Meeting:	NuLeAF Steering Group, 9 April 2014
Agenda Item:	5
Subject:	An update on NDA Strategy and Operations
Author:	Stewart Kemp
Purpose:	To provide updates on developments in NDA Strategy and Operations

Introduction:

This report briefly updates on:

- Publication of NDA's progress on approaches to the management of separated plutonium, and a DECC 'consultation on the management of overseas origin nuclear fuels held in the UK';
- Publication of NDA's uranics: credible options paper;
- Publication of NDA's magnox fuel strategy: contingency options paper;
- Publication of NDA's strategic position paper on the management of graphite wastes;
- Developments with NDA Theme Overview Groups; and
- Publication of the 2013 UK Radioactive Waste Inventory.

Recommendation:

1. That the Steering Group agree a response to the DECC 'consultation on the management of overseas origin nuclear fuels held in the UK' in the terms at para 1.7 below.

2. That the Steering Group agrees a response to the NDA's 'uranics: credible options paper' in the terms at paras 2.7 and 2.8 below.

Contribution to 2013/15 Service Plan:

The activities described in this report relate to the following Key Tasks:

- *Continue to monitor and advise NDA and NuLeAF membership on IWM Strategy implementation.*
- *Continue to engage NDA TOGs representing the interests of LAs.*
- *Promote engagement between NDA/SLCs and host LAs to ensure site decommissioning and waste planning is consistent with LDPs.*

1. **Publication of NDA's progress on approaches to the management of separated plutonium, and a DECC 'consultation on the management of overseas origin nuclear fuels held in the UK'**

1.1 NDA continues to assess options for reuse of the UK civil plutonium stockpile and published in January a position paper. See: http://www.nda.gov.uk/documents/upload/Progress-on-approaches-to-the-management-of-separated-plutonium-position-paper-January-2014.pdf.

1.2 Identified credible options remain 1) fabrication of MOX fuel for use in light water reactors (e.g. of the type currently being considered for new build in the UK), or 2) reuse in either of two potential reactors capable of burning plutonium (the Canadian CANDU EC6 or the General Electric Hitachi PRISM reactors). For all options the current Government intention would be to directly dispose of used MOX/plutonium fuel directly to a geological repository and not pursue further reprocessing to recover useable materials.

1.3 NDA say that "there is insufficient understanding of the options to confidently move into implementation and consider that significant further work must be undertaken, focusing on technical and commercial risks and uncertainties." NDA intend to undertake further technical studies over the coming one to two years "to establish a consistent level of understanding of risks and uncertainties for each option."

1.4 NDA will also: 1) work with technology vendors, suppliers, utilities and Government to establish funding options; 2) further investigate whether there is any market for MOX; 3) continue to assess non reuse options (conditioning and packaging for geological disposal – which in any event will likely be needed for 10-15% of plutonium stockpile unsuitable for reuse); and 4) develop the next steps including the approach to 'justification' of new practices (as required by European law). NDA do not foresee any 'bulk reuse' of plutonium before around 2030-35 with any programme "concluding several decades after that." NDA say further progress will be reported in due course.

1.5 In March DECC launched a consultation to amend Government policy and permit small volumes of overseas nuclear fuels to remain in UK storage at Sellafield for eventual direct disposal to a UK geological disposal facility (GDF). This included some plutonium based fuels currently at Dounreay.

1.6 NDA now assesses these materials as either unsuitable or uneconomic for reprocessing through the Sellafield THORP plant, though this is what original overseas customer contracts intended. NDA wishes to tie up these outstanding contractual lose ends, and allow the THORP plant to close in 2018, by negotiating the return of a radiological equivalent amount of material to overseas customers. See: https://www.gov.uk/government/consultations/management-of-overseas-origin-nuclear-fuels-held-in-the-uk. This consultation closes on 28 May 2014.

1.7 The materials under consideration total 30 tonnes (from an original 5,000 tonne THORP order book) and whilst Government says there will be an

(unspecified) cost to the UK taxpayer for storage and disposal in the UK, it will be substantially less than replacement of highly active liquor storage tanks which would be needed if THORP continued operation beyond 2018.

The consultation raises a number of questions including:

- Whether all the options for completing overseas contracts have been considered (to allow completion of contracts and avoid of penalties)? NDA say overseas reprocessing was considered but ruled out because of transportation and materials repackaging costs. However in some instances repackaging for transportation may be needed for transportation within the UK, and to meet NDA geological disposability requirements. Could other UK facilities offer a materials processing option to enable overseas contracts to be completed?
- What impacts arise at Sellafield as a result of overseas materials storage pending disposal? The volume of materials may be relatively small but presumably there will be an opportunity cost. Assuming NDA is to continue working within existing budgets, what work will not now be done, or deferred, if additional resources are needed for the management of overseas materials?
- Will any plutonium be added to the UK civil stockpile, and what materials have, or will, be offered in exchanged? (Note that the journal, *Nuclear Engineering International*, on 21 March 2014, reported 800kg of Swedish plutonium would enter the UK stockpile).
- The consultation document advises approximately two tonnes of material is currently held at Dounreay and will need to be transferred to Sellafield to enable Dounreay site decommissioning to progress. What are the assessed impacts of this transfer? The consultation is silent on this.
- The consultation document includes no information on actual costs. What is the overall assessed financial impact of the consultation proposals?

1.8 The consultation document asks: "Are there any possible consequences of this proposal which the Government might not have anticipated? Are there any significant factors that we may have overlooked or over/under estimated that would influence our decision on the NDA proposals? Are there any general comments that you would like to make?" The Steering Group is asked to consider whether the issues identified in para 1.7 above should be submitted to Government in response to its consultation questions, and whether there are any other matters that the Steering Group would wish to raise in response to Government.

2. Publication of NDA's uranics: credible options paper

2.1 In January NDA published a paper assessing the high level credible options for the future management of materials containing uranium (termed *uranics*). See: http://www.nda.gov.uk/documents/upload/Uranics-Credible-Options-Summary-Gate-A.pdf.

These materials largely comprise uranium hexafluoride tails (from nuclear fuel manufacture), Magnox depleted uranium (from uranium enrichment processing), and THORP product uranium, and exist in several forms (including metals, powders, pellets) at Capenhurst, Dounreay, Harwell, Springfields, Sellafield and Winfrith.

2.2 Identified options are continued storage, recycling, or disposal. NDA say: "Our assessment is considering the options against a number of criteria such as cost, safety, security, environment and socio-economics, as defined in our Value Framework. Given the variety of types of uranics, we anticipate that no single strategic option will be suitable for the entire uranics inventory."

2.3 Currently this material is a nil value asset, but in the future: "…our assessment may ascribe a value or a liability to each type of uranic material. The dividing line between value and liability is likely to be sensitive to external Commercial factors such as the future price of freshly mined natural uranium and may change markedly with time. This may mean that we choose to continue to store some types of uranic materials for an extended period pending a future decision on whether to dispose of them or realise a commercial value through reuse."

2.4 About 98% of this inventory (by weight) is at the Capenhurst enrichment plant (26,000 tonnes depleted uranium and 20,500 tonnes uranium hexafluoride tails). About 900 tonnes of uranium hexafluoride tails are stored at Springfields and 300 tonnes of THORP product is held at Sellafield (though this should be returned to THORP customers under existing contracts). Small quantities of materials are held at Dounreay, Harwell and Winfrith.

2.5 NDA says it is assessing the market for these materials but under current conditions, large scale commercial recycling appears unlikely. Continued storage pending disposal appears the most likely option in future and NDA says that it is factoring in all the uranics inventory into the design and development of a geological disposal facility. However, NDA also say "The case for whether large volumes of uranics should be committed to the GDF *has not yet been evaluated*. Disposal in an alternative manner could be preferable."

2.6 NDA continue: "As part of the process leading to decisions on how to manage our uranic materials we will, as appropriate, discuss the credible options with regulators, Government departments, local communities and other interested parties." The NDA invites comments from its stakeholders.

2.7 From NuLeAF's perspective it is important for NDA to clarify as soon as possible how the uranics inventory could impact on a GDF inventory and on GDF design, scale and development. NDA refers to 'alternative' disposal options and these should be made explicit. Continued on site storage may impact on site lifetime plans and future decommissioning timescales. NDA

should identify where ongoing storage could compromise current site decommissioning and discuss the implications with site host local authorities.

2.8 NDA says: "As part of the process leading to decisions on how to manage our uranic materials we will discuss the credible options with regulators, Government departments, local communities and other interested parties." It also indicates that it aims to decide its preferred approach in FY2015/16 suggesting the 'window' for engagement with local authorities is during the next 12 to 18 months. In this case NDA should really be consulting local authorities about its engagement plan now.

2.9 The Steering Group is asked to consider whether the points in paras 2.7 and 2.8 above should be submitted to NDA in response to its Credible Options papers, and whether there are other points that the Steering Group would wish to raise.

3. Publication of NDA's magnox fuel strategy: contingency options paper

3.1 In January NDA published a paper assessing the contingency options for managing spent Magnox fuel should the Magnox reprocessing line at Sellafield irreversibly fail. Three options are considered feasible: 1) development of fuel drying and dry storage technology; 2) extended interim wet storage; and 3) extended in-reactor storage. See: http://www.nda.gov.uk/documents/upload/Magnox-Fuel-Strategy-Contingency-Options-January-2014.pdf.

3.2 On current plans, after the closure of Wylfa, the remaining inventory of Magnox fuel will be interim (wetted) stored at Sellafield pending reprocessing. The paper considers in turn the non reprocessing options should they be required, their costs, and the scope for eventual direct disposal of spent Magnox fuel to a geological disposal facility.

3.3 Should alternatives to reprocessing be required then NDA consider that it will impact on existing lifetime plans at Magnox sites. Defueling would be delayed and this would impact on site safety and security arrangements, workforce skill set requirements, and local communities. At Sellafield impacts are assessed to be significant and impact on a range of fuel and materials storage strategies, asset management, revenue optimisation, research and development and skills requirements.

3.4 Spent fuel management costs would increase, impacting adversely on long term financial liabilities carried by the UK taxpayer. Currently the Magnox Operating Plan 9 (MOP9) is costed at a total of about £16.5bn. NDA estimate that should the Magnox reprocessing line shutdown in 2014, then about 30% additional cumulative liabilities could be incurred across the estate i.e. approx. £5.5bn.

4. Publication of NDA's strategic position paper on the management of graphite wastes

4.1 In January NDA published a Strategic Position Paper on the Management of Waste Graphite. NDA says: "The position paper summarises a number of pieces of work that have been undertaken to better understand the challenges of managing radioactive graphite." See: http://www.nda.gov.uk/documents/upload/Strategic-position-paper-on-the-management-of-waste-graphite.pdf.

4.2 NDA reports that they have "…developed a Preferred Option for management of *operational* graphite waste and Credible Options for management of graphite waste from reactor *decommissioning*." (emphasis added).

4.3 NDA continue: "Our position is that at the current time no change is needed to the baseline strategy for the management of graphite in England and Wales. For operational graphite waste, we have determined a preferred option that the waste will be managed as follows:

• Berkeley Site – to manage all the graphite waste as Intermediate Level Waste (ILW) for interim storage (in resilient, self-shielding containers) and un-encapsulated disposal to GDF.

• Hunterston A Site – to manage all the graphite waste as ILW for interim storage (in stainless steel containers) and encapsulation at final site closure prior to management in accordance with Scottish Government Policy.

• Sellafield Site – to manage all the graphite waste as ILW for interim storage (in mild or stainless steel drums) and encapsulation prior to disposal to a GDF.

4.4 Graphite represents around 30% of the current GDF intermediate level waste inventory but NDA reports that its review concludes "…that the impact of graphite on the GDF footprint is expected to be relatively small, around 2% of the total GDF volume/capacity." How this conclusion is reached is not explained but is probably due to the projected density of disposed ILW compared with the spacing required between heat generating spent nuclear fuels which significantly increases overall repository dimensions, as revealed through the work of the former West Cumbria MRWS Partnership.

4.5 NDA also notes that "…disposal costs of graphite waste are not a significant portion of the overall cost of the GDF. No significant challenges are posed by waste scheduling and it is believed that a safety case can be made that includes graphite waste. The review has provided good underpinning information for the current baseline option in England and Wales, but did identify a number of areas where graphite management for disposal could be optimised."

4.6 Further: "Near-surface options for management of graphite have been initially investigated through both the Low Level Waste Repository (LLWR)

Environmental Safety Case submission and the Hunterston A project. It is apparent that the use of LLWR for the direct disposal of a large proportion of the graphite waste is not a credible option, in the context of the current Environmental Safety Case. Any use of the LLWR for disposal of graphite would impact on the radiological capacity of the LLWR and impact on the main function of the facility, to facilitate the management of LLW." However, this need not preclude alternative surface or shallow burial options subject to site availability and characteristics and NDA goes on to acknowledge that "The extended period of quiescence that reactors are scheduled to be in means that there is sufficient time for alternative options to develop such that any future decisions on the management of radioactive graphite waste will be appropriately informed."

5. **Developments with NDA Theme Overview Groups**

5.1 NDA convenes four Theme Overview Groups (TOGs) to facilitate NDA strategy implementation. NuLeAF has representation on three of these groups covering Site Restoration (SR), Integrated Waste Management (IWM), and Critical Enablers (CE). NuLeAF's request for representation on the Nuclear Materials and Spent Nuclear Fuels TOG has been reconsidered following an appeal by the Chair to NDA's Strategy Director, Adrian Simper, but security vetting would be required to enable full participation and the cost of this was considered by NDA to be prohibitive. However, NDA has agreed to provide quarterly briefings for the Executive Director on the work of the Nuclear Materials and Spent Nuclear Fuels TOG and this has been welcomed by the Chair.

5.2 The SR TOG last met on 5 March and an Executive Co-Director attended. The main points from the meeting are:

- All future TOG meetings will include reports on progress against plans. Prior to meetings a report template will be circulated for updates from all TOG members (including NuLeAF) on work undertaken in support of task delivery.

- NDA's newly launched Knowledge Hub was discussed. Generally TOG members considered it to be working well for NDA, SLCs and Regulators, but value to external stakeholders is less clear. The Hub is inward rather than outward facing. NDA said the Hub was still in its pilot phase and all comments will be considered.

- There was long discussion about what NDA means by an 'interim state' (in context of site decommissioning). The meeting gave NDA lots of comments and key issues arising from discussion will be circulated to TOG members to ensure all relevant matters are captured.

- Progress with 'road maps' was reported. Content to include for each site: Phases of decommissioning, intensity of decommissioning (e.g. spend), milestones, and contribution to reduction in future liabilities. Each site

road map will also capture for each site milestones identified through the work of the different TOGs.

- At the last meeting Arup produced a spend profile for Sellafield. Now Arup has created spend profiles for all NDA sites and is developing the individual site road maps. NDA say they intend to consult on the 'look and feel' of the road maps in due course.

- Finally MoD provided a presentation about lessons learned from the SDP project. (See below for further details.)

5.3 The IWM TOG met on 13 March but unfortunately neither an Executive Co-Director, nor a Cumbria County Council officer, were able to attend. Minutes will be reported to the Steering Group when these become available. Topics from the meeting included: an outline NDA Higher Activity Waste strategy (but not the umbrella national HAW strategy that NuLeAF has called for); a higher activity waste treatment implementation plan; and updates from RWMD, LLWR, MoD (re: the submarine disposal programme – See details of NuLeAF's engagement with the SDP).

5.4 Since the last Steering Group meeting the 'Critical Enablers' TOG has not met.

6. Publication of the 2013 UK Radioactive Waste Inventory

6.1 At the end of February DECC and NDA jointly published the 2013 UK Radioactive Waste Inventory (UKRWI). See: https://www.nda.gov.uk/ukinventory/. The inventory is published triennially and provides a 'snap shot' in time of radioactive waste arisings in the UK.

6.2 It is important to note that the inventory is not fixed – and that waste producers supplying information project future arisings and sometimes under or over shoot. Not all wastes and materials are included in the inventory. Routine liquid and gaseous radioactive discharges are not included. 'Exempt' and 'Out of Scope' radioactive wastes at very low concentrations disposed of with domestic refuse to landfill or incineration are not included. Most contaminated land is not included, NORM wastes are not included, and materials not yet deemed to be wastes (e.g. irradiated or unirradiated nuclear fuel, thorium, and some or all of the plutonium and uranium stockpiles) are not included.

6.3 Thirty five major sites across England, Wales and Scotland generate radioactive wastes. The 2013 UKRWI Summary document says: "About 91% by volume of all radioactive wastes in the UK are produced in England, 6% in Scotland and 3% in Wales."

6.4 The Summary continues: "The total volume of radioactive waste that exists today or is forecast over the next century or so from existing facilities is

about 4.5 million cubic metres (4.9 million tonnes). This volume would fill Wembley stadium about four times over. A further 1 million cubic metres of radioactive waste has already been disposed.

"Although 4.9 million tonnes of radioactive waste is a large amount, it is small when compared to other wastes the UK produces annually. Over 300 million tonnes of other wastes are produced annually in the UK, which includes about 6 million tonnes of hazardous waste.

"About 96% (4.3 million cubic metres) of the total volume of radioactive waste has already been produced. Some has been processed, and is being held in stores, but most is contained within existing nuclear facilities, including reprocessing plants and nuclear reactors, and will not be processed until these are shut down and dismantled. This waste is the legacy of past and current civil and military nuclear programmes.

"About 4% (160,000 cubic metres) of the radioactive waste total has yet to be produced. This waste is that forecast from the future planned operations of the existing nuclear power industry, from ongoing defence programmes and from the continued use of radioactivity for medical and industrial purposes….

"…. About 94% (about 4.2 million cubic metres) of radioactive waste falls into the LLW & VLLW categories. Of this volume, about 3.9 million cubic metres are from the dismantling and demolition of nuclear facilities and the clearance of contaminated ground at nuclear sites.

"About 6% (about 290,000 cubic metres) of radioactive waste is in the ILW category, and less than 0.1% (1,100 cubic metres) is in the HLW category. Although the volume of HLW is relatively small, it contains about 95% of all radioactivity in radioactive wastes. LLW contains less than 0.01% of the total radioactivity. These percentage values will change gradually over future time as radioactivity decays."

	Total cubic metres
VLLW	2,800,000
LLW	1,400,000
ILW	290,000
HLW	1,100
Total	4,500,000