

Progress on approaches to the Management of Separated Plutonium

LEAD OFFICER: John Groves
REPORT AUTHOR: Denice Gallen

Summary and Recommendation:

On the 20th Jan the NDA released a position paper stating the progress made on approaches to the Management of Separated Plutonium, there is no formal period of consultation however comments can be made to strategy@nda.gov.uk.

Recommendation: Members note the content and consider if a response is required?

1. Background

- 1.1 In December 2011 the Government announced its preferred policy position to pursue reuse of Plutonium as Mixed Oxide (MOX) fuel for burning in current reactor designs.
- 1.2 In Feb 2012 the NDA approached the market and asked for any parties who believed that they could offer a credible alternative to reuse as MOX to approach them.
- 1.3 Two large commercial organisations then came forward with alternative methods to the management of the Plutonium stock they were, Candu Energy (Candu) and General Electric Hitachi (GEH)

2. Overview of the three technologies that may be used:

2.1 MOX

- 2.1.1 NDA has made significant progress on understanding the technical and implementation aspects of MOX.
- 2.1.2 The USA is managing their surplus weapons grade plutonium via reuse as MOX. There have been significant cost increases and schedule overruns at the US MOX Fuel Fabrication Facility. Although the USA project is separate to the UK MOX project this development affects NDA confidence in the predictability of implementation and costs of reuse as MOX.
- 2.1.3 The earliest commercial operation of new build reactors in the UK, which is critical path for MOX use, is now estimated to be 2023. Although no new build reactors have yet committed to using MOX and the appetite of

developers to ultimately include MOX in their considerations remains uncertain.

- 2.1.4** However, a window of opportunity may exist to factor in use of MOX, whilst developers establish their business cases for new reactors. The NDA has developed commercial and financial models to understand how new nuclear developers evaluate the financial aspects of a scheme, and the potential impact of MOX on this.
- 2.1.5** The NDA consider the next 1-2 years are critical to establishing the options for implementation of MOX and for understanding the willingness and potential involvement of technology vendors, utilities and investors to realize the solution.

2.2 Enhanced CANDU 6 (EC6)

- 2.2.1** Candu indicated that they were interested in re-entering the UK market, specifically to support the management of the UK plutonium, as they believed their solution could be efficiently applied to this mission and was deployable on the required timescales. For plutonium, the timescale was regarded as around 25 years.
- 2.2.2** There are a number of potential benefits of utilising dedicated CANDU reactors to manage separated plutonium, notably a simplified CANMOX fuel manufacturing process, compared to LWR MOX (above).
- 2.2.3** There is supply chain interest to be involved in the project from fabrication through to operations. There are also high levels of interest from third parties willing to provide equity.
- 2.2.4** The costs are lower than that of MOX (due to a simpler design). The technical readiness of the system is generally high. However, the integrated system has not been demonstrated on a commercial scale for plutonium based fuels.
- 2.2.5** Based on their worldwide experience, the overall implementation timetable to first irradiation is claimed by Candu to be in the range of 10-12 years, with the duration to disposition the stockpile through 2 reactors of 60 years. The NDA believe the implementation timetable to be ambitious considering the delivery performance norms currently seen in the UK and European nuclear landscape.

2.3 PRISM

- 2.3.1** In the NDA's original Credible Option analysis on plutonium disposition fast reactors were not considered credible as the market did not intend to deploy them for many decades and therefore, they were unlikely to be available in time to meet the policy objective since they would not be commercially available for several decades.
- 2.3.2** However following the NDAs request for other vendors to come forward with credible options General Electric Hitachi (GEH) responded to this providing information to the NDA on the use of PRISM technology, their

PRISM fast reactor is one of three reactors that GEH now offers to a world market.

- 2.3.3** The use of PRISM has a number of advantages notably the reduced time to disposition the UK stockpile and the ability to utilise the full inventory of plutonium which should consequently reduce the overall costs of implementation of plutonium reuse.
- 2.3.4** GEH estimated that licensing these first of a kind facilities would take around 6 years, similar to the period it took to licence Sizewell B.
- 2.3.5** The proposal overall would require development work to be undertaken, with the cost and time to complete this work still to be defined in detail.
- 2.3.6** Given commercial approaches are in the very early stages of development, GEH did not seek to gain firm utility or third party commitments, although the US EXIM bank has indicated export credit is available for the project.
- 2.3.7** The overall implementation timetable to first irradiation is claimed by GEH to be in the range of 14-18 years the NDA believe this to be ambitious considering delivery performance norms currently seen in the UK and European nuclear landscape.
- 2.3.8** RWMD see no fundamental impediment why spent fuel arising from the operation of the scheme could not ultimately be disposed of in a Geological Disposal Facility, although the fuel does represent some unique challenges.

3. Way Forward

- 3.1** Given the above assessment of the three types of technology the NDA believes that there is merit in working with the three vendors and to include Candu and PRISM in the next stages, that is developing an application for justification.
- 3.2** The NDA will develop their Justification approach alongside refining their understanding of licencing aspects, with a view to subsequently making an application.
- 3.3** Further progress will be reported in due course