Legal and Regulatory Frameworks for Decommissioning and Waste Management

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1 Introduction and abstract

Safe and efficient decommissioning and waste management requires clear structures for allocating responsibility and funding. Organisation of decommissioning and waste management activities and the regulatory environment within which those activities are undertaken should also allow the supply chain to prosper and, wherever possible, reduce barriers to international availability of resources and waste facilities. Radioactive waste treatment and disposal in particular raises both legal and political challenges to effective international co-operation, yet options for decommissioning and waste management are maximised where international barriers can be minimised.

Added to this, international nuclear liabilities issues must be managed so as to avoid unnecessary deterrents to international mobility of capability within the decommissioning market. Contractual terms and insurance arrangements for international shipments of nuclear waste and materials will also need to take into account imminent changes to liabilities conventions, ensuring compliance and management of compliance costs (of both insurance and management time).

This paper explores legal and commercial structures intended to support effective decommissioning and waste management and examines regulatory and commercial factors affecting the ability of facility operators to utilise internationally available capability. It focusses on:

- strategic approaches developed in the UK to address decommissioning and waste management liabilities associated with the UK's first and second generation civil nuclear sites and comparison of those approaches with other jurisdictions with significant decommissioning liabilities;
- liability and compliance risks associated with navigating international nuclear liabilities regimes in context of both mobility of decommissioning capability and international waste shipment; and
- regulatory issues affecting international availability of waste treatment facilities, including considerations of best available technique, proximity and trans-frontier shipments.

2 Background to the UK approach to decommissioning

The UK provides an interesting example, both because of its extensive decommissioning liabilities and the strategy now in place to manage those liabilities. Over the past decade the UK has pursued an innovative model for management of legacy nuclear liabilities and development of nuclear decommissioning capability, delivered primarily through the Nuclear Decommissioning Authority (NDA).

Intense focus on decommissioning and waste management was triggered by privatisation of the electricity industry in the 1980s and 1990s, coupled with early experience of decommissioning the two Berkeley Magnox reactors (shutdown in 1988 and 1989). Historically, no effective and sustained

financial provision had been made for future decommissioning liabilities and there was no commercial incentive to plan and provide for decommissioning. Concerns over decommissioning liabilities for future owners of the UK's nuclear fleet resulted first in exclusion of the Magnox reactors and subsequently the Advanced Gas Cooled Reactors and Sizewell B from privatisation in 1989.

The most recent undiscounted estimate (known as the 'Nuclear Provision') indicates that clean-up costs for the UK's legacy facilities are likely to exceed £115 billion[1], with 74% of this undiscounted figure relating to Sellafield. The NDA estimates that final costs will be "*somewhere between £90 billion and £220 billion*", with outlay "*spread over the next 120 years or so*"[2] (equivalent to making an estimate in 1896, when the English law requiring a man waving a red flag to walk in front of a moving car was repealed, of costs to be incurred up to the present day). Liabilities have been exacerbated by a range of factors, including rapid early expansion of first generation nuclear capacity, early focus on production of materials for weapons, lack of consideration for decommissioning in reactor designs and neglect of historic materials and storage facilities leading to deterioration and inadequate records.

The UK strategy divides broadly into the following elements, corresponding to stages in development of the UK nuclear industry:

- legacy liabilities, for which the NDA has financial responsibility;
- decommissioning of the UK's current fleet of Advanced Gas Cooled Reactors and Sizewell B, to be funded by the Nuclear Liabilities Fund with a state guarantee for any shortfall; and
- establishment of Funded Decommissioning Programmes to ensure that adequate financial provision is made for future decommissioning of new nuclear facilities.

The NDA has significant but very different roles across each of these elements.

3 The Nuclear Decommissioning Authority

Creation of the NDA under the Energy Act 2004 introduced a new layer of control and influence into the UK decommissioning arena. The NDA has a central strategic and financial role in delivery of decommissioning and waste management and maintaining a healthy supply chain.

The NDA's "*principal function*" is to "*have responsibility for securing … the operation … decommissioning and the cleaning-up of designated nuclear sites; … [and] operation of designated facilities for treating … or disposing of hazardous material …*"[3] Those designated sites include Sellafield, Dounreay, the first generation Magnox sites and the UK's low level waste repository. NDA's role expressly includes "*financial responsibility"*[4] for decommissioning, effectively satisfying the licence obligation placed on the operator of each of those sites to maintain adequate financial resources for decommissioning.[5]

Opportunities to enhance delivery of this principal function arise from the NDA's "*supplementary functions*", which including research, education and training. Notably, the NDA also has specific statutory duties to:

- *"promote, and to ensure, the maintenance and development in the United Kingdom of a skilled workforce able to undertake the work of decommissioning nuclear installations and of cleaning up nuclear sites"; and*

[1] The current discounted figure in the NDA's accounts (using the government specified discount rate) is £70 billion
[2] NDA website, Explaining the Nuclear Provision, 11 February 2015 (https://www.nda.gov.uk/2015/02/explaining-the-nuclear-provision/)
[3] Energy Act 2004, Section 3(1)
[4] Energy Act 2004, Section 21(1)
[5] As required by Licence Condition 36(1)

- *"promote effective competition for contracts to provide it with the services it must secure in order to discharge its responsibilities."*[6]

The NDA also has wider roles in implementing government policy on radioactive waste, advising government on future decommissioning and supporting development of a strong supply chain, including:

- advising on decommissioning plans for the UK's second generation nuclear fleet;
- implementing government policy on low level and higher activity radioactive waste, including geological disposal; and
- advising on appropriateness of decommissioning plans and costs estimates submitted under Funded Decommissioning Programmes for proposed new nuclear development (as a technical advisor to the Nuclear Liabilities Financing Assurance Board and DECC).

Despite the scale of its task, the NDA is a relatively small organisation with approximately 200 employees. Around half of those are engaged in preparations for the UK's proposed deep geological repository. In contrast, the site licence companies operating the NDA's designated sites have approximately 18,000 direct employees, supplemented by a substantial supply chain workforce.

Control not regulation

The NDA is not a safety regulator. Nor does it operate as a licensed site operator (although it does have the power to do so[7] and does have operational subsidiaries, for example providing rail freight, shipping and other transport related services for nuclear materials). The NDA's role in setting strategy, approving plans and sanctioning spending does nevertheless give significant influence over and ability to control its site licence companies.

In practice, the NDA's influence and control is exercised through contractual relationships with its site licence companies. The NDA also has statutory power to issue directions, with corresponding duties for its site licence companies to comply. The person with control of a site has a duty to "*prepare such plans for the decommissioning or operation … cleaning-up or management of the site … as the NDA may direct*", submit those plans to NDA for approval and comply with NDA directions.[8] The scope of directions NDA may issue is broad, and includes directions *"requiring … specified decommissioning or cleaning-up work";* "*requiring the … site … be operated or managed … in the specified manner*"; or "*requiring the implementation of a plan that the NDA has approved …*"[9]

The extent of control available to the NDA extends into areas that relate directly to the manner in which a site licensee chooses to meet its obligations under nuclear site licence conditions and other regulatory obligations relating to health, safety, security and the environment. This creates a risk of interference and conflict with regulatory and licence obligations. That risk is tacitly acknowledged in the Energy Act , which seeks to maintain a balance by imposing a number of pervasive and (in some cases) overriding duties on the NDA and its site licence companies.

- The NDA has a duty "*to have particular regard to … the need to safeguard the environment … the need to protect persons from risks to their health and safety from activities involving the use, treatment, storage, transportation or disposal of hazardous material; and … the need to preserve nuclear security*"[10] (although primary responsibility for each of those matters rests with the site licence companies).

[6] Energy Act 2004, Section 9
[7] Energy Act 2004, Section 10(2)
[8] Energy Act 2004, Section 18(2)
[9] Energy Act 2004, Section 18(3)
[10] Energy Act 2004, Section 9(1)

- "*A direction [given by the NDA] cannot authorise a contravention in relation to an installation, site or facility of any obligation to which the person with control of it is subject by or under an enactment.*"[11] In effect, this restricts the NDA's power to directions that do not contravene regulatory obligations.
- Finally, the Act requires the site licence company to "*secure that … the … site is [not] used … except for purposes which … secure that there is no contravention, in relation to the discharge of [the NDA's] responsibilities, of any obligations imposed by or under any enactment on the person with control of the … site …*" [12] A site licence company must therefore use the site only for purposes that do secure compliance with regulatory and licensing obligations, even if contrary to NDA instructions.

These provisions must however be considered in context of the UK's non-prescriptive regulatory framework, which requires site licence companies to determine the means by which they will achieve required outcomes. There is much scope for interference with the selection of that means without necessarily contravening any regulatory obligation, and hence a risk of usurping the site licence company's responsibility for determining how to comply with regulatory and licence obligations. To date the NDA has been careful to emphasise that it will specify only 'what' must be done and not 'how' outcomes are to be achieved. There is nevertheless an inbuilt potential for tension created by the NDA's role in context of the UK's nuclear regulatory regime. That tension requires on-going vigilance, both within the UK and should aspects of the NDA model be replicated in other jurisdictions.

NDA budget and funding

The NDA's annual budget gives an indication of the magnitude of its task. For 2015/16, the total budget was approximately £3.31 billion, comprising £2.09 billion of government funding[13] (more than 40% of DECC's budget for the year) and £1.22 billion of commercial revenue. Sellafield accounts for almost 60% of the NDA's annual spend (£1.95 billion for 2015/16[14]). Commercial revenues for the year arose primarily from power generation at Wylfa (the last operational Magnox reactor, which ceased generation in December 2015) and fuel re-processing activities at Sellafield.

The NDA does not benefit from segregated funding and so is dependent on the public sector spending review processes, albeit with some protection within DECC's budget. The 2010 Spending Review confirmed that "*[s]pending on the highest hazards at sites such as Sellafield has been protected.*"[15] The recent 2015 Spending Review included announcements that government will provide £11 billion to the NDA over the period 2016 to 2020[16] (although government expects over £1 billion of efficiency savings). Despite elements of protection, the absence of segregated funds means that all NDA spending is subject to annual limits, a feature which permeates the NDA's contracting models and plans for each of its sites.

NDA competition and contracting strategy

The NDA has developed a range of contracting strategies across its estate, intended to comply with its duty to promote effective competition whilst also preserving the identity of existing site license companies and ensuring that organisational changes are consistent with site licence requirements.[17]

Leaving aside Springfields and Capenhurst (see below), each site within the NDA estate is operated by one of four site licence companies: LLW Repository Ltd; Sellafield Ltd; Magnox Ltd or Dounreay Site Restoration Ltd. Under the NDA's primary contracting model, referred to as the 'Parent Body

[11] Energy Act 2004, Section 18(7)
[12] Energy Act 2004, Section 17(2)
[13] NDA Business Plan, April 2015 to March 2018
[14] NDA Business Plan, April 2015 to March 2018
[15] HM Treasury Spending Review 2010, Paragraph 2.109
[16] HM Treasury Spending Review and Autumn Statement 2015, Paragraph 2.94
[17] Under Licence Condition 36(4), changes to organisational structures or resources that may affect safety can only be made in accordance with arrangements approved by the Office for Nuclear Regulation

Organisation' or 'PBO' model, each of those site licence companies is currently owned by a private sector Parent Body Organisation selected under a competitive procurement process. The PBO model has if anything removed NDA further from the role of operator.

The PBO model

The PBO model uses a two-contract structure for each site licence company, comprising:

- a bilateral contract between the NDA and the site licence company (referred to as either a 'Management & Operations Contract' or 'Site Licence Company Agreement'); and
- a tripartite contract between the NDA, the site licence company and the Parent Body Organisation (referred to as a 'Parent Body Agreement').

The Site Licence Company Agreement governs the work done by the site licence company as the NDA's contractor. It allocates the site licence company's costs, liabilities and revenues and includes commercial arrangements to incentivise performance. In contrast, the Parent Body Agreement defines the terms on which the parent body organisation holds the shares in the site licence company and defines the role and financial obligations of the parent body organisation. Given the contractual terms governing shareholding the parent body organisation is in reality a steward rather than an owner of the site licence company.

The PBO model maintains the site licence company as a neutral enduring entity. It does not have financial risks or commercial interests of its own. Instead performance incentives are a commercial incentive for the parent body organisation, generating profits to be passed on in the form of dividends. The model therefore seeks a balance when defining the role of the parent body organisation. It must give the parent body organisation sufficient influence over the site licence company's performance for commercial incentives to be effective. It must at the same time avoid the parent body organisation intermeddling in performance of the site licence company's regulatory and licence obligations.

The operational role of the parent body organisation is limited, comprising: secondment of 'Nominated Staff' into the site licence company to provide strategic leadership in board level and other senior positions; and provision of 'additional support' where required. Secondment ensures the control of the site licence company continues to be exercised from within, consistent with the licensee's obligation to "*provide and maintain adequate … human resources to ensure the safe operation of the licensed site.*"[18] The parent body organisation is expressly forbidden from seeking to influence performance of license obligations other than through provision of Nominated Staff.

Annual funding limits

The site licence company must manage spending within an 'annual site funding limit' set and notified annually by the NDA. This is a consequence of the NDA's dependence on annual funding from government. To maximise efficiency, site licence companies must plan to utilise all but no more than the available funding, taking into account anticipated efficiencies and identifying areas where costs can be reduced or delayed if necessary. The impact of fluctuating funding profiles on programme and cost is particularly significant where the NDA has established long-term target cost based incentives.

There is a risk that unanticipated events and liabilities may result in an unavoidable breach of a funding limit, particularly as activities required to keep sites safe and secure must continue regardless of funding constraints. To avoid arbitrarily passing that risk to the parent body organisation, costs in excess of funding limits should only be disallowed (and so fall to the parent body organisation) where avoidable with good cost management.

[18] Licence Condition 36(1)

Sellafield 'market enhanced SLC' model

The NDA has recently announced a fundamental change to its contracting model for Sellafield, moving away from the PBO model and instead adopting a new model badged as a 'Market Enhanced SLC'. This is a response to the NDA's conclusion that complexities and uncertainties associated with the work required at Sellafield mean that a commercial interface between the NDA and a parent body organisation is not the best model.

Under the Market Enhanced SLC model Sellafield Ltd will become a wholly owned subsidiary of the NDA, giving the NDA direct governance control over the site licence company responsible for its most complex site. Sellafield Ltd will then appoint one or more strategic partners and a number of programme partners. The full scope and incentivisation model for those roles is not yet clear, although the NDA has drawn comparisons with strategic partnerships put in place by the 2012 Olympic Delivery Authority and CrossRail.[19]

Springfields and Capenhurst

Contract models for Springfields and Capenhurst sites were designed to allow NDA to dispose of on-going commercial operations while still meeting its statutory responsibilities to secure decommissioning.

- Springfields Fuels Ltd operates a commercial fuel manufacturing business, continuing a history of fuel fabrication on the site that goes back to the 1940s. In 2010 the NDA sold and permanently transferred Springfields Fuels to Westinghouse together with a 150 year lease of the site. At the same time the designation of the Springfields site as part of the NDA estate was amended to allow new fuel manufacturing activities.
- The NDA's Capenhurst site was sold to Urenco in 2012, allowing amalgamation with Urenco's neighbouring enrichment facilities. It is now operated by Capenhurst Nuclear Services Ltd.

Both site licence companies provide decommissioning and clean-up services to the NDA in relation to historic liabilities on the sites. The NDA also contracts with Urenco for processing of legacy uranium enrichment tails.

Shared services

Drawing together sites within the NDA estate provides greater opportunities for collaborative procurement, delivered through a shared service alliance encompassing the NDA and its site licence companies. The objective of the alliance is to deliver enhanced value through economies of scale, shared procurement costs and reduced bidding costs for the supply chain.

4 Nuclear Liabilities Fund

The Nuclear Liabilities Fund exists to fund decommissioning of the UK's second generation fleet of Advanced Gas Cooled reactors (currently scheduled for closure between 2019 and 2028, with the majority to cease operation in 2023) and the Sizewell B pressurised water reactor (currently scheduled to operate until 2035). In contrast with funding arrangements for the NDA's estate, it is an externally managed segregated fund.[20] To date the only significant payments relate to construction of the Sizewell B dry fuel storage facility.

The fund was established in 1996 with an initial contribution of £228 million from public funds and quarterly contributions from British Energy. The scope and contribution arrangements changed as part of

[19] Sellafield Options, Outline Business Case, November 2014, Executive Summary

[20] The fund is held by Nuclear Liabilities Fund Ltd, which is in turn owned by The Nuclear Trust (a Scottish public trust governed by a trust deed between EDF Energy, the Secretary of State for DECC and five trustees)

the UK Government's rescue and restructuring of British Energy in 2004, with Government agreeing to underwrite any shortfall should the fund prove insufficient to cover British Energy's decommissioning liabilities. The fund subsequently raised substantial sums from the sale of its own interests in British Energy, including £2.34 billion in 2007 and £4.4 billion on the sale to EDF in 2008. As at 31 March 2014 the total value stood at £8.85 billion.[21] EDF Energy continues to make quarterly contributions, comprising a fixed amount of £20 million per year plus additional contributions calculated by reference to fuel loaded at Sizewell B. For the year ended 31 March 2014 this gave a total annual contribution of approximately £26.6 million.[22]

EDF Energy's strategy and estimates are set out in a Baseline Decommissioning Plan submitted to the NDA for review and approval every five years. The fund's most recent published accounts give EDF Energy's undiscounted estimated decommissioning costs as £19.1 billion.[23] Whether the fund is sufficient will depend on many factors and uncertainties, including timing of decommissioning (and associated discounting), regulatory changes, investment strategy and returns. The UK Government has ultimate control over investment strategy and has chosen to use the fund to reduce Government borrowing to the detriment of investment returns. As at 31 March 2014, 86% of the fund was invested in the National Loans Fund, generating interest averaging less than 0.4% before tax.[24] The benefits of segregated funding in freeing projects from annual budgetary limits and uncertainty created by government spending reviews (including greater flexibility for acceleration of work and consequent opportunities for savings in on-going site maintenance costs) will of course be lost if funds prove insufficient.

Payments from the Nuclear Liabilities Fund can only be made with approval of the NDA. Depending on precise governance arrangements, it is also possible that the Nuclear Liabilities Fund may be subject to the Public Contracts Regulations 2015. This would in turn require that funded projects are competed in accordance with those regulations, a position that has the potential to drive significant changes in arrangements for decommissioning the second generation fleet.

5 Comparison with other approaches

The UK is unique in having created a body combining the financial and strategic responsibilities of the NDA. Similar models may be beneficial wherever there is a need to control state funding obligations for extensive decommissioning activities coupled with opportunities to benefit from greater collaboration across those activities. For existing public decommissioning liabilities a strategic and financial oversight role may also facilitate greater private sector engagement whilst allowing government to focus expertise, financial control and accountability within a single oversight body. It is also conceivable that a similar model could be applied to current private sector decommissioning liabilities where adequate funds exist to cover those liabilities (such as in the case of the current German fleet) or where liabilities are already underwritten by the state (as in the case of the UK's second generation fleet).

Application of elements of the NDA model to decommissioning Germany's current nuclear fleet would require a radical change in approach, but potential benefits of restructuring decommissioning activities to allow greater collaboration across all decommissioning sites may merit consideration, building on current collaboration (including the role of Gesellschaft für Nuklear-Service (GNS) in management, treatment, packaging and disposal of spent fuel and radioactive waste). Passing both decommissioning liabilities and associated financial provision to government would also provide an alternative means of securing decommissioning funds, removing concerns over isolation of decommissioning liabilities within corporate structures of the four German nuclear operators (and the consequent imposition of liability for

[21] Nuclear Liabilities Fund Ltd Annual report and Accounts for the Year Ended 31 March 2014
[22] Ibid
[23] Ibid
[24] Ibid

decommissioning and clean-up costs on companies in the chain of control of those operators[25]). Government would take the risks of cost overruns but also the benefit of savings realised through collaboration.

The status and role of Energiewerke Nord (EWN) as a publicly owned and financed entity responsible for decommissioning publicly owned nuclear facilities in former East Germany already has some similarities with the status and role of the NDA and would provide a strong basis for an expanded role. There are of course marked difference between EWN and the NDA in terms of ownership structures and decommissioning responsibilities. EWN is itself the licensed and regulated site operator, with no intervening financial and strategic entity between government and operator.

The Spanish and Italian models may also offer a different and potentially more streamlined option than is provided by the NDA, with state owned companies (respectively ENRESA and Sogin) having responsibility for waste management and taking ownership of nuclear power stations for decommissioning, funded via segregated funds built up from levies on power consumed. This avoids the need for a separate umbrella body as both are directly responsible for delivery. The absence of a discrete strategic and financial oversight role perhaps reflects differences in approaches to public financial control and accountability driven by the existence of segregated funds. Ultimately a vehicle for ensuring strategic oversight and financial sanction may be equally important if the adequacy of those segregated funds were to be in question.

6 International availability of capability and facilities

Greater availability of international expertise and capability can only enhance efficient and cost effective decommissioning and waste management. Notably, each of the four PBO competitions run by the NDA to date has resulted in selection of a parent body organisation that brings together capability from Europe and the US. International movement of wastes to access treatment services may also become increasingly significant as decommissioning activity increases. Mobility of capability and materials within the nuclear industry does of course raise legal and regulatory challenges, not least of which is the absence of a consistent and comprehensive global regime governing nuclear liabilities risks. International movement of waste also raises questions around acceptability, availability and selection of cross border treatment options.

Managing nuclear liabilities risks

Movement of nuclear materials or capability between jurisdictions may increase exposure to liability risks falling outside current convention liability regimes and also raises the need to consider imminent changes in Paris and Brussels Convention provisions affecting international shipments.

Even when working within a state that is party to the Paris and Brussels Conventions (such as the UK, France or Germany) there is a risk that nuclear liabilities may escape convention liability regimes, either because a claim is for a type of loss not currently covered by the conventions (for example, loss of income derived from the un-owned environment and liabilities for costs of preventive measures or environmental reinstatement) or because a claim is brought in a non-convention state. Cross border claims are a particular concern where a contractor has substantial assets in a non-convention state. It is for this reason that the NDA has provided wide ranging nuclear liabilities indemnities to each of the parent body organisations appointed to take ownership of its site licence companies.

The risk of liabilities escaping convention liabilities regimes will diminish when the 2004 Protocols to the Paris and Brussels Conventions are finally ratified (now expected early in 2017), but will not be removed entirely. The possibility of claims being brought in non-convention jurisdictions will remain, although

[25] under the Act on Continued Liability for Nuclear Decommissioning and Disposal Costs

increases in the level of compensation available (up to a maximum of €1.5 billion) may reduce the incentive to attempt this other than for higher value claims. The long awaited entry into force of the Convention on Supplementary Compensation (CSC) in April 2015 is a welcome step towards reducing cross border risks. Crucially, CSC provisions allocating jurisdiction following a nuclear incident operate regardless of membership of other nuclear liabilities conventions. Membership of the CSC will however need to expand substantially if it is to provide an effective solution.

Allocation of liability risks for nuclear materials in transit is complex and at times inconsistent. Shipments between countries that are members of the same, different or no nuclear liabilities convention each raise different issues. Even where two states are members of the same convention, inconsistencies in national law may mean that allocation of jurisdiction following an incident has a significant impact on liability exposure. Added to this, contractual terms for international shipment will need to be reviewed in light of the 2004 Protocols to take into account changes to territorial extent and liability transfer provisions.

Under the 2004 Protocols transfer of liability risks for nuclear substances in transit, whether by contract or taking charge of those nuclear substances, will only be possible where the transferee has "*a direct economic interest in the nuclear substances that are in the course of carriage.*"[26] This is intended to deter risk transfers between operators in order to engage a more favourable liabilities regime. The 2004 Protocols do not otherwise change convention provisions dealing specifically with liabilities for materials in transit. Those provisions will however take on greater significance in context of the revised territorial extent of the conventions. Currently the Paris and Brussels Conventions do not apply to a nuclear incident in, or to damage suffered in, a non-contracting state (unless a contracting party chooses to widen its national legislation to cover this or the Joint Protocol applies). Under the 2004 Protocols the location of an incident is irrelevant. In addition, territories within which damage will be covered are extended to include territory of: a contracting party; a party to the Vienna Convention and Joint Protocol (provided that operator's home state is also party to the Joint Protocol); a state with no nuclear installations; and a non-contracting state with nuclear liability legislation "*which affords equivalent reciprocal benefits … based on principles identical to those of this Convention*".[27] The Conventions will also apply to damage on board a ship or aircraft registered in but operating outside those territories, but (contrary to the general widening of coverage) will not otherwise apply to nuclear damage in international waters.

Where nuclear substances are sent to a non-contracting state the consigning operator can only be liable if an incident occurs "*before they have been unloaded from the means of transport by which they have arrived*"[28] in that territory. Where nuclear substances are sent from a non-contracting state to (and with the consent of) an operator in a contracting state, liability can only arise "*after they have been loaded on the means of transport by which they are to be carried from the territory of that State.*"[29] Under current convention provisions, national law may however curtail liabilities as soon as a shipment enters the territorial waters of a non-contracting state or (in the case of shipment from a non-convention state) only allow liability to arise once the shipment enters international waters. Under the 2004 Protocols this will no longer be possible. Where nuclear substances are sent to a non-contracting state the consigning operator will remain at risk (subject to restrictions on the location of damage covered) until the nuclear substances are unloaded from the means of transport by which they have arrived in that state. Similarly, where nuclear substances are sent from a non-contracting state to (and with the consent of) an operator in a convention state, that operator will carry convention liability risk once those substances are loaded on the means of transport by which they are to be carried from the territory of that non-contracting state.

[26] Paris Convention, 2004 Protocol, Paragraph E (amending Paris Convention Article 4)
[27] Paris Convention, 2004 Protocol, Paragraph C (replacing Article 2)
[28] Paris Convention, Article 4.a.iv
[29] Paris Convention, Article 4.b.iv

7 International availability of waste treatment capability

The regulatory environment controlling international shipments of radioactive waste and spent fuel is of course well established under Euratom directives, commission recommendations and national legislation. Despite this, international shipment of radioactive waste can generate political and public controversy, particularly where secondary wastes are disposed of in the destination state. There is also a risk that misconceptions surrounding proximity and associated regulatory requirements may artificially restrict available options or (subject to the status of the parties) lead to breach of procurement regulations.

In the UK, the Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008 (the 'TSRW Regulations') (which implement Council Directive 2006/117/Euratom on the supervision and control of shipments of radioactive waste and spent fuel) impose specific restrictions on the purpose of shipment of radioactive waste[30] and also require the applicant for authorisation to "*make a written assessment of all practicable options for management of the radioactive waste.*"[31] Despite this requirement, the TSRW Regulations say nothing about the circumstances in which options requiring transfrontier shipment should be selected. The requirement to assess all practicable options is perhaps best seen as a cross-check against compliance with environmental permitting and other requirements governing selection of waste treatment and disposal techniques.

Consistent with other European jurisdictions, availability and selection of waste management options is based on application of the waste hierarchy and use of the best available technique (BAT). The concept of BAT derives from European legislation and international law.[32] BAT informs what limit, measure or condition an operator should meet or perform so as to best protect people and the environment. Cost is only relevant if grossly disproportionate to the benefit. Operators are required to dispose of each form of solid radioactive waste by an "*optimised*" disposal route. Environment Agency guidance confirms that optimisation is equivalent to BAT[33], and that operators should "*demonstrate the use of BAT*" by "*selecting optimal treatment and disposal routes (taking account of the waste hierarchy and the proximity principle)*"[34]. This reference to proximity is potentially misleading. According to Environment Agency guidance, "*optimisation*" applies "*only to radiological risks to any member of the public and the population as a whole*"[35] (although other references to optimisation in the same document also refer to the environment). Proximity is therefore only relevant to BAT where transportation could have a material effect on radiological risks to people and (possibly) the environment. Given the extent of safety regulation surrounding transportation of radioactive materials it seems unlikely that distance will affect radiological risk, particularly for lower level wastes. Where EU procurement rules apply to selection of waste management services, any discrimination on the basis of proximity may therefore be subject to challenge.

In addition to risks associated with control of shipments (including criminal sanctions and liability for costs of return shipments[36]) consignees may need to consider regulatory compliance and potential liability risks in the destination state, encompassing import licencing requirements, export regimes for any secondary

[30] TSRW Regulations, Regulation 12
[31] TSRW Regulations, Regulation 12(2)
[32] In the non-nuclear sector, BAT derives from the Industrial Emissions Directive 2010/75/EU (the IED) and the Integrated Pollution Prevention and Control (PPC) Directive 2008/1/EC. BAT as referred to within nuclear industry policy documents is slightly different and is taken from the Oslo and Paris Convention for the protection of the marine environment in the north-east Atlantic (OSPAR).
[33] Environment Agency RSR: Principles of optimisation in the management and disposal of radioactive waste (version 2, April 2010), Section 1
[34] Environment Agency Regulatory Guidance Series No. RSR 2: The regulation of radioactive substances activities on nuclear licenced sites, Version 2, August 2012, Paragraph 83
[35] Environment Agency RSR: Principles of optimisation in the management and disposal of radioactive waste (version 2, April 2010), Section 1
[36] TSRW Regulations, Regulation 14(4)

waste and environmental liability risks resulting from treatment or disposal. It must be kept in mind that radioactive waste may be regulated as hazardous waste, particularly where mixed with other hazardous materials.

Local licensing processes may also be subject to public concerns and associated political pressures, particularly where secondary wastes are not to be returned to the country of origin. For example:

- In 2007 Energy Solutions applied to the US Nuclear Regulatory Commission ('NRC') to import 20,000 tonnes of waste with various levels of radioactive contamination from decommissioning nuclear facilities in Italy. Most of the material was to be recycled in Tennessee as shielding blocks, with 1,600 tonnes to be sent to a disposal facility in Utah and some secondary waste to be re-exported to Italy. Energy Solutions' applications, particularly the proposed disposal in Utah, led to significant public opposition. The state of Utah intervened in the NRC proceedings to object. More than 2,500 public comments were filed in those proceedings and US congressmen became involved, with proposals for legislation that would ban most imports of radioactive waste. Ultimately Utah vetoed shipments to the disposal facility and Energy Solutions withdrew its application.
- In contrast, Energy Solutions was successful in obtaining an NRC licence to import 1,000 tonnes of low level radioactive waste for incineration in Tennessee and, significantly, an export permit to return secondary and non-conforming wastes to Germany. Again there was significant public opposition, but the State of Tennessee was supportive. Notably, the NRC considered the German consignors were willing and able to receive and dispose of secondary and non-conforming wastes, so the amount of waste remaining in the US was minimal.

8 Conclusions

Elements of the UK model for delivery of decommissioning may provide opportunities to develop alternative means of managing public sector decommissioning liabilities or allowing the state to take responsibility and control over existing segregated decommissioning funds. This may be attractive where the state already carries ultimate financial responsibility for decommissioning or there are other significant benefits arising from increased opportunities for collaboration, both between decommissioning sites and in supporting wider supply chain capability. Any introduction of a body to provide strategic oversight and financial control will however require careful management to ensure consistency with existing nuclear regulatory regimes.

Turning to issues of international mobility of resources, imminent advances in the scope of nuclear liability risks covered by the Paris and Brussels Conventions and progress in adoption of the Convention on Supplementary Compensation are positive steps towards addressing inhibitors to international collaboration created by nuclear liability risks, although there is still much work to do in broadening membership of the CSC if it is to provide an effective answer to the risk of claims being brought in jurisdictions not covered by applicable convention liabilities regimes. In a shorter timescale, all parties involved in international shipment of nuclear materials between or from Paris / Brussels Convention jurisdictions need to be satisfied that contract terms and nuclear liabilities insurance arrangements are ready for the changes to be made by the 2004 Protocols.

Equally, the requirement for optimisation in selection of treatment and disposal options should not artificially restrict options on the basis of proximity, although public concerns and political pressures may provide a more immediate barrier, particularly in context of waste disposal.