

# DECC CONSULTATION ON THE MANAGEMENT OF THE UK'S PLUTONIUM STOCKS: PROPOSED RESPONSE

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## Executive Summary

- 1. Government is consulting on options for the future management of the UK's 112 tonne stockpile of civil separated plutonium stored mainly at Sellafield. Government considers the costs and benefits of three options (a) continued storage, (b) immobilisation and disposal to a geological facility, and (c) recycling through fabrication into mixed plutonium and uranium oxide fuel (MOX). Government says it is minded to take a 'preliminary policy view' in favour of the MOX option and 'then taking forward work to progressively address the practical issues of implementation.'***
- 2. Government asks for comments on its preliminary policy view and any factors it may have overlooked in weighing the options. This report considers the Government's case and supports Government's 'preliminary policy view' and urges progress towards practical implementation. It agrees with Government that 'MOX fuel fabrication is a proven and available technology that offers greater certainty of success.' It notes NDA data identifying a MOX route as the least cost option for managing the UK's civil plutonium stockpile. The report also urges consideration by Government of the development of additional reactors on land adjacent to Sellafield and NuGeneration Ltd sites to utilise MOX fuel. Such a commitment would avoid the need for significant MOX fuel transportation, provide for increased security, and further support the development of Britain's Energy Coast.***
- 3. The terms of a response to Government is set out in Appendix A which, subject to Members views could form a joint submission with Cumbria County Council, Allerdale BC, and Britain's Energy Coast (West Cumbria).***

## Recommendation

**That Members consider the report and draft response to Government as set out in Appendix A and that the Chief Executive in consultation with the Portfolio Holder be authorised to agree the final submission to Government prior to the 20<sup>th</sup> May deadline.**

## BACKGROUND

### Introduction

- 4 On 7 February 2011, the Department of Energy and Climate Change launched a public consultation on its proposed approach to the long-term management of UK plutonium. The deadline for responses is 10 May 2011.
- 5 The UK currently stores about 112 tonnes of civil separated plutonium in specialist facilities, mainly at Sellafield. This amount includes about 28 tonnes of material belonging to overseas customers. The plutonium stored in the UK has been derived largely from nuclear fuel reprocessing activities that have been ongoing at Sellafield since the 1950s. The bulk of the UK's material is owned by the Nuclear Decommissioning Authority (NDA) and a smaller amount by British Energy (a part of EDF Energy).
- 6 The Government does not favour continued long term storage because it would still require permanent disposal at a future date, and would leave a burden of security risks and proliferation sensitivities for future generations to manage on a continuing basis.
- 7 There are two main alternatives for managing plutonium in the long term: (a) through disposal as an immobilized waste or (b) through reuse in the form of mixed oxide nuclear fuel (MOX) which, after use as fuel in nuclear reactors, leaves spent fuel in a state where it can be prepared for emplacement in a geological disposal facility. The disposal of immobilized plutonium or irradiated MOX fuel has yet to be demonstrated in practice.
- 8 There are various technologies that might be used to immobilize plutonium, prior to its disposal. However, the Government argues that there is currently no immobilization technology that can reasonably and reliably be used to manage *all* of the plutonium. It adds that in general the immobilization technologies that would realistically need to be pursued for the quantity of civil plutonium in the UK are less mature than that of a MOX reuse option.
- 9 The Government points out that the MOX reuse option is being pursued by the US and Russia as the preferred method for managing their excess weapon grade plutonium. It notes that the manufacture of MOX fuel has been undertaken in France with reactors in France capable of using the fuel, and to a limited extent elsewhere in Europe and Japan. UK experience has, however, been much less successful with the Sellafield MOX plant achieving only a small fraction of its original production target. Only circa 15 tonnes of MOX, as completed fuel assemblies, has been manufactured over 9 years of operation, against an original target of 560 tonnes over an expected 10 year operational life. Any new MOX plant would have to be developed in the light of the design and operational lessons drawn from these contrasting experiences overseas and in the UK.
- 10 Government also points out that MOX fuel has some market value which can be used to offset the costs of converting plutonium into MOX. However, the Government's current expectation is that, at current uranium prices, the value of the fuel generated is significantly less than the costs of its manufacture: in other words, for the foreseeable future, manufacture of MOX is primarily a route for consuming plutonium stocks rather than a commercial operation in its own right. Commercial utilities would need to be incentivised to burn it.

Government's Preliminary Policy View

- 11 Although there remain many practical issues to be resolved before any policy could be implemented, the Government believes that there is sufficient information available now to make a high level judgment as to the right strategic policy option for plutonium management. Rather than continuing to pursue all options with equal vigour, the Government proposes adopting a preferred solution, or preliminary policy view, and then taking forward work to progressively address the practical issues of implementation. This does not mean that work on alternative options will cease, only that the Government's focus would shift to the preferred option.
- 12 The UK Government's preliminary policy view is that reusing plutonium either in the UK or overseas in the form of MOX fuel offers the best prospect to deliver a solution for long-term plutonium management.
- 13 The Government stresses that this preliminary view will be conditional in that it will have to be tested to show that it is affordable, deliverable and offers value for money, taking into account safety and security requirements, before it would be in any position to take a final view. Work is ongoing on both the reuse and immobilization options in support of this. While the Government believes it has sufficient information to set out a direction and take a preliminary policy view, it is not yet sufficient to make a commitment to proceed with a new MOX plant. As well as being open to the prospect that other credible options develop and are more attractive, the UK Government would have to be sure that reusing the plutonium would continue to represent the best prospect for long-term plutonium management.
- 14 For these reasons, the Government takes the view that further ongoing work on the reuse option is necessary to be sure that such a direction can be taken forward. If the conditions above cannot be satisfied, it states that the option may need to be amended or abandoned. It also stresses that it is not closing off alternatives, particularly because immobilization options will need to be worked up in any case, to deal with a small percentage of waste plutonium from the existing inventory that is not recyclable as MOX fuel.

#### Consultation Questions

- 4.12 The Government poses the following consultation questions:
1. Do you agree that it is not realistic for the UK Government to wait until fast breeder reactor technology is commercially available before taking a decision on how to manage plutonium stocks?
  2. Do you agree that the UK Government has got to the point where a strategic sift of the options can be taken?
  3. Are the conditions that a preferred option must in due course meet, the right ones?
  4. Is the UK Government doing the right thing by taking a preliminary policy view and setting out a strategic direction in this area now?
  5. Is there any other evidence government should consider in coming to a preliminary view?
  6. Has the UK Government selected the right preliminary view?
  7. Are there any other high level options that the UK Government should consider for long-term management of plutonium?

These questions with proposed responses are set out at Appendix A.

## Discussion

4.13 The current 'wait and see' storage strategy for the civil plutonium stockpile is unsustainable in the long-term because there will be no storage infrastructure available well before the current Dounreay 'end date' of 2078 and the Sellafield 'end date' of 2120, assuming current site Lifetime Plans are fully implemented.

4.16 Additionally 'in growth' of Americium in some plutonium isotopes further militates against a 'wait and see' approach. The NDA's *Plutonium Topic Strategy* paper, January 2009 states: "One of the most important characteristics is the rate at which the plutonium isotope with the shortest half life decays to form Am-241, which is more radioactive than plutonium. The in-growth of americium makes the plutonium which is currently stored more difficult to handle. The americium will last about 300 years before it starts to decay away."

4.17 Whilst clearly there will be significant technical challenges to be resolved with the disposal of spent MOX fuel to a geological disposal facility, there will also be significant technical challenges to disposal of plutonium as a waste to a geological repository. A proven and regulatory acceptable disposal route does not yet exist, but will need to be identified, for the small fraction (about 5%) of the current plutonium stockpile unsuited to MOX fuel fabrication. Of the potential disposal options identified by Government possibly the least attractive is cementation as this would add an estimated 200,000 tonnes of waste material to a geological disposal facility inventory, significantly increasing a repository size and cost.

4.18 Government sets out some high level costings provided by the NDA of different management options in its consultation paper. Government considers the construction of a new MOX plant and operation for 30 years could cost between £5bn and £6bn, but the market value of MOX fuel produced could be £2bn giving a net cost of £3bn - £4bn. This is substantially less than the cost of conditioning, packaging and emplacing plutonium in a geological disposal facility which is estimated at £5bn - £7bn, and possibly half the cost of the current strategy of storage and ultimate disposal which is estimated by NDA to be about £8bn. Financially, plutonium recycling through MOX manufacture appears to be the least cost approach for managing the UK plutonium stockpile.

4.19. This conclusion is supported by recent independent research conducted by Sir David King, former Government Chief Scientific Adviser. On 15 March 2011 Sir David publishes his study into the costs of future management of the plutonium stockpile and spent nuclear fuel not contracted for reprocessing at Sellafield. Sir David's report models four scenarios:

- (a) Store plutonium and used AGR fuel prior to declaring them as a waste for disposal in a geological disposal facility;
- (b) Convert the plutonium into MOX in a new MOX plant, and use it as fuel for new build reactors, while continuing to treat the unprocessed used AGR fuel as a waste;
- (c) Convert the plutonium into MOX in a new MOX plant, reprocess the AGR fuel in a refurbished THORP, and use the separated uranium and plutonium as fuel for new build reactors; and

(d) As Scenario c) but continue reprocessing of UK or overseas fuel in a refurbished THORP, and recycle the separated plutonium and uranium as fuel.

4.20 For all options and scenarios, the report models the cumulative total costs of plant and their operation, and deducts the income from MOX fuel sales. In Scenarios b, c, and d the modelled price obtained for fuel sales gives a large reduction in overall management costs. The key conclusion of Sir David King's report is that all management options will cost Government money (as DECC recognise) but the least cost options are those that involve reuse of nuclear materials (through refurbishment of THORP and construction of a new MOX fuel fabrication plant).

4.21 However, UK commercial utilities have shown little enthusiasm for MOX to date – though clearly this could change if Government subsidises the cost of burning MOX fuel primarily to dispose of the plutonium stockpile, or natural uranium prices rise significantly through demand from a resurgent international nuclear energy sector.

4.22 On 7 February the Guardian newspaper reported that Areva, a partner in the Sellafield site parent body, Nuclear Management Partners, proposed to Government in 2009 that it build a new MOX plant at Sellafield. Proposed funding arrangements at the time are not clear but if MOX fuel fabrication is the least cost option for managing the UK plutonium stockpile, as it appears to be, then Government funding would be appropriate. For West Cumbria this would represent significant additional investment and significant new construction and ongoing employment. The operational skills base is already available as the current Sellafield MOX plant supports a workforce of 1,000.

4.24 Government is therefore urged to go further than its proposed strategic environmental options assessment and immediately commission a full generic sustainability assessment for public consultation evaluating all the options including costs, environmental, socio-economic, safety, security, proliferation, political, international, technical feasibility, transportation, radiological, and climate change impacts. Implementation timelines for different options and impacts on current Government policy (e.g. Managing Radioactive Waste Safely) should be addressed to fully underpin or challenge Government's 'preliminary policy view'.

4.25 A generic sustainability assessment should evaluate options for constructing one or more dedicated MOX burning reactors on available land beside the Sellafield and the NuGeneration Ltd sites. Estimates suggest that a 40% MOX core could fuel two reactors for 60 years, contributing **XX** Gw of electricity, increasing the UK's low carbon generating capacity and assist Government carbon reduction and energy security objectives. Reducing demand for natural uranium and its transportation and processing by recycling the UK civil plutonium stockpile might have a very positive net CO<sub>2</sub> benefit.

4.26 Consuming the plutonium stockpile on a reactor site adjacent to the main storage facility at Sellafield could also provide very significant safety and security benefits and further support the economy of West Cumbria and the development of Britain's Energy Coast as a globally recognised centre for leading nuclear, environmental and related technologies. Potentially MOX fuel use in commercial

new build reactors elsewhere in the UK could have net benefits though there would be higher security and transportation costs nationally, and internationally if MOX fuel produced from UK plutonium was traded overseas.

#### CONCLUSION

Government concludes that “MOX fuel fabrication is a proven and available technology that offers greater certainty of success” in disposing of the UK civil plutonium stockpile. This report supports Government’s conclusion. It also appears from NDA and independent assessment that recycling the UK civil plutonium stockpile is the least cost option. The Sellafield site is the obvious location for a new MOX plant because most of the stockpiled plutonium is already in storage there and the Sellafield workforce has the appropriate skills base to operate a new plant.

To maximise safety and security, and to minimise transportation nationally or internationally, Government should evaluate the case for constructing one or more dedicated reactors adjacent to the Sellafield and NuGeneration Ltd sites to consume MOX fuel. Such investment could help achieve Government carbon reduction and energy security objectives and further develop Britain’s Energy Coast.

#### **WHAT ARE THE LEGAL, FINANCIAL AND HUMAN RESOURCES IMPLICATIONS?**

6.1

#### **7. HOW WILL THE PROPOSALS BE PROJECT MANAGED AND HOW ARE THE RISKS GOING TO BE MANAGED?**

7.1

#### **8. WHAT MEASURABLE OUTCOMES OR OUTPUTS WILL ARISE FROM THIS REPORT?**

8.1

**List of Appendices:**

**List of Background Documents:**

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## **APPENDICES**

### ***Appendix A: Draft joint response from Cumbria County Council, Copeland Borough Council, Allerdale Borough Council, and Britain's Energy Coast (West Cumbria) to the DECC consultation on the Management of the UK's Plutonium Stocks***

#### ***Appendix A***

### ***Draft joint response from Cumbria County Council, Copeland Borough Council, Allerdale Borough Council, and Britain's Energy Coast (West Cumbria) to the DECC consultation on the Management of the UK's Plutonium Stocks***

- 1 *Do you agree that it is not realistic for the UK Government to wait until fast breeder reactor technology is commercially available before taking a decision on how to manage plutonium stocks?*

Yes, there are a number of significant drivers for change including:

the need for the ongoing refurbishment or replacement of specialist and costly plutonium storage facilities;  
uncertainties about the ageing processes that may affect plutonium in long-term storage;  
the finite life of packaging and the likely need for periodic re-packaging;  
the radioactive decay of plutonium to americium, which is more challenging from a dose and heat perspective, thereby making the plutonium more complex and costly to handle over time;  
the inherent long-term unsustainability of long-term storage with site clearance at Dounreay by 2078 and Sellafield by 2120;  
the need to more accurately characterise the inventory for eventual disposal to a geological disposal facility; and  
the responsibility of this generation not to defer difficult decisions and costs to the next generation.

These drivers provide significant reasons to implement options other than the continued storage of separated plutonium.

- 2 *Do you agree that the UK Government has got to the point where a strategic sift of the options can be taken?*

Yes. We agree with Government that "MOX fuel fabrication is a proven and available technology that offers greater certainty of success' in disposing of the UK civil plutonium stockpile. We therefore urge Government to go further than its proposed strategic environmental options assessment and immediately commission a full generic sustainability assessment for public consultation evaluating all the options including costs, environmental, socio-economic, safety,

security, proliferation, political, international, technical feasibility, transportation, radiological, and climate change impacts. Implementation timelines for different options and impacts on current Government policy (e.g. Managing Radioactive Waste Safely) should be addressed to fully underpin or challenge Government's 'preliminary policy view'.

We consider that a generic sustainability assessment should evaluate options for constructing one or more dedicated MOX burning reactors on available land beside the Sellafield and the NuGeneration Ltd sites. Estimates suggest that a 40% MOX core could fuel two reactors for 60 years, contributing **XX** Gw of electricity, increasing the UK's low carbon generating capacity and assist Government carbon reduction and energy security objectives. Reducing demand for natural uranium and its transportation and processing by recycling the UK civil plutonium stockpile might have a very positive net CO2 benefit.

Consuming the plutonium stockpile on a reactor site adjacent to the main storage facility at Sellafield could also provide very significant safety and security benefits and further support the economy of West Cumbria and the development of Britain's Energy Coast as a globally recognised centre for leading nuclear, environmental and related technologies. Potentially MOX fuel use in commercial new build reactors elsewhere in the UK could have net benefits though there would be higher security and transportation costs nationally, and internationally if MOX fuel produced from UK plutonium was traded overseas.

*1 Are the conditions that a preferred option must in due course meet, the right ones?*

We note the proposed conditions, that the preferred option:

must be achievable and deliverable

must be shown to be capable of meeting health, safety and environmental requirements as well as meeting non-proliferation and security objectives

must demonstrate that it provides value for money and is of overall benefit to the UK.

We consider that the MOX fuel option meets all these objectives but urge Government to demonstrate this by moving urgently to a detailed sustainability assessment

*4 Is the UK Government doing the right thing by taking a preliminary policy view and setting out a strategic direction in this area now?*

We think it appropriate that the Government takes a preliminary policy view and sets a strategic direction.

However we recognize that a small proportion of the UK civil plutonium stockpile will need to be directly disposed to a geological disposal facility and therefore we agree it is important to continue work on disposal options (and to enable realistic contingencies to be developed should a preferred option ultimately not meet the conditions outlined above).

*5 Is there any other evidence government should consider in coming to a preliminary view?*

We believe any other evidence can be captured through a public consultation on a generic sustainability assessment of the disposal and MOX options.



We recognize that all the options for management of the UK plutonium stockpile will impact on development of a geological disposal facility (GDF). As the principal local authorities currently engaging with Government through the Managing Radioactive Waste Safely process we need to understand the implications of reuse and immobilization options for (i) the design of a GDF and surface facilities, (ii) the size of the underground footprint, (iii) the period of operation of the GDF, (iv) the developing GDF safety case, (v) the number of required GDFs and (vi) the use of alternative disposal methods.

On the potential use of MOX fuel in proposed new nuclear power stations, as a starting point, all potential host communities and their local authorities will wish to understand the implications for (i) safety case development and licensing of a new nuclear power station, (ii) security arrangements for the transport, receipt and storage of fresh MOX fuel and for the interim storage and transport of spent MOX fuel, and (iii) the duration of the interim storage of spent MOX fuel at the nuclear power station site. We believe these issues can begin to be addressed in a generic sustainability assessment.

6 *Has the UK Government selected the right preliminary view?*

Yes, the MOX route for consuming the civil plutonium stockpile appears the least cost option which can also assist other Government policy objectives (security of energy supply and low carbon generation) but we believe Government must present its case far more persuasively by detailing of the impacts of both MOX fuel fabrication and immobilization to present more clearly the advantages of plutonium recycling.

7 *Are there any other high level options that the UK Government should consider for long-term management of plutonium?*

None that are considered by the nuclear industry to be viable.

