

The UK's Plutonium Stockpile – Early Regulatory Assessment of Credible Options – 14240

R.P Maitland*, K. McDonald*

*Office for Nuclear Regulation, Redgrave Court, Liverpool L20 7HS, United Kingdom

ABSTRACT

The UK Government is currently considering the various options for managing its plutonium stockpile, supported by the UK's Office for Nuclear Regulation and the UK Environment Agency in the early consideration of credible options. This work follows on from an earlier Government publication in December 2011: 'Management of the UK's Plutonium Stocks: A consultation response on the long-term management of UK-owned separated civil plutonium'. The Nuclear Decommissioning Authority [NDA] has been tasked by government to explore options for plutonium management. UK regulators are developing a flexible approach to advise NDA in its work, without unduly jeopardising regulatory independence or using disproportionate resource. The approach is based on lessons learnt from the early stages of the UK's Generic Design Assessment process for looking at new reactor designs. It will encompass consideration of all the lifecycle activities required to deliver plutonium reuse and is expected to cover aspects such as feasibility of fuel manufacture, rate at which the plutonium can be reused and decommissioning and radioactive waste issues.

A number of parties have proposed solutions for managing the plutonium and the proposed approach would involve structured interactions with them, resulting in a view from the regulators on the suitability, or otherwise, of the solution to enter a formal GDA, permissioning process, or equivalent. This paper details the work carried out on the regulatory approach and the identification of potential issues.

INTRODUCTION

In the absence of a defined strategy for management of the UK plutonium stockpile, the current Site Licence Company [SLCs] have to date treated plutonium as a zero value asset¹ which is planned to be stored for an indefinite period. As yet no ultimate disposition route has been fully developed. The material is currently stored at two locations, Dounreay and Sellafield. Both sites have defined end-points and so their plans only progress as long as activity is maintained on the sites. The Dounreay plan shows the material being stored until 2075. The Sellafield plan shows material being

¹ The concept of a zero value asset means that there are no cost or revenues attributed to the balance sheet, either from immobilisation or from any revenue that may be generated by recycle options

stored until the site end-point in 2120, with the assumption that the material will remain in place beyond that date. After those dates no provisions are included in the plans for the subsequent management of the material.

In 2011, NDA published a strategy for managing the existing stocks of UK-owned civil separated plutonium and the future arisings resulting from the completion of the Sellafield reprocessing programme [1]. Included within this inventory is the material owned by the Nuclear Decommissioning Authority (NDA) and British Energy (a part of EdF Energy). It is recognised however, that the inventory may change if, for example, British Energy choose a different route for their material or if Ministry of Defence (MOD) owned material became part of the inventory

A more detailed description of the options under assessment was provided in the "NDA Plutonium Credible Options" paper, which was issued for comment during Summer 2008, published in January 2009 and has been revised, updated and published in February 2011. The credible options paper has been used to support the Government policy development.

At a high level the options can very broadly be described as:

1. Continued long term storage (prior to disposal)
2. Reuse as fuel followed by disposal
3. Prompt Immobilisation and disposal as soon as practicable (subject to technical and financial constraints).

OFFICE FOR NUCLEAR REGULATION

The Office for Nuclear Regulation (ONR) is an independent safety, security and transport regulator of the UK nuclear industry. ONR regulates all civil nuclear reactor power stations, fuel manufacture, enrichment, spent fuel reprocessing, most defence sites and installations that store and process legacy spent fuel and radioactive waste. The responsibility for funding and strategic direction of decommissioning and radioactive waste management of state owned legacy sites has rested solely with the Nuclear Decommissioning Authority (NDA) since 2005. A key component of NDA's mandate was to encourage new strategic approaches and innovation to dealing with the UK's waste legacy, as well as to secure value for money to the UK taxpayer.

By the nature of its role, ONR adopts a conservative approach to regulation; however ONR also recognises that in the decommissioning (and ultimately the site closure) domain, it is often necessary to consider and support novel approaches to achieve the nationally desired end-state. Crucial to successful and compliant operation in this regulatory environment is early and sustained engagement of the contractor with the regulator. There must be a 'no-surprises' culture to engender regulatory confidence early in a project.

NDA CONSULTATION WITH REGULATORS REUSE OPTIONS

In response to a consultation on the long-term management of UK owned civil separated plutonium, the UK Government has identified reuse of plutonium as mixed oxide fuel (MOX) as the preliminary preferred option. The UK is currently storing a significant quantity of civil plutonium. The Government considered that due to both domestic and global concerns over the security risks and non-proliferation sensitivities associated with the long-term storage of plutonium that a clear policy for its long-term management was required. The UK's NDA are supporting government with taking the policy forward.

The disposition of the civil plutonium stocks will require the development and construction of new plant(s). The NDA invited the market to propose approaches for reuse of plutonium by converting the plutonium stocks into fuel with subsequent use in a reactor. The NDA has engaged with 3 parties [termed consortia for brevity] proposing different potential reactor types with differing degrees of known capability to burn plutonium based fuels. The three proposed approaches are:

- Fabrication of Light Water Reactor (LWR) MOX in an AREVA designed plant followed by irradiation in one of the following types of LWR: European Pressurised Reactor [EPR], Westinghouse AP1000 or an Advanced Boiling Water Reactor [ABWR].
- Fabrication of CANMOX in GE Hitachi Canada designed MOX plant followed by irradiation in CANDU EC-6 Heavy Water Reactors
- Fabrication of metallic fuel in a GE Hitachi designed fuel plant followed by irradiation in PRISM fast reactors.

All approaches have merit and which proposal is best suited to meet the UK's needs has not yet been established.

To support this, NDA sought regulators' advice on the suitability of each proposal to enter a permissioning process, based on a limited evidence of the safety and environmental impacts of their proposals. ONR's view was that this advice can be provided. However, ONR recognises that the proposals are in their initial stages and that regulatory advice will be based on the limited data. ONR's conditional view could change significantly when detailed applications from the consortia are considered.

This report documents ONR's interim position on its requirements for the NDA to progress its proposal to reuse plutonium. There is novelty involved in both the proposal and in the process that is being developed to assess the safety and environmental impact of the options. Therefore, this report also provides assurance of the robustness of the ONR process for assessing options.

EARLY REGULATORY ASSESSMENT STRATEGY

NDA asked the UK regulators to make a high level review of the candidate technologies proposed and to identify potential barriers for a prospective vendor to overcome. In particular the review will:

- Consider the whole lifecycle, with due regard also given to matters of technology maturity and decommissioning
- Articulate regulatory challenges associated with safety, dose, security and transport
- Identify potential tensions between them such as emergency response (disperse) and security (consolidate)

Each of the three consortia were asked to submit a report to regulators covering:

- A description of each proposed facility.
- The design reference for each facility, including design base accidents.
- Details of any international regulatory reviews of the process, or parts of.
- The approach to safety function categorisation and system classification.
- Identification of the key safety structures, systems and components together with details of the evidence, provided in a future submission, to show that they are robust.
- Any matters that might conflict with UK government policy.
- Identification of novel plant and their technical readiness level.
- The proposed approach to licensing the facilities in the UK.
- A list of the documents that would be presented in a licensing/GDA submission and a plan for when these would be provided.
- A high-level decommissioning strategy and proposals for disposal of any waste and fuel generated.

INTERNATIONAL COOPERATION

ONR has established links with both US Nuclear Regulatory Commission and the Canadian Nuclear Safety Commission to secure early intelligence of technical and regulatory aspects of candidate technologies. Both have some knowledge of the systems being proposed and therefore their experience will be beneficial to the views established by UK regulators.

Whilst the challenges faced by various countries on plutonium management are unique to their individual situations, early international cooperation is essential:

1. To minimise abortive work and diversion of limited resources on detailed assessments of technology
2. To establish international consensus on novel technologies – this reduces the burden on individual countries and emphasises the importance of a continuous improvement in safety standards.

BENEFITS AND CHALLENGES OF EARLY REGULATORY ENGAGEMENT

Early regulatory assessment and advice to NDA carries reputational risks for ONR:

- The regulator's independence must be preserved – ONR has to carefully balance the level of advice it offers to NDA and ultimately UK Government.
- Decisions taken by government could lead to significant inward investment in novel technologies to the UK. ONR has to offer realistic expectations but in a context where there is a national imperative to expedite the management of the plutonium stockpile
- ONR has to be astute to the potential [premature] commercial harm that could arise if its findings are misconstrued. Conversely, its advice must not be seen by the market as a commercial endorsement.

ONR is confident that undertaking this work in an open and transparent manner, according to the approach described above will appropriately mitigate these risks. It will allow NDA to make a recommendation informed by the likely safety issues for the different options

CONCLUSIONS

- This report presents an approach to the provision of regulatory advice to the NDA and subsequently HMG on the disposition of plutonium. Because of the unique nature of this project the proposed approach has built upon standard ONR processes to provide an approach that does not undermine regulatory independence whilst providing the NDA with an indication of whether the reports have addressed the major safety, environmental and security aspects that the regulators would anticipate to be necessary
- NDA has proposed to use the advice provided by the UK regulators in formulating its own advice to DECC on the management of civil stocks of plutonium
- UK Government is currently considering NDA's conclusions; at the time of writing a decision from Government is anticipated towards the end of March 2014. .

REFERENCES

1. NDA plutonium strategy – current position paper [2011];
<http://www.nda.gov.uk/documents/upload/NDA-Plutonium-Current-Position-February-2011.pdf>
2. NDA plutonium credible options
<http://www.nda.gov.uk/strategy/nuclearmaterials/plutonium/documentation.cfm>
3. UK Office for Nuclear Regulation <http://www.hse.gov.uk/nuclear/>