Baseline Review of UK Nuclear Infrastructure

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ABSTRACT
The Environment Agency is the principal environmental regulator at nuclear sites across England and Wales in the United Kingdom (UK), and is also responsible for regulation of the use of radioactive substances at non-nuclear sites. Responsible management of radioactive substances, including radioactive wastes, across both the nuclear and non-nuclear sectors relies on a robust nuclear infrastructure across the UK.

This paper describes our recent work, supported by our contractors, Jacobs, to establish the current status of UK nuclear infrastructure in order to understand how it is able to cope with foreseeable future needs..

INTRODUCTION
The UK nuclear sector involves organisations carrying out a wide variety of activities at nuclear sites. In addition to nuclear operators and regulatory bodies such as the Environment Agency, other key players in the sector include Government departments, including Scottish Government and the Welsh Assembly Government, as well as the Nuclear Decommissioning Authority, Ministry of Defence, Health and Safety Executive, Scottish Environment Protection Agency, and Food Standards Agency.

Each operator relies on a number of common elements to ensure continued successful operation. These include having access to radioactive waste management facilities; nuclear fuels and materials management facilities (including reprocessing and post-irradiation examination of nuclear fuel); research and development; appropriate skills and resources; co-ordinated radiation incident management response arrangements; and, robust and efficient regulation.

This reliance on common elements means that the sector relies on a limited number of critical facilities, some of which are ageing and require ongoing maintenance, or which the Nuclear Decommissioning Authority is starting to decommission and clean-up. For example, the UK's first generation Magnox stations , two of which are still operating, rely on ageing fuel reprocessing facilities at the Sellafield site; British Energy's Advanced Gas-Cooled Reactor (AGR) nuclear fuel elements have until recently been examined in post-irradiation facilities originally built 50 years ago; most nuclear operators use compaction facilities at two nuclear sites for treatment of Low Level Waste prior to disposal.

Non-nuclear users of radioactive materials also rely on nuclear industry facilities for end of life management of radioactive wastes. For example, the UK surplus source disposal programme which the Environment Agency managed, relied until recently on a single, 50 year old "cave line" facility at the Sellafield site .

In addition to the established nuclear industry in the UK, the nuclear infrastructure is also important to any new nuclear facilities that are built. UK Government wants nuclear power to play a significantly greater part in the electricity generating mix in the future. We expect several applications for new nuclear power plants to be submitted in the next few years.

The focus on new developments may put increased pressure on existing activities. There needs to be integrated planning coupled with innovation, optimisation and opportunity taking, to make best use of synergies between new and decommissioning needs which would help to further both new build, existing industry operations and decommissioning, clean up and ultimately, waste disposal. An optimised management strategy needs to be developed for new build wastes taking into account the impact on overall waste volumes and liabilities, and providing access to disposal and recycling facilities.

To realise these benefits the UK, at a strategic level, needs to identify the nuclear infrastructure it requires, including for example capability for research and development such that where problems arise, for example with materials,

fuels or waste treatment, they can be properly addressed and solutions developed. Vendors of new power reactors, and the companies operating them will be from outside the UK, which means that design expertise will be located outside the UK. The UK needs to be an "intelligent client" for work that might be carried out overseas.

The UK has started to improve oversight arrangements for some aspects of the UK's nuclear infrastructure. For example, UK Government and the Nuclear Decommissioning Authority are looking at longer term issues relating to civil nuclear decommissioning and clean-up, and a Nuclear Development Forum chaired at Ministerial level is considering wider issues related to new nuclear build.

As an environment regulator we need to ensure that radioactive substances are being responsibly managed, which means that an adequate nuclear infrastructure must be in place. To this end, we commissioned Jacobs to carry out a Baseline Review of UK Nuclear Infrastructure. The aim of this was to clarify the current status of nuclear infrastructure and how it would need to be able to respond to future developments.

UNDERTAKING THE REVIEW

We commissioned Jacobs to undertake this review using a team of its senior managers with wide experience of the whole UK nuclear industry. The purpose of the review was to identify the key elements of the UK nuclear infrastructure, the current status of each element, as well as future challenges that might affect its status. The work primarily involved a series of structured interviews with senior representatives of organisations from across the UK nuclear sector. The review included senior representatives of government and regulatory organisations as well as nuclear industry companies, representatives of the supply chain and of other relevant national organisations such as the sector skills council for nuclear. It was supported by literature searches where appropriate.

KEY ELEMENTS OF UK NUCLEAR INFRASTRUCTURE

Infrastructure includes people, processes -including regulation- and financial aspects, as well as the plants and facilities. The infrastructure delivers the capabilities and facilities needed by organisations that operate in the nuclear sector in terms of those professional services, technical services and facilities which are outwith the corporate control of the organisation itself but which are critical to the delivery of its business model.

For the UK we identified the key elements of nuclear infrastructure as radioactive waste management facilities, nuclear fuel and material management, research and development, transport, reactor vendors and supply chain, skills and resources, incident response and emergency arrangements, and regulation, supported by appropriate governance arrangements.

CURRENT STATUS OF UK NUCLEAR INFRASTRUCTURE

Our review highlighted a number of specific issues relating to each key element of nuclear infrastructure.

Radioactive Waste Management

Our findings highlighted that there needed to be more robust arrangements for the long term storage and / or disposal of higher activity waste. In England and Wales the development of a Geological Disposal Facility is recognised as being vital to enabling the safe and secure disposal of some of the highest hazard radioactive wastes. Waste strategies need to develop into credible delivery programmes - to increase public confidence in the nuclear industry and enable clean-up, as well as to provide a platform for funding certainty and investment for new nuclear build. The strategy needs to recognise current and future requirements as well as the UK's Nuclear Decommissioning Authority's (NDA's) focus on legacy liabilities.

The NDA currently is responsible for most of the waste management infrastructure. However the legal statutory remit requires NDA to focus on the management of these for purposes of decommissioning and clean-up of the civil nuclear liabilities. There is a need to clarify how future waste management infrastructure requirements will be delivered to support the needs of other non-NDA activities.

Progress is being made in the area of lower activity radioactive waste strategy and facilities and this needs to continue. Greater certainty around capacity and future availability would aid planning and give greater confidence to future investors There has been good progress in developing the overall waste strategy with recognised industry involvement and collaboration. This focus needs to be maintained and concentrated on cost effective, long term low activity waste facilities.

Spent Fuel
Existing nuclear power utilities in the UK rely on ageing facilities to convert the radioactivity in spent fuel to passive long term waste forms. The uncertainties over the continued availability of the Sellafield facilities and the associated technical issues present risk to the ability to continue to manage UK spent fuel effectively, particularly for Advanced Gas-cooled Reactor (AGR) and Magnox fuel

Whilst the challenge of safely completing these programmes must not be underestimated, the risks and issues are well understood and documented. Effective governance processes exist for their management and the scope and accountability is clear. However there are still important issues that need to be addressed over for example, long term storage of AGR fuel.

Post Irradiation Examination (PIE)
Defence and civil nuclear programmes require secure access to facilities for the PIE of irradiated material. This involves the transport, examination and disposal of hazardous material. The reduced availability of UK facilities and their poor performance has forced a change of approach by UK nuclear operators. The limited access to UK facilities has led the nuclear sector to seek solutions overseas. However , while the ability of the international market to respond to this need is welcome, international solutions have associated risk in terms of transport and security and need to be considered from an overall perspective.

The ongoing provision of this critical element of UK Infrastructure is currently being developed via the response of individual companies to commercial circumstance combined with NDA's development of a single facility via a third party operator. The UK's requirements for PIE demand a joined up holistic approach. The strategic approach could involve private and public sector facilities either in the UK, or internationally, and should be designed rather than arrived at by default.

Transport
Safe and available transport is a key enabling element of UK nuclear infrastructure. Improvements can be made within the UK application of an international framework. The government department responsible for transport (Department for Transport, DfT) is aware of this and making good progress towards a more integrated system. In the longer term there will be a requirement for greater focus on programme management and logistics within the UK if the volume and number of movements of radioactive waste increases.

Healthcare, small users and fuel manufacturers are particularly affected by the impact of transport regulation. The main challenges are the reducing number of transport carriers and the complexity of the regulatory framework, particularly for cross border shipments. Our review found that some believe the security and radiological classification of low hazard materials to be disproportionate to the overall risk which in turn presents a challenge to the healthcare and industries using small quantities of radioactive substances. Beyond the challenges presented in the transport of lower hazard packages, the overall transport of radioactive material currently presents no significant safety or environmental concerns.

Emergency Arrangements
The nuclear industry must be able to demonstrate its safety. Having the infrastructure to provide fit for purpose emergency arrangements is an essential prerequisite for operating a UK nuclear industry. The review found that local arrangements by individual operators are well managed and implemented. More UK-wide support systems for incidents such as National Arrangements for Incidents involving Radioactivity (NAIR), RadSafe, and the Nuclear Emergency Planning Liaison Group (NEPLG) are well supported by the industry and contribute to an effective UK wide set of arrangements.

Following diversification of the UK nuclear industry , there is now a greater number of independent operators and contractor organisations working in the UK. However , there is a need for a more proactive framework to enable compatibility between systems and equipment to manage effectively the national response .

Research and Development

There is wide recognition of the importance of sustained capability for research and development. Whilst operating in a large global market, the UK capability has become weakened following a sustained period of significant change. Access to the global market is important and brings significant benefit but it is important to recognise that this might not meet all specific UK requirements such as some of the unique challenges in legacy clean up at Sellafield.

The review found that most players were confident that short term research and development requirements could be met but there is some risk regarding the more fundamental, longer term research programmes and capability. Whilst the new NDA 'National Nuclear Laboratory' model is in its early stages of implementation, there remains some concern over its longer term prospects and viability.

Skills, Resources and Knowledge Management

The availability of educated and trained personnel is vital to the ongoing compliance and continuous improvement in all areas of the industry, including the area of the Environment Agency's responsibility which is environmental protection. Good progress has been made on a national basis in identifying future training requirements and solutions. The development of a Nuclear Skills 'Passport' scheme is a critical element in enabling the re-skilling of a mobile nuclear workforce. This supports a level of standardisation which will enable a more efficient transference of skills between employers and should significantly reduce down time.

Knowledge transfer as well as skill development needs strong management. Due to the demographics of the industry's work force, a significant experience gap could result if this is left to reach its natural end point. The nuclear industry is competing for the skill base with other sectors for the broader engineering skills which will be required

Reactor Vendors

Power reactor vendors are part of the infrastructure upon which the future UK nuclear utilities will rely. This reactor design capability will be delivered from within the international market.

Future nuclear utilities wish to secure the operational and commercial benefits of operating plant that are very similar within a wider international fleet. In considering nuclear infrastructure, the UK must recognise the international market and capability in reactor technology, fuel supply, R&D, in service support capacity and facilities.

Regulation

Regulation is a critical aspect of infrastructure with a key effect on the confidence and delivery of the overall supply chain. It should be seen as an enabler, not a hurdle. Regulation should be strategically driven and , while being independent, regulators' work should fit within the framework of Government policy. It must be properly resourced with the appropriate skill and knowledge base.

Increasing collaboration between the UK's nuclear regulators, as demonstrated by the HSE/ EA Joint Programme Office for the Generic Design Assessment of new nuclear build, is successful and has been widely welcomed. Proportionality of regulation and incorporation of the wider aspects of societal needs and benefits are important aspects of regulatory decision making , and the regulatory interface with industry has been enhanced recently with a new Protocol for engagement, the Regulatory Nuclear Interface Protocol [1].

Within the NDA's programme there is a need to improve the clarity of the relations and interactions around the so called "golden triangle" between Regulators, Operators and NDA. This remains an area of concern particularly around the topics of funding and the priority given to hazard reduction . Some further clarification of accountabilities and responsibilities would help.

Following a high level review of nuclear regulation [2], the initiative to establish a single Nuclear Statutory Corporation (NSC) with responsibility for safety security safeguards and transport regulators is a positive step [3].

A simplified approach to some regulation would help small users of radioactivity and the Healthcare industry, in particularly in the area of transport and waste disposal for low hazard material such as medical isotopes.

Governance

In broad outline UK Nuclear Infrastructure consists of those facilities and services that provide common functionality to the industry. This includes waste management assets and facilities used today (such as the Low Level Waste Repository, fuel recycling facilities at Sellafield, transport assets, source disposal facilities, R&D facilities and fuel inspection facilities), as well as the assets and facilities needed in the future (such as a geological disposal facility) and the common infrastructure needed to support new nuclear build (road, sea and rail links for construction and the power grid).

Managerial and governance arrangements that support the effective functioning of the industry in the UK are critically important This includes generation and ownership of vision, policies and prioritisation of national strategic issues, regulation of the industry consistent with these policies, clarity of accountability for delivering national programmes including emergency arrangements, and research and development.

SUMMARY

During the course of our review we have received considerable input and support from across the UK nuclear industry. There is a growing recognition that the UK needs to consider its nuclear infrastructure arrangements as a key asset which requires proper oversight and maintenance. Considerable progress is already being made to establish leadership within government, particularly with regard to new nuclear build. However, it is important to underpin this progress with an integrated programme for the UK's future nuclear infrastructure which is comprehensive in scope, transparent and steered by appropriate governance.

Improvements in the oversight and stewardship given to UK infrastructure will help to ensure that it remains fit for purpose to address current and foreseeable challenges. It is pleasing that the UK's Government recognises the need for strategic planning of an integrated programme for future nuclear infrastructure, which will need to be underpinned by a governance framework for its development and delivery.

References

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