social/economic factors are given a weighting far higher than public health and environmental protection.

Full transparency required

The consultation document notes that responses will be summarised and released in a report - this is not acceptable. All responses must be published in full unless the Government can prove there is an overwhelming need for confidentiality on safety/security grounds.

Inquiry

The Justification regulations allow for a full inquiry by the SoS before any Justification decision is made - such an inquiry was called for on the EPR and AP1000 and refused.

There is no reason why this should not be applied to plutonium reuse and involve hearings for experts (in spent fuel disposal, or non proliferation for example) and key stakeholders. Any Guidance should advise this will be a part of the Justification process for the reuse of plutonium stocks.