Nuclear Decommissioning Authority

Research and Development

Approve Strategy (Gate C)

March 2011

Critical Enablers
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Contents

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Executive Summary

Research and Development (R&D) is a supplemental function as specified in the Energy Act 2004. As such the NDA is required to promote and, where necessary, carry out research in relation to its prime function of decommissioning and clean-up.

Technology and the underpinning R&D are fundamental to ensuring the safe, cost-effective delivery of our mission. Together with innovation and the sharing of good practice, both nationally and internationally, the intelligent application of R&D can reduce costs and timescales. The objective is to ensure that delivery of the NDA's mission is technically underpinned by sufficient and appropriate R&D. There are close links to other requirements from the Energy Act such as sharing national and international good practice and to enable innovation and skills development.

The R&D Topic Strategy defines our approach to ensuring sufficient and appropriate R&D is carried out to deliver our mission. The scope of this topic spans technical underpinning work carried out by the Site Licence Companies (SLCs) and R&D work sponsored directly by NDA. For example, it ranges from technical development and optioneering studies to underpin delivery of key decommissioning projects to focussed research to develop and preserve key technical and engineering skills.

Our strategy is that, where possible, R&D is undertaken by the SLCs and their supply chain. Where necessary the NDA will directly maintain and sponsor a strategic R&D programme. Overall strategic coordination is provided by the NDA. Using an integrated and transparent approach, and working closely with SLCs, we will ensure that R&D is identified and prioritised in order to underpin strategic decision making and implementation. Our NDA strategic R&D portfolio will focus on targeted, estate-wide R&D needs, risk and opportunities to inform and develop strategy, encourage innovation and support key technical skills through structured engagement with the supply chain. Implementation of this aspect of the strategy is via the NDA Direct Research Portfolio that is the responsibility NDA R&D Strategic Authority. For financial year 2010/11 the budget for this portfolio was £6M. Significant benefits have arisen to date from this portfolio including cost savings in low level waste re-categorisation across the estate, improvements in safety by development of remote inspection techniques and contribution to development of plutonium management strategy by investigation of enduring plutonium storage techniques.

As a critical enabler this strategy interfaces with the majority of other Topic Strategies, e.g. Higher Activity Waste, Spent Fuels and Nuclear Materials, and an integrated approach with the key driving strategic themes is essential.

We will continue to work with Government and other stakeholders to identify opportunities for strategic coordination of R&D for decommissioning and clean-up. The terms of reference and membership of the NDA Research Board are being reviewed and we intend to appoint an independent chair to this Board to focus on effective spending of R&D funds and ensure strategic oversight.

With regard to R&D there are close links between NDA and many organisations including the nuclear regulators (Nuclear Directorate (ND) of Health and Safety Executive (HSE), Environment Agency (EA) and Scottish Environment Protection Agency (SEPA)), Research Councils and Government. In all cases safety, security and environmental regulation of the SLC programmes is carried out by the appropriate regulator. This may involve the regulator requesting that SLCs carry out or fund R&D that they believe is essential. The NDA will continue to work with regulators to ensure that their requirements are met within the decommissioning

programmes if possible. We will also work closely with organisations such as Research Councils and universities to encourage and leverage investment in R&D, taking advantage of collaborative programmes and match-funding opportunities. In particular we will identify synergies with other organizations such as EDF Energy and MoD in order to promote sharing of experience and avoid duplication.

This strategy and the accompanying guiding principles have been shared with regulators and stakeholders at regulator meetings, NDA Research Board, Nuclear Waste Research Forum, Strategy Development and Delivery Group and the National Stakeholder Group. Stakeholder engagement will continue as the strategy is implemented. Responses to the recent consultation have also been considered in updating the topic strategy.

1 The Strategic Case (Stage 0) 'Research'

Research and Development (R&D) is a supplemental function for the NDA as specified in the Energy Act 2004. As such NDA is required to promote and, where necessary, carry out research in relation to its primary function of decommissioning and clean-up.

1.1 Topic Background and Context

The R&D topic strategy defines the approach that NDA will take in ensuring that delivery of the NDA's mission is technically underpinned by sufficient and appropriate R&D and to meet our obligations under the Energy Act 2004. The scope of this topic spans technical underpinning work carried out by the Site Licence Companies (SLCs) and R&D sponsored directly by NDA. For example it ranges from technical development and optioneering studies to underpin delivery of key decommissioning projects to focussed research to develop and preserve key technical and engineering skills. There are close links to other Energy Act requirements such as ensuring that national and international good practice is gained and shared, encouraging and enabling innovation, ensuring a vibrant supply chain and developing skills.

With regard to R&D there are close links between the NDA and many other organisations including the nuclear regulators (Nuclear Directorate (ND) of Health and Safety Executive (HSE), Environment Agency (EA) and Scottish Environment Protection Agency (SEPA)), Research Councils and Government. The scope of the R&D strategy includes working closely with these organisations and supply chain companies to ensure national and international good practice is gained and publicised to support innovation. We also need to work closely with other organisations including Research Councils and universities to encourage and leverage investment in R&D and take advantage of collaborative programmes and match-funding opportunities. In particular the NDA should identify synergies with other organizations such as EDF Energy and MoD in order to promote sharing of experience and avoid duplication.

The R&D strategy has evolved since the NDA was formed and continues to develop by building on the good practice demonstrated and by responding to feedback received from stakeholders to date. Prior to formation of the NDA, R&D activities associated with decommissioning and clean-up in the UK were carried out by many different organisations including nuclear operators, specialist contractors and universities but with limited collaboration and therefore reduced potential for innovation to be realised. This meant that the potential for duplication of work addressing common technical needs was increased. When the NDA was formed our R&D strategy was to ensure that technical underpinning work and the resultant R&D needs, risks and opportunities were captured and linked in the SLC decommissioning plans (Lifetime Plans – LTPs). We also set up a number of groups to provide both strategic governance and opportunities for sharing and cross-fertilisation of technical ideas (NDA Research Board on waste management and decommissioning (NDA Research Board) and Nuclear Waste Research Forum (NWRF)). We published our skills strategy in November 2008 where key scientific and technical skills were identified. We also established a strategic R&D portfolio to sit alongside the SLC R&D programmes and to focus on generic and strategic R&D issues which may relate to critical technical skills, innovation against identified technical challenges and help inform strategy development. We have also invested in projects directly with the supply chain to ensure innovation is supported at all levels.

The R&D Topic Strategy Summary was published on the NDA website in November 2009 and the strategy content presented at the National Stakeholder Group in November 2009 and other stakeholder meetings thereafter.

1.2 Current Situation

We require each site to document the R&D work required to technically underpin the operational and/or decommissioning programmes in their LTP. R&D work required on resultant technical needs, risks or opportunities is also captured here. NDA also directly sponsor a strategic R&D portfolio covering multi-site R&D needs, risks and opportunities. This directly-funded research portfolio includes work directly with the supply chain on small scale innovation projects, medium scale technology demonstration projects and an R&D programme that is contracted to a number of specialist R&D organisations delivering strategic R&D on prioritised technical underpinning issues. For financial year 2010/11 the budget for this portfolio was £6M.

The NDA has set up groups such as the NDA Research Board and NWRF to provide strategic coordination and opportunities for sharing of good practice between SLCs. The NWRF in particular has shown good progress in determining and sharing common R&D needs, risks and opportunities and considering how best to address them collectively. In order to ensure effective strategic coordination and in line with recent Government recommendations the Terms of Reference of the NDA Research Board are being reviewed (Ref 1) and the Board will be re-constituted in the near future. The NWRF have also recently reviewed its terms of reference.

We have engaged regularly with stakeholders at a variety of stakeholder meetings including, the Research Board, NWRF, Strategy Development and Delivery Group and National Stakeholder Group as appropriate and more recently by developing and sharing our strategy and work as part of the NDA website (www.nda.gov.uk/research).

1.3 The Case for Change

The NDA recognises the importance of R&D in technical underpinning of decommissioning programmes and in ensuring we meet our obligations in respect of short, medium and long term support of R&D activities relevant to our mission. Science and technology are fundamental to ensuring the safe, cost-effective delivery of our mission. Together with innovation and the sharing of good practice both nationally and internationally, the intelligent application of R&D can reduce costs and timescales.

The NDA wish to ensure that this approach to R&D is robust, integrated with our key driving strategic themes, coordinated with other key responsibilities such as skills, sharing of good practice and innovation and delivers against the breadth of our obligations in the Energy Act 2004.

In order to do this we believe that, where possible, the R&D necessary to underpin the LTP will be carried out by the SLCs and their supply chain. This identification of technical work required to either underpin the delivery plans and/or the identification of residual technical risk or opportunity needs to follow an integrated and transparent approach. We are building on the good work carried out to date in identification of technical baselines in the LTPs and the use of Technology Readiness Levels (TRLs) to assess maturity and degree of underpinning. This information is captured in the LTPs as the Technical Baseline and underpinning Research and Development (TBuRD) sections. In conjunction primarily with our SLCs and via the NWRF we have been reviewing the technical underpinning requirements and strengthening our requirements for a robust and transparent approach to technical underpinning of the operation and/or the decommissioning of individual facilities or groups of facilities across the NDA estate. These revised requirements have recently been published on our website (Ref

2). We believe that there is scope for more inter-SLC work in this area to increase collaboration, remove potential duplication of work, share good practice and skills and thus accelerate programmes and/or reduce cost. In addition to this we believe that there are generic and multi-site technical issues that can be addressed by a portfolio of strategic R&D work that NDA sponsors directly. The size of this portfolio should be driven by the need to meet strategic objectives and to recognise early opportunities for strategic innovation. It is proposed that the size of this portfolio will flex in accordance with the key strategic decisions that may need to be technically underpinned but recognises that this will need to be prioritised in the current fiscal climate and to ensure that maximum benefit is derived from the portfolio. We believe the optimum delivery vehicle for this portfolio is with a variety of specialist contractors to foster collaboration, broaden capability development and maximise innovation. Integral to this approach is a focussed work programme in conjunction with academic institutions such as universities, mainly at a postgraduate level to ensure critical technical skills necessary for delivering the decommissioning programmes will be available when required. The approach to R&D management is summarised in Figure 1. As well as the detailed underpinning captured in the LTPs it is necessary to provide a top down strategic view that will be summarised in an NDA estate Technical Baseline.

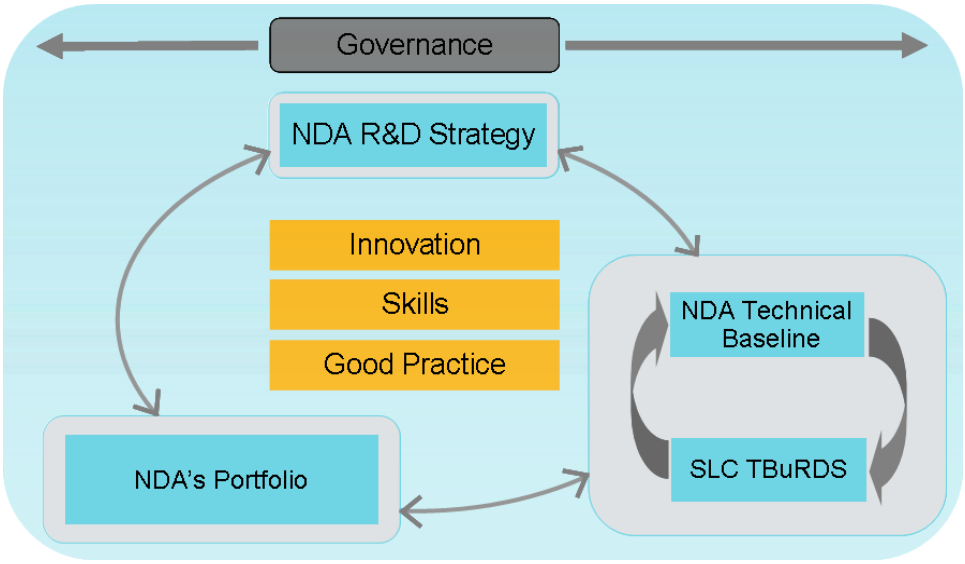


Figure 1: Approach to R&D Management

Technical underpinning plays a fundamental role in successful delivery of decommissioning programmes. To enable this, the clear linking of R&D work to lifetime plans and strategic co-ordination requires further strengthening. This will ensure the technology required has been identified along with the associated R&D needs, risks and opportunities. Analysis of the generic and multi-site technical needs and opportunities highlighted by the SLCs has been carried out annually to date and identified several key areas in which opportunity exists to progress alongside the LTPs, for example Higher Activity Wastes and Plutonium Management Strategy. A initial summary of R&D needs, risks and opportunities was published in 2006. Many of these key issues identified are captured within the key driving strategic themes. By strengthening the hierarchical approach we will consider an NDA estate-wide perspective of strategic technical issues and opportunities across the estate in an NDA Technical Baseline (Figures 1 and 2). This will provide a strategic top down approach to areas

of R&D through the strategic driving themes and objectives and also a detailed bottom up approach by analysis of the SLC technical risks and opportunities.

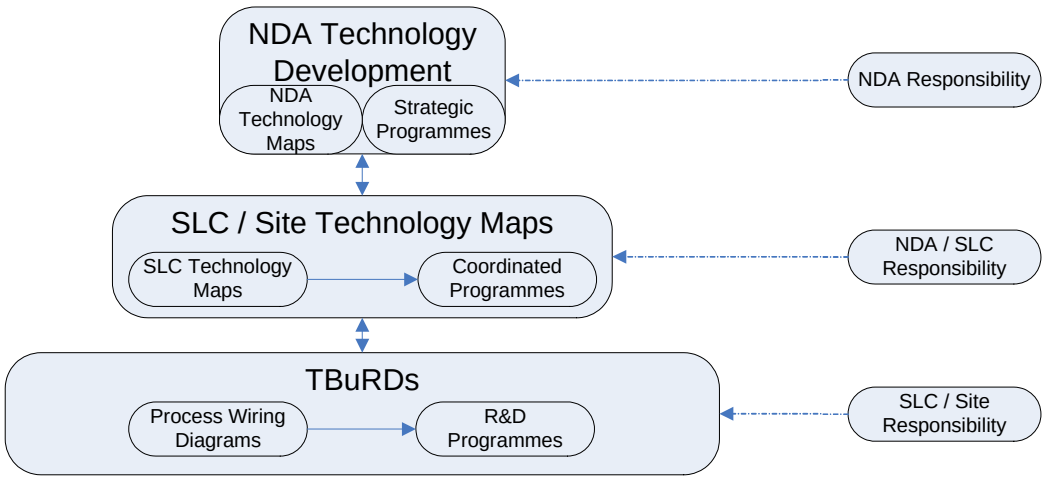


Figure 2: Hierarchical to Technical Underpinning

There are a variety of stakeholders to whom demonstration of robust technical underpinning is essential. This includes regulators some of whom can commission independent research in specific areas should their needs not be addressed in the LTPs. Similarly there are key technical skills that will need to be available on a medium to long term and therefore we need to ensure we have a robust strategy for delivery of these skills which includes investment in university-based work. Our initial university-based portfolio was largely inherited around previously committed continuing support to established specialised centres of excellence. We have already taken opportunities to shape this element of our R&D strategy and there are further opportunities to develop our strategy going forward so as to ensure appropriate capability within the university sector is developed and key technical and engineering skills critical to delivery of our mission are available at the appropriate time. We will review and prioritise our support in line with implementation of our skills strategy. We need to ensure alignment of our strategy with other bodies funding university-based work (e.g. Research Councils) to ensure maximum leverage and value for money to the UK taxpayer and take opportunities to participate and share knowledge nationally and internationally as they arise. We expect that our SLCs will also have a university strategy and that their interactions will be more focussed around specific SLC requirements. The NDA will work with them to ensure these are integrated across our estate.

We have attempted to organise our R&D work on a national basis where this is possible. The NWRF meeting includes representatives from other nuclear sector participants and there is scope for the NDA and its R&D strategy to consider strategic coordination of decommissioning and clean up R&D across these sectors. We will continue to work with Government and other stakeholders to identify opportunities for strategic coordination of R&D for decommissioning and clean-up. The terms of reference and membership of the NDA Research Board are being reviewed and we intend to appoint an independent chair to this Board to focus on effective spending of R&D funds and strategic oversight. There is scope for the good practice already demonstrated at NWRF to be shared and developed further.

In summary, our objective is to ensure that the delivery of the NDA's mission is technically underpinned by sufficient and appropriate R&D. This is currently being carried out by various means ranging from funding work directly, indirectly through Tier 1 contractors or working with other government (e.g. Research Councils) or non-government (e.g. Universities) organisations to encourage investment in relevant R&D. Key elements of discharging this responsibility include the strategic coordination of technical issues / challenges facing the NDA estate, communication of those challenges and co-ordinating work programs with other relevant groups thereby gaining leverage for R&D investment and providing best value for the UK tax payer.

In the following sections we have reviewed the credible options to achieve our strategic objective. However it should be noted that the preferred option as highlighted later in the document is principally the method by which we currently deliver our strategy in although we have identified areas where we will strengthen our method of delivery. This means that in principle the strategy remains unchanged from our existing strategy.

1.4 Investment Objectives

We have reviewed how best to deliver the R&D strategy in terms of organisations sponsoring and delivering work in order to maximise benefit. We have also sought stakeholder views on this topic. These reviews have confirmed that the best way to meet the R&D strategy objectives is by ensuring development and implementation of a technical baseline process with accompanying assurance programmes for the SLCs complemented by a strategic NDA direct R&D portfolio. This portfolio can serve as a technology and skills pipeline through which ideas and solutions can be developed and potentially taken forwards by SLCs at a later stage as appropriate. Past experience has shown us that very early innovation ideas are less likely to flourish unless supported outside the LTPs and this development of the supply chain will be essential if longer term technical challenges are to be overcome. For financial year 2010/11 the budget for the NDA directly-funded portfolio was £6M. In the current fiscal climate it is expected that pressure on this budget will remain. Significant benefits have arisen to date from this portfolio including cost savings in low level waste re-categorisation across the estate, improvements in safety by development of remote inspection techniques and contribution to development of plutonium management strategy by investigation of enduring plutonium storage techniques.

Structured investment in innovation has the potential to accelerate decommissioning programmes over the short, medium and long term. In addition such technical work also has the benefit of developing and ensuring the critical technical skills, such as the ability to work with plutonium, are available when required. Better coordination of technical issues across the SLCs and identification of technical risk and opportunity will be essential in understanding whether the decommissioning plans are deliverable. The importance of robust technical underpinning has been acknowledged internationally by the nuclear industry and other technology based industries such as the defence sector as having the potential to prevent unnecessary spend, duplication or significant delays to programme. This understanding of whether it will "technically" work is acknowledged and demonstrated to have accounted for significant spend in international nuclear programmes where insufficient underpinning has has led to expensive redesign or retrofitting of processes.

1.5 Scope and boundaries of proposed change

The R&D Topic Strategy defines the approach that NDA will take in ensuring that delivery of the NDA's mission is technically underpinned by sufficient and appropriate R&D. The scope of this topic covers technical underpinning work carried out by the Site Licence Companies (SLCs) and

R&D sponsored directly by NDA. The scope includes working closely with the organisations listed above and supply chain companies to ensure national and international good practice is shared to support innovation and avoid duplication. It also includes working with other organisations such as research councils and universities to encourage and leverage investment in R&D, taking advantage of collaborative programmes and match funding opportunities.

This review has confirmed that the existing strategic option remains the preferred option. However there are improvements to the implementation that will be delivered as described above in strengthening the visibility of R&D in the decommissioning plans and the strategic coordination of generic R&D issues. The improvements to the transparent approach for technical underpinning (TBuRD) are currently being implemented by the SLCs and we will look to review how this progresses. In addition we will further strengthen the strategic "top down" view by implementing the use of Technology Maps to help us better determine the NDA estate Technical Baseline. We will continue to share this approach and if possible benchmark its application in meeting our objectives with other appropriate organisations. We will work with the Government to identify opportunities for strategic coordination of R&D for decommissioning and clean-up, focusing on effective spending of R&D funds and removing duplication of effort. We will re-constitute the NDA Research Board to ensure we are meeting the recommendations recently published by the Government including appointing an independent Chair to the Research Board.

As a critical enabler the strategy interfaces with the majority of other Topic Strategies, but with particular relevance to the following:

- Decommissioning because it determines the approach to delivering our mission
- People (skills and capability) in terms of availability of technically skilled people
- International Relations because of the need to access international experience
- Supply Chain Development because of the need to achieve innovation and better value for money
- Higher Activity Waste (HAW) because of the links to the Geological Disposal Facility and the need to technically underpin the interim storage and ultimate disposal of HAW
- Land Quality Management because of the impact on site end states
- Lower Activity Waste because of the potential for waste re-categorisation
- Information and Knowledge Management because of the need to share good practice
- Nuclear Materials and Spent Fuels because of the need to underpin credible options and inform strategy development

Good practice in ensuring robust technical underpinning is essential to successful delivery of the NDA's mission and requires both systematic and cultural changes.

Development of the strategy will focus on continuing to meet our Energy Act obligations by:

- Implementation of a robust technical baseline approach and ensuring decommissioning plans are based on sound technical approaches
- Strategic coordination of estate wide R&D needs, risk and opportunities including appointment of an independent chair to the NDA Research Board
- Maximising opportunities for timely innovation and focussed securing and sharing of good practice
- Continuing to seek opportunities for collaboration in the UK and internationally to reduce costs and create innovation

This will be delivered by working closely with our SLCs and direct funding of strategic R&D work.

1.6 Constraints

NDA have responsibilities under the Energy Act 2004 to ensure we are delivering our R&D obligations through our SLCs programmes and where necessary our own programmes.

Technical underpinning of decommissioning programmes and fostering of innovation to accelerate programmes have the potential to bring significant cost savings. However it must be acknowledged that in the current fiscal climate this area will remain under scrutiny although the case for maintained funding to ensure strategy delivery is strong. Any R&D work required to underpin critical strategic decisions will have to be carried out on an appropriate timescale so consideration of scheduling of such R&D work is important.

Some regulators have the ability to commission and ensure work is carried out on safety or environmental R&D issues should these not be included in the decommissioning programmes currently. We hope to work collaboratively with regulators and other stakeholders to ensure such areas are not omitted in the LTPs.

1.7 External Dependencies

We will work alongside Research Councils and other R&D funding organisations such as international projects to ensure maximum return on investment and leverage of existing programmes in the medium to long term. In order to bring benefit from such programmes it is important that our support is committed for their entire duration. For example, a focussed postgraduate study should be supported for the entirety of the project e.g. three years from start in order.

We believe that there are synergies that can be explored with MoD and other nuclear sector participants on R&D issues and we will seek to strengthen these synergies (e.g. those established through NWRF) through the R&D strategy. There is scope for the NDA and its R&D strategy to provide a broader strategic steer across these sectors. We will continue to work with the Government to identify opportunities for strategic coordination of R&D for decommissioning and clean-up, focusing on effective spending of R&D funds and removing duplication of effort.

1.8 Key risks, assumptions, issues and concerns

The fundamental risk associated with developing the R&D strategy is that failure to develop and implement it further will lead to increased costs and extended schedule of the decommissioning plans. This will be due to failing to identify the technical challenges within the decommissioning plans and failing to ensure appropriate development work is then carried out to mitigate risk or realise innovation opportunity. It is of concern in that if a robust baseline is not developed across the estate there will be no level to measure innovation against and reward appropriately.

There is also a significant risk in that failing to deliver the R&D strategy key requirements of the NDA's strategy will not be delivered or underpinned e.g. Higher Activity Waste strategy on an acceptable timescale.

It is assumed that the NDA will continue to fund R&D work indirectly via the SLCs where the majority of technical programmes are embedded and directly via its own R&D portfolio where necessary. Some regulators have the ability to challenge and commission work in such instances themselves leading to the possibility of a levy charge across our estate.

1.9 Stakeholders

There are many stakeholders in relation to R&D. Key stakeholders identified are NDA, SLCs, safety and environmental regulators, government, research councils, universities and academic institutions, technology suppliers and specific groups such as CoRWM. In addition there are multiple stakeholders from across the wider nuclear sector including MOD, British Energy and AWE in the UK. R&D is an important area in which we gain and share good practice from abroad as required in the Energy Act and we have established links overseas via IAEA and NEA and under our bilateral agreements with DoE, CEA and JAEA.

We have developed a comprehensive R&D website as part of the NDA website to ensure that we can engage with our broadest spectrum of stakeholders. Focussed engagement with stakeholders also occurs through regular meetings and dialogue and our participation in broader R&D programmes in the UK. (www.nda.gov.uk/research).

To understand the different perspectives and seek coordination NDA formed a Research Board on Decommissioning and Clean-up R&D. Whilst this currently focuses on the regulator, government and research council stakeholders it is proposed that other stakeholders from the nuclear sector could be included in the Research Board. This would further increase our stakeholder engagement and we will respond to government recommendations in this area including the appointment of an independent chair to the NDA Research Board.

We will continue to work closely with our regulators in development and implementation of this strategy. We have regular meetings and take part in focussed topic meetings with them (*e.g* Higher Activity Waste Strategy).

1.10 Work programme and scope

The work programme for delivery of this strategy will meet the requirements of Strategy II and also other external stakeholder requirements.

Development of the strategy will focus on continuing to meet our Energy Act obligations by:

- Implementation of a robust technical baseline approach and ensuring our plans are based on sound technical approaches
- Strategic coordination of estate wide R&D needs, risk and opportunities including appointment of an independent chair to the NDA Research Board
- Maximising opportunities for timely innovation and focussed securing and sharing of good practice
- Continuing to seek opportunities for collaboration in the UK and internationally to reduce costs and create innovation

This will be delivered by working closely with our SLCs and stakeholders and direct funding of strategic R&D work.

Delivery of the strategy includes specialist support from the supply chain from many technology organisations and institutions, primarily to our SLCs. In addition our current direct R&D portfolio includes framework suppliers National Nuclear Laboratory, Babcock International Group, Hyder Consulting and Serco but also includes the broader supply chain. Universities also provide an essential external resource to both NDA and our SLCs with regard to targeted research and development of capability.

There are a number of milestones we wish to reach over the next 12-24 months:

- We aim to deliver the implementation of the hierarchical approach to technical underpinning in a staged method with the first submission of the revised process

targeted at March 2011. This includes the TBuRDs within the LTPs with our SLCs but also the Technology Maps that will show areas of common technical need, risk and opportunity across our estate. We will seek to share our NDA estate-wide technical baseline in an appropriate format with stakeholders.

- We will consider how best to support concept and technology demonstration projects over the next 24 months in areas of common technical need and/or opportunity. We will review benefits to date from previous investments.
- We will publish and implement a university R&D strategy (see Appendix 1)
- We will continue to seek opportunities for collaborative R&D with national and international organisations and identify specific projects over the next 12 months

It should be noted that this overall plan will be subject to revision as the topic strategy develops and issues arise or are resolved.

2 The Economic Case part I - (Stage A) 'Credible Options'

It should be noted that the existing R&D strategy is derived from the preferred option. Our strategy is that, where possible, R&D is undertaken by the SLCs and their supply chain. Where necessary the NDA will directly maintain a strategic R&D programme. Overall strategic coordination is provided by the NDA. However to ensure completeness and to acknowledge that there have been changes in the R&D community since NDA was formed the review of potential options was carried out again.

2.1 Potential options

A number of potential options were considered in determining how best to deliver the NDA R&D strategy. The NDA, SLCs and supply chain were considered as the major contributors to meeting the R&D strategy requirements.

To ensure sufficient R&D is carried out in the short, medium and long term to ensure delivery of the decommissioning and clean-up plans the following options were considered.

1. SLCs carry out R&D to deliver the NDA's mission
2. NDA carry out R&D to deliver the NDA's mission
3. Supply chain carry out R&D to deliver NDA's mission
4. SLCs carry out R&D in conjunction with the supply chain to deliver the NDA's mission
5. SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by a sole third party. NDA provide overall leadership in order to deliver the NDA's mission
6. SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by multiple organisations in the supply chain. NDA provide overall leadership in order to deliver the NDA's mission

2.2 Identification and application of screening criteria

It was resolved that the NDA did not have the remit or capacity to deliver all the R&D requirements by itself and as a strategic body. It was also resolved that SLCs themselves working in isolation would not have the capability to deliver all their R&D requirements, ensure innovative ideas were being developed and that the potential for duplication or omission or would be increased. The supply chain would require a fundamental and detailed understanding of the issues facing the decommissioning challenge so it would not be credible for them to work on R&D issues in isolation either.

Therefore only the options that included the supply chain as an integral part of the delivery options were taken forwards. It is worth noting that the resultant credible options reflect the position from which we started in 2005 to the present day and provide confidence that all credible options were comprehensively identified.

- SLCs carry out R&D in conjunction with the supply chain to deliver the NDA's mission
- SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by a sole third party. NDA provide overall leadership in order to deliver the NDA's mission
- SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by multiple organisations in the supply chain. NDA provide overall leadership in order to deliver the NDA's mission

The credible options were considered in light of which would enable NDA to meet its R&D responsibilities under the Energy Act 2004 and were more flexible and enabled delivery of NDA strategy in total.

2.3 Strategic Options Diagrams (SODs)

A generic R&D Strategic options diagram has been prepared and is attached in Appendix 1. The preferred option is SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by multiple organisations in the supply chain. NDA provide overall leadership in order to deliver the NDA's mission. Activities that would result from this option include:

- Ensure technical underpinning and short, medium and long term R&D requirements to deliver the site mission are reflected in the SLC LTP (Ref 2)
- Communicate common R&D needs, risks and opportunities via the Nuclear Waste Research Forum (NWRF)
- Actively share with other SLCs good practice in R&D programmes and consider implementation, as appropriate of good practice identified by other SLCs
- Utilise PBO expertise through reach back arrangements where they exist, to share good practice and realize innovation opportunities
- Identify and support the preservation of key scientific and technical skills required to deliver the site mission currently and for future requirements.

2.4 Stakeholder Engagement Plan

Feedback on these credible options was sought at targeted and general stakeholder meetings and the NDA National Stakeholder Group meeting in November 2009. These engagements did not present any further options and reinforced the view that the credible options had been correctly identified.

At all times feedback received indicated that R&D and technical underpinning as defined in this strategy are essential and not optional to successful delivery of NDA's strategy.

The topic strategy summary was published in November 2009 on NDA's website and shows the direction of development for the R&D strategy and guiding principles through which the strategy will be delivered.

2.5 Communications plan

As the topic strategy has been developed the principles and scope of the strategy have been shared with key stakeholders. This has been carried out in individual communications with key stakeholders and at groups such as Strategy Development and Delivery Group (SDDG), Research Board, Waste Management Group (WMG), Regulator meetings and also at National Stakeholder Group.

Further communications will take place at regular regulator meetings as well as through the Research Board, R&D events and SLC meetings. We have also developed a dedicated section within NDA's external website (www.nda.gov.uk/research).

2.6 Work programme and scope

The Programme will continue to be developed to meet the requirements of the Strategy II programme in key strategic areas e.g. Higher Activity Wastes.

See previous section in Strategic Case.

3 Economic Case part II - (Stage B) 'Preferred Option(s)'

3.1 Credible Option Descriptions

The following credible options were taken forwards

1. SLCs carry out R&D in conjunction with the supply chain to deliver the NDA's mission
2. SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by a sole third party. NDA provide overall leadership in order to deliver the NDA's mission
3. SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by multiple organisations in the supply chain. NDA provide overall leadership in order to deliver the NDA's mission

These options also represent how the R&D strategy has evolved since NDA was formed.

In option one where the SLCs carry out the R&D required with the supply chain it is believed that opportunities for collaboration and sharing of good practice will not be realised and that there is potential for SLCs to work in isolation which may impact both overall cost and schedule.. The potential for duplicatory or nugatory work is also greater. This was the situation prior to formation of the NDA.

The second option whereby SLCs work with the supply chain supported by an NDA led strategic R&D programme delivered by a sole supply chain organisation is a positive step in identifying and progressing common, generic and strategic technical issues in a timely manner. However the opportunities for innovation due to a sole provider may be reduced.

Therefore the final option where the SLCs work with the supply chain supported by an NDA led strategic R&D programme with multiple supply chain organisations allows maximum opportunity for collaboration and innovation. It is important that the overall strategic lead for R&D comes from the NDA. This provides integration and strategic coordination across the whole of the NDA estate. This is the current situation whereby the NDA Direct Research Portfolio has been competed and framework contracts established.

3.2 Assumptions, Constraints and Risks

It is assumed that NDA will continue to have a directly funded R&D portfolio. The NDA Head of R&D is the budget holder for this portfolio currently. The portfolio budget was £6M for

financial year 2010/11. There is a continuing risk that this budget will come under pressure and that the opportunities to work direct with the supply chain on strategic issues and innovation may be reduced which may compromise underpinning of key strategic decisions in the NDA strategy driving themes e.g. Higher Activity Waste strategy. The R&D university strategy which is a component of the R&D portoflio is primarily to support development and maintenance of critical technical skills in the medium to long term. The nature of the work means that these projects are likely to run over several years. It is assumed that such programmes of work, if committed to, will be for the duration of the projects. Exiting such programmes early is not only detrimental to the work, personnel involved and NDA reputation but can also cost more in legal challenge in the long term.

3.3 Initial Assessment and Short listing

As discussed in the previous section the credible options reflect how the R&D strategy has evolved since the NDA was formed. As the current strategy is one of those options and for the reasons described above it is possible to progress directly to the Preferred Option,

3.4 Preferred Option

Stakeholder consultation and analysis within NDA has identified only one preferred option.

- SLCs carry out R&D in conjunction with the supply chain, with an NDA led strategic R&D programme being carried out by multiple organisations in the supply chain. NDA provide overall leadership in order to deliver the NDA's mission

This preferred option represents the best value to NDA of ensuring technical underpinning of the decommissioning and clean-up programmes. The guiding principles through which this strategy will be delivered are as follows:

- Promote and actively support a balanced portfolio of short, medium and long term R&D programmes that support NDA's mission in decommissioning and clean up and associated skills programmes
- Ensure the appropriate application of technical governance in delivery of R&D programmes
- Ensure robust technical underpinning of LTPs and clear identification of associated R&D work to mitigate risk and reduce cost and timescales across NDA's mission
- Understand the impact of directly and indirectly funded R&D on NDA's mission through development and implementation of metrics
- Actively support and encourage innovation through the supply chain including challenging the traditional approach to R&D and promoting dissemination of knowledge and experience
- Ensure strategic alignment and sufficient peer review in developing national programmes of R&D work. Where appropriate seek to organise R&D on a national basis so that the necessary capabilities are available to support all NDA sites
- Establish mechanisms to support access to national and international experience and good practice. Where appropriate this may involve funding R&D in conjunction with other international organisations and companies
- Identify and support the preservation of key scientific and technical skills as part of the wider skills programme including investment in universities and strategic facilities
- Encourage and support world class R&D in strategic nuclear centres of excellence
- Engage with training organisations and the supply chain to ensure key scientific and technical skills are available to meet medium to long term needs

Comments received during the consultation for Strategy II were also supportive of this option.

3.5 Regulator and Stakeholder Engagement Plan

Engagement with government and research councils will be via the NDA Research Board and specific groups such as the Nuclear Research Coordination Group. Regulator engagement will be continued on an individual basis as appropriate with NII, EA and SEPA and via the Strategy Delivery Group, NDA Research Board and Theme Overview Groups. Engagement with SLCs will continue to be through the NWRF and specific projects. Breakout sessions were held at the National Stakeholder event in November 2009 on the preferred option and the guiding principles.

3.6 Communications plan

As part of regulator engagement feedback has been received and the strategy and principles updated. This process will continue to be an iterative process. Comments received during the consultation of Strategy II have also been incorporated into the R&D strategy where appropriate.

There is also a new section on the NDA website where R&D information and documentation is co-located. This will be updated as the strategy develops (www.nda.gov.uk/research).

3.7 Work programme and scope

It is envisaged that the principles and the overall R&D strategy will drive packages of work. For example to ensure robust technical underpinning of LTPs and clear identification of associated R&D work to mitigate risk and reduce cost and timescales across NDA's mission we are developing the technical baseline process as part of the NDA Project controls procedures. This will set out our expectations of what underpinning is required and an accompanying assurance process to understand the maturity of this across the SLCs.

The work programme is detailed in the Strategic Case.

4 The Commercial Case - (Stage C) 'Approvals'

Although the preferred option is that which NDA is already following some relevant information has been included in this section.

4.1 Contracting Options

In order to deliver the credible option the majority of technical underpinning and R&D work will be carried out by the SLCs in conjunction with their supply chain. The existing requirements are captured within the existing SLC contracts in the LTP requirements. As these evolve the requirement to ensure sufficient and appropriate R&D is being carried out to underpin delivery of decommissioning and clean up programmes will remain a requirement within the SLC contracts. Our requirements will be in a set of principles which allow some flexibility as to the breadth and depth which is required for each site. Revised documentation has recently been issued to our SLCs as part of the contract procedures and engineering guidance (Ref 2). Experience to date has shown us that the requirement to ensure an integrated approach to technical underpinning must be embedded through the contracts. We would encourage the SLCs to be flexible in their contracting approach with the R&D supply chain but look to seek best value for money in collaborative projects. We will continue to work with the SLCs on both their approach to innovation and ensuring the technical underpinning process is implemented.

For the strategic NDA led R&D portfolio the contracting options with the supply chain will take the path of competed framework contracts. The scope of these framework contracts will be determined by the top down strategic themes coupled with the bottom up SLC analysis of prioritised common and generic R&D needs, risks and opportunities. Currently there are four framework contracts that are in the following areas:

1. Lot 1 : University Interactions - Supports critical technical skills identified in the NDA skills strategy 2008
2. Lot 2 : Waste Processing
3. Lot 3 : Materials Characterisation (includes graphite and contaminated land)
4. Lot 4 : Strategic Nuclear Materials (Pu, U, Exotics, Oxide, Magnox)

Additional areas identified and prioritised for possible competition in the future include remote decommissioning and robotics and environmental topics. The framework contracts were competed under OJEU procurement rules in 2008 and are currently with multiple suppliers under each framework. This has brought increased and focussed collaboration which will save the NDA money in the medium term as the suppliers understand our needs and opportunities better. The contracts are reimbursable although we have sought to introduce incentivisation into some individual contracts. It is hoped to extend this approach where appropriate.

Where appropriate the NDA seeks to take advantage of national or international R&D programmes with direct or indirect advantage to the decommissioning and clean-up mission. This may include top-up or industrial awards as part of our university strategy or contributions to EU programmes. Such contracts will be devised to ensure NDA benefit is maximised. Opportunities to ensure leveraging of NDA contributions will continue to be sought,

It is proposed that each SLC should follow a flexible contracting strategy that meets the guiding principles of the R&D strategy (e.g. include working with the supply chain and universities) and that the NDA should continue to let its strategic portfolio under a series of competed framework contracts.

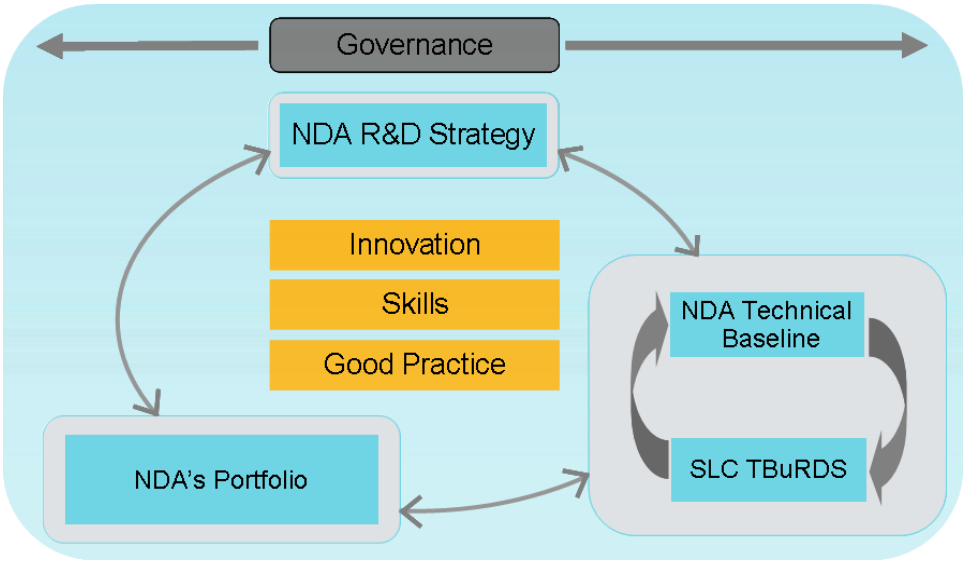
5 The Financial Case - (Stage C) ‘Approvals’

This section is not applicable. However it should be noted that regulators have the potential to require R&D work to be carried out on safety and environmental issues should these not be within the LTPs. In addition to deliver the R&D strategy financial provision for an NDA funded portfolio is required. Delivery in this manner enables NDA to meet it’s Energy Act requirements. The portfolio budget was £6M for financial year 2010/11. The R&D budget should be maintained to enable implementation of the strategy and remain flexible to ensure key strategic decisions can be underpinned.

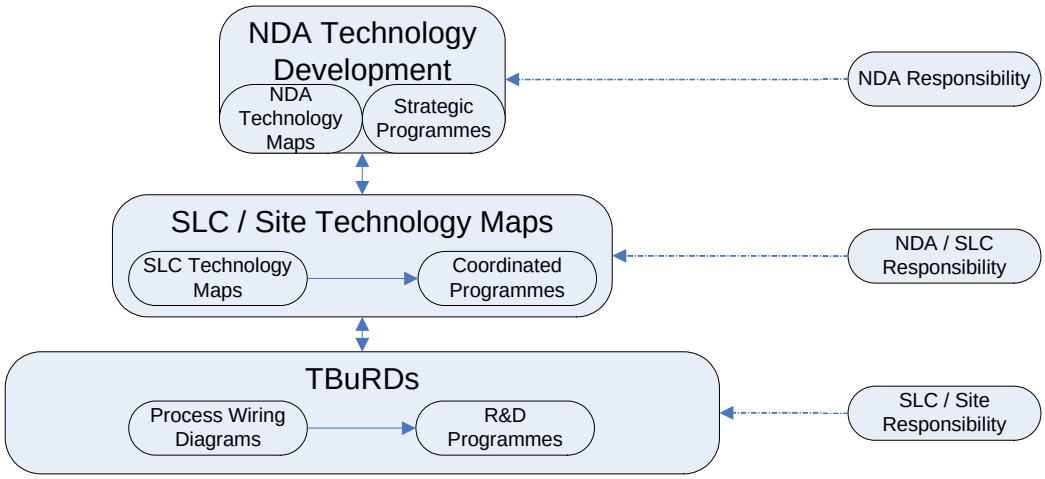
6 The Management Case - (Stage C) ‘Approvals’

Completion of this section is not required as the NDA is already delivering the preferred option. Delivery of the R&D strategy will be via a hierarchical approach including work with the SLCs complemented with a NDA-led strategic portfolio that focuses on common and strategic R&D needs, risks and opportunities across the estate. This requires NDA to continue to commit to funding R&D work itself. The benefit of this is in enabling strategy to be delivered, allowing innovation opportunities to be realised and critical technical skills to be developed and maintained across the estate. If this were to be done by the SLCs alone then the risk of duplication or omission of essential technical underpinning work is increased and thus overall cost to NDA increases.

The requirement to ensure robust technical underpinning will continue to be implemented with the SLCs. The hierarchical approach discussed earlier will be implemented which includes a strategic dashboard and technology maps highlighting the technical needs, risks and opportunities across the NDA estate. This approach maximises transparency, ensures strategic coordination and prioritisation of work to address the key issues and provide maximum benefit. The overall approach is included here again for completeness.



Approach to R&D Management



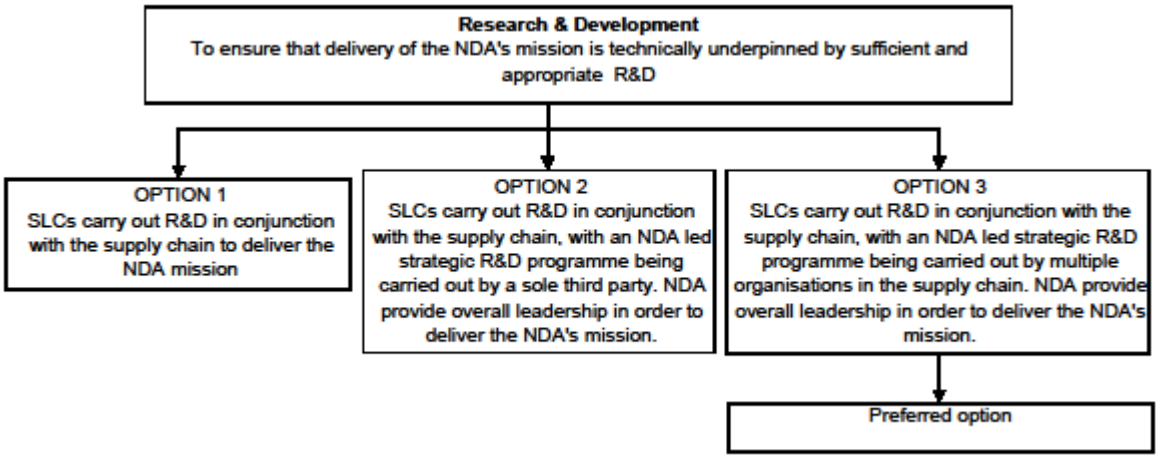
Hierarchical approach to Technical Underpinning

References

1. Response of the UK Government and the Devolved Administrations of Northern Ireland, Scotland and Wales to the Committee on Radioactive Waste Management's (CoRWM) report on "National Research and Development for Interim Storage and Geological Disposal of Higher Activity Radioactive Wastes, and Management of Nuclear Materials." 19th November 2010.

2. EGG10 Technical baseline and underpinning Research and Development Requirements.

Appendix 1: Generic R&D Strategic Options Diagram



Appendix 2 NDA University R&D Strategy

Background

Our University R&D strategy is derived from two of our critical enabling strategies, R&D and People. In order to successfully deliver our mission NDA needs to ensure that our mission is technically underpinned by sufficient and appropriate R&D and that the relevant skills and capability are available to our estate to carry out the mission efficiently and effectively. University research plays an essential role in this delivery through the advancement of knowledge with regard to decommissioning and clean-up and in the maintenance of key technical and engineering skills required to deliver the decommissioning and clean-up plans. Universities are therefore key organisations with which NDA, SLCs and the supply chain work with in order to deliver the NDA's mission.

University research has two principal impacts:

- The development of innovative solutions to support strategic decisions or against identified technical needs, risks or opportunities can potentially make multimillion pound cost savings, accelerate decommissioning and clean-up plans and significantly reduce workforce exposure to radiation.
- The provision of a technically skilled workforce without whom it is highly likely that decommissioning and clean-up plans will be both more expensive and delayed.

The nature of academic research means that the timescale for the research and training is generally over the medium to long term. It is therefore essential that appropriate links with industry are developed and maintained so that the innovative solutions developed by universities can be delivered by industry and the skilled researchers engaged in delivering the decommissioning and clean-up plans.

Our Strategy

Our University R&D Strategy is therefore to communicate to universities the challenges associated with our decommissioning and clean-up mission, promote existing relevant University research programmes and where necessary fund University research programmes using the most appropriate means (*i.e.* directly *via* the Direct Research Portfolio, indirectly *via* our SLCs or collaboratively with other organisations in order to leverage our funding and increase the overall impact). This strategy is aimed at ensuring that the appropriate technical capability can be developed and/or maintained to support key strategic decisions and provide innovative solutions to identified needs, risks and opportunities on an appropriate timescale. It is an integral part of our R&D strategy and follows the same principles of promoting and where necessary funding R&D in relation to our primary function of decommissioning and clean-up.

The NDA University R&D strategy does not encompass the full nuclear fission sector but is bounded by our remit to areas related to decommissioning and clean-up of the UK's civil public sector nuclear sites. We therefore aim to work strategically with other

organisations (*e.g.* Research Councils, National Nuclear Laboratory, Regulators and other consumers of similar capability such as AWE, British Energy and major players in the nuclear supply chain) to ensure our strategies and investments are aligned. This is essential in order to ensure that research is not duplicated and best value for money is achieved.

Examples of how NDA is currently delivering its university R&D strategy include:

- Coordination of nuclear research activities through the Nuclear Research Coordination Group
- Coordination of SLC university activities through the Nuclear Waste Research Forum (University R&D sub-group formed in 2010)
- NDA Bursary Call – Seven PhD projects were funded via an open bursary call in FY 2009-10 (www.nda.gov.uk/stakeholders/newsletter/bursary-awards.cfm)
- Capability at University of Sheffield in Radioactive Waste Immobilisation – Includes supporting a Chair in Radioactive waste Management in conjunction with Royal Academy of Engineering
- Decommissioning, immobilisation and management of nuclear waste for disposal (DIAMOND) – Additional studentships, industrial support and conference awards to support the EPSRC supported consortium (www.diamondconsortium.org)
- Research Centre for Non-Destructive Evaluation (RCNDE) – Membership, industrial support and targeted projects (www.rcnde.ac.uk).
- Nuclear FiRST Doctoral Training Centre – Membership of Management Board (www.nda.gov.uk/stakeholders/newsletter/partnership-skills.cfm)
- Industrial supervision – Support to knowledge transfer between NDA estate and NDA-funded university projects via National Nuclear Laboratory
- Development of Dalton Cumbrian Facility (DCF) and associated capability (www.nda.gov.uk/news/dcf-construction-milestone.cfm).
- Specific projects linked to strategic driving themes (e.g. EngDoc on Plutonium disposal). See www.nda.gov.uk/research for more details.