Department for
Business, Energy
& Industrial Strategy

The United Kingdom's Sixth National Report on Compliance with the Obligations of the Joint Convention on the Safety of Spent Fuel and Radioactive Waste Management

October 2017

Contributors to the United Kingdom's National Report

The Office for Nuclear Regulation (ONR) prepared this report on behalf of the Department for Business, Energy and Industrial Strategy (BEIS) in consultation with and incorporating contributions from:

- Civil Aviation Authority
- Department for Business, Energy and Industrial Strategy
- Department of Health
- Dounreay Site Restoration Limited
- EDF Energy Limited
- Environment Agency
- Food Standards Agency
- GE Healthcare
- Public Health England
- UK Home Office
- Low-level Waste Repository Limited
- Magnox Limited
- Maritime Coastguard Agency
- National Nuclear Laboratory
- Natural Resources Wales
- Northern Ireland Environment Agency
- Nuclear Decommissioning Authority
- Radioactive Waste Management Limited
- Scottish Environment Protection Agency
- Scottish Government
- Sellafield Limited
- Springfield Fuels Limited
- Urenco UK Limited
- Welsh Government

Foreword

The United Kingdom (UK) remains firmly committed to meeting its obligations under the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (the Joint Convention) and to sharing its experience with other Contracting Parties, as well as learning lessons from the peer review process.

This sixth UK national report aims to demonstrate that the UK's approaches to safety and environmental protection relevant to the management of radioactive waste and spent fuel comply with the obligations placed by the Joint Convention. The UK is clear that its nuclear waste and spent fuel should continue to be safely managed, and that undue burdens should not be placed upon future generations.

The overarching government body responsible for ensuring that the UK obligations under the Joint Convention are met is the Department for Business, Energy and Industrial Strategy (BEIS) and its executive arm, the Nuclear Decommissioning Authority (NDA). The NDA is responsible for coordinating the safe management and clean-up of the UK nuclear legacy, including its radioactive wastes, and contracts out the work on the sites it owns, to licensed nuclear operators. The legal responsibility for adequate safety and environmental performance rests firmly with the licensed nuclear operators, both NDA contracted and others, who have to meet their legal obligations and demonstrate that they are meeting relevant good practice to minimise risks to people and the environment. Considerable sums of money are being spent in the UK to clean-up the nuclear legacy arising from more than 60 years of operating nuclear facilities. The NDA's planned expenditure for the financial year 2017/2018 is £3.24 billion.

The principal independent regulators for the purposes of the Joint Convention are the Office for Nuclear Regulation (ONR) and the three environment agencies for England, Scotland and Wales.

This report also provides the UK's response to the feedback provided at the fifth Joint Convention Review Meeting via the respective Summary and Rapporteur's Reports.

The UK has met some of the challenges identified in the Summary and Rapporteur's report, and has made significant progress against the other challenges identified in the Summary and Rapporteur's Reports, published after the fifth Joint Convention Review Meeting, which included:

Challenges from the Summary report:

- staffing, staff development, reliability of funding, and other human resource areas;
- maintaining or increasing public involvement and engagement on waste management, to provide public confidence and acceptance;
- developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage; and
- management of disused sealed sources.

Challenges from the Rapporteur's report:

- need for a National Integrated Waste Strategy;
- siting, design, permissioning, construction and commissioning of a proposed Geological Disposal Facility (GDF);
- maintenance of the spent fuel and radioactive waste infrastructures;
- management of 140 tonnes of separated plutonium either by reuse or by immobilisation as waste;

- management of graphite waste;
- reduction in radioactive discharges by 2020;
- updating on the Magnox Operating Programme (MOP) and Oxide Operating Plan to manage overall safety of the fuel cycle;
- continuing to make progress on high hazard legacy facility priority programmes; and
- providing a statement on whether Naturally Occurring Radioactive Material (NORM) waste is under the scope of the Joint Convention according to Article 3.

UK licensed nuclear operators are required as a condition of their site licences to undertake periodic reviews of safety, typically on a decennial basis, which provides opportunities to improve the safety of their nuclear facilities and activities. The environment agencies periodically review nuclear operators' permits and authorisations to seek improvements in environmental performance. These fundamental regulatory expectations will continue to drive further improvements into the future. The UK works closely with its counterparts in other countries to ensure its approaches reflect international good practice and capture lessons learnt from experience elsewhere.

Significant challenges remain to be overcome, particularly, the remediation of high hazard facilities at the Sellafield site; decommissioning the fleet of shutdown Magnox nuclear power plants; identifying a suitable site for a deep geological radioactive waste disposal facility; maintenance of the UK's spent fuel management infrastructure, and sustaining the UK's nuclear skills base. In addition, the UK has decided to leave the European Union and this may bring further challenges related to our obligations under the Joint Convention over the next few years.

This report demonstrates that the UK's approaches to safety and environmental protection relevant to the management of radioactive wastes and spent fuel are well-established, effective, and drive sustained improvements, clearly meeting the requirements of the Joint Convention. Responsibility for adequate safety and environmental performance rests with the UK's licensed nuclear operators, who have to meet the expectations of a comprehensive goal-setting regulatory regime.

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Section A – Introduction

Structure and Basis of the Report

A.1. This is the sixth report explaining how the United Kingdom (UK) complies with the obligations of the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management – hereafter referred to as the 'Joint Convention' (Reference 1).

A.2. The UK nuclear industry reflects its role in the significant development of nuclear technology since the 1950s and recently a policy to embark on building new nuclear power stations. As a result, the UK has a very diverse range of nuclear facilities that are relevant to the Joint Convention. These facilities encompass all stages of the nuclear fuel cycle and include: operational and decommissioning power stations, research facilities, uranium enrichment, fuel manufacturing, spent fuel storage and reprocessing, and radioactive waste processing, storage and disposal facilities. The scope of the report covers all of these and further details on the scope are provided in Section C – Scope of Application.

A.3. The structure of the report follows the guidance issued by the Joint Convention (Reference 2). In accordance with the guidance, Section A includes general introductory remarks, a survey of the main safety issues, main themes of the report, and references to any matters not covered elsewhere in the report.

A.4. In addition to the requirements of the Joint Convention Articles (Reference 1) and dedicated guidance (Reference 2), a number of other information sources have informed the scope and structure of this report. These include:

- the UK fifth national report on compliance with the Joint Convention (Reference 3);
- summary Report of the fifth review Joint Convention Review Meeting (Reference 4); and
- guidelines regarding the Joint Convention Review Process (Reference 5).

Title
A.5. In addition to describing how compliance with the articles of the Joint Convention and other requirements have been achieved, this report also illustrates the practical application of safe spent fuel and radioactive waste management. It does this by presenting examples of safe spent fuel and radioactive waste management, which are mostly cases where the UK has had successes or faces challenges in the future. These have the same format as this paragraph.

A.6. Within this section, the developments since the publication of the fifth UK Joint Convention Report (Reference 3) are summarised under the following headings:

- changes in applicable laws, regulations and practices;
- update on major programmes, safety and environmental issues;
- developments in response to the Fukushima accident; and
- identified future developments.

A.7. Within this section, the report usually only provides a brief summary of the topic. Where this is the case, it provides a clear reference to the relevant section of the report where further detail is provided. Developments in the safe management of spent fuel and the safe management of radioactive waste are on-going and, hence, this report can only cover the position at a particular point in time. In describing compliance and development, this report generally describes the position at 30 April 2017.

A.8. A key purpose of the report is to demonstrate compliance with the obligations in the Articles of the convention. This is the sixth report to the Joint Convention and means of compliance with the Joint Convention has not changed significantly in many areas since the fifth report and in some cases the first report. Hence, it has been subject to previous peer review.

A.9. Where the means of compliance has changed, the relevant text is identified at the beginning of the relevant section or Article. It is highlighted in the same way as this paragraph.

A.10. Where the text has not been highlighted in this way, it may have been revised to improve the presentation, but the means of demonstrating compliance has not changed significantly.

A.11. The UK presentation to the sixth Joint Convention Review Meeting in Vienna in May 2018 will be based on this report, augmented with any relevant developments that occur in the interim period.

A.12. Lists of facilities, inventories, reference data, and links to further information are provided in Section L.5 – Lists and Inventories. References are listed at the end of the report.

Changes in Applicable Laws, Regulations and Practices

Policy Developments in the United Kingdom

UK Departure from the European Union (Brexit)

A.13. On the 23 June 2016, the UK held a referendum which resulted in a majority vote for the UK to leave the European Union (EU). The UK Prime Minister's letter to the President of the European Council of 29 March 2017 invoking Article 50 on EU withdrawal (Reference 6) also informed the Council of the UK's intention to withdraw from the Euratom Treaty and the European Atomic Energy Community.

A.14. The UK's withdrawal from the Euratom Treaty will lead to the UK developing new arrangements in areas such as a State System of Accountancy and Control of Nuclear Materials and others that are likely to impinge on aspects of the Joint Convention. These are in the early stages of development and are outside the scope of this report.

Implementing Geological Disposal

A.15. The 2014 White Paper, 'Implementing Geological Disposal' (Reference 7), sets out an overarching policy framework for implementing geological disposal. It identifies initial actions to be led by the UK Government and the intended delivery organisation Radioactive Waste Management Ltd. (RWM), which is a wholly owned subsidiary of Nuclear Decommissioning Authority (NDA) to support a siting process that is based on the willingness of communities to participate. These initial actions are described in detail in paragraphs B.43 to B.46. The White Paper 'Implementing Geological Disposal' also states that the planned GDF will be a licensed nuclear site under the Nuclear Installation Act 1965 (NIA65) and will, therefore, be subject to regulation by the Office for Nuclear Regulation (ONR) (see paragraphs. E.35 to E.38).

Policies on Higher-Activity Waste (HAW) Disposal

A.16. Some aspects of radioactive waste management policy are devolved to the government administrations of Scotland, Wales and Northern Ireland. The Welsh and Scottish governments

have further developed their policies and strategies for radioactive waste disposal since the last Joint Convention report.

A.17. In December 2016, the Scottish Government published its strategy to support the implementation of its policy (Reference 8). The Strategy supports Scotland's Higher Activity Radioactive Waste Policy published in 2011 (Reference 9). The 2011 Policy states that long-term management of higher activity waste should be in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible. Further information on the strategy can be found in paragraphs B.47 to B.51.

A.18. Following the 2008 White Paper (Reference 10), the Welsh Government reserved its position on geological disposal. In 2014, the Welsh Government issued a call for evidence to seek views on whether it should review its policy (Reference 11). After a review of the responses to the call for evidence and subsequent public consultation, the Welsh Government issued its new policy on the management and disposal of Higher Activity Waste (HAW) in Wales in 2015 (Reference 12). Further information can be found in paragraphs B.52 and B.53.

Implementation of Policy and Strategy for the Management of Solid Low-Level Waste (LLW)

A.19. The 'UK Strategy for the Management of Solid Low-Level Radioactive Waste (LLW) from the Nuclear Industry', known as the 'Nuclear LLW Strategy' and was published in 2010 (Reference 13) and was reviewed by NDA on behalf of Government in 2014/15. The revised strategy was published in February 2016 (Reference 14). The key themes and aims of the strategy remain unchanged and are described in paragraphs B.75 to B.91.

Proposal to Exclude Disposal Sites for LLW and Very Low-Level Waste (VLLW) from the Requirements of the Paris-Brussels Conventions

A.20. The UK is in the process of implementing changes to the Paris and Brussels Conventions on nuclear third-party liability (which govern the payment of compensation for damage caused by nuclear incidents) into UK law, in particular the NIA65.

A.21. The UK Government considers this liability regime should not apply to low-level waste disposal sites, such as landfill facilities. This is on the basis that those sites do not present a sufficient level of risk to warrant compliance with the requirements of the Paris regime and has sought exclusion for such sites through the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA) Nuclear Law Committee. Further information can be found in paragraphs B.61 to B.62.

Regulation of Nuclear Sites in the Final Stages of Decommissioning and Clean-Up

A.22. In November 2016, the UK Government's Department for Business, Energy and Industrial Strategy (BEIS) published a discussion paper on an opportunity to improve the current arrangements that apply to the regulation of the final stages of nuclear site decommissioning and clean-up in Great Britain. The paper considers a proposal developed by BEIS, the safety and environmental regulators and the NDA that would improve the regulation of nuclear sites in the final stages of decommissioning and clean-up to be regulated more efficiently, reflecting the very low residual risks. Additional information can be found in paragraphs. E.42 to E.45.

NDA Strategy 2016–2021

A.23. The NDA is required to review and publish its strategy every 5 years. Following a public consultation, the third NDA Strategy (April 2016 to 31 March 2021) was published in 2016 (Reference 15).

A.24. The NDA Strategy includes five strategic themes: site decommissioning and remediation, spent fuel management, nuclear materials, integrated waste management, and critical enablers. Additional information can be found in Section L.1 – Legislative and Regulatory System.

Developments in Integrated Waste Strategies and Plans

A.25. The NDA has responsibilities for effective management of radioactive wastes and spent fuels across an estate of 17 civil licensed nuclear sites, which contain the majority of the UK's nuclear liabilities.

A.26. All sites in the NDA estate produce Integrated Waste Strategies detailing how they will manage all wastes during operations and decommissioning. This is recognised as good practice by the regulators, so in addition, many non-NDA sites also use this guidance to produce their Integrated Waste Strategies.

A.27. In its 2016 Strategy, (Reference 15), the NDA commits to produce a single Radioactive Waste Strategy covering all the sites across its estate with the aim of providing clarity of the strategic needs and greater opportunities to optimise the management of radioactive wastes. This strategy will be published in spring 2018. Additional information can be found in paragraphs. B.110 to B.115.

Organisational Developments

Radioactive Waste Management Ltd. (RWM)

A.28. The NDA has a responsibility for implementing geological disposal for HAW and has established RWM (a wholly owned subsidiary company) as the geological disposal delivery organisation.

A.29. RWM's corporate strategy 2015-2018 was published in May 2015 (Reference 16). It sets out RWM's vision, mission and values, and the factors on which RWM based its strategic approach. Additional information can be found in paragraphs. L.1.81 to L.1.85.

National Nuclear Archive

A.30. A new purpose-built archive facility named Nucleus has been constructed in the north of Scotland to manage records and other archive material from the nuclear industry. Nucleus will manage between 20 and 30 million digital, paper, and photographic records dating back to the 1940s. A commercial partner will operate the facility on behalf of the NDA and was appointed in July 2015. The NDA has a statutory obligation to manage public records, keeping them safe and accessible to the public and the UK nuclear community, whilst at the same time ensuring their integrity remains intact to deliver the NDA's decommissioning programme.

Legislative and Regulatory Framework

A.31. The main developments to the UK legislative and regulatory framework since the fifth Review Meeting are related to the implementation of the Environmental Permitting Regulation 2010 (EPR10) in April 2010. The Environmental Permitting Regulations 2016 (EPR16) incorporate radioactive substances regulation with other regulated activities, such as the management of non-radioactive wastes, to provide industry, regulators and stakeholders with a single overarching permitting and compliance system. For example, under EPR16, the developer of a Geological Disposal Facility (GDF) would require an environmental permit before starting intrusive site investigation, such as drilling boreholes, at any candidate site. This is further described in paragraph E.35, and paragraphs E.84 to E.87.

Update on Major Programmes, Safety and Environmental Issues

Management of Spent Fuels

A.32. The NDA reviewed its Spent Fuel Strategy as part of its overall strategy review to secure and, subsequently, implement the most appropriate management approach for spent Magnox and oxide fuels and, where possible, take advantage of these approaches to manage spent exotic fuels, additional information on this topic can be found in paragraphs. B.11 to B.35.

Spent Magnox Fuel and Delivery of the Magnox Operating Programme (MOP)

A.33. The last operating Magnox reactor, Wylfa Reactor 1, shut down in December 2015.

A.34. The NDA and its Site Licence Companies (SLCs) have made significant progress with removal of spent fuel from the shutdown Magnox reactors in the last three years, with two further sites, Sizewell A and Oldbury, being declared free of fuel, leaving just two reactors at Wylfa and two at Calder Hall with fuel in them.

A.35. The Magnox Operating Programme (MOP) is the practical level programme to deliver the Magnox fuel strategy, and is now in its ninth iteration (MOP9). The aim of the MOP has not changed since its inception in 2001 and is still to optimise the remaining Magnox lifetime programme for fuel reprocessing and consolidation.

A.36. As of March 2017, there will be less than 1,600 tU of Magnox fuel to reprocess, which means over 97% of Magnox fuel has been reprocessed at Sellafield. Defueling of both Calder Hall and Wylfa is expected to finish in 2019 and based on a lower bound reprocessing performance of 450 tU per year, Magnox fuel reprocessing will complete by December 2020. More detail on the MOP and the management of spent Magnox fuel is presented in paragraphs. B.11 to B.16.

Spent Advanced Gas Reactor (AGR) Fuel and the AGR Operating Plan (AGROP)

A.37. The situation with regards to spent AGR fuel has not changed significantly since the fifth UK national report. Électricité de France (EDF) Energy has contracts in place with Sellafield for the reprocessing of part of its AGR fuel in the Thermal Oxide Reprocessing Plant (THORP). The NDA (as Sellafield's parent company) aims to finish reprocessing of oxide fuels in THORP in 2018.

A.38. In April 2016, the AGR Operating Plan was relaunched to develop an integrated, collaborative delivery programme covering the activities of all the delivery partners (including Sellafield, EDF Energy, NDA, and Integrated Nuclear Services (INS) for consolidation of spent fuel at Sellafield. Additional details can be found in paragraphs. B.20 to B.24.

Sizewell B Spent PWR (Pressurised Water Reactor) Fuel

A.39. Spent civil PWR fuel arises from the Sizewell B power station on the Suffolk coast.

A.40. Sizewell B safely and successfully completed the first dry fuel cask transfer of 24 irradiated fuel assemblies to the newly constructed Dry Fuel Store (DFS) early in 2017. The site's spent fuel will be stored on site for the remainder of the station's life, and beyond, until a GDF is available. Additional information can be found in paragraphs. B.25 to B.27 and E.52 to E.57.

Exotic Fuels

A.41. The NDA has taken a decision to transfer all of the exotic fuels (see definition in Glossary and Abbreviations) to Sellafield for longer-term storage. This strategy of consolidation accelerates

clean-up and decommissioning of sites, including Dounreay. In June 2015, Dounreay completed the transfer of 11 tonnes of nuclear material to Sellafield. The material, a legacy of the site's fast reactor programme, consisted of rods of natural uranium that had been irradiated to breed new plutonium fuel for power stations. A further 33 tonnes of breeder material remains inside the Dounreay Fast Reactor (DFR). It is also scheduled to be transported to Sellafield and this is due to start in 2017. Additional information on exotic fuels can be found in paragraphs. B.28 to B.35.

Management of Nuclear Materials

Plutonium Disposition

A.42. On completion of reprocessing operations, there will be around 140 tonnes of civil separated plutonium stored safely and securely in the UK. The NDA manages all of the civil separated plutonium in the UK. The vast majority of this material is held at Sellafield, with a relatively small amount currently held at Dounreay arising from historic activities at this site.

A.43. UK government policy (Reference 17) is to provide a solution that puts the vast majority of UK held plutonium beyond reach. Additional information on nuclear materials can be found in paragraphs L.3.4 to L.3.16.

Update on Radioactive Waste Management and Decommissioning

Sellafield

A.44. Sellafield is one of Europe's largest industrial complexes with a large radioactive waste inventory on the site dating back to its earlier missions. Some of the facilities have aged and no longer meet the high standards required for nuclear facilities storage of nuclear material. The possible consequences of a serious accident in these facilities would be extremely damaging for the surrounding Cumbrian region and the rest of the UK, with long-term repercussions potentially extending to Europe. Hazard and risk reduction on this site is, therefore, the top decommissioning priority for the UK.

A.45. Since the fifth national report, there have been a number of areas where good progress has been made in hazard reduction, notably in the following areas:

- Pile Fuel Cladding Silo (PFCS) to start retrievals in 2019;
- First Generation Magnox Fuel Ponds (FGMSP): retrieval of fuel and sludge and treatment of sludge;
- Pile Fuel Storage Pond (PFSP): completion of fuel retrieval and retrieval and encapsulation of sludge; and
- Magnox Swarf Storage Silo (MSSS): new strategy for retrieval and storage, implementation to start in 2019.

A.46. The new Intermediate Level Waste (ILW) strategy for the MSSS has been a success as it allowed the waste retrieval to start early.

A.47. Additional information can be found on the above activities in paragraphs. K.6 to K.14 and in Section L.5 – Lists and Inventories.

Low-Level Waste Repository (LLWR) Environmental Safety Case (ESC)

A.48. LLWR is a licensed nuclear site, owned by NDA and operated under contract by LLW Repository Ltd. (LLWR Ltd.).

A.49. LLWR submitted a fully revised Environmental Safety Case (ESC) in May 2011. Based on this ESC, the LLWR later submitted an application for a revised permit for disposal of LLW. A consultation on the draft decision and a draft environmental permit, in which the Environment Agency proposed to grant the permit, took place from May to July 2015. The varied environmental permit became effective in October 2015.

A.50. LLWR also submitted an application for planning permission to the local waste planning authority, Cumbria County Council, to allow LLW to be stacked higher in Vault 8 and 9 and in three further vaults yet to be constructed. Permission was received in July 2016. Additional information can be found in paragraphs B.84 and B.85.

Developments in Response to the Fukushima Accident

A.51. Since the fifth UK national report, all the actions identified in the Chief Nuclear Inspector's report (Reference 18) and in the European Stress Tests (Reference 19) have been completed. After the publication of the International Atomic Energy Authority (IAEA) Fukushima Report, the ONR assembled a multi-disciplinary team of senior inspectors to review its findings.

A.52. In February 2016, the ONR concluded that it was content that the industry had addressed all the major findings identified in its Fukushima Implementation Report, and that remaining actions would become part of normal regulatory business. Completion of these packages of work have enabled final closure of the European Nuclear Safety Regulators Group (ENSREG) Stress Test findings and the ONR Chief Nuclear Inspectors post Fukushima recommendations that relate to Sellafield Ltd. Additional information can be found in paragraphs K.24 to K.30.

Identified Future Developments

A.53. As noted in paragraph A.7 developments in the safe management of spent fuel and the safe management of radioactive waste are on-going. Future developments which could impact on the means of compliance with the Joint Convention are identified below. The areas that are likely to be affected are identified, although the detailed implications cannot be described until the changes have been completed.

A.54. For this report, the only identified on-going developments are the transposition of the revised European Union's Basic Safety Standards Directive (BSSD 2013) (Reference 20) into UK law, and the UK exit from Euratom.

- Section F - Other General Safety Provisions: Article 24 (Operational radiological protection) and Article 25 (Emergency preparedness); and
- Section J – Disused Sealed Sources (Article 28 – Disused sealed sources).

A.55. The text and means of compliance in this report are based on the current version of the UK (and Devolved Administrations) legislative framework, some of which is based on the current version of the BSSD (BSSD 1996) (Reference 21). Changes induced by the implementation of the BSSD 2013 will be described in the next UK national report.

Section B - Policies and Practices

Article 32.1: In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) Spent fuel management policy;

(ii) Spent fuel management practices;

(iii) Radioactive waste management policy;

(iv) Radioactive waste management practices; and

(v) Criteria used to define and categorise radioactive waste.

B.1. Under this Article, the only significant changes to the United Kingdom's (UK's) means of complying with the Joint Convention since the Fifth UK national report are the following and have been highlighted:

- consolidation of exotic fuels – see paragraphs B.28 to B.32;
- publication of the Welsh Government's policy on the management and disposal of High Activity Waste (HAW) (Reference 12) – see paragraph B.53;
- progress in pursuing the 2014 White Paper "Implementing Geological Disposal" (Reference 7) – see paragraphs B.43 to B.46;
- progress in the Magnox Operating Programme (MOP) and Magnox reactors defueling – see paragraphs B.11 to B.18;
- progress in the Advanced Gas-cooled Reactors (AGR) Operating Programme – see paragraphs B.20 to B.24;
- start of operations of the Dry Fuel Store (DFS) at Sizewell B – see paragraphs B.25 to B.27;
- publication of the Nuclear Decommissioning Authority (NDA) HAW Strategy in May 2016 (Reference 22) – see paragraphs B.54 to B.57;
- proposals to exclude disposal sites for Low-level Waste (LLW) and Very Low-level Waste (VLLW) from the requirements of the Paris-Brussels Convention – see paragraphs B.61 to B.62;
- opening of a new LLW disposal facility at Dounreay – see paragraph B.86; and
- revision of the Low-level Waste Repository permit for waste disposal – see paragraphs B.84 to B.85.

B.2. Other less significant changes include:

- publication of the Scottish Government's HAW Strategy in December 2016 (Reference 8) – see paragraphs B.47 to B.51; and
- publication of the revised "UK Strategy for the Management of Solid LLW from the Nuclear Industry" in February 2016 (Reference 14) – see paragraph B.60.

B.3. The examples demonstrating successes and future challenges are:

- defueling of Magnox reactors – paragraphs B.17 and B.18;

- Dounreay exotic fuel consolidation – paragraphs B.33 to B.35; and
- key progresses in waste disposability assessments – paragraphs B.100 to B.101.

Article 32.1(v) – Criteria Used to Define and Categorise Radioactive Waste

Definition of Radioactive Waste

B.4. Definitions of radioactive waste in UK legislation are specific to the purposes of each piece of legislation. The classification system uses broad categories according to the waste's heat-generating capacity and radioactive content. The definitions of the four categories of waste in the list below can be found in Section L.4 – Radioactive Waste Policies and Practices:

- High-Level Waste (HLW)
- Intermediate-Level Waste (ILW)
- Low-Level Waste (LLW)
- Very-Low-Level Waste (VLLW)

B.5. In the UK, HAW is defined as the collection of HLW, ILW, and the relatively small proportion of LLW that is not currently suitable for disposal in existing LLW disposal facilities (due to some chemical, physical or radiological property that is incompatible with the extant waste acceptance criteria) (Reference 7).

B.6. Spent fuel that is not currently destined for reprocessing and some nuclear materials (separated plutonium and uranium) are not currently classified as waste. If in the future it is decided they have no further use and are declared as wastes, they will need to be managed as waste.

B.7. Further considerations on whether to regulate spent fuel and radioactive materials as radioactive waste are provided in E.139 to E.143 and in Section L.3 – Spent Fuel and Radioactive Materials Policies and Practices (for plutonium and uranics).

Article 32.1(i) – Spent Fuel Management Policy

B.8. In the UK, the question of whether spent fuel (as well as plutonium and uranium) should be reprocessed, or alternative spent fuel management options be adopted, is to be assessed by the owners (which can be different from the operator of the storage facility) of the spent fuel, subject to them meeting all appropriate legal requirements. The UK Government believes that spent fuel should not be categorised as a radioactive waste so long as the option of reprocessing remains open and a practicable future use for the fuel is foreseen. However, the Government is currently not expecting any proposals to reprocess spent fuel from proposed new nuclear power plants in the UK and therefore spent fuel from these power stations will be designated as HAW in due course.

B.9. There are no proposals to build any new facilities to reprocess the spent fuel arising from either existing or new nuclear power plants. The new nuclear power station being built at Hinkley Point C (HPC) is proceeding on the basis that the resulting spent fuel will not be reprocessed. This is also the case for the operating Pressurised Water Reactor at Sizewell B. Plans for handling and storage of spent fuel, and financing of, radioactive waste management in the future are proceeding on this basis. The UK Government concluded that it is technically possible to dispose of new

higher activity radioactive waste in a GDF and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations, including spent nuclear fuel.

B.10. The UK Government's policy is that, before development consents for new nuclear power stations are granted, it will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the fuels and wastes the sites will produce. In 2014, the Government's White Paper 'Implementing Geological Disposal' (Reference 7) confirmed that the current policy remains valid. Disposability at the UK's planned GDF of the radioactive waste and spent fuel expected to arise from the new reactors proposed for sites in England and Wales has been assessed by the NDA; this concluded that, given a disposal site with suitable characteristics, the radioactive waste and spent fuel from new reactors are expected to be disposable at a GDF.

Article 32.1(ii) – Spent Fuel Management Practices

Spent Magnox Fuel and Magnox Operating Programme (MOP)

B.11. As of 1 April 2017, Magnox reactors at Wylfa and Calder Hall are in the process of being defueled whilst all the other nine Magnox stations (22 reactors) have been completely defueled (see Section L.5 – Lists and Inventories). Defueling of both Calder Hall and Wylfa is expected to finish in 2019. Since the last UK report, four reactors have completed the defueling process: Oldbury (two reactors) and Sizewell A (two reactors).

B.12. All the UK's spent Magnox fuel is owned by the NDA. The baseline management strategy is for all this fuel to be reprocessed at Sellafield, as the metallic uranium cladding suffers from corrosion over extended periods of storage. More details on Magnox reprocessing can be found in Section L.3 – Spent Fuel and Radioactive Materials Policies and Practices.

B.13. The MOP is the practical level programme to deliver the Magnox fuel strategy, the latest version of which (MOP9) was published on 13 July 2012 (Reference 23).

B.14. In MOP9, the NDA explicitly recognises the operational and throughput uncertainties associated with Magnox reprocessing due primarily to the age of the plants involved which has led to variable delivery performance. As of March 2017, there will be less than 1,600tU of Magnox fuel to reprocess, which means less than 3% of the total quantity of spent Magnox fuel generated in the UK. Based on a lower bound reprocessing performance of 450tU per year, Magnox fuel reprocessing will complete by December 2020.

B.15. The risks mentioned above, associated with reprocessing of Magnox spent fuel, could hamper the ability of the UK to reprocess all fuels currently scheduled to be reprocessed. In line with the NDA strategy published in 2016 (Reference 15), the NDA is working with its Site Licence Companies (SLCs) on alternative options to treat these fuels, so that any remaining fuel can be safely and cost-effectively managed.

B.16. Due to associated radioactive discharges to the marine environment, the conclusion of Magnox Reprocessing is a consideration within the UK Strategy for Radioactive Discharges and the OSPAR Convention. The Treaty requires discharges of radioactive substances to the North East Atlantic to be subject to progressive and substantial reduction, such that by 2020, additional concentrations of radioactive substances in the marine environment resulting from such discharges are close to zero, in comparison to historical levels. The UK's approach to reducing radioactive discharges to the environment is further discussed in paragraphs F.128 to F.134.

Figure 1: Magnox Reprocessing Plant at Sellafield

Defueling of Magnox Reactors

B.17. The position of the Magnox power stations whose spent fuel management status has changed since the previous UK Joint Convention report is as follows:

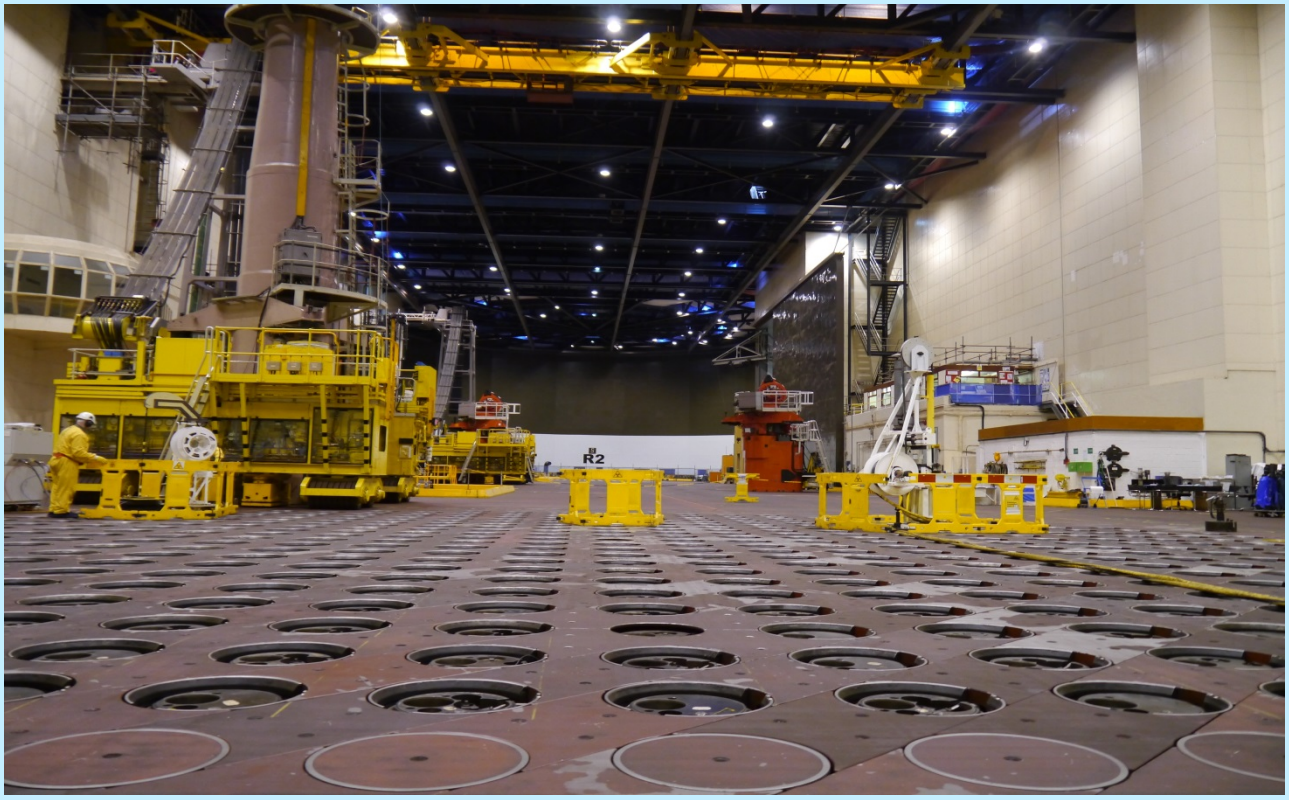
- Calder Hall (four Magnox Reactors) - Approximately 55% of the fuel has been removed from the station and Reactors 1 and 4 are completely defueled. Completion of defueling on all four reactors is anticipated around June 2019.
- Oldbury (two Magnox Reactors) - Removal of all fuel from the reactors was completed in January 2016.
- Sizewell A (two Magnox Reactors) - Removal of all fuel from the reactors was completed in August 2014.
- Wylfa (two Magnox Reactors) - Wylfa Reactor 2 ceased its operational phase in April 2012; Reactor 1 continued to operate until December 2015. Station defueling has commenced and 35% of fuel was removed from site by April 2017. Defueling at Wylfa is scheduled to be completed by July 2019.

B.18. This leaves only four reactors with fuel remaining in them – two at Wylfa and two at Calder Hall and 22 of the 26 UK Magnox reactors free of fuel. The fuel removed from the other reactors has been sent to Sellafield for reprocessing.

B.19. Originally Wylfa was due to shut down in 2010 but, through innovative methods, continued to generate for an additional five years. This was made possible by a method of moving partly

used fuel from one reactor to the other – the manufacture of Magnox fuel having ceased in 2008. The Inter-Reactor Fuel Transfer or IRX process required approval from the regulators and aimed to optimise fuel usage between the two reactors at Wylfa.

Figure 2: Wylfa Inter-Reactor Exchange Facility



Spent AGR Fuels and the AGR Operating Plan (AGROP)

B.20. Spent AGR fuel is initially buffer dry-stored, and then placed under water in the power station's cooling pond for a period of at least 100 days. The spent fuel is then transported to Sellafield. AGR fuels do not suffer from the same level of degradation during storage as Magnox fuel, allowing for a broader range of management options to be implemented.

B.21. Electricité de France (EDF) Energy has contracts in place for the potential reprocessing of approximately 5,500te of its spent AGR fuel at Sellafield (see Figure 3). Rather than being reprocessed, spent AGR fuel in excess of this contracted quantity will be stored underwater in the Thermal Oxide Reprocessing Plant (THORP) Receipt and Storage Ponds in the near-term. The THORP Receipt and Storage Ponds (see Figure 4) are expected to store between 5,500te and 6,000te of spent AGR fuel. The historic Fuel Contracts cover the period to 2086; activities beyond this contracted period will be the responsibility of EDF Energy.

B.22. The NDA aims to finish reprocessing of oxide fuels in THORP in 2018. The remaining and future arisings of AGR spent fuel will be placed into interim storage pending a future decision on whether to declare them as waste - see paragraphs E.139 to E.143, for disposal in a GDF.

B.23. Following a review in 2015, the AGR Operating Programme (AGROP), sponsored by BEIS, was reformed and relaunched in April 2016 to develop an integrated, collaborative delivery programme covering the activities of all delivery partners (Sellafield, Direct Rail Services (DRS),

EDF Energy, the NDA, and International Nuclear Services (INS)). The AGROP is based on the following lessons learnt from the MOP:

- end-to-end defueling optimisation is required to offer best value for money for the Nuclear Liabilities Fund (NLF)/UK taxpayer;
- an early start is beneficial, recognising the Ltd. timescales before end-of-generation to implement any plant changes or improvement works;
- collaborative behaviours are key to the integrated outcome that is desired;
- the programme should recognise other strategic drivers of the delivery partners; and
- the programme should develop plans to build resilience to a range of scenarios.

B.24. The AGROP will seek balance between the following objectives:

- reduce hazards through the safe management, reprocessing, storage and disposal of the spent AGR fuel;
- reduce the exposure to the UK taxpayer through the effective management of specific Nuclear Liabilities funded through the NLF, specifically AGR defueling; and
- maximise the economic benefit for the UK through the generation of low carbon electricity to meet the needs of the UK population.

Figure 3: AGR Fuel Reception at the Fuel Handling Plant

Figure 4: The Fuel Storage Ponds in THORP

Sizewell B Spent PWR Fuel

B.25. In the UK, spent civil PWR fuel arises only from the Sizewell B power station, which has been operational since 1995. Following discharge from the reactor core, the spent fuel is initially stored at Sizewell B in a water-filled storage pond. The pond was constructed with sufficient capacity to store the spent fuel from station operations up to 2015. For accounting purposes, Sizewell B has an expected operational lifetime of 40 years and an assumed closure date of 2035.

B.26. To address the potential shortfall in spent fuel storage capacity, EDF Energy has constructed and commissioned in early 2017 an Independent Spent Fuel Storage Installation (ISFSI) or Dry Fuel Store (DFS) on the Sizewell B licensed site. The store is designed to accommodate all the spent fuel arising from site operations. The estimated total spent fuel arising from 40 years' operation at Sizewell B is 1,049t of uranium. EDF Energy's intention is to switch all the station's spent fuel to dry storage by 2040.

B.27. The DFS also secures the capacity to support an extension of the life of Sizewell B to approximately 2055, subject to the normal plant lifetime extension processes including regulatory permissions. Following the end-of-generation at Sizewell B, the DFS is planned to operate until fuel is retrieved commencing circa 2080, and transported over a 20-year period to the planned GDF. Detailed information on the regulation of the ISFSI is provided in paragraphs E.52 to E.57.

Exotic Fuels

B.28. The NDA's exotic fuels inventory is a legacy inherited from earlier nuclear industry activities such as the development of research, experimental and prototype fuels and reactors in the 1960s and 1970s. These fuels include metallic, oxide and carbide materials. The NDA has taken a series of decisions to transfer all of the exotic fuels to Sellafield for management.

B.29. The NDA has decided to reprocess specific exotic fuels, including Steam-Generating Heavy Water Reactor (SGHWR) and Dounreay Fast Reactor (DFR) fuel, alongside bulk fuels which have common characteristics.

B.30. Some exotic fuels are not suitable for reprocessing in the current facilities. These fuels will continue to be safely and securely stored pending development of final disposition options. For example, the NDA has decided to store mixed oxide fuels from the Prototype Fast Reactor (PFR, Dounreay) alongside AGR fuel. In the event that not all of DFR fuel can be reprocessed alongside Magnox fuel, the NDA will develop an alternative option for the DFR material so that it can be managed at Sellafield

B.31. For the DRAGON reactor fuel, the NDA has chosen to encapsulate the fuel to simplify the approach to its storage pending disposal.

B.32. Details on the current work undertaken to deal with Dounreay's exotic fuel are provided below.

Dounreay Exotic Fuel Consolidation

B.33. Known as "breeder", 11 tonnes of the material was removed from the DFR after its closure in 1977 and stored at the site. In 2011, after canvassing the views of the public on the options, the decision was taken by the NDA to remove it from Dounreay. In December 2012, the first of 32 shipments left the site by road and rail. The final shipment arrived in Sellafield in June 2015, where it is being reprocessed. Extensive inspections and assessments are carried out before, during, and after each move confirmed the transport was carried out without incident and in compliance with safety, security and transport regulations.

B.34. A further 33 tonnes of breeder material remains inside the DFR and is also scheduled to be transported to Sellafield. Purpose-built retrieval equipment has been installed above the reactor; shipments of all of the remaining material to Sellafield has commenced.

B.35. Over a third of the unirradiated fuel and other types of nuclear fuel and material that had accumulated at the site when its research and development role came to an end in 1994 has been transferred to Sellafield as part of a programme of shipment that began in November 2015. The NDA's decision to remove its nuclear fuel and material from Dounreay has resulted in a rescheduling of some other decommissioning work to accommodate the additional costs associated with transport, with 2030-2033 now projected for completion of the site clean-up and interim end-state.

Other Spent Fuels

B.36. The NDA continues to receive and store at Sellafield spent fuels from nuclear-powered submarine reactor cores on behalf of the Ministry of Defence until the strategy for their long-term management and disposition is decided.

B.37. The NDA has also received fuel from the CONSORT research reactor at Imperial College and is continuing to store this fuel alongside other materials with similar properties.

Article 32.1(iii) – Radioactive Waste Management Policy

B.38. The following is a summary of the key points of the UK policy for the management of radioactive wastes.

General Radioactive Waste Management Policy

B.39. The UK Government's policy towards the management of radioactive wastes has the same basic principles as apply more generally to environmental policy and, in particular, sustainable development (Reference 24). More specifically, radioactive wastes should be managed in a manner that protects the public, workforce and environment.

B.40. Within this approach, the UK Government continues to develop further policies and a regulatory framework which ensure that:

- radioactive wastes are not unnecessarily created, in accordance with the waste hierarchy;
- the radioactive wastes that are created are safely and appropriately managed, and
- treated radioactive wastes are safely disposed of at appropriate times in appropriate ways.

B.41. Within that framework, the producers and owners of radioactive waste are responsible for developing their own strategies for the radioactive wastes they create, ensuring that:

- nuclear operators do not create waste management problems which cannot be resolved using current techniques, or techniques which could be derived from current lines of development;
- where it is practical and cost-effective to do so, nuclear operators characterise and segregate radioactive wastes on the basis of physical and chemical properties, and store it in accordance with the principles of passive safety; and
- nuclear operators undertake strategic planning, including the development of programmes for the disposal of waste accumulated at their sites within an appropriate timescale, including wastes from the decommissioning of redundant plants and facilities.

B.42. The producers and owners of radioactive waste in the UK are responsible for bearing the cost of managing and disposing of the wastes their activities generate (see paragraphs F.37 to F.49).

UK Government Policy on Higher-Activity Waste (HAW)

B.43. The UK Government reiterated in the 2014 White Paper 'Implementing Geological Disposal' that it favours an approach based on voluntarism and partnership for identifying a suitable site for a GDF. It identified initial actions to be led by the UK Government and the intended developed Radioactive Waste Management Ltd. (RWM), a wholly owned subsidiary of the NDA. These initial actions include:

- A national geological screening exercise: this considered what level of information is already available about geology across the country, how this can usefully be related to the safety case for a GDF and how this can help the developer engage openly with interested communities. National geological screening guidance and detailed technical instructions

were published in April 2016;

- Land-use planning: this involved bringing GDFs and boreholes that support their development in England within the definition of a 'Nationally Significant Infrastructure Project' in the Planning Act 2008 (Reference 25). This was achieved in March 2015 through Infrastructure Planning (Radioactive Waste Geological Disposal Facilities) Order 2015 (Reference 26).
- Working with communities: this aims to develop the processes for working with communities including community representation, the test of public support, details of community investment, and a means of obtaining independent views. A Community Representation Working Group (CRWG) has been convened to bring together experts and stakeholders to inform policy development.

B.44. A more detailed description of this White Paper and of the events leading to its publication can be found in Section L.4 – Radioactive Waste Policies and Practices.

B.45. The UK Government will continue to progress the 'initial actions' with a view to launching the revised siting process once they are complete. This is when formal discussions between interested communities and RWM can commence

B.46. Development of a GDF is clearly an important part of the long-term strategy for managing HAW in England and Wales. Interim storage provides a temporary, safe and secure environment for HAW until a GDF is available but it is not a permanent solution. Details on the regulation of a GDF can be found in paragraphs E.35 to E.38

Scottish Government HAW Policy

B.47. The Scottish Government is not a sponsor of the current 2014 White Paper "Implementing Geological Disposal", but remains committed to the responsible management of the radioactive wastes arising in Scotland. It published its own policy on the long-term management of HAW in January 2011 (Reference 9), based on management in near-surface facilities, based on the following key points:

- long-term management of HAW should take place in near-surface facilities;
- these facilities should be located as near as possible to the site where the waste was produced (the proximity principle); and
- developers will need to demonstrate how the facilities will be monitored and how waste packages, or waste, could be retrieved.

B.48. The Scottish Government published its Policy Statement and Post-Adoption Strategic Environmental Assessment Statement for HAW in January 2011, based on the long-term management of HAW in near-surface facilities

B.49. The Scottish HAW Policy does not include HLW, due to there being no HLW accumulated in Scotland, nor does it cover spent fuels or nuclear materials that are not presently classified as waste, all of these will be transferred to Sellafield as described in paragraphs B.28 to B.35.

B.50. In December 2016, the Scottish Government published an implementation strategy to support and expand on the framework set out in the 2011 policy (Reference 8).

B.51. The Scottish Government supports the Committee on Radioactive Waste Management's (CoRWM) recommendations for a robust programme of interim storage of HAW, endorses the UK-

wide LLW policy published in March 2007 (Reference 27) and supports associated research and development.

Welsh Government Policy on Higher-Activity Waste

B.52. Previously, the Welsh Government had reserved its position on geological disposal for HAW in Wales. However, it has continued to play an active part in the Managing Radioactive Waste Safely programme (described in the previous UK national report) to ensure that the interests of the people of Wales were recognised in the process.

B.53. In 2014, the Welsh Government issued a call for evidence seeking views on whether or not it should review its policy (Reference 11). After a review of the responses to the call for evidence and subsequent public consultation, the Welsh Government issued its new policy on the management and disposal of HAW in Wales in May 2015 (Reference 12) based on the principle of voluntary participation by potential host communities, similar to that of England.

New High Activity Waste Strategy

B.54. The UK policy for the long-term management of HAW recognises that it is appropriate to investigate alternative options to a GDF for some of the inventory where there could be the potential to improve the overall management of HAW. To support this policy position, the NDA published its HAW strategy in May 2016 (Reference 22). The overall aim is to convert the HAW inventory into a form that can be safely and securely stored for many decades. At the appropriate time, the stored waste in England and Wales will be transported to and disposed of in a GDF and the NDA will continue to work with Scottish government to implement its policy for the long-term management of HAW at its sites in Scotland. The NDA recognises that there are well established plans in place for the management of HAW across the estate and the HAW strategy is to progress these plans (the 'reference strategy') while at the same time seeking to:

- identify and promote good practice;
- give guidance and leadership in key strategic areas; and
- pursue opportunities to make overall improvements.

B.55. The HAW strategy aims to foster the benefits of improved efficiency for the management of HAW across the NDA estate while supporting the technical challenges in implementing the reference strategy. The strategic themes can be broadly described as:

- application of the waste hierarchy;
- development of alternative waste management routes (incl. credible options for the disposal of some HAW in the near-surface environment); and
- making the best use of existing and future planned assets.

B.56. As a result, the NDA will explore a range of disposal options together with its subsidiary RWM and its SLCs (see Section L.1 – Legislative and Regulatory System for further details on roles and responsibilities for HAW policy implementation and NDA structure).

B.57. To support the strategy, the NDA has also launched Integrated Project Teams to coordinate and support a range of thermal treatment and other initiatives to deal with problematic waste streams to enable technology transfer to the industry (the scope of the Project Teams is not Ltd. to HAW and covers all the categories of radioactive waste in an integrated manner).

Reversibility and Retrievability

B.58. Reversibility of waste emplacement and retrievability of waste from a GDF are matters of UK Government policy. The current position is that the purpose of a GDF is to dispose of waste, not to store it but that during the operational phase of the facility, waste could be retrieved if there were a compelling reason to do so (Reference 7). Permanently closing a GDF at the earliest possible opportunity once operations have ceased provides for greater safety, greater security, and minimises the burden on future generations.

Policy for the Management of Low-Level Waste

B.59. The 'Policy for the Long-Term Management of Solid Low-level Radioactive Waste in the United Kingdom' (Reference 27) was issued in 2007 to address an impending shortfall in LLW disposal capacity, arising as a result of decommissioning of nuclear facilities and Ltd. capacity of the LLWR. It also introduced a risk-based approach to the use of a range of potential alternative disposal options. The policy outlined the following priorities for managing solid LLW:

- allowing greater flexibility in managing the wide range of LLW that already exists and will arise in the future;
- maintaining a focus on safety, with arrangements supported by the independent UK regulators;
- seeking to minimise the amount of LLW created through avoiding generation, minimising the amount of radioactive substances used, recycling and reusing, before looking at disposal options; and
- the requirement to publish three strategy documents: for solid LLW from the nuclear industry (Reference 14), from the non-nuclear industry (Reference 28) and for wastes contaminated with Naturally Occurring Radioactive Materials (NORM) (Reference 29).

Updated Low-level Waste Strategy

B.60. When the UK Strategy for the Management of Solid Low-level Radioactive Waste from the Nuclear Industry was published in 2010, a five-yearly review cycle was identified. As a result, the NDA led the review of the strategy in 2015/16 on behalf of the UK Government and the devolved administrations; the revised strategy document was published by the UK Government in February 2016 (Reference 14). The main elements of the strategy remain unchanged, although the revised document reflects the significant changes that have occurred in the LLW management environment since the publication of the original strategy and have been reflected in the LLW management practices.

Proposals to Exclude Disposals Sites for LLW and VLLW from the Requirements of the Paris-Brussels Convention

B.61. The UK is in the process of implementing changes to the Paris and Brussels Conventions on nuclear third-party liability (which governs the payment of compensation for damage caused by nuclear incidents) into UK law, in particular the Nuclear Installations Act 1965 (NIA65). The revised Paris Convention imposes a liability regime on installations for the disposal of nuclear substances, including landfill sites that accept LLW and VLLW, in their pre-closure and post-closure phases and requires insurance or other approved financial security to cover third party

liability.

B.62. The UK Government considers this liability regime should not apply to such landfill facilities, on the basis that those sites do not present a sufficient level of risk to warrant compliance with the requirements of the Paris regime. The UK Government therefore made proposals to the Organisation for Economic Co-operation and Development Nuclear Energy Agency (OECD NEA) Nuclear Law Committee, seeking exclusion under Article 1(b) of the Paris Convention from the special liability regime for this type of site. The OECD Steering Committee for Nuclear Energy adopted the exclusion decision and recommendation in November 2016 (Reference 30) which gives Contracting Parties the option to exclude such sites, provided certain criteria are met. Exclusion from the Paris regime would not affect the regulation of the landfill facilities and any person suffering damage as a result of an incident at such facilities would be able to claim compensation under ordinary civil law.

Policy on Management of the Radioactive Wastes that arise from Decommissioning

B.63. Government policy on the decommissioning of nuclear facilities is set out in the 2004 statement issued by the UK Government and the devolved administrations (Reference 31) and in the Energy Act 2004 (Reference 32), which also created the NDA. Key points of the policy are noted below.

Objective of Decommissioning

B.64. The key objective of decommissioning is to progressively reduce the hazard that a redundant facility poses. Decommissioning should be carried out as soon as reasonably practicable following the cessation of a plant's operational life, taking all relevant factors into account.

Decommissioning Strategies

B.65. Each UK nuclear operator is required to produce and maintain a decommissioning strategy and plan for each site it is responsible for. Such strategies and plans should take into account the views of stakeholders (including relevant local authorities and the public as well as national bodies). In developing a strategy, a nuclear operator should consider relevant factors such as worker and public safety, the environment, technical, social and economic factors, presenting them in a transparent way and demonstrating in an objective way how each has been reflected in the adopted approach. In this manner strategies are developed with robust underpinning and are based upon a consideration of all relevant factors. Such an approach may propose a short-term increase in risk as a means to achieve lasting and prompt reduction of overall risk.

B.66. The future intended use of the site is a significant factor in determining the scope, and in particular, defining the end state to which the decommissioning mission is aiming for.

B.67. Decommissioning strategies may look to harness the general benefits of radioactive decay but will also need to demonstrate that other factors such as plant and facility ageing during that process are also considered. They should seek to avoid the creation of radioactive wastes in forms that may reduce the number of options for safe and effective long-term waste management.

B.68. Some decommissioning tasks can lead to a need for short-term increases in discharges of some radionuclides to the environment. In such circumstances, the site operator will need to demonstrate to the relevant environmental regulator that the adopted strategy represents an optimal approach and reflects the application of the Best Available Technique (BAT) principle to ensure public doses are kept As Low As Reasonably Achievable (ALARA).

B.69. Operators are required to review their strategies periodically to ensure they are up to date, reflect the latest thinking on decommissioning approaches and respond to any significant change in circumstances. An up-to-date decommissioning strategy is an established regulatory expectation of a robust Periodic Review of Safety.

B.70. The operators of sites owned by the NDA are required through their contracts with the NDA to produce and maintain detailed plans to a prescribed format that covers the whole site lifecycle, including decommissioning. These plans are reviewed regularly and summaries of the extant plans are made available on the NDA's website.

B.71. It is an established expectation of the Office for Nuclear Regulation's (ONR) Safety Assessment Principles (SAPs) and the Environment Agency's Radioactive Substances Regulation Environmental Principles (REPs) that the design of new nuclear facilities should take account of the need to decommission the plant safely, securely and with respect for the environment at the end of its operational life and dispose of the wastes that arise.

B.72. Aspects of policy related to the financial provisions for decommissioning and the management of waste arising from such activities are described in paragraphs F.37 to F.49.

Article 32.1(iv) – Radioactive Waste Management Practices

B.73. Since the last report, a number of more efficient waste management practices have been implemented, including the more effective use of Low-level Waste Repository Ltd. (LLWR Ltd.) through diversion practices to make best use of alternative treatment and disposal routes. In addition, a more regional approach to ILW storage has been implemented on several sites. This allows for other licensed sites to move waste into these stores, making better use of existing or future planned facilities. This approach requires careful stakeholder engagement by all interested organisations.

Very Low-Level Waste

B.74. VLLW covers wastes with very low concentrations of radioactivity, the policy on which remains unchanged since the last report. Low-volume VLLW can be safely disposed of to unspecified destinations under exemption provisions and high-volume VLLW to specified landfill sites. Controls on disposal of high volume VLLW, after removal from the premises at which it originates, will be necessary in a manner specified by the environmental regulators. The 2016 UK Radioactive Waste Inventory (UK RWI) indicates that at 1 April 2016 the volume of VLLW in stock was about 935 m^3, of which 728 m^3 was held at the Harwell site. All VLLW is in interim storage awaiting disposal to landfill.

Low-Level Waste (LLW)

B.75. The 'UK Strategy for the Management of Solid Low-level Radioactive Waste from the Nuclear Industry' provides a high-level framework which guides LLW management decision makers to work flexibly to ensure safe, environmentally acceptable and cost-effective management solutions.

B.76. Central to the UK LLW strategy is the implementation of the waste hierarchy in the management of LLW, which supports the provision of continued capability and capacity for managing LLW in the UK. Three strategic themes have been particularly successful in driving implementation of the strategy:

- application of the waste hierarchy;
- best use of existing LLW management assets; and
- development of new fit-for-purpose waste management routes.

B.77. The UK Government has encouraged all those who generate radioactive wastes to use a broader range of options for managing LLW, rather than focusing wholly on disposal.

B.78. The UK's only national disposal facility for LLW is the LLWR (operated by LLWR Ltd.). Today, waste disposed of at LLWR is placed in metallic Intermodal Shipping Containers (ISO). Any voidage inside the containers is minimised by filling with grout at LLWR and the containers are then placed in engineered concrete-lined near-surface vaults. At 1 April 2017, the containers occupied 227,650 m^3 of vault space (compared to the 2013 UK Radioactive Waste Inventory (RWI), the granting of the revised permit in November 2015 and the planning permission in July 2016 enabled the containers in both Vaults 8 and 9 to be classed as disposed). Consignments to the LLWR over the past ten years have totalled about 67,170m^3.

B.79. LLWR Ltd. also offers a broad range of waste management services either directly or via framework agreements which include:

- metallic waste treatment;
- combustible waste treatment;
- super-compaction;
- VLLW disposal;
- packaging processes;
- waste characterisation service;
- transport service;
- alternate treatment service;
- expert support service; and
- LLW disposal.

B.80. The provision of these services has enabled the diversion of 88% of the LLW/VLLW arisings away from the LLWR during 2016/17 (approximately 13,500 m^3), and has also been successfully used to manage problematic materials such as alpha contaminated oils.

B.81. The 2016 UKRWI indicated that at 1 April 2016 the volume of un-disposed LLW accumulated across the UK was about 30,100m^3. The majority of this is in temporary storage waiting either recycling or disposal.

B.82. Other wastes were being held for characterisation, processing and/or repackaging, before decisions are taken on whether the wastes need to be consigned to the LLWR. Once consigned these wastes may be stored at the LLWR awaiting future disposal in Vault 9, or may undergo treatment by specialist providers engaged via LLWR Limited's framework agreements.

B.83. A small fraction of LLW is unsuitable for consignment to the LLWR or disposal to landfill because the wastes do not meet the LLWR's extant acceptance criteria, which incorporate limits on non-radiological properties in addition to radiological properties. Some of these wastes are oils that may be incinerated. Some will require the development of new treatment techniques in order to meet the LLWR acceptance criteria or as a last resort will need to be managed as HAW.

LLWR Environmental Safety Case (ESC) and Permit

B.84. In accordance with a condition in its environmental permit, LLWR Ltd. provided the Environment Agency (EA) with an updated Environmental Safety Case (ESC) in 2011. Between May 2011 and October 2013, the EA undertook a detailed technical review of the ESC.

B.85. By October 2013, the EA was content that LLWR Ltd. had adequately addressed all of their additional information requirements, such that it had sufficient information to conclude its review and support a permit decision. On that basis LLWR Ltd. subsequently submitted an application to vary its permit to allow continued disposals of LLW at the repository. A consultation on the draft decision and a draft environmental permit, in which the EA proposed to grant the permit, took place from May to July 2015. The varied environmental permit became effective in October 2015. In July 2016 LLWR Ltd. received planning permission from Cumbria County Council for the development of two new vaults at the LLWR along with an extension to a third vault. It also permitted the construction of a final cap over existing and new vaults, and seven landfill-style trenches where waste was disposed of prior to the use of engineered vaults. The picture below shows Vault 9 under construction at the LLWR.

Figure 5: Construction of Vault 9 at LLWR

Dounreay LLW Disposal Facility

B.86. At Dounreay, LLW is disposed of in a new LLW disposal facility, which started receiving waste in April 2015. Planning permission from the Highland Council allows for disposal of LLW that originates either from the Dounreay site or from the adjacent Vulcan authorised defence site previously used to test PWR reactors used in nuclear-powered submarines. The LLW disposal facility is located adjacent to and off the licensed Dounreay site and currently comprises two vaults: a “low-level waste vault” and a “demolition low-level waste vault” to accommodate waste

accumulated on the site arising from previous operations and from decommissioning operations. Similar to LLWR, waste is packed into ISO containers and then encapsulated in grout. Future vaults will be developed as required. Currently there is permission for up to a total of six vaults. However, Dounreay Site Restoration Ltd. (DSRL) will review requirements as the decommissioning programme develops. To enable it to grant a disposal authorisation, the Scottish Environment Protection Agency (SEPA) assessed the ESC for the Dounreay LLW disposal facility using dedicated guidance (Reference 33). The picture below shows this facility at Dounreay.

Figure 6: The Dounreay LLW Disposal Facility

Metal LLW Recycling

B.87. Through LLWR Ltd.'s commercial frameworks or direct contracts with other nuclear licensed sites, the Cyclife Metal Recycling Facility (MRF), in Lillyhall, West Cumbria, manages metallic LLW in accordance with the requirements of the waste hierarchy, using size reduction and shot blasting to reduce the volume of waste and recover valuable metals. In 2016, this facility was purchased from Studsvik by Cyclife (part of the EDF Group) which also obtained the melting facility in Nyköping, Sweden. Cyclife in the UK also arranges transfrontier shipments of metal wastes to its Swedish melting facility.

B.88. Tradebe Inutec offers producers of LLW a range of sorting and segregation services in the UK for metallic and combustible waste in its facility situated on the licensed site at Winfrith. Tradebe is currently a tenant and has applied to the ONR for a nuclear site licence in its own right. Tradebe can also arrange transfrontier shipments of compatible metallic wastes to the smelter at Siempelkamp in Germany and the Energy Solutions Bear Creek facility in the United States of America (USA).

B.89. LLWR Ltd. has additional framework agreements for the treatment of metallic wastes with Doosan Babcock for large item size reduction at its facility in the UK.

Combustible LLW Treatment

B.90. Within the UK, incineration is a mature waste treatment technology and has been permitted for many years for treating suitable LLW. The process typically reduces waste volumes by up to 98% by burning combustible solid and liquid wastes, breaking down the reactive compounds and organics to create a stable homogeneous waste form (ash) for disposal.

B.91. Several commercial incinerators are presently permitted by the environment agencies and are available to the UK nuclear industry, as well as a facility in Sweden and another in the USA. These facilities have significant differences in the quantity, type of radioactivity and physical nature of the waste that they can accept. They are available to waste generators through LLWR Ltd.'s commercial frameworks or by using direct contracts.

Intermediate-Level Waste

B.92. ILW currently arises from a range of facilities and activities in the UK, including reprocessing of spent fuel, operations and maintenance of radioactive plant, and decommissioning. An additional historical legacy of ILW that arose from the 1950s onwards is stored, pending retrieval and conditioning into a disposable form. The major components of current arisings of ILW are metals and organic materials, with smaller quantities of concrete, graphite, glass and ceramics. As more facilities enter the decommissioning phase, the quantities of metal, concrete and graphite will increase. Until a long-term HAW management solution is available, ILW is typically conditioned into a passively-safe form and stored in interim stores, potentially for several decades. Sellafield holds by far the single largest inventory of ILW in the UK. The NDA has been successful in facilitating the consolidation of some of the ILW from sites across its estate into a smaller number of locations.

B.93. The concept of passive safety is intended to secure a long-term reduction in risks without the need for complex safety systems (administrative and engineered), whilst also avoiding the detrimental consequences of repackaging. Waste conditioning is therefore carried out, as far as practicable, in ways that anticipate the requirements for future long-term management, such as disposal at a GDF. Current arisings from reprocessing of spent fuel are conditioned promptly prior to interim storage.

B.94. There is a pressing need to retrieve wastes from a number of the UK's legacy waste management facilities at Sellafield and this is highlighted within the NDA's Strategy. The NDA recognises that to deliver the overall reduction in risk and hazard that is core to its mission they may need to accept short-term increases in risk whilst quiescent states are disrupted during retrieval. Where there are initial overriding safety concerns, a progressive risk and hazard reduction strategic solution of waste retrievals and raw waste containerisation can be employed, with final conditioning and packaging for disposal being deferred until a later date.

B.95. A summary of the 2016 UK RWI is provided below. Detail on the inventory of ILW is reported in Section L.5 – Lists and Inventories. All this waste is stored and conditioned on sites licensed under NIA65.

Table 1: Summary of the 2016 UK RWI for ILW

	2013	2016
ILW in stock (m^3)	95,000	99,000
Treated (m^3)	28,100	31,200

Radioactive Waste Management Cases (RWMCs) and Letters of Compliance (LoC)

B.96. Guidance for the management of HAW that was issued jointly by the UK regulators advises licensees to produce RWMCs to cover every significant waste type found on its site (Reference 34). These should demonstrate how short-term and longer-term safety and environmental issues associated with the waste are addressed to demonstrate overall optimisation of radiological protection. The RWMC should also provide a reasoned judgement on whether the proposed waste form will meet the anticipated conditions for acceptance of the operator of the intended disposal site.

B.97. The UK regulators recognise NDA's RWM as the appropriate body to advise licensees on the packaging and conditioning of HAW that is destined for the planned GDF. RWM provides this advice through its Disposability Assessment process (also known as the Letter of Compliance (LoC) process). In undertaking its assessment, RWM assesses waste packaging proposals against safety, environmental and security assessments for transportation and geological disposal.

B.98. The outcome of an RWM disposability assessment is a report on the disposability of the waste, which the licensee can use in support of its RWMC. Where the proposed arrangements for waste packaging are found to meet the geological disposal packaging requirements, RWM will issue a Letter of Compliance.

B.99. The assessment of the adequacy of waste packaging and storage arrangements for Scottish HAW will also be based around the RWM LoC process, as it is assumed that waste packages conditioned in anticipation of geological disposal are also suitable for long-term management in near-surface facilities, as envisaged for Scottish HAW. The ONR and SEPA have carried out a joint assessment which concluded that RWM disposability assessment and packaging advice is suitable for Scottish HAW (Reference 35).

Key Progresses in Waste Disposability Assessments

B.100. Several Final stage Letters of Compliance (fLoC) have been issued by RWM since the last UK report, which have been key to enable the continuation of high priority decommissioning activities. In particular, fLoCs have been issued to:

- Magnox Ltd. for:
  - the packaging of Ion Exchange materials in 500 litre robust shielded drums originating from Bradwell and Dungeness A;
  - the packaging of Miscellaneous Intermediate Level Wastes in 500 litre robust shielded drums arising from fuel pond clean-up operations at Bradwell; and
  - the encapsulation of wastes arising from decommissioning activities at Hunterston A and Trawsfynydd in 3 m^3 boxes and drums.

- Sellafield for:
  - the packaging of Pile Fuel Storage Pond sludges at the existing Wastes Encapsulation Plant in support of high hazard risk reduction from the legacy fuel pond; and
  - packaging of 100% Rotary Skip Wash Debris through the Magnox Encapsulation plant in support of improved operation of the Sellafield Fuel Handling Plant;
  - In addition, a fLoC has also been provided for the packaging of Dragon fuel at the Sellafield Magnox Encapsulation Plant. The transfer of the Dragon fuel from Harwell Nuclear site to Sellafield will be a key enabler to the de-licencing of the Harwell site.

B.101. In addition, the NDA has made significant progress in the area of disposability records. It has established an estate wide programme for the improvement of package disposability records, and, through RWM, clarified waste packaging requirements. This programme is a key risk mitigation activity to future package disposability and ensures that all key information associated with the manufacture of the waste form and the waste package have been identified and secured for transfer to the national archive.

High-Level Waste

B.102. HLW is heat-generating waste that has accumulated since the early 1950s at Sellafield as a by-product of reprocessing of spent nuclear fuel. HLW is concentrated and stored in engineered containment prior to undergoing a process of vitrification to make it physically stable. Vitrification involves the encapsulation of HLW in liquid glass, which is poured into high-integrity stainless steel containers to undergo cooling and solidification. The vitrified HLW is then stored in environmentally controlled, safe and secure conditions, pending either return to the country of origin or the availability of long-term management arrangements in the UK. Current government policy is that the UK's vitrified HLW should be stored for at least 50 years to benefit from radioactive decay and to simplify the subsequent long-term management steps.

B.103. A summary of the 2016 UK RWI is provided below. Detail on the inventory of ILW is reported in Section L.5 – Lists and Inventories. All this waste is stored and conditioned on licensed nuclear sites.

Table 2: Summary of the 2016 UK RWI for HLW

	2013	2016
HLW in storage (m^3)	1,770	1,960
Fluid form (m^3)	931	1,100
Vitrified (m^3)	844	867

B.104. The Store Operations Forum (SOF) is designed to feed into and drive strategy development through shared learning concerning the storage of containerized HAW across the UK prior to disposal. It brings together NDA strategic leads, RWM, waste producers and store operators.

B.105. The Industry Guidance on the Interim Storage of HAW (Reference 36) was updated in January 2017 to reflect a number of improvements which had been identified through engagement with the industry, represented through the SOF and following an invited review by International Atomic Authority (IAEA).

It seeks to:

- cover the main technical issues currently identified from interim storage of packaged HAW;
- be practicable;
- widen the scope to more waste package types (e.g. stainless steel, mild steel etc.); and
- clarify the management approach to decay storage.

Management of Overseas Origin Fuels Held in the UK

B.106. In 2010, the UK carried out the first shipments to return vitrified HLW by-products from reprocessing of spent fuels to overseas clients. Such shipments are now routine and are detailed below.

B.107. In 2005, after the NDA took over the UK's civil nuclear liabilities it inherited, from British Nuclear Fuels Ltd. (BNFL) and the United Kingdom Atomic Energy Authority (UKAEA), a range of historical reprocessing contracts with overseas customers which then came under the NDA's responsibility. The contracts mainly concern reprocessing through THORP at Sellafield as well as reprocessing of small amounts of fuel at Dounreay. The fuels at Dounreay were originally intended to be reprocessed but that did not take place before that site's reprocessing facilities were closed in July 2001.

B.108. Directions provided to the NDA under the Energy Act 2004 committed NDA to complete the THORP reprocessing contracts with any change or variation requiring approval from the Secretary of State. The majority of this fuel is suitable for reprocessing in THORP before the plant closes in 2018. However, a small tonnage of fuel, comprising non-standard spent fuel, cannot be reprocessed by this date.

B.109. The 2014 Government policy (Reference 37) requires the NDA to prepare business cases to support recommendations to store, at Sellafield, fuel from THORP and Dounreay contracts where it is not technically feasible or economic to reprocess. The fuels will be managed alongside bulk fuel which is already destined for interim storage pending disposal. In addition, to avoid the UK becoming a net importer of nuclear waste, where appropriate the NDA can employ "virtual reprocessing" whereby title is taken to materials, where necessary, and a radiological equivalent amount of waste (from existing stocks at Sellafield) is allocated to a customer as if reprocessing had taken place, and the waste is returned to the customer, except for those instances where repatriation of a very small amount of waste is uneconomic. The NDA is currently in the process of implementing this policy as a means of completing the overseas contracts.

Developments in Integrated Waste Strategies and Plans

B.110. The NDA undertook a review of its Integrated Waste Strategy guidance and specification in 2015 and determined that the guidance document was fit for purpose. All sites in the NDA estate produce Integrated Waste Strategies detailing how they will manage all wastes during operations and decommissioning. In addition, many non-NDA sites also use this guidance to produce their Integrated Waste Strategies. Magnox and Sellafield Ltd. have used the guidance to produce Integrated Decommissioning and Waste Management Strategies for their respective sites.

B.111. In its 2016 Strategy (see Section L.1 – Legislative and Regulatory System for details), the NDA committed to produce a single Radioactive Waste Strategy with the aim of providing clarity of its strategic needs and greater opportunities to optimise the management of radioactive wastes. This strategy should be published in the spring of 2018.

B.112. Nuclear site licensees on the sites owned by the NDA are contractually required to produce an Integrated Waste Strategy to a Specification published by the NDA. The NDA published an updated Specification in March 2013, following extensive consultation with the regulators and industry (Reference 38).

B.113. The updated Specification promotes a more open and transparent description of how waste is managed, to secure improvements in treatment and disposal routes and encourage more effective ways of working. The Specification emphasises the importance of the waste hierarchy, as supported by the UK Government policy, and aims to increase levels of recycling and reuse, with disposal as the last resort option.

B.114. The Specification also provides a benchmark of good practice that has proven useful to site licensees outside the NDA estate.

B.115. The UK regulators, licensees and the NDA have monitored the effectiveness of the Specification in facilitating the desired improvements in waste management practices. The ONR has produced targeted guidance for its inspectors, to assist in the process of regulatory assessment and inspection of the adequacy of licensees' Integrated Waste Strategies. The EA and Natural Resources Wales (NRW) undertook a radioactive waste management arrangements themed inspection of nuclear operators in England and Wales in 2014/5. The inspection found significant improvements to the integration of waste management taking place across the industry. The majority of operators (including the non-NDA estate) have integrated waste strategies which meet the NDA specification and plans in place for further improvement.

Section C – Scope of Application

Article 3:

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities, as part of a reprocessing activity, is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.

2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.

3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.

4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

C.1. The United Kingdom's (UK's) arrangements to comply with this Article have not changed since the fifth UK national report in 2015.

C.2. As agreed during the 1997 diplomatic conference to adopt the Joint Convention, the UK will report on the reprocessing of spent fuel as an integral part of spent fuel management under the terms of the Joint Convention, on a voluntary basis.

C.3. As a result, this report has addressed the Government's approach to:

- safety of spent fuel management, when the spent fuel results from the operation of civilian nuclear reactors – including the storage of spent fuel where that takes place as part of a reprocessing activity;
- safety of radioactive waste management, when the radioactive waste results from civilian applications – primarily focused on the radioactive wastes that originate from the nuclear fuel cycle and disused sealed sources; and
- discharges and disposals of radioactive wastes to the environment – provided for in Articles 4, 7, 11, 14, 24 and 26 of the Joint Convention.

C.4. This report does not address the safety of spent fuel or radioactive wastes within the UK's defence programmes, except when such materials have been transferred permanently to and managed within exclusively civilian programmes, as identified in Article 3(3) of the Joint Convention.

C.5. Whilst the UK has other types of sites that generate relatively small volumes of Low-level Waste (LLW) including disused radioactive sources, such as hospitals, educational facilities and non-nuclear industries, the UK's policy is to primarily focus its report on the arisings of radioactive waste that occur from the UK's nuclear industry. As such, wastes contaminated with Naturally Occurring Radioactive Materials (NORM) are not explicitly included in the scope of this report.

Section D - Inventories and Lists

Article 32.2: This report shall also include:

- a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;
- an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;
- a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;
- an inventory of radioactive waste that is subject to this Convention that:
  - is being held in storage at radioactive waste management and nuclear fuel cycle facilities;
  - has been disposed of; or
  - has resulted from past practices.

  This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides; and
- a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D.1. The United Kingdom's (UK's) arrangements to comply with this Article have not changed substantially since the fifth UK national report in 2015. The UK Radioactive Waste Inventory (UK RWI) has been updated and improved as detailed below.

D.2. The UK RWI presents the best available information on wastes and materials at a specific point in time (the 'stock date'). A full review of the data collection template for the 2016 UKRWI was undertaken to ensure that the data collected would support waste management planning, strategy development and reporting activities. Certain new data fields were added, including fields for a number of hazardous substances and non-hazardous pollutants that were not previously included in the inventory.

D.3. After the national inventory is produced, the UK Government Department for Business, Energy, and Industrial Strategy (BEIS) and the Nuclear Decommissioning Authority (NDA) (the national inventory sponsors) provide feedback to waste producers on areas for improvement, including:

- General improvement measures which are applicable to all data providers.
- Data improvement measures that are applicable to all wastes for a data provider or a specific site.
- Data improvement measures for particular waste streams.

D.4. The waste producers use this information, alongside their own improvement plans, to prioritise inventory improvement activities between the three yearly reporting cycles.

D.5. The information provided in the inventories and lists required by Article 32.2 for the UK is based on the 2016 UK RWI and are in the following parts of this report.

- Spent Fuel Management Facilities: Section L.5 – Lists and Inventories.
- Inventory of Spent Fuel: Section L.5 – Lists and Inventories Table 4. No spent fuel has been disposed of in the UK to date.
- Radioactive Waste Management Facilities: Section L.5 – Lists and Inventories.
- Inventory of Radioactive Waste: Section L.5 – Lists and Inventories Table 5 to Table 9 summarise the inventory of radioactive waste held in storage and disposed of in the UK. The full inventory is published every three years, with the latest version being the 2016 UK Radioactive Waste Inventory.
- Decommissioning facilities: Section L.5 – Lists and Inventories.

D.6. The UK also holds quantities of uranic materials as the result of reprocessing or enrichment operations. These are not considered to be waste materials since they can potentially be reused in the nuclear fuel cycle (see paragraph B.6). They are generally in the form of uranium oxide or uranium hexafluoride (known as ‘hex tails’). The quantities involved are published in the UKRWI.

Section E – Legislative and Regulatory System

E.1. Section E describes how the United Kingdom (UK) complies with Articles 18-20 of the convention.

E.2. Within this section, the only significant changes to the UK's means of complying with the Joint Convention since the fifth UK report are the following and have been highlighted by blue-edged boxes (see paragraph A.8):

- A new approach to the licensing of a Geological Disposal Facility (GDF) – see paragraphs E.35 to E.38;
- Regulatory developments in the decommissioning and clean-up of licensed nuclear sites – see paragraphs E.42 to E.45; and
- Introduction of the Environmental Permitting (England and Wales) Regulations 2016 (EPR16) (Reference 39) – see paragraphs E.84 to E.87.

E.3. The examples demonstrating successes and future challenges have been identified in shaded blue boxes (see paragraph A.5) as follows:

- Regulation of the construction and commissioning of the new Dry Fuel Store (DFS) at Sizewell B – see paragraphs E.52 to E.57; and
- Stakeholders working together on waste management and decommissioning – see paragraphs E.108 to E.112.

Article 18 – Implementing Measures

Article 18: Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

E.4. The implementing measures are all within the legal framework of the UK. This framework is described under this Article, with the specific legislation relating to the safety of spent fuel and radioactive waste management being described under Article 19.

E.5. The Parliament of the United Kingdom of Great Britain and Northern Ireland is the supreme legislative body in the UK. It is located in Westminster, London. Parliament alone possesses legislative supremacy and, thereby, ultimate power over all other political bodies in the UK and its territories.

E.6. Laws can be made by Acts of the UK Parliament, which are primary legislation. Acts can apply to the whole of the United Kingdom or only parts of it.

E.7. There are a number of Acts of Parliament that apply to the management of spent fuel and radioactive waste. Under the UK system of legislation all Acts of Parliament have equal status and must be complied with.

E.8. Due to the continuing separation of Scottish law many Acts do not apply to Scotland and are either matched by equivalent Acts that apply to Scotland alone or, since 1999, by legislation set by the Scottish Parliament relating to devolved matters. Nuclear safety is not a devolved power,

and hence any legislation must be passed by the UK Parliament, although protection of the environment is and hence the Scottish Government has responsibility for this area.

E.9. Wales and Northern Ireland have devolved administrations, although they do not have the power to make laws. Nonetheless some of the administration of the law is performed through bodies reporting to the devolved administrations. Protection of the environment is undertaken in this manner.

E.10. There is a final grouping, which some laws can apply to, which is Great Britain. Great Britain includes England, Scotland and Wales and hence is the United Kingdom excluding Northern Ireland.

E.11. Secondary legislation, in the form of regulations which, within the UK legislation system, are one type of statutory provision, can be made by a secretary of state if there is provision for them in primary legislation. The scope of these regulations is specified in the primary legislation. This legislation also includes those who must be consulted during their drafting, which includes the relevant regulators.

E.12. Regulations come into force at least 21 days after they are laid before Parliament. This is a complex process but, in simple terms, allows for scrutiny by parliamentary committees as to the merits and drafting accuracy of the regulations.

E.13. As a member of the European Union, UK must implement directives issued by the European Council. It does this by implementing the requirements into the UK legal framework.

Article 19 – Legislative and Regulatory Framework Governing the Safety of Spent Fuel and Radioactive Waste Management

Article 19:

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

2. This legislative and regulatory framework shall provide for:

   (i) the establishment of applicable national safety requirements and regulations for radiation safety;

   (ii) a system of licensing of spent fuel and radioactive waste management activities;

   (iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;

   (iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;

   (v) the enforcement of applicable regulations and of the terms of the licences; and

   (vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.

3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

Article 19.2 (i), (ii), (iv) and (v) - Legislative and regulatory framework

E.14. There is a wide range of legislation that needs to be described to demonstrate compliance with the Joint Convention. This section describes the key legislative and regulatory measures that apply directly to the overall safety of spent fuel management and radioactive waste management and are described under the following headings:

- Nuclear Safety
- Environmental protection
- Transportation of radioactive material
- Interfaces between regulatory bodies
- Freedom of information and transparency

For these items it describes, where applicable, the primary and secondary legislation and licensing regimes.

E.15. There are some legislative provisions which relate to specific sections of this report. The legislative arrangements for these are not described in this section, but in the other relevant sections as follows:

- Operational radiation protection – Section F
- Emergency preparedness – Section F
- Siting of proposed facilities – Section G
- Transboundary movement of radioactive waste – Section I
- Disused sealed sources – Section J

Nuclear Safety

Legislation for Nuclear Installations (Article 19.2 (i))

E.16. The legislation governing nuclear safety at nuclear installations applies only to Great Britain (England, Scotland and Wales) only and not to Northern Ireland. However, there are no nuclear installations in Northern Ireland, nor are any planned.

E.17. The principal primary legislation for ensuring the safety of nuclear installations consists of the following Acts of Parliament:

- The Energy Act 2013 (Reference 40)
- Health and Safety at Work Act 1974 (Reference 41)
- Nuclear Installations Act 1965 (Reference 42)

The key features of each of the statutes above are summarised below.

The Energy Act 2013 (TEA13)

E.18. TEA13 (Reference 40) sets out the provisions which set up the Office for Nuclear Regulation (ONR) as a statutory body, establishing its purpose, its powers and functions. The ONR's purposes are those relating to regulating nuclear safety, nuclear site conventional (industrial) health and safety, civil nuclear security, nuclear safeguards and the transport of radioactive material.

E.19. TEA13 also allows for 'nuclear regulations' to be made to provide additional statutory requirements with respect to nuclear safety, security, safeguards and the transport of radioactive material, although none have been made to date.

E.20. TEA13 establishes the ONR's ability to appoint inspectors and provides those inspectors with numerous legal powers, which are described later in this section.

E.21. ONR formally came into existence on 1 April 2014. Its regulatory functions were formerly carried out by other bodies. Within this report, the term 'the ONR' is used to denote not only the current regulatory body, but also any of its predecessor bodies.

Health and Safety at Work Act 1974 (HSWA74)

E.22. HSWA74 (Reference 41) applies to all work activities within UK and hence is much broader than nuclear safety. HSWA74 allows regulations to be made and there are many of these relating to industrial safety and also radiation protection (see Section F - Other General Safety Provisions).

E.23. Under HSWA74 a general duty is placed on all employers and the self-employed to conduct their undertaking in such a way as to ensure, So Far As Is Reasonably Practicable (SFAIRP), the health and safety at work of their employees and also those affected by their work activities.

E.24. TEA13 made the ONR the enforcing body for HSWA74 on licensed nuclear sites and for any adjacent construction areas and for the supply chain where Structures, Systems and Components (SSC) are being made that may affect nuclear safety on the licensed sites.

E.25. HSWA74 also allows the ONR to appoint inspectors and to provide them with similar enforcement powers to those under TEA13.

Nuclear Installations Act 1965 (NIA65)

E.26. Under NIA65 (Reference 42) no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force, granted by the ONR. Only a corporate body, such as a registered company or a public body can hold a licence and the licence is not transferable. Those parts of the NIA65 relevant to safety and licensing are 'relevant statutory provisions' of TEA13, which means they are enforced by the ONR under that legislation.

E.27. NIA65 requires and permits the ONR to attach such conditions to a site licence as it sees appropriate in the interests of safety or radioactive waste management. It is an offence under the law to not comply with the licence conditions.

E.28. NIA65 also allows the ONR to recover all costs associated with licencing and enforcement of the licence conditions from licence holders.

Licensing of nuclear installations (Article 19.2(ii) and (iii))

Nuclear Site Licensing

E.29. The ONR's publication "Licensing Nuclear Installations" (Reference 43) provides guidance on the licensing process and the factors that the ONR takes into account when considering licence applications.

E.30. A nuclear site licence is issued to a corporate body on the basis of a satisfactory outcome of regulatory assessment of an applicant's case including the:

- adequacy of its licence condition compliance arrangements
- adequacy of its safety documentation

E.31. A licence is issued for an indefinite period – potentially covering all phases of the life of the site from construction and commissioning through operations and then decommissioning and site remediation. The grant of a site licence brings an operating organisation, or potential operating

organisation, into a more rigorous regulatory regime than would be achieved using conventional health and safety legislation. The granting of a site licence does not automatically give permission for a proposed plant to be built and operated; further permissions are required for these activities. Routine regulatory inspection and assessment, and the Periodic Safety Review (PSR) process, ensure that the licensing basis is maintained.

E.32. Regulatory control of activities on a licensed site is exercised using the site licence conditions. The ONR has promulgated 36 standard Licence Conditions (LCs) that together form a legal basis for requiring high standards of nuclear safety and radioactive waste management (Reference 44). The conditions are generally non-prescriptive but set goals for all aspects of managing and assuring nuclear safety. Each licensee can develop licence condition compliance arrangements that best suit its activities, while demonstrating that safety is being managed properly. The arrangements may change as the facility progresses through its life from initial design to final decommissioning. Licensees' compliance with the conditions and with their own compliance arrangements is mandatory. The ONR requires the licensee to provide evidence that it can comply with the licence conditions. While the system gives flexibility to licensees, it secures high standards in a wide spectrum of nuclear facilities without being prescriptive or requiring detailed rule making by the regulatory body. The licence conditions provide the basis for effective regulation by the ONR.

E.33. The 'period of responsibility' of a licensee for a site handling, treating or storing spent fuel or radioactive waste under a nuclear site licence begins with the granting of the licence and ends with whichever of the following dates is the earlier:

- the date when the ONR gives notice in writing to the licensee that in the opinion of the ONR there has ceased to be any danger from ionising radiations from anything on the site; or
- the date when a new nuclear site licence is granted, either to the same licensee or another organisation.

E.34. The legislation provides for a continuous period of institutional control of a licensed nuclear site, whether it is operated by a single organisation for the whole of its life or if responsibility is transferred between operators, until the ONR considers there to no longer be any danger from ionising radiations on the site.

Licensing a Geological Disposal Facility (GDF)

E.35. After identification of a prospective site (or sites) for investigation, the relevant environmental regulator will regulate the development of any future GDF under the Environmental Permitting (England and Wales) Regulations 2016 (EPR16) (Reference 39) using a process known as 'staged regulation'. In Northern Ireland, a different, voluntary process for staging can be used under the Radioactive Substances Act 1993 (RSA93) (Reference 45 and 46). Staged regulation provides regulatory control from very early in the investigation and development stages of a GDF. It enables the environmental regulator to maintain regulatory control throughout each stage of development from the start of intrusive site investigation, through construction and operation, and eventually to closure. The developer will need regulatory approval before each stage of development can begin and, in particular, disposal of radioactive waste will not be allowed without the appropriate environmental permit.

E.36. The staged regulation process is more fully described in the regulatory guidance for authorisation of geological disposal facilities for solid radioactive waste published by the Environment Agency and Northern Ireland Environment Agency (NIEA) (Reference 47)

E.37. The 2014 White Paper "Implementing Geological Disposal" states that the planned GDF will be a licensed nuclear site under the Nuclear Installations Act 1965 (NIA65) (Reference 42) and will therefore also be regulated by the ONR. The ONR assessed the applicability of its current standard licence conditions and guidance to prospective licensees, for the specific case of a GDF

(Reference 48). The licence conditions were found to be adequate with very minor amendment. The ONR considered further guidance was required regarding licensing a GDF; a GDF specific annex will be included in the next revision to its guidance, Licensing Nuclear Installations (Reference 43) and additional guidance will be delivered through drafting a new Technical Assessment Guide related to assessing the safety case for a GDF.

E.38. In 2017, Radioactive Waste Management (RWM) has submitted to the ONR and the Environment Agency an update to its 2011 generic Disposal System Safety Case (gDSSC). The gDSSC is termed 'generic' as at this time no site had been selected for development of a GDF; thus, the gDSSC includes generic environmental, operational and transport safety cases, considering a range of potential geological settings and disposal facility designs. RWM is not seeking a permit or licence at this stage, but advice from the ONR and the Environment Agency's scrutiny on the current suitability of the submission for a future licence application.

Regulation of Nuclear Sites in the Final Stages of Decommissioning and Clean-Up and Criteria for Nuclear Site De-licensing

E.39. The ONR has published a policy statement and supporting guidance for its Inspectors (Refs. 49 and 50) to provide a basis for regulatory judgements on the de-licensing of a nuclear licensed site. De-licensing in this context means the ending of a licensee's period of responsibility under NIA65 (see paragraph E.26).

E.40. The policy statement concluded that, after termination of licensable activities on a site and following decontamination and clean up, an acceptable level of residual risk from any radiological hazard remaining on site should be in line with the ONR's views on broadly acceptable risks and the concept of reducing risks As Low As Reasonably Practicable (ALARP).

E.41. The ONR considers that an additional risk of death to an individual of one in a million per year, is 'broadly acceptable' to society in line with the tolerability of risk framework (Refs. 51 and 52). Applying this to nuclear licensed sites, any residual radioactivity above natural background, which is satisfactorily demonstrated to pose a risk of less than one-in-a-million per year, would be deemed 'broadly acceptable'. For practical purposes, the ONR currently uses this criterion as a threshold for removal of a site from regulatory control under NIA65, i.e. allows the site to be de-licensed. However, it is recognised that this criterion might not be proportionate in several cases. As a result, Government and the regulators are currently reviewing the approach to de-licensing, as described in the following table.

Regulatory Developments in Decommissioning and Clean-Up of Licensed Nuclear Sites

E.42. In November 2016 the Department for Business, Energy and Industrial Strategy (BEIS) published a discussion paper on an opportunity to improve the current arrangements that apply to the regulation of the final stages of nuclear site decommissioning and clean-up in Great Britain. The paper considers a proposal developed by BEIS, and the safety and environment regulators and the Nuclear Decommissioning Authority (NDA), that would allow nuclear sites in the final stages of decommissioning and clean-up to be released from regulation under NIA65 once the ONR was satisfied for that to happen, on grounds of nuclear safety and security, rather than demonstrating that there was no danger from ionising radiation. The environmental regulators would continue to regulate these sites in accordance with environmental legislation. The health and safety of any work activities on such a site would be regulated by the Health and Safety Executive, in place of the ONR. The proposal is consistent with radiological public protection standards established by Public Health England, which fully align with international standards.

E.43. Adopting a more flexible approach to nuclear site clean-up would enable those sites to be managed in ways that take account of a range of factors. These include the particular characteristics and features of any site, the implications of any plans for the generation and

management of waste, and any future plans for land use. In some cases this might mean that there would be no need to remove low-levels of radioactive contamination from the ground if leaving it in situ is demonstrated to be both safe and the optimal solution. More flexibility offers the potential for a more sustainable approach to clean-up work, thereby enabling earlier re-use of sites, avoiding unnecessary generation of radioactive waste (thus preserving the capacity at waste repositories elsewhere which are vital for radioactive waste that requires that level of control) and reducing the transportation of waste from the site to those other locations.

E.44. In conjunction with this, the environmental regulators (Environment Agency, Scottish Environment Protection Agency, and Natural Resources Wales) have published a consultation document on 'Guidance on Requirements for Release of nuclear sites from Radioactive Substances Regulation (RSR)', referred to as the 'Draft Guidance on Requirements for Release of nuclear sites from radioactive substances Regulation (GRR)'. This guidance explains the requirements the environmental regulators will expect nuclear site operators to fulfil when developing their plans for the management of radioactive waste from decommissioning and how implementing these plans will leave sites in a state suitable for release from RSR. Increased flexibility, together with a proportionate approach to managing residual risk, is achieved through application of the draft GRR, which will require that an optimised solution to protection of people and the environment is demonstrated through a Waste Management Plan (WMP) and a Site Wide Environmental Safety Case (SWESC).

E.45. The draft GRR is being trialled through three 'lead and learn' NDA sites (Winfrith, Dounreay and Trawsfynydd), and draft WMPs and SWESCs are currently under review by the environmental regulators. These sites are at various stages of decommissioning and are currently considering what a more flexible approach might mean for each of their sites. As well as helping to inform thinking on any revised regime, this work should also ensure that the sites are ready to adopt any revised approach sooner rather than later should the proposals for legislative change be implemented, thereby minimising the risk of delays to existing decommissioning and clean-up programmes. This is of particular relevance for the Winfrith site, which is scheduled to deliver an Interim End State by 2023, with a potential application to vary the permit to allow on-site in situ disposal in 2019. Any early lessons learned through the 'lead and learn' sites and other engagement activities will be incorporated within the development of the proposals. End State Tactical Groups involving the site licensee, the NDA, the ONR, the relevant environment regulator and the relevant planning authority have been established for each of the three 'lead and learn' sites. The findings from the Tactical Groups inform the Site End State Strategic Steering Group (SES-SSG) which has oversight of the progress of the 'lead and learn' sites. The environment agencies and the ONR have issued a statement of common understanding on disposal of radioactive waste on nuclear sites (Reference 53).

Enforcement Powers (Article 19.2(v))

E.46. There are a range of enforcement powers available to the ONR; these arise from both TEA13 and HSWA74, which are broadly the same across both Acts.

E.47. Individual inspectors are appointed through a legal instrument called a warrant and this document confers a wide range of powers on the inspector, such as the power of entry to premises at any time, power to take evidence into possession, power to have an incident scene left undisturbed etc.

E.48. The ONR has an Enforcement Policy Statement (EPS) (Reference 54) that sets out the purpose of enforcement, and the principles that should be applied during enforcement activities. Inspectors are guided by an Enforcement Management Model (EMM) (Reference 55) to assist in determining which enforcement measure is the most appropriate in a given situation. The version of the EMM currently used was developed by the Health and Safety Executive (HSE), when the ONR was part of that organisation, and is applicable to enforcement across a broad range of

industries. The ONR is developing its own version, which will be more suited to the ONR's specific needs and is planned to be launched in 2018.

E.49. Key enforcement powers that are available to the ONR inspectors, as set out in TEA13 are:

- **Improvement Notice (IN)** - if an inspector is of the opinion that one or more applicable legal provisions is being contravened or has been contravened in circumstances that will continue or be repeated, they can serve an IN. The Notice requires that the stated improvements be made within a specified timescale.

  The ONR has put in place internal processes which require senior level approval before an Improvement Notice can be issued.

- **Prohibition Notice (PN)** - if an inspector is of the opinion that an activity is being or is likely to be carried out which risks causing serious personal injury, they can serve a PN to immediately halt an activity.

  In practice, this power is rarely used by the ONR for nuclear safety purposes, as there are other powers available under the licence conditions to use.

- **Prosecution** – the ONR inspectors have the power, in England and Wales, to institute proceedings in a court of law for an offence under any of the relevant statutory provisions including failure to comply with an IN or PN. In Scotland, an inspector can recommend that a prosecution be initiated to the Crown Office Procurator Fiscals Service. Again, the ONR's own administrative arrangements require senior approval to exercise this power.

E.50. The ONR has other regulatory powers through the standard LCs, and these are referred to as primary powers. There are six primary powers and they provide for regulatory control of certain activities. When used, they are done so through issuing Licence Instruments (LI) to the licensee, which are legally binding. The primary powers are described below:

- **Direction:** A direction is issued by the ONR when it requires the licensee to take a particular action, such as shutting down specified operations.
- **Specification:** This power gives the ONR discretionary controls with regard to a licensee's arrangements.
- **Notification:** This power gives the ONR the ability to request the submission of information by notifying the licensee of the requirement.
- **Consent:** This power is used to insert a legal hold-point before the licensee can carry out any activity which has been specified or directed to require consent from the ONR. Before being given consent, the licensee must satisfy the ONR that the proposed action is safe and that all procedures necessary for control are in place.
- **Approval:** This power can be used to control a licensee's arrangements. Once formally approved by the ONR, such arrangements or procedures cannot be changed without the licensee seeking a further approval from the ONR.
- **Agreement:** This power allows the licensee to proceed with a particular activity or course of action when an LI from the ONR is issued.

E.51. The powers through the licence and the primary legislation above are deemed sufficient to regulate nuclear safety. However, to ensure efficient regulation, the licensee's arrangements incorporate further provisions referred to as derived powers. The most frequently used example of this is that the licensee has to consider the safety significance and categorise any modifications to plant, operations, maintenance and the licensee's organisation. By virtue of the licensees' arrangements the highest category modification proposals are usually submitted to the ONR for its agreement before they can be implemented. The same control could be achieved through primary

powers by the ONR specifying that consent is required. The use of derived powers does not preclude the use of primary powers and in some cases they are used. Using agreement through the licensee's arrangements, the onus is on the licensee, rather than the ONR, to identify which modifications need the ONR agreement. To assure itself that these arrangements are being implemented correctly, the ONR inspections periodically check that categorisation of modifications is appropriate and that the licensee is seeking agreement when required by its arrangements.

Regulation of the Construction and Commissioning of the New Dry Fuel Store at Sizewell B

E.52. Regulation of the construction and commissioning of the Sizewell B Dry Fuel Store (DFS) is described here as an example of the application of the control used through powers under the site licence and the licensee's arrangements.

E.53. The licensee at Sizewell B identified the need for long-term interim dry fuel storage to provide additional spent fuel storage capacity. It proposed to use a multi-purpose spent nuclear fuel container, the Dry Fuel Store Shielding Container (HI-STORM).

E.54. The licensee submitted a proposal to construct and commission the facility to the ONR. This paper set out the strategy by which the safety case for the new facility would be made in a series of stage submission papers. The paper also identified a number of hold points to provide for adequate control and regulation of the project.

E.55. The licensee's arrangements for construction and commissioning of the new facility make provision for the identification and release of hold points by the ONR. A hold point is a stage in a project beyond which work may not proceed until cleared by an appropriate permission.

E.56. In response to the paper of principle, the ONR identified a number of hold points that were necessary to proportionately regulate the construction and commissioning of the Sizewell B Dry Fuel Store. It identified the necessary conditions for these hold points to be lifted, taking into account the safety significance of the activities beyond the hold points. These included the documentation that the licensee had to submit and the ONR assessment and inspection activities that it would need to complete to assure itself that the hold points could be lifted. For three of the key hold points, the type of permission that was required was as follows:

- Commencement of inactive system commissioning – a letter stating that the ONR had no objection to the licensee continuing;
- Commencement of active system commissioning at the point where spent nuclear fuel is placed into the Dry Fuel Store system – the ONR issued a primary power specification requiring the licensee to request consent, before it could introduce spent fuel;
- Commencement of normal operation – a derived power agreement LI.

E.57. Sizewell B safely and successfully completed the first dry fuel cask transfer of 24 irradiated fuel assemblies to the newly constructed Dry Fuel Store (DFS) early in 2017.

Figure 7: Exploded View of a Spent Nuclear Fuel Container Contained within the Dry Fuel Store Shielding Container (HI-STORM)

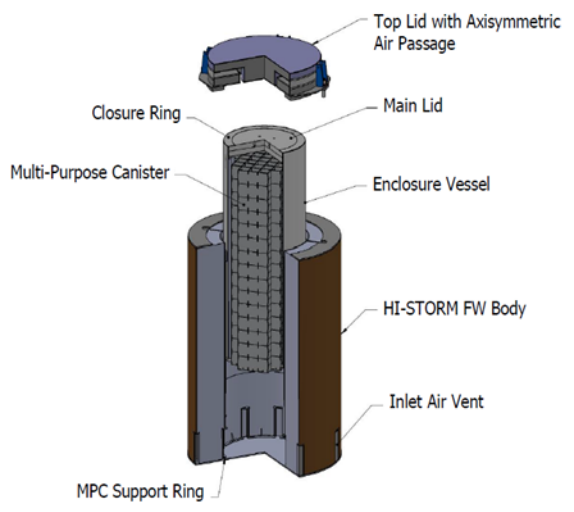


Figure 8: HI-STORM Containers Located within Sizewell B Dry Fuel Store During Commissioning

Regulatory Control of Highly Active Liquor Stocks at Sellafield

E.58. Regulatory control of highly active liquor stocks at Sellafield is described here as an example of changing the application of the powers under the site licence as the hazard from waste storage decreases.

E.59. Reprocessing of spent nuclear fuel produces a highly radioactive liquid waste ("HAL") which is stored safely in stainless steel tanks before being solidified using a vitrification process. HAL requires continuous cooling to ensure that it remains safe.

E.60. To reduce the potential hazard from HAL, the ONR issued its first specification to the licensee in 2001 requiring the licensee, Sellafield Limited, to reduce the HAL stocks on the site. A specification placed a legally binding requirement on the licensee, which could only be amended by the ONR.

E.61. Over the period 2001-15 HAL stocks have been reduced by approximately 70%. During the latter part of that period the two reprocessing programmes (for Magnox and oxide fuels) were being managed to secure safe and orderly closure. Details of the specification were subject to periodic review and amendment by the ONR, in order to maintain the regulatory intent and enable Sellafield Ltd. (duty-holder) to continue to maintain overall risk as low as reasonably practicable. The outcomes of these reviews were published by the ONR.

E.62. In 2015, the ONR formally informed Sellafield Ltd. that it would no longer enforce the specification. It was replaced by an Operating Rule justified by the licensee as being in the best interests of year-on-year hazard and risk reduction at Sellafield Site. Ensuring compliance with an Operating Rule places a less onerous burden on the licensee than complying with a specification. Furthermore, changes to the Operating Rule can be proposed by Sellafield, subject to an acceptable safety justification, but this is a less onerous process than changing a specification. This has improved nuclear safety and aided licensee operational efficiency.

E.63. Highly radioactive liquid waste stocks continue to decline and the published schedule for closure of the reprocessing plants is being maintained, with the extent of regulatory control for these stocks reflecting the change in the potential hazard.

Appeals Process

E.64. NIA65 includes provision for a licensee or licence applicant who is dissatisfied with a particular regulatory decision to may raise concerns with the relevant ONR inspector and the ONR senior management. Should issues not be resolved at this level, they may request a 'decision review' to be undertaken by the ONR Chief Executive Officer.

E.65. There has been very Ltd. experience of this provision being exercised and it only allows appeal to the ONR. There is no other provision in NIA65 for the granting of a legal instrument or for regulatory decisions by the ONR to be formally challenged, reflecting the robustly independent nature of the UK regulatory regime.

E.66. Nuclear site licensees have the right of appeal to an employment tribunal in respect of Improvement and Prohibition Notices issued to them under TEA13 or HSWA74.

E.67. Within UK law, a judicial review can challenge the lawfulness of a decision or action by any regulatory body or any other public body. This challenges the way a decision has been made. If the regulator has followed lawful procedures, the decision cannot be changed.

Regulatory Inspection and Assessment (Article 19.2(iv))

E.68. The ONR has responsibility for the day-to-day exercise of the nuclear licensing function. The regulatory functions are vested in the Chief Nuclear Inspector (CNI), as the authoritative regulatory head, who delegates these functions as appropriate to nominated inspectors.

Inspections Carried Out to Verify Compliance with the Licence and Relevant Regulation

E.69. Inspection is mainly undertaken on licensees' premises. It entails inspection of licensees' compliance with the licence conditions and their corresponding arrangements and, in particular, to ensure that operation remains within the boundaries of the safety case. Most of the routine site inspection is carried out by the ONR's site inspectors who spend about 30% of their time on site. Additionally, the ONR undertakes team inspections on particular topics.

E.70. To ensure that the regulatory interpretation of the licence conditions is consistent, the ONR has published a set of Technical Inspection Guides (TIGs), (Reference 56), which provide guidance for ONR's inspectors on the planning, content and reporting of inspections to monitor the adequacy of nuclear site licensees' arrangements against legal requirements.

Assessments Carried Out in Support of Permissioning Activities

E.71. This entails the assessment of licensees' safety cases. A safety case is the totality of documented information and arguments developed by the licensee, which substantiates the safety of the facility, activity, operation or modification. It provides a written demonstration that relevant standards have been met and that risks have been reduced So Far Is Reasonably Practicable (SFAIRP). The ONR technical specialist assessors, who are themselves inspectors and technical experts in specific fields, will examine aspects of the safety case to establish whether a licensee has demonstrated that it understands the hazards associated with its activities and how to control them adequately.

E.72. The technical principles which the ONR uses to judge safety cases are set out in its Safety Assessment Principles (SAPs), (Reference 57). These form a framework of regulatory expectations for the use of the ONR Inspectors when making technical judgments on the adequacy of licensees' safety submissions. The principles are supported by more detailed guidance in a suite of Technical Assessment Guides (TAGs), (Reference 58), which provide guidance to the ONR's Inspectors on the interpretation and application of the ONR's SAPs when assessing the adequacy of licensees' safety cases and other safety documentation within the nuclear safety regulatory process.

E.73. The SAPs are available to the public and provide nuclear site dutyholders with information on the regulatory principles against which the adequacy of their safety provisions will be judged by the ONR Inspectors. However, the SAPs are not intended or sufficient to be used as design or operational standards as they reflect the non-prescriptive nature of the UK's nuclear regulatory system.

E.74. The basis for demonstrably adequate safety is to meet the normal requirements of good practice in engineering, operation and safety management. This is a fundamental requirement for the safety cases submitted to the ONR by the UK nuclear site licensees. In addition, the ONR expects safety cases will include a graded application of risk assessments and probabilistic analysis to identify potential weaknesses in proposed facility designs and operations. These should show what improvements were considered and demonstrate that an adequate level of safety is not unduly reliant on a small set of particular features.

E.75. Following the Fukushima accident the SAPs were reviewed and revised to include the lessons identified relevant to the UK nuclear industry and were re-issued in 2014.

Periodic Safety Reviews

E.76. A nuclear site licence requires the licensee to conduct periodic safety reviews at each site. This means that for many years, the UK has been regularly reviewing and re-assessing the safety of its nuclear installations, and making improvements where necessary. The ONR assesses the outcomes of licensee's reviews. It maintains oversight of safety significant issues and ensures a proportionate response is taken by licensees to implementing improvements.

Environmental Protection

Legislation for Environmental Protection (Article 19.2 (i) and (ii))

Environment Act 1995 (EA95)

E.77. The EA95 (Reference 59) provides the regulatory framework for environmental protection. There have been some subsequent revisions to the framework, resulting in the following being the environmental regulators for the four countries of the UK:

- Environment Agency (EA) in England;
- Scottish Environment Protection Agency (SEPA) in Scotland;
- Natural Resources Wales (NRW) in Wales; and
- Northern Ireland Environment Agency (NIEA) in Northern Ireland.

E.78. EA95 also provided for the transfer of functions to the environmental regulators, including powers and duties in relation to radioactive substances regulation.

Radioactive Substances Act 1993 (RSA93)

E.79. RSA93 (Reference 45) was originally pertinent to environmental protection across the entire UK nuclear industry, but its application has subsequently been restricted to Scotland and Northern Ireland.

E.80. RSA93 requires an authorisation from the relevant regulator (SEPA or NIEA) prior to the disposal of radioactive wastes.

E.81. RSA93 also requires registration for the keeping and use of radioactive material (other than by nuclear site licensees) and authorisation for the accumulation of radioactive waste (other than

on nuclear licensed sites). RSA93 empowers the appropriate environmental regulator to attach limits and conditions to any authorisation it issues.

E.82. The Energy Act 2004 amended RSA93 to allow nuclear licensed sites to transfer authorisations from one person to another following a statutory consultation process. This avoided the need for a new application to be made for authorisation under RSA93 when a site's management contract was changed by NDA and harmonised radioactive substances regulation with other areas of environmental regulation.

E.83. Nuclear site licensees are exempted from the requirements of RSA93 relating to the keeping and use of radioactive materials and accumulation of radioactive waste. These aspects are addressed by the licence conditions attached to each nuclear site licence and enforced by the ONR.

Environmental Permitting (England and Wales) Regulations 2016 (EPR16)

E.84. EPR10 came into force in April 2010 and replaced RSA93 in England and Wales. EPR16 is a consolidation of EPR10 and subsequent amendments. EPR16 incorporates radioactive substances regulation with other regulated activities, such as the management of non-radioactive wastes, to provide industry, regulators and stakeholders with a single overarching permitting and compliance system.

E.85. EPR16 requires prior authorisation, in the form of an environmental permit, to dispose of radioactive wastes. It also requires an operator to hold an environmental permit for the keeping and use of radioactive material (other than by nuclear site licensees) and for the accumulation of radioactive wastes (other than on nuclear licensed sites).

E.86. EPR16 empowers the EA and NRW to attach limits and conditions to any environmental permit that they issue.

E.87. EPR10 also introduced provision of a new power to the EA to allow staged regulation of Geological Disposal Facilities (GDF). Under EPR16, the developer of a GDF would require an environmental permit before starting intrusive site investigation, such as drilling boreholes, at any candidate site.

Regulatory Reform (Scotland) Act 2014

E.88. The Regulatory Reform (Scotland) Act was passed by the Scottish Parliament on 16 January 2014. The Act enabled the regulation of environmental activities, which were defined in terms of activities capable of causing, or liable to cause, environmental harm. The Act therefore shifted the focus of the Scottish regulatory framework from pollution control to environmental harm.

E.89. The Act allowed for the implementation of a simpler, proportionate and single integrated regulatory framework enabling integration of the permissioning arrangements of SEPA's four main regimes of: water; waste; radioactive waste; and pollution prevention and control. Over the next couple of years, the requirements of RSA93 will be incorporated into the new regulatory framework.

Environmental Protection Act 1990

E.90. Part IIA of the Environmental Protection Act 1990 (EPA90) (Reference 60) set up a system for the regulation of contaminated land in England, Wales and Scotland. The regime provides a framework for identification and remediation of contaminated land. Part IIA defines contaminated land as land that poses unacceptable risks through its current use.

E.91. In 2006 in England and Wales, and 2007 in Scotland, the Part IIA regime was extended to apply to harm caused by land contaminated with radioactivity resulting from uses of radioactive materials. It only applies in circumstances where the radioactivity is the result of a past practice or

work activity, or the after-effects of a radiological emergency. This includes substances containing artificial radionuclides or processed natural radionuclides. Radioactivity originating from nuclear sites was initially excluded from these regulations but in 2007 (in England) the regime was extended to cover land contaminated with radioactivity from a nuclear installation that lies outside of the boundary of that installation. The liability for any harm that such radioactivity might cause within the boundary of a licensed nuclear site is covered by NIA65.

Enforcement powers (Article 19.2(v))

E.92. There are a range of enforcement powers available to the environmental regulators, which arise from EPR16 (in England and Wales) and RSA93 (in Scotland and Northern Ireland), and are broadly the same across both pieces of legislation.

E.93. Individual inspectors are appointed through a legal instrument called a warrant and this document confers a wide range of powers on the inspector under Section 108 of EA95, such as the power of entry to premises at any time, power to take evidence into possession; and power to have an incident scene left undisturbed etc.

E.94. The Environment Agency has published Enforcement and Sanctions Statement, Guidance and Offence Response Options (ORO) (Reference 61) that explain how the Environment Agency makes enforcement decisions, the types of tools available and associated processes. These range, for example, from providing advice and guidance through to prosecution. Similarly, NRW has published regulatory guidance on its enforcement powers (Reference 62), and SEPA has published enforcement policy and enforcement guidance (Reference 63).

E.95. Key enforcement powers that are available to the environmental regulators include:

- **Warning Letters:** a written notification that regulators believe an offence has been committed. It will be recorded and may, in the event of further non-compliance, influence subsequent choice of sanction.
- **Statutory Notices**
  - **Enforcement / Improvement notices** identifying a non-compliance or likely non-compliance or significant impact or likely impact and requiring steps to be taken.
  - **Prohibition notices** identifying an activity with an imminent risk of pollution or harm, and directing which steps need to be taken to remove the risk, and suspending any authorisation related to the activity.
- **Formal Caution:** A formal caution is the written acceptance by an offender that he has committed an offence and may only be used where a prosecution could properly have been brought. Where a formal caution is not accepted the environmental regulator will normally prosecute for the original offence.
- **Prosecution** The sanction of prosecution is available for all criminal offences by law. The legislation which establishes the penalty provisions gives the courts considerable scope to punish offenders and to deter others. In some cases imprisonment and unlimited fines may be imposed.

Appeals process

E.96. Enforcement action (specifically the imposition of a sanction) can normally be appealed either through the criminal court process or as a result of specific appeal provisions. The environmental regulators' notices set out the rights of appeal which apply in the specific circumstances of each sanction or provision. When considering any type of appeal against enforcement and sanctioning action it will usually be appropriate for the recipient to obtain independent legal advice.

Regulatory Inspection and Assessment to Verify Compliance with the Permit/Authorisation and Relevant Regulation (Article 19.2(iv))

E.97. This is mainly done on operators' premises. It entails inspection of operators' compliance with the permit conditions and their corresponding arrangements. Additionally, the environmental regulators undertake team inspections on particular themes. Where appropriate, joint inspections between the ONR and the environmental regulators are also undertaken.

Transportation of radioactive materials

E.98. This section describes the legislative framework for the transportation of radioactive materials including spent fuel and radioactive waste. The obligations within the convention for transfrontier shipment are under Article 27 and are described in Section I of this report.

E.99. The regulation of the transportation of radioactive material, which includes spent fuel and radioactive waste, depends on the mode of transport and in some cases the locations. The regulations require there to be a Competent Authority (CA), which are appointed within the regulations as described in table E.1.

Table E.1 Competent Authorities for Transport of Spent Fuel and Radioactive Waste

Mode of transport	**Great Britain (England, Scotland and Wales**	**Northern Ireland**
Road	ONR	Department of Agriculture, Environment and Rural Affairs (DAERA)
Rail		
Inland waterway		
Sea	Maritime and Coastguard Agency (MCA), an Agency of the Department for Transport	
Air	Civil Aviation Authority (CAA)	

E.100. The ONR has entered into agency agreements (Reference 64) with each of the other CAs, which authorise the ONR to perform some of the functions of the other CAs These include approval of packages and other permissioning activities identified in the regulations, but exclude inspection functions, which are undertaken by the CA. Approvals of packages and other permissioning activities are therefore performed by the ONR for all modes of transport throughout the UK.

E.101. The legislative and regulatory framework is dependent on the mode of transport and results in a combination of primary and secondary implementation, which implement a range of international obligations. This is too detailed to include in the main body of this report and therefore is described in paragraphs L.1.87 to L.1.107.

Article 19.2(iii) – Prohibition of Operation without a Licence

E.102. The UK legislative framework described above prohibits the operation of spent fuel or radioactive waste management facilities without a licence. Table E.2 below shows the possible activities with spent fuel or radioactive waste and shows that in each case a licence is required from either the ONR or one of the environmental regulators, depending on the activity and location.

Table E.2 Provisions for Prohibition of the Operation of Spent Fuel or Radioactive Waste Management Facilities Without a Licence

Activity	Legislation	Enforcing Authority	Type of licence
Construction, commissioning, operation and decommissioning of spent fuel or radioactive waste management facilities required as a result of nuclear industry activities, including accumulation. Cannot take place on a non-Crown site without a nuclear site licence	EA13 and NIA65	ONR	Nuclear Site Licence
The keeping and use of radioactive material (other than on licensed nuclear sites)	EPR16 (E and W) RSA93 (S and NI)	Environment Agency (E) NRW (W) SEPA (S) NIEA (NI)	Permit Permit Registration Registration
Accumulation of radioactive waste (other than on licensed nuclear sites)	EPR16 (E and W) RSA93 (S and NI)	Environment Agency (E) NRW (W) SEPA (S) NIEA (NI)	Permit Permit Registration Registration
Disposal of radioactive waste	EPR16 (E and W) RSA93 (S and NI)	Environment Agency (E) NRW (W) SEPA (S) NIEA (NI)	Permit Permit Registration Registration
(E) = England: (W) = Wales, (S) = Scotland, (NI) = Northern Ireland			

Interactions Between Regulators

E.103. The ONR inspectors and environmental regulators' inspectors are granted powers under their own respective legislation. The legislation is written to ensure that there is no overlap between the purposes of the regulatory bodies.

E.104. Whilst the ONR and the environmental regulators have separate regulatory purposes, there is both a legislative and operational need for communication, consultation and joint working to deliver the respective outcomes. Memoranda of Understanding (MoU), (Reference 64) have been established to provide the high level framework for how the regulatory activities of the ONR and the each of the environmental regulators achieve their regulatory goals.

E.105. The MoUs require the ONR and the environmental regulators to build structured interactions at all levels, including areas of strategy, work planning and programming, and operational regulation. Furthermore they must consult each other at the earliest opportunity, and with the fullest of information, during the process of formal regulatory decision making on matters that may affect the other taking full account of each other's views.

E.106. Inspectors from the ONR and the environmental regulators have regular interactions and, in areas where more than one body may have a shared interest, joint inspections are undertaken. Where necessary the inspectors agree what enforcement action is necessary. They will also consult one another in accordance with the relevant MoU if it is recognised that the other body has an interest in any findings from inspections or assessments.

E.107. One example of the close joint working between UK regulators is the Senior Regulators' Group comprising senior staff from the ONR and each of the environment agencies with responsibilities for nuclear regulation. The group's objectives are to:

- share high level strategies and plans for regulating the nuclear industry and look for ways of joining up to deliver these where beneficial;
- discuss key regulatory issues and challenges and identify ways forward to address these;
- work together on areas where potential conflicts between regulatory regimes may hinder progress on safety or environmental improvements in the wider context; and to

- work together to ensure plans are in place for future resilience of skills across regulators.

Stakeholders Working Together on Waste Management and Decommissioning

E.108. The Sellafield site is the largest and most complex in the UK civil nuclear estate and probably one of the most complex in the world. The continuing challenge for Sellafield Ltd. is to retrieve nuclear waste from some of the world's oldest nuclear facilities The timescales for the completion of some of these decommissioning projects may be decades away. The scale of the Sellafield legacy is such that it demands an unwavering focus on the long-term clean-up mission. Remediation work at Sellafield has been slow and in 2013 a new approach was adopted to facilitate its acceleration. While responsibility for hazard and risk reduction rests clearly with Sellafield Ltd., following a comprehensive review by the regulators a revised strategy with six strands was intended to enable timely, safe and secure hazard and risk reduction:

- Prioritisation – ensuring all relevant stakeholders share the same list of priorities for delivery in terms of hazard and risk reduction at Sellafield.
- Removal of barriers to progress – minimising unnecessary bureaucracy and working practices on site and streamlining processes to enable delivery.
- Avoidance of distractions and diversions – providing a focus on the key areas needing improvement rather than low-level improvements which can significantly add to the workload.
- Incentivisation – creation of an environment that encourages positive behaviours in terms of hazard and risk reduction.
- Fit-for-purpose solutions – avoidance of overly complex designs and processes and favour simplicity and practicality.
- Effective use of resources and communications

E.109. The ONR engaged with key stakeholders to publicise the strategy and held a high-level strategic workshop in 2013 involving Sellafield Limited, NDA, the EA and Department of Energy and Climate Change (DECC) (now Business, Energy and Industrial Strategy (BEIS)). It was readily apparent that there was clear alignment between stakeholders, with a common purpose identified – to 'accelerate the safe and secure hazard and risk reduction at Sellafield'. A key outcome of the workshop was to set up a group that includes all of the stakeholders. The group is there to oversee and influence the remediation programme. The group became known as the G6.

E.110. As well as engaging at a strategic level, the G6 created a tactical subgroup made up from representatives of each organisation, which identified a number of key projects as priorities for achieving safe and secure hazard and risk reduction as well as serving as case studies to demonstrate new ways of working. Some of the projects under the auspices of the G6 have already led to the remediation of hazardous material from legacy facilities to more robust buildings (see K.1– Planned activities to improve safety and Feedback from the Fifth Joint Convention review meeting).

E.111. Hence, the constructive approach with relevant stakeholders to enable effective delivery against clear and prioritised safety, security and environmental outcomes has been successful at Sellafield. The approach taken by the G6 is having a positive impact in reducing hazard and risk at some of the highest profile facilities at Sellafield. The approach must be understood in the context of the legal obligations on the ONR, other regulators and duty holders. Nothing in this approach alters the obligations on industry to comply with the law, but the interactions between the regulators, licensee and other stakeholders has focused on safety outcomes to ensure more effective and efficient progress on hazard and risk reduction.

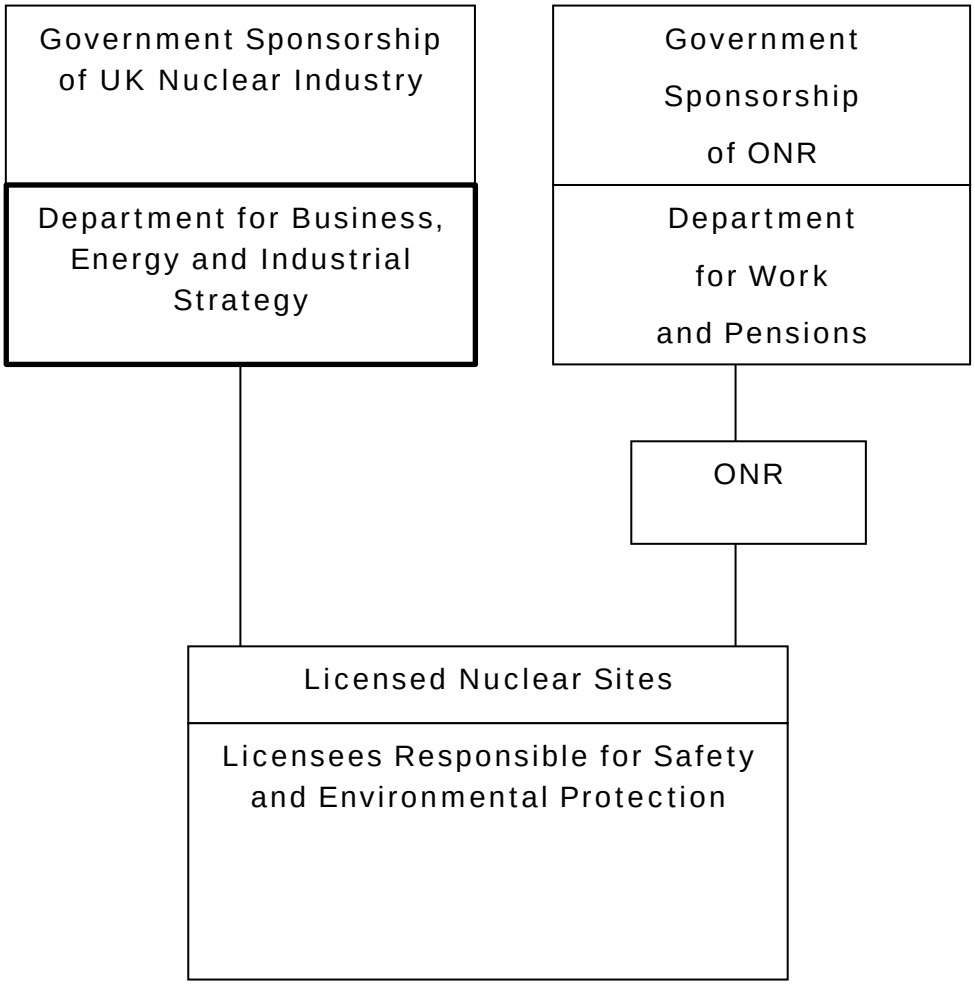
E.112. The successful application of the G6 constructive working at Sellafield has also been

implemented to support the UK Government/Nuclear Decommissioning Authority policy to consolidate the UK's Special Nuclear Materials (SNM) in one location for long term safe and secure storage. In this area a similar group known as the C6 has been formed to ensure the alignment to deliver safe and secure outcomes for these packages of work. Further details of these activities are presented elsewhere in paragraph L.1.76

Article 19.2 (vi) – Responsibilities of Bodies Involved in Spent Fuel and Radioactive Waste Management

E.113. Figures 9 and 10 illustrate the responsibilities of the various bodies in the UK and how they interact.

Figure 9 Responsibilities for the Safety of Spent Fuel, Reprocessing and Radioactive Waste Management at Nuclear Licensed Sites



Government Responsibilities

E.114. The Department for Business, Energy and Industrial Strategy (BEIS) website sets out in summary the distribution of responsibility and accountability among Ministers, independent bodies and the devolved administrations, including:

- safety regulation at civil nuclear sites;

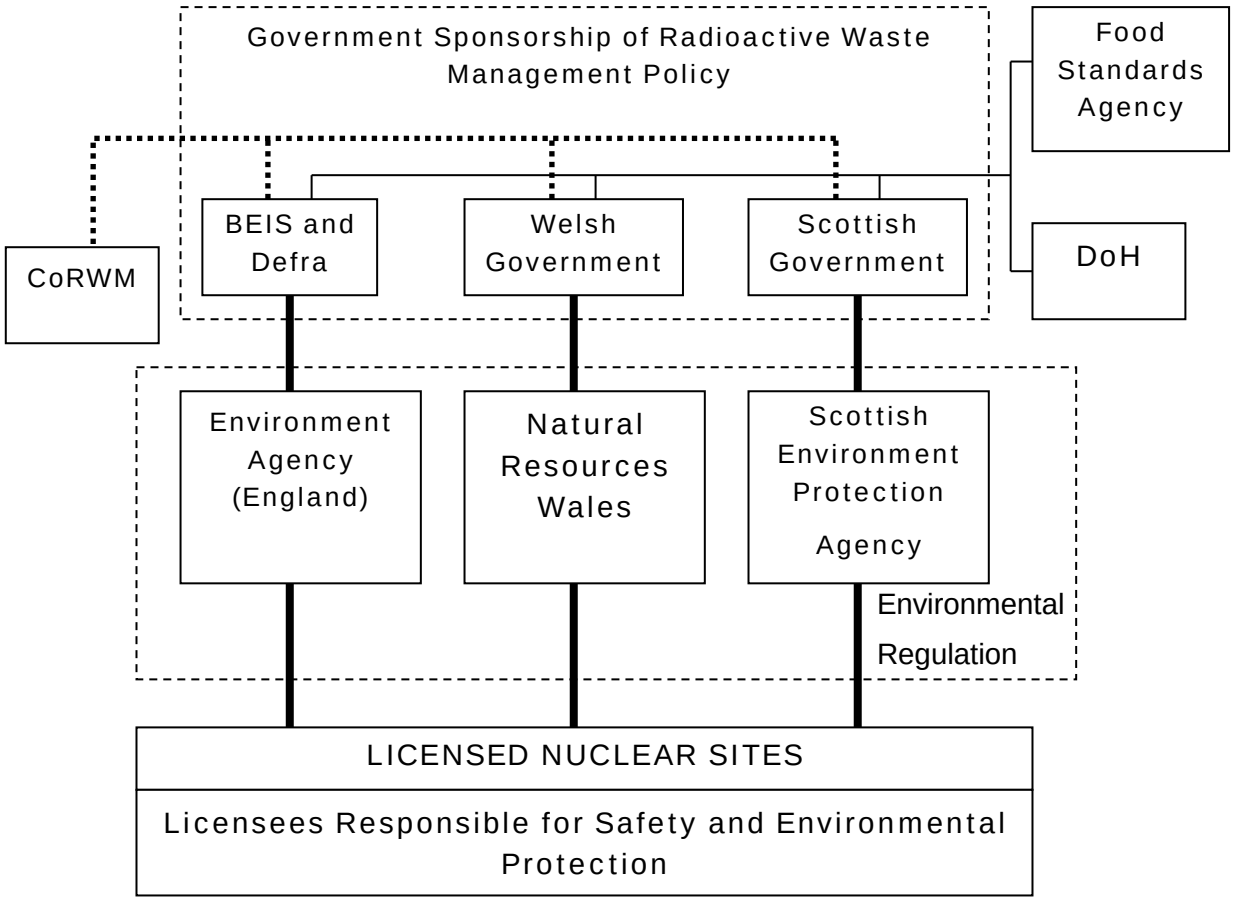
- nuclear emergency planning and response to a nuclear emergency or incident;
- safe storage, use, discharge and disposal of radioactive materials; and
- international work on nuclear safety.

E.115. Sponsorship of the civil nuclear industry and accountability to Parliament for civil nuclear safety in Great Britain and radioactive waste policy in England rests with the Secretary of State for Business, Energy and Industrial Strategy.

E.116. Matters of radioactive waste management policy are devolved to the Scottish Government, the Welsh Government and the Northern Ireland Government in their respective regions of the UK. However, the Secretary of State for Business, Entergy and Industrial Strategy remains accountable for the safe management of radioactive wastes kept or stored at licensed nuclear sites in England, Wales and Scotland.

E.117. The Secretary of State for Work and Pensions is responsible for the sponsorship of the ONR, and accountable to Parliament for radiation protection matters as well as general health and safety at work issues throughout Great Britain.

Figure 10 Responsibilities for the environmental regulation of spent fuel, reprocessing and radioactive waste management



E.118. The Department of Health (DoH) and the territorial health departments have general responsibility for public health.

E.119. The Food Standards Agency (FSA) is a non-ministerial government department with responsibility for the safety of foods. FSA monitors radioactivity in food and holds the principal responsibility for any radioactivity in food in England, Wales and Northern Ireland. The FSA would also advise the Government on food safety-related environmental effects of radioactivity released to the environment; it is free to publish this advice to ensure its independence.

E.120. Food Standards Scotland (FSS) is a non-ministerial office, part of the Scottish Administration, alongside, but separate from, the Scottish Government. FSA is a statutory consultee to SEPA for the granting of new or revised authorisations under RSA93 in Scotland. The FSS has a working level agreement with the FSA to provide support with technical assessments to enable them to fulfil this role.

Responsibilities of Operators or Employers

Operators / Employers

E.121. Under HSWA74, all operators and employers have the prime responsibility for ensuring the safety of their workers and the public from dangers arising from their work. This includes nuclear site licensees, operators of non-nuclear facilities producing or processing radioactive waste and transporters of radioactive material.

E.122. In accordance with UK government policy, the producers and owners of radioactive waste are responsible for ensuring that:

- they do not create waste management problems which cannot be resolved using current techniques or techniques which could be derived from current lines of development;
- where it is practical and cost-effective to do so, they characterise and segregate waste on the basis of physical and chemical properties and store it in accordance with the principles of passive safety; and
- they undertake strategic planning, including development of programmes for the disposal of waste accumulated at nuclear sites, within an appropriate timescale and for the decommissioning of redundant plant and facilities.

E.123. The producers and owners of radioactive waste bear the cost of managing and disposing of the waste.

Responsibilities of Regulators

E.124. The responsibilities of regulators arising from the legal and regulatory framework have been described in the earlier parts of this section and are well defined in the legislation.

E.125. In addition to the responsibilities described earlier, each of the regulators provides advice on matters within their remit as required, or when requested, to other bodies, government and the public.

E.126. UK regulators take an active part in international co-operation and development, contributing to international standards, taking part in meetings of European and world regulators, and negotiating and implementing bilateral information exchange agreements with other national regulators.

E.127. Whereas operators have a duty to carry out environmental and safety assessments, the regulators similarly need to assess the operators' submissions to satisfy themselves that the operators are meeting their obligations.

Responsibilities of Other Agencies and Bodies

The Nuclear Decommissioning Authority (NDA)

E.128. The NDA is a Non-Departmental Public Body (NDPB) sponsored by BEIS. It was established by the Energy Act 2004 to ensure that the UK's nuclear legacy sites are decommissioned and cleaned up safely, securely, cost-effectively and in ways that protect people and the environment. NDA was appointed to take responsibility for developing nuclear decommissioning plans and implementing them through an estate-wide strategy.

E.129. NDA's clean-up mission covers 17 sites, 14 in England and Wales as designated by the Secretary of State and 3 in Scotland also designated jointly by the Scottish ministers.

E.130. The NDA delivers its mission through other organisations, primarily Site Licence Companies (SLCs) who hold the site licence granted by the ONR to operate the nuclear site(s). The NDA sets the estate-wide strategy; contract manages the SLCs, and provides performance assurance across the estate. The SLCs are responsible for delivering NDA site progress through their running of day to day activities. The NDA also has a portfolio of subsidiaries.

E.131. Competition is a core concept for the delivery of NDA's strategy and private sector expertise has been introduced through competition for the ownership of SLCs by Parent Body Organisations (PBOs). The PBO provides management and leadership for the SLC during their tenure. PBOs are in place for the following sites:

- Low-Level Waste Repository;
- Dounreay Site Restoration Ltd. (DSRL);
- Magnox Ltd. – the current contract will be terminated at the end of August 2019. The NDA is currently undertaking a review to determine what approach will be taken to management of Magnox Ltd. in the future;
- Sellafield Ltd. - In 2015 NDA decided to end the contract with the PBO and Sellafield Ltd. on 1 April 2016. Under new arrangements, Sellafield Ltd. is now a subsidiary of the NDA and will acquire the support of a strategic partner or partners from the private sector to assist in its delivery; and
- Springfields – the freehold at Springfields is owned by the NDA. Westinghouse Electric UK is a long-lease holder and owns a lot of the assets; however, the NDA have some liabilities on the site.

E.132. Additional details on the NDA, its strategy, the PBOs, and its subsidiaries are provided in Section L.1 – Legislative and Regulatory System.

E.133. NDA is also responsible for implementing both geological disposal and the UK nuclear industry's Solid Low-level Radioactive Waste Strategy (Reference 14). The NDA performs certain advisory functions to the Secretary of State, detailed in paragraphs F.37 to F.49.

E.134. As a Non-Departmental Public Body (NDPB), the NDA's annual spending limits are set by parliament, combining government grant with income from commercial activities. The NDA's planned expenditure for the financial year 2017/2018 is £3.24 billion.

Responsibilities of Advisory Bodies

Committee on Radioactive Waste Management (CoRWM)

E.135. CoRWM's role is to provide independent scrutiny and advice to UK government ministers on the long-term management, including storage and disposal, of HAW.

E.136. The committee's primary task is to provide independent scrutiny on the Government's and NDA's proposals, plans and programmes to deliver a GDF, together with robust interim storage, as the long-term management option for the UK's higher-activity wastes.

Committee on Medical Aspects of Radiation in the Environment (COMARE)

E.137. COMARE assists and advises the Department of Health (DoH) and the Scottish Government Health Department on behalf of Scottish Ministers on the health effects of natural and anthropogenic radiation in the environment and assesses the adequacy of the available data and the need for further research. Further information can be found on COMARE's website.

Chief Nuclear Inspector's Advisory Panel

E.138. TEA13 enabled the ONR to create advisory committees to provide independent advice on any of its functions. Although not a legal requirement, custom and practice has been to constitute advisory committees in relation to activities in the nuclear sector. The ONR Board has acknowledged that a mechanism is needed to ensure the CNI has ongoing access to independent strategic technological advice and this is provided by the Chief Nuclear Inspector's Advisory Panel.

Article 19.3 – Consideration of Whether to Regulate Radioactive Materials as Radioactive Waste

E.139. The UK adopts a position in line with the definition of radioactive waste in the Joint Convention, i.e. "radioactive waste means radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party".

E.140. Assessment of waste management options includes not only materials currently classified as waste, but also takes into consideration the consequences of providing for other materials which may have to be managed as waste in the future. This includes separated plutonium and uranics, as well as a proportion of the UK's spent nuclear fuel that is not destined for reprocessing.

E.141. With the support of NDA, the UK Government is continuing to develop its policy on the management of separated plutonium. At this time, the NDA holds its uranics at a nil value pending development of long-term options and cost estimates. In the future, assessments may ascribe a value or a liability to each type of uranic material.

E.142. Some radioactive materials are likely to be classified as radioactive waste in the future, as circumstances change. The UK Government encourages site operators to undertake forward planning by identifying robust options for the future management of these materials, up to and including the point of disposal.

E.143. More information on the management of plutonium and uranics is given in Section L.3 – Spent Fuel and Radioactive Materials Policies and Practices

Openness, Transparency and Maintaining or Increasing Public Involvement and Engagement on Waste Management Issues

E.144. All regulators operate in an open and transparent way within their regulatory remit and comply with the UK's Freedom of Information legislation. This legislation requires all public bodies to respond openly to public enquiries and requests for information. Each regulator has a website on which information on its work is published, in particular, and where appropriate, including:

- any internal guidance on implementing legislation;
- reports of inspection or assessment or other regulatory activities; and
- specific guidance to operators on complying with legislation.

Similarly NDA and BEIS must comply with the same legislation and have their own websites.

E.145. The websites for the key public bodies are listed in Section L.6 – List of Primary Website Addresses.

E.146. The majority of the licensed sites have established a local stakeholder group that includes local authorities, trade unions and interested local groups and is usually open for members of the public to attend. These meet periodically and the ONR inspectors and the environmental regulatory

site inspectors usually attend the meetings as observers but will respond to questions arising from their written reports submitted on inspection and other regulatory activity. These meetings provide an opportunity for the local communities to discuss matters of interest and to raise any concerns they may have with the operators and regulators.

E.147. The development of UK legislation that sets out safety requirements involves consultation with the public, and the government has produced overarching guidance on how this should be done (Reference 65). Requirements to consult on various matters are written into legislation. Examples include section 81(3) of TEA13, which states that the ONR should consult on proposals about regulations before submitting them to the Secretary of State.

E.148. There is no legal requirement to consult members of the public with respect to licensing decisions. However, the ONR aims to be open and transparent in publishing the basis for its regulatory decisions to help all of its stakeholders, including the public, to understand its work.

E.149. The ONR also publishes an annual statement by the Chief Nuclear Inspector (CNI) which provides an overview of ONRs work in regulating the safety and security of the nuclear industry. The ONR's internal operational instructions and guidance documents are published on its website, so stakeholders can gain understanding of the basis for regulatory decisions. The ONR routinely publishes its most significant regulatory decisions, through full project assessment reports and executive summaries of inspection reports which are written by its inspectors following site visits. The ONR is committed to responding openly to any questions on its published information.

E.150. The environmental regulators agencies' have legal responsibilities to consult on permitting applications, and, where there is considered to be a high public interest, may also consult on permitting decisions. The consultations make use of the expertise of others to ensure all environmental risks are considered (Reference 66).

E.151. The environmental regulators also maintain public registers for activities regulated under EPR16 and RSA93. The public registers contain all applications (for a new permit, variation, transfer or surrender), additional information received, consultee responses (unless the consultee requests that it not be included) and the final determination (decision document and any permit or notice), subject to addressing national security and commercial confidentiality.

Article 20 – Regulatory Body

Article 20:

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

Article 20.1 – Authority, competence and resources

Office for Nuclear Regulation

E.152. TEA13 created the ONR as a standalone, fully independent, regulator responsible in law for delivering its own regulatory functions. Creation of the ONR has consolidated into one

organisation: regulation of nuclear safety; transport of civil radioactive materials and wastes; nuclear security; and oversight of the UK's arrangements to meet International Safeguards commitments.

E.153. The ONR has its own board consisting of non-executive and executive members, the non-executive members always being in the majority. The role of the ONR Board is to provide leadership, set strategy, agree the overarching policy framework within which ONR operates as a regulator, agree and monitor resources and performance and ensure good governance.

E.154. Central to delivery of the ONR's core activities are effective governance arrangements. To achieve this, the ONR has adopted an operating model based on matrix management arrangements, with staff organised into specialisms and working in divisions.

E.155. The regulation of similar sites is organised into operational divisions, each headed by a director. This structure allows the ONR to focus on the context of the sites, is aligned with industry structures and enhances the efficiency and consistency of regulatory activities.

E.156. The line management of inspectors within the ONR is through a professional lead for each identified specialism, including a professional lead for the ONR's specialists involved with the management of radioactive wastes and spent fuels. The main responsibilities of each professional lead cover:

- strategy and standards;
- support and guidance;
- resource planning and allocation; and
- knowledge management and succession planning.

E.157. Technical specialists are generally embedded within the operational delivery divisions and may carry out work for more than one division concurrently.

E.158. The professional leads in turn report to the Technical Director who heads the Technical Division. In addition to this management role, the Technical Director also has a role to ensure ONR's regulatory decisions are robust and subject to an appropriate process of peer review. This assurance function secures compliance with the ONR's own arrangements in addition to being responsible for the review and development of the ONR's technical standards and associated regulatory business processes.

E.159. On entering the ONR, inspectors undergo an extensive training programme to ensure that the technical skills that they have are supplemented to ensure that they become effective regulators. This includes significant training on legal matters and the ONRs processes. In conjunction with their line manager, any additional technical training is identified and arranged.

E.160. Inspectors are formally appointed through a legal instrument called a warrant. This is not issued until the inspector has completed any appropriate training, participated in activities with experienced inspectors and been subject to an interview to test the inspector's knowledge, experience and suitability to hold the warrant.

E.161. The ONR is committed to inspector development, dedicating three experienced inspectors to deliver a wide range of in house training programmes to both new and experienced inspectors. Throughout an inspector's career learning and development needs are regularly reviewed with their line manager and any needs addressed using the most appropriate means.

E.162. This year the ONR has launched a project to further enhance the learning and development offered to all staff by establishing an ONR Academy. This central approach for learning and development in the ONR will build on the strong foundations of the current in house training provision, but better integrate on the job learning, practical workshops and leadership and behavioural skills to develop all staff to deliver the ONR's mission and respond to the changing face of the UK nuclear industry. Key activities already underway are an organisational Training

Needs Analysis, procurement of a learning and content management system (which includes an e-learning portal) and opening key modules to the Industry Internal Regulatory Community.

E.163. The ONR's financial and human resources are summarised in Section L.1 – Legislative and Regulatory System.

Environmental regulators

E.164. The Environment Agency (EA) is a non-departmental public body (NDPB). The board is directly responsible to government ministers for all aspects of its organisation and performance. The EA is accountable to Parliament through ministers. The EA board has 9 non-executive members appointed by the Secretary for Environment, Food and Rural Affairs. The board meets 4 times a year and delegates day-to-day management to the Chief Executive and staff through a non-financial scheme of delegation, so that all duties and activities carried out by the Environment Agency are approved at the appropriate level. The EA has a team of 3 executive directors. They oversee, co-ordinate and put into effect national policies. Three other Directors sit on the Executive Directors team.

E.165. Many of the EA's regulatory teams are organised on a geographical area basis (14 areas across England). However, the regulation of nuclear licensed sites is carried out by the national Nuclear Regulation Group, which is organised into a group of teams covering the north of England and the other covering the south of England, each with its own manager. Those regulatory teams which deal with radioactive substances permits on non-nuclear sites operate on a pan-Area basis, while reporting through a single Area management structure.

E.166. Decision-making relating to radioactive substances permits is, in the main, delegated to the managers of the Area teams and the Nuclear Regulation Groups, supported, as appropriate, by the legal department and the head office radioactive substances and installations regulation department. The head of the latter acts as head of profession.

E.167. On recruitment, radioactive substances regulators undergo training to ensure that their existing technical skills are supplemented to enable them to become effective regulators. This includes training on legal matters (including enforcement) and EA's processes.

E.168. Radioactive substances regulators are given full regulatory powers through a warrant. This is not issued until the regulator has completed any appropriate training, participated in activities with experienced regulators and demonstrated their knowledge, experience and suitability to hold the warrant.

E.169. Additional details on the environment agencies can be found in Section L.1 – Legislative and Regulatory System.

E.170. Regulators are also expected to achieve 'radioactive waste compliance adviser' status, by demonstrating an extensive level of knowledge and capabilities, and to maintain this through continuing professional development.

Article 20.2 – Regulatory body independence

E.171. The ONR's demonstrable independence as a regulator has been strengthened under the terms of TEA13, by having direct responsibility for the enforcement of the nuclear safety regulatory system focussed on sites licensed under NIA65. Similarly, the environmental regulators are responsible for providing the environmental protection regulatory system under EPR16 in England and Wales and RSA93 in Scotland and Northern Ireland. HSE has responsibilities for the regulation of radiological protection on sites that are not licensed under NIA65.

E.172. Governmental mechanisms are in place to maintain the independence of the regulatory bodies. The ONR is sponsored by the Department for Work and Pensions, which has no role in promoting nuclear technology or responsibilities for nuclear facilities or activities.

E.173. The Secretary of State for Business, Energy and Industrial Strategy is answerable to Parliament for nuclear safety in Great Britain. The ONR can provide factual information to this Minister on matters of nuclear safety regulation, but this Minister is not responsible for the ONR's nuclear regulatory actions. The Secretary of State can issue a direction as to ONR's exercise of its functions. A direction may modify a function of The ONR but (except in matters of national security) cannot be given in relation to the exercise of a regulatory function in a particular case.

E.174. **The EA** is governed by an independent Board that is accountable to the Secretary of State for Environment, Food and Rural Affairs. The Board delegates responsibility for the day-to-day management of the organisation to the EA's Chief Executive. The Board provides the necessary separation between the EA's day-to-day regulatory decision-making and Government. The EA is independent of the undertakings that it regulates and has no role in promoting nuclear technology and no responsibilities for developing or operating facilities for radioactive waste disposal or spent fuel management.

E.175. **NRW** is answerable to an independent Board appointed by and accountable to the Welsh Ministers. Day-to-day management of the organisation is delegated to NRW's Chief Executive. NRW is independent of the undertakings that it regulates and has no role in promoting nuclear technology and no responsibilities for developing or operating facilities for radioactive waste disposal or spent fuel management.

E.176. **SEPA** is a non-departmental public body established under section 20 of EA95. SEPA operates at arm's length from the Scottish Government but is accountable through Scottish Ministers to the Scottish Parliament. SEPA has an Agency Board that is accountable to Scottish Ministers. The day-to-day management of the organisation is delegated to the Chief Executive of the Board. As Scotland's environmental regulator, SEPA has no role in the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the operation of facilities for the management of spent fuel and radioactive waste.

E.177. **NIEA** is an Executive Agency within the Department of Agriculture, Environment and Rural Affairs (DAERA) and leads on advising on and implementing the Government's environmental policy and strategy including radioactive waste management, in Northern Ireland. Under RSA93(NI), the Chief Inspector is responsible for implementing regulatory regime in NI. The Chief Inspector is appointed by the Department of Environment which has no role in promoting nuclear technology.

Section F - Other General Safety Provisions

Article 21 – Responsibility of the Licence Holder

Article 21:

2. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility;

3. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.

F.1. Under this Article, compliance with the Joint Convention is demonstrated in ways that have not substantially changed since the fifth United Kingdom (UK) national report.

Article 21.1 – Prime Responsibility for Safety

F.2. A fundamental principle of the non-prescriptive, goal-setting UK legal system is that responsibility for health and safety clearly rests with those who own, manage, and control the work in industrial and commercial undertakings. Thus, the prime responsibility for safety lies with the site licence holder, who is the organisation in control of day-to-day operations.

F.3. For sites owned by the Nuclear Decommissioning Authority (NDA) (see paragraphs L.1.59 to L.1.67), the prime responsibility for safety on those sites remains with the relevant Site Licence Companies (SLCs).

Article 21.2 – Contracting Party Responsibility if there is no Licence Holder or Other Responsible Party

F.4. The UK Government takes the steps necessary to ensure that spent fuel and radioactive wastes are managed in a safe manner, including in the eventuality of radioactive waste or spent fuel being found on a site that does not hold a licence under the Nuclear Installations Act 1965 (NIA65).

F.5. If adequate facilities are not available for the safe disposal or accumulation of radioactive waste, the Secretary of State in England and Welsh Ministers in Wales have the power, under the Environmental Permitting Regulations 2016 (EPR16) (Reference 39), to provide such facilities, or may arrange for their provision by such persons as they may think fit. Similar powers are available to the Scottish Ministers under the Radioactive Substances Act 1993 (RSA93) (Reference 45).

F.6. Site operators are expected to hold a nuclear site licence for storage of a ‘bulk quantity’ of radioactive material in accordance with the defined scope of NIA65 (Reference 42). On sites where activities are not prescribed under NIA65, the relevant employer still bears responsibility for safety under the provisions of the Health and Safety at Work Act 1974 (HSWA74) (Reference 41).

F.7. Any radioactive waste accumulated on a site without a nuclear site licence is subject to the full requirements of the environmental permitting legislation. If the appropriate environmental regulator is satisfied that the waste ought to be disposed of, but that it is unlikely that the waste will be lawfully disposed of, EPR16 and RSA93 provide powers to the environmental regulators to arrange disposal of the waste themselves. On nuclear licensed sites, the Office for Nuclear

Regulation (ONR) has regulatory powers provided by the site licence conditions to direct the disposal of radioactive waste from a licensed site, in so far as such a direction is in accordance with the requirements of the applicable environmental legislation.

Article 22 - Human and Financial Resources

Article 22: Each Contracting Party shall take the appropriate steps to ensure that:

1. qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;
2. adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning; and
3. financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

F.8. Under this Article, the only significant changes to the UK's means of complying with the Joint Convention since the fifth UK national report are the following and have been highlighted:

- creation of the Nuclear Skills Strategy Group (NSSG) – see paragraphs F.11 to F.17; and
- the total lifetime cost of decommissioning for the NDA's sites has been updated – see paragraphs F.40 to F.44.

F.9. Reskilling of workforce for decommissioning has been identified as a future challenge – see paragraphs F.34 to F.36.

Article 22.1 – Availability of Qualified Staff

F.10. Ensuring that qualified staff are available for safety - and environmental protection - related activities at individual sites is the responsibility of the plant operator. In addition, the UK has national plans and programmes in place to ensure that a sufficient pool of qualified resources is available to meet the future demands in the nuclear sector.

Maintaining and Enhancing the National Nuclear Skill Base

F.11. The UK nuclear sector (civil and defence) currently employs around 80,000 people. A programme of continued operations, decommissioning and clean-up, together with a potential programme of new nuclear build, means the nuclear industry has a sustained demand for recruitment and training, whilst a large share of existing nuclear engineers in the UK is nearing retirement.

F.12. The Government is anticipating and addressing the threat of skill shortages through a collaborative approach with industry. To address these skills gaps collectively, the NSSG has been formed, which is supported by key industry members. These organisations, in partnership with the UK Government, regulators, and trade unions have developed the Nuclear Skill Strategic Plan in December 2016 (Reference 67). The UK Government is also acting to increase the numbers of young people with Science, Technology, Engineering and Mathematics (STEM) skills by working with schools and is committed to creating three million apprenticeships by 2020 (not all in the nuclear sector).

F.13. The NSSG has commissioned research (Reference 68) to analyse the workforce requirements for the full range of nuclear activities. This research indicated that in the next five years, an average of 8,200 new recruits is required to meet expansion and replacement demand. These new recruits will be a combination of apprentices, graduates and experienced hires.

F.14. As part of these activities, in 2015, the National College for Nuclear was established with Government and industry funding; it will open in autumn 2017 operating through a "virtual college model" aiming to deliver industry-specific courses and train 7,000 people by 2020.

F.15. The NDA has a statutory duty under the Energy Act 2004 (Reference 32) to ensure adequate skills are available for it to carry out its duties, and an annual budget to develop those skills through its People Strategy and associated delivery plan. This strategy is linked to the NSSG strategic plan and includes skills development activities for staff engaged in nuclear decommissioning and for the supply chain. It focuses on the specific requirements of the UK decommissioning programme.

F.16. The National Nuclear Laboratory (NNL) is charged by the UK Government to protect and grow the UK's national nuclear technology capability and skills base. NNL has around 940 staff across a number of sites, as well as several laboratory facilities, including the Central Laboratory on Sellafield site - a £250 million purpose-built facility, which houses a wide range of radioactive and non-radioactive experimental programmes, as well as offering a wide range of analytical services.

F.17. Further detail is provided in Section L.2 – General and Specific Safety Provisions.

Management of Human Resources for Safety-Related Activities

Regulatory Background

F.18. HSWA74 places the responsibility for safety on the plant operator. This responsibility includes the competence and training of staff with safety-related roles. More specific requirements are included in the Management of Health and Safety at Work Regulations 1999 (MHSWR99) (Reference 69), in particular Regulation 13 on Capabilities and Training.

F.19. Several of the NIA65 site licence conditions (Reference 44) set goals that are relevant to training and management of human resources. Overall, in order to comply with regulatory requirements, a nuclear licensee must demonstrate to the ONR's satisfaction that it has:

- lines of authority leading to adequate control and supervision over its activities – whether those activities are carried out by the licensee's own staff or by contractors;
- human and financial resources at a level that maintains adequate safety margins and competent management of radioactive wastes;
- a precise definition and documentation of staff duties relevant to safety and the management of radioactive wastes (definition of duties);
- suitable qualified, trained and experienced staff, ensuring adequate in-house expertise; and
- the provision of, or access to, a high level of health and safety expertise used in an active manner for the independent peer review of safety cases, internal audits and reviews.

F.20. The licensee is also required to have arrangements for the control of any change to its organisational structure or resources which may affect safety.

F.21. This requirement was introduced specifically to guard against any undermining of safety-related resources as a consequence of ill-considered cost-cutting. In addition to all personnel having some responsibility for the delivery of the management system and its components,

dedicated personnel are responsible for the assessment, review and collation of management information to support continual improvement.

F.22. The ONR monitors the adequacy of, and compliance with, the arrangements made by licensees under the NIA65 site licence conditions. Under normal circumstances, the ONR does not have any specific role in the selection, training and authorisation of staff to perform safety-related duties. However, the ONR does have the power to intervene if, in its opinion, a person nominated by a licensee to perform the duties of a duly authorised person is unfit to fulfil the role.

F.23. The Safety Assessment Principles (SAPs) provide guidance to assist ONR inspectors in their judgments on the adequacy of licensees' provisions for training staff with responsibilities for safety. Relevant factors include: the management system for training on the site, analysis of jobs and tasks, development of training methods, assessment of trainees, provision of refresher training as required, and regular evaluation of the effectiveness of training. Licensees are expected to have a systematic and comprehensive approach to training and assessment of personnel with safety roles to comply with established ONR expectations.

F.24. Environmental permits and authorisations for radioactive substances activities (including disposal of radioactive waste) issued under EPR16 and RSA93 also require the site operator to use sufficient competent persons and resources when operating and managing the permitted activities.

F.25. The Radioactive Substances Regulation Environmental Principles (REPs) (Reference 70) issued by the Environment Agency (EA) include principles related to management and leadership for the environment.

Qualification, Experience and Training

F.26. For all tasks undertaken on a nuclear licensed site, it is a regulatory expectation that the staff of licensees and permits / authorisation holders and their contractors should receive adequate training. Such training should make all relevant personnel aware of the hazards on the site, together with the systems in place to control the risks to health and safety. For each post or role with a responsibility for safety, licensees are expected to ensure that all safety-related duties, responsibilities and competencies are systematically identified and the training needs of each individual are met.

F.27. Procedures for assessing the competence of personnel prior to them undertaking a safety-related task will form part of a licensee's arrangements under the site licence conditions.

F.28. The licence also requires that any posts on site that may affect operational safety, or implement actions connected with site licence conditions, can only be performed by 'suitably qualified and experienced persons'. Where such actions need to be controlled or supervised, this must be done by 'duly authorised persons' appointed by the licensee. The ONR regularly inspects the adequacy and implementation of this process, and has powers under the site licence to ensure no person acts as a duly authorised person when considered unfit to do so.

Training of External Personnel

F.29. Licensees and permits / authorisation holders at all times hold primary responsibility for ensuring safety on the licensed site; when licensees use contractors for safety-related work, they must satisfy themselves that the contractors' staff have appropriate qualifications and training to undertake the required tasks safely and competently. The ONR and the environment agencies expect the licensee to have sufficient in-house expertise and available resources to accurately specify the required work using adequate standards, set up the contracts, oversee the quality of the work undertaken and, if necessary, challenge the work of contractors.

Training Programme Development

F.30. The ONR and the environment agencies expect licensees and permit / authorisation holders to keep the adequacy of all their training courses under review, including:

- To reflect modifications to the plant, instructions, and procedures identified and made under the site licence conditions; and
- To reflect lessons learnt from on-site incidents.

F.31. Training instructors are expected to be staff of proven competence with relevant experience in the area of work on which they provide training and should themselves be mentored on how to present training materials effectively. Arrangements should be in place for assessment of the performance of instructors, informed by feedback from the staff who have received instruction.

Provision of Resources

F.32. Provision of adequate resources is recognised by the ONR and the environment agencies to be a key element of delivering compliance with the site licence and the disposal permits / authorisations. For example, to comply with the requirements for appropriate arrangements for radioactive waste management, adequate resourcing is required both in terms of specialist waste management expertise and in terms of resources (number of staff, equipment, funding) to undertake the waste management processing steps.

F.33. Licensees and permit / authorisation holders are expected to determine the level of resources necessary to safely carry out their activities during the planning stage. This should include the resources and tasks needed to manage all anticipated radioactive wastes in a manner that is safe and protects the environment. The minimum level of competent personnel for activities that may affect safety should be included in the site's nuclear baseline. The nuclear baseline is the means by which the licensee demonstrates that its organisational structure, staffing and competencies are, and remain, suitable and sufficient to manage nuclear safety throughout the full range of the licensee's business.

Reskilling of Workforce for Decommissioning

F.34. Decommissioning redundant reprocessing facilities requires a very different mind-set from that associated with operating and maintaining modern nuclear facilities to high safety standards. The decommissioning situation is often characterised by increased uncertainty over the radioactive inventory and physical condition of the facility.

F.35. Reskilling begins with the recognition that decommissioning is generally different from reprocessing. Progress with decommissioning relies on fit-for-purpose engineering solutions complementing the competence and know-how of nuclear workers. Learning from experience whilst carrying out disciplined decommissioning operations is then fundamental and can be supported by periodic review and sharing of case-studies or examples to inform and engage an expanding decommissioning team.

F.36. Realisation that a reprocessing programme is within a few years of closure brings with it both challenges and opportunities. The challenges include maintaining focus within the operations / maintenance team in order to deliver safe operations and successful closure. Preparing for the first stage of decommissioning will involve a substantially smaller team undertaking generally familiar waste management activities. A significant number of roles will become surplus providing an opportunity to match the aspirations of individuals to the needs of the organisation viewed over a period of several years. An important consideration is the socio-economic impact within the host community as the site nears the end of decommissioning.

Article 22.2 and 22.3 – Financial Resources

F.37. Financial resources that support the safety of facilities dealing with radioactive wastes and spent fuel are generally managed by licensees as part of normal operating costs, the principal elements of which tend to comprise:

- maintenance and enhancement of safety and environmental protection;
- plant monitoring and asset care;
- sampling, analysis and treatment of radioactive waste;
- materials and services (the costs of engineering, consumable components such as filters, transport costs and other miscellaneous charges such as insurance);
- staff costs (salaries and pension provisions), and
- depreciation (representing the proportion of the fixed assets written off in relation to their assumed life for accounting purposes).

F.38. The ONR expects that licensees will have sufficient funding to undertake the construction and remediation of radioactive wastes. Where a licensee is part of a group of companies with a parent company, it is expected that the parent will provide sufficient funds for the licensee to carry out its activities and to ensure that nuclear safety is not compromised.

F.39. Financial arrangements for the disposal of high-activity sealed sources are detailed in Section J – Disused Sealed Sources.

Financing Current Decommissioning Programmes and Radioactive Waste Management

F.40. The audited accounts of the UK's operators of spent fuel, reprocessing and radioactive waste management facilities include details of waste management costs and the provisions made to meet them. There is currently no available disposal route for High Activity Waste (HAW) in the UK, so such wastes at present have to be kept in safe and secure interim storage awaiting development of the planned Geological Disposal Facility (GDF).

F.41. The cost of managing radioactive waste during the operational phase of a facility is typically spread across materials, services and staff costs in the reported accounts. Materials and services costs in accounts tend to include the costs associated with disposals of Low-level Waste (LLW), with an estimated price that reflects both the short-term operational cost and onwards disposal costs.

F.42. The NDA requires its site operators to prepare detailed plans for their sites to a prescribed format, known as Lifetime Plans (LTPs). LTPs cover commercial activities as well as decommissioning and clean-up costs.

F.43. Although the plans are detailed, there is significant inherent uncertainty in the future cost estimates that underpin the provisions for management of spent fuel and radioactive wastes on the NDA sites. Some specific uncertainties that the NDA and its SLCs are working to address include:

- site end-states;
- inventory of material to be retrieved from legacy facilities;
- performance of aged infrastructure that is reaching the end of its operational life;
- contaminated land quantities and treatments required;
- programming of work and risks arising from programme inter-dependencies; and
- disposition plans for wastes – HLW, ILW, and LLW – and spent fuels

F.44. The NDA has responsibility for contracting the operation of commercial and waste management operations on the sites within its estate and for the eventual decommissioning of those sites. The current estimate for the total lifetime cost of decommissioning the sites is around £164 billion (discounted) and the programme is likely to take up to 120 years to complete (Reference 71). The NDA is exploring ways to reduce this cost and shorten the timescales, while still maintaining safety, security and environmental standards. Audited accounts of the NDA are made available to the public via the NDA's website and include more information. The NDA's funding is discussed in Section L.1 – Legislative and Regulatory System; the total planned expenditure for the financial year 2017 to 2018 is £3.24 billion.

Funding for Future Decommissioning and Spent Fuel (Advanced Gas-cooled Reactors (AGRs) and Sizewell B)

F.45. The UK Government expects all nuclear operators to take the steps necessary to ensure that they have sufficient financial provision to fund the decommissioning work required on the sites they are responsible for.

F.46. The UK Government's restructuring of British Energy in 2005 created a new independent funding mechanism, the Nuclear Liabilities Fund (NLF). EDF prepares and submits a decommissioning strategy and plan every five (or three years prior to the station closure), which is subject to review and approval by NDA. In addition EDF Energy can also apply for funding from the NLF for work carried out within the agreed scope of the NLF, subject to review and approval by the NDA. The UK Government stands behind the NLF and retains the ability to compete all or part of the decommissioning scope to achieve improved value for money.

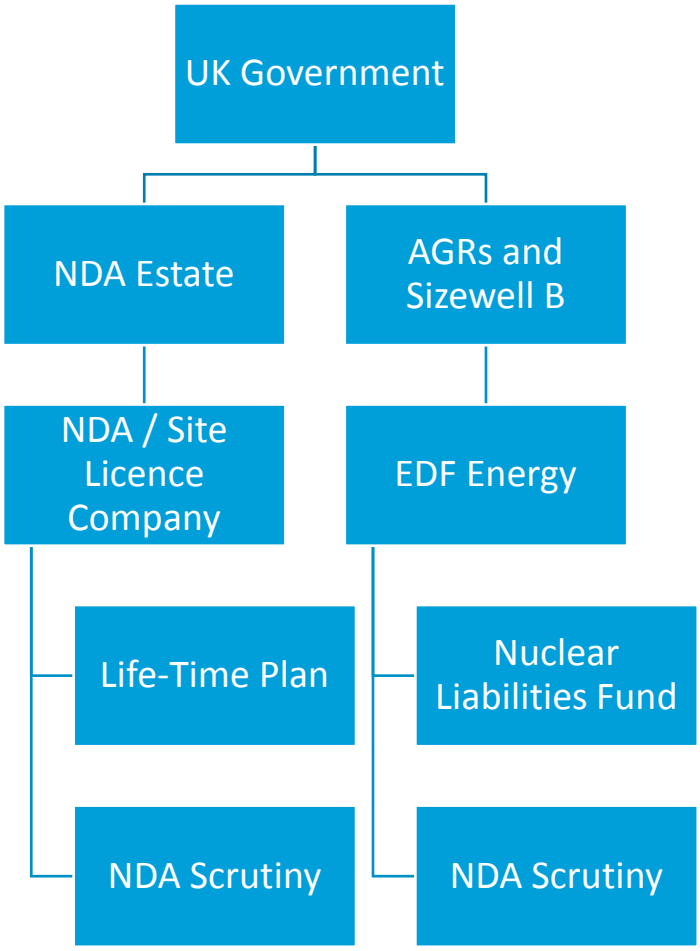
Funding for Waste Management and Decommissioning of Proposed New Nuclear Power Stations

F.47. Under the Energy Act 2008 (Reference 72) all new nuclear power stations must have a government approved Funded Decommissioning Programme (FDP) before operations begin. The programmes ensure that new nuclear power station operators have secure financing arrangements in place to meet the full costs of decommissioning, waste management and the disposal of spent fuel. The FDP is also used to satisfy licensing regime requirements regarding decommissioning liability.

F.48. The FDP has a strong governance framework that helps to further ensure a prudent approach to decommissioning. This includes working with technical decommissioning experts such as the NDA and consulting relevant regulators such as the ONR and the EA. Furthermore, before the Hinkley Point C FDP was accepted by the Secretary of State, it was reviewed by the independent Nuclear Liabilities and Financing Assurance Board (NLFAB) to ensure it met the criteria of prudence. Given that the FDP is agreed at the early stages of constructing a nuclear power plant, governance measures have been put in place to ensure that the estimated liabilities remains accurate as possible well into the future. These measures include: receiving cost and financing verification reports from independent third-party experts; annual reports to ensure that the fund is on track and a wider ranging review of the FDP costs every five years.

F.49. A summary of the roles and responsibilities related to financial provisions for decommissioning and waste management is provided in Figure 11.

Figure 11: Roles and Responsibilities related to Decommissioning and Waste Management Funding



Article 23 - Quality Assurance

Article 23: Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

F.50. Under this Article, compliance with the Joint Convention is demonstrated in ways that have not substantially changed since the fifth UK national report.

F.51. Within the UK, quality assurance is an inherent feature of licensees' management systems. Quality assurance controls are applied to all work activities on the licensed site that have implications for nuclear safety, security and environmental protection. This includes the production, categorisation, storage, conditioning, discharge and transportation of radioactive wastes.

F.52. Compliance with this Article is linked to the requirements of the International Atomic Energy Agency (IAEA) Safety Standards - General Safety Requirements (GSR) Part 2, 'Leadership and Management for Safety' (Reference 73), supported by Safety Guide GS-G-3.1, Application of the Management System for Facilities and Activities' (Reference 74) and Safety Guide GS-G-3.5, 'The Management System for Nuclear Installations' (Reference 75). The 2014 version of the ONR's SAPs and the Environment Agency's REPs broadly reflect these IAEA requirements. The SAPs

and REPs recognise the importance of leadership and management for safety and expect quality management systems to be an integral part of this.

Regulatory Requirements, Review and Control Activities

F.53. The site licence conditions and environmental permits / authorisations place a duty on licensees to:

- establish and implement management systems which give due priority to safety;
- make and implement adequate quality management arrangements in respect of all matters which may affect safety; and
- ensure their management systems are effective in managing radioactive wastes, including their minimisation and accumulation on-site.

F.54. As a benchmark of established good practice, the ONR and the environment agencies expect licensees to base their quality management arrangements on recognised national or international quality management standards to adequately address all relevant matters of safety. ONR encourage licensees to establish and maintain integrated management systems, as set out in GSR Part 2, to ensure safety is an inherent consideration within all the licensee's activities, including environmental management.

F.55. Many of the UK nuclear licensed sites use routes through which radioactive wastes transfer from the point of generation through several steps before dispatch off the site or placement into long-term storage. Radioactive wastes may be managed by a series of business units or contracted organisations that each carry out one or more parts of the overall waste management process. In such circumstances, the ONR and the environment agencies place particular emphasis on the importance of licensees maintaining effective oversight of the entire waste management system and integrating the individual steps.

F.56. The deployment of adequate management systems by the licensees are requirements of the discharge permits and authorisations issued by the UK environmental agencies. These are similar to the quality assurance requirements of the nuclear licence conditions.

Status of Integrated Management Systems

F.57. Licensees' management systems are authorised for use by senior management and are mandatory for all personnel.

F.58. Licensees deploy integrated management systems. This promotes a consistent approach to the wider aspects of their activities, e.g.: quality/safety, environment, security, transport, safeguards, and other business activities. This simplifies the management system and reduces the likelihood of incompatible arrangements. However, due priority is still given to safety.

F.59. Licensees' management systems demonstrate compliance with licence and permit / authorisation conditions and also national and international quality management requirements. The arrangements are subject to periodic management review to ensure these arrangements remain fit for purpose and identify opportunities for continual improvement. In addition, they are subject to self-assessment and internal audit.

F.60. Most licensees' management systems are certified to ISO 9001 and ISO 14001 by independently accredited bodies. These standards require independent third party audit of their management systems, and periodic surveillance and re-certification of the licensees against the requirements of the standards.

Main Elements of Management Systems

Processes

F.61. For safety related processes the licensees ensure that the processes are planned, documented, assessed, reviewed and continually improved. Work performed under each process is carried out under controlled conditions, by suitably qualified and experienced personnel, using approved procedures and instructions. These process-control arrangements are subject to periodic review.

F.62. The licensee retains overall responsibility and intelligent customer capability where processes or process activities are contracted to other organisations.

Graded Application of Management System Requirements

F.63. The extent of management system controls applied to activities by the licensee is graded to provide a hierarchy of controls proportionate to the safety significance and the related risk associated with activity being carried out. This approach ensures that appropriate and proportionate levels of controls are in place (e.g. scrutiny, supervision, inspection, monitoring, documentation, training, audit and surveillance) with respect to the safety significance of the activities undertaken, items procured or plant arrangements.

Documentation of the Management System

F.64. Licensees typically describe their management systems in a hierarchical structure. The top tier generally includes policies, organisational structure, values and the mission or principal objectives. The second tier contains processes and procedures and job or post profiles. The third tier normally contains working level instructions, check-sheets/records and training material.

Planning

F.65. Licensees develop business plans for the various stages in their facility's lifecycle. The quantities and forms radioactive wastes generated will vary as a nuclear plant transitions through its lifecycle stages. This generally results in a need for the licensee to modify its arrangements in order to continue satisfying regulatory expectations. For example, a large decommissioning project may generate radioactive wastes on a scale that is beyond the capacity of the site's pre-existing waste management infrastructure and outside the experience of staff; requiring a programme of plant/facility upgrades and training.

Performance monitoring and improvement

F.66. To assess conformance to, and the effectiveness of, their management system arrangements, licensees carry out, or are subject to, a range of monitoring and measuring activities. This includes: quality control inspections, process monitoring, self-assessment, multi-layered oversight, independent internal and external audit and review, benchmarking, national and international peer review missions.

F.67. Licensees carry out similar assessments of suppliers of safety related goods and services.

F.68. The ONR and the environment agencies carry out inspections of the licensees' quality management arrangements as part of their regulatory activities.

F.69. Licensees have arrangements for reporting, assessing, addressing and learning from non-conformances/events/incidents. Licensees share and have access to operational feedback from the international nuclear and other industries.

F.70. Most licensees carry out periodic management reviews, as required by the various quality standards, to assess the effectiveness of their arrangements and to provide a basis for the ongoing

improvement. Annual reviews of safety are carried out by the licensees. They consider the above indicators of performance and identify areas for improvement. The findings and identified improvement actions are presented to the regulators by the licensees.

F.71. Depending on the scale of the required changes, improvements may be realised as specific activities or as part of the licensees' business plans.

Article 24 Operational Radiation Protection

Article 24:

3. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

   (i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

   (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

   (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

4. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

   (i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

   (ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

5. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

F.72. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK national report. The opportunity has been taken to improve the layout and clarity of this section.

F.73. The following examples have been identified to demonstrate successes and challenges associated with operational radiation protection in spent fuel and radioactive waste management activities:

- good practices identified by the ONR during its Control of Occupational Exposure inspections – see paragraphs F.81 to F.85;
- the reception of several Article 37 positive opinions from the European Commission – see paragraphs F.122 to F.127; and
- the application of Best Available Techniques (BAT) to the reduction in radioactive discharges to sea and the link with the recent OSPAR periodic evaluation pararaphs F.128 to F.134.

Article 24.1(i) – Optimisation of Exposure to Levels As Low As Reasonably Achievable (ALARA) / As Low As Reasonably Practicable (ALARP)

F.74. In the UK, the Ionising Radiations Regulations 1999 (IRR99) were made under powers granted to the Secretary of State under the Health and Safety at Work Act 1974 (HSWA 74) as explained in paragraphs E.5 to E.13. These regulations are supported by an Approved Code of Practice (ACOP) (Reference 76) which gives practical guidance on the most appropriate methods of complying with regulatory requirements. Please note that these regulations are in the process of being revised under work undertaken to implement the revised Basic Safety Standards Directive 2013/59/Euratom (BSSD 2013) (Reference 20).

F.75. The requirement in IRR99 Regulation 8(1) is for radiation employers to restrict So Far As Is Reasonably Practicable (SFAIRP) exposure of employees and the public to ionising radiations. This principle is equivalent to reducing the risk from radiation exposure to levels that are ALARP, which in turn is equivalent to ALARA; economic and social factors being taken into account.

F.76. Under IRR99 and the SFAIRP principle, there is no notion of a dose below which optimisation is regarded as satisfactory. Thus, this principle has no lower dose boundary and is satisfied only when the radiation exposures are demonstrably ALARP. The ONR has published SAPs which include some lower dose targets called Basic Safety Objectives (BSOs) of 1mSv/year for employees working with ionising radiation, 0.1mSv/year for other employees, and 0.02mSv/year for any person off the site. The BSO represents a dose value below which the regulator will not normally use its resources to seek further improvements, provided it is satisfied with the validity of the licensee's arguments. It does not represent a notional value of optimisation and a radiation employer at a nuclear licensed site would still have to seek further dose reductions below the BSOs if these were reasonably practicable. More detail on the application of these principles in the UK can be found in Section L.2 – General and Specific Safety Provisions.

F.77. The IRR99 requirements are augmented by nuclear site licensing requirements; licensees must optimise protection to provide the highest level of safety that is reasonably practicable. This optimisation would include, but not be Ltd. to, the following criteria reflecting the fundamental principles of the SAPs:

- the safety of the public and workers from the effects of ionising radiation should be assessed during design, construction, commissioning, operation and decommissioning. Through this systematic process of safety assessment, the duty holder for a nuclear site or facility must demonstrate effective understanding of the hazards;
- measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm;
- all reasonably practicable steps must be taken to prevent and mitigate nuclear or radiation accidents; and
- arrangements must be made for emergency preparedness and response in the case of nuclear or radiation incidents.

F.78. Licensees are required under IRR99 to restrict exposure by means of engineering controls, such as shielding, physical separation, containment, ventilation and warning devices, where these are reasonably practicable, rather than relying on systems of work or personal protective equipment. At nuclear installations, whether or not licensees' employees undertake the work, the licensees are ultimately responsible for controlling work and ensuring doses to individuals are ALARP.

F.79. A dose constraint is a prospective restriction on the individual dose caused by a source of ionising radiation, which serves as an upper bound on the dose to optimise the protection and

safety of persons who may be affected by the source. IRR99 Regulation 8 requires employers to use dose constraints, where appropriate, in the planning stage of radiation protection. This is achieved through good planning of work activities. In general, licensees have considerable experience in developing dose databases which provide accurate dose forecasts for planned tasks.

Regulatory Activities

F.80. The provisions of IRR99, for both workers and members of the public, at spent fuel, reprocessing and radioactive waste management facilities, are enforced through inspections undertaken by the ONR. Note that the Health and Safety Executive (HSE) is the enforcing authority for the IRR99 on non-nuclear sites.

Control of Occupational Radiation Exposure – Areas of Good Practice

F.81. The ONR has recently completed inspections on the Control of Occupational Radiation Exposure (CORE). These considered whether worker radiation doses across the entire nuclear industry were ALARP. Whilst the report of this work is yet to be finalised, these inspections have confirmed industry compliance with the ALARP principle and have highlighted areas of good practice, detailed below.

F.82. Work preparation and scheduling: When working conditions are challenging, several licensees use mock-ups and rehearsals for training prior to high-dose exposure work. Telemetric (real time) dosimetry is sometimes used during these high-dose operations.

F.83. Trending and use of Operational Experience (OPEX): Several licensees use extensive trending of doses to ensure that activities remain ALARP. The ALARP committee is involved in monitoring trends. OPEX is extensively recorded and used by licensee through the use of post-activity briefs. The OPEX is then used to inform pre-job briefs and site-wide communications and awareness campaigns. Licensees collaborate to share relevant lessons learnt on specific events.

F.84. Training arrangements: Licensees use the Electronic Personal Dosimeter (EPD) system as a means of controlling entry in controlled areas such that both employees and contractors whose training records are not up-to-date are automatically declined entry.

F.85. Benchmarking: Several licensees are making extensive use of benchmarking opportunities through engagement with other stations of a same fleet, interactions with other sites to discuss topics of mutual interest, and engagement with national and international fora and industry groups. Several examples were identified of how this intelligence had been used to improve the licensee's own arrangements.

Article 24.1(ii) – Dose Limitation under National Prescriptions

F.86. IRR99 sets dose limits for persons engaged in work with ionising radiation. For adult employees, the dose limit for whole body exposure is currently 20mSv per year.

F.87. IRR99 also allows for dose limitation for an individual worker in specified circumstances to be based on a dose of 100mSv averaged over a period of five consecutive calendar years, with a maximum of 50mSv in any one year. However, this is acceptable only if the licensee can demonstrate to HSE or the ONR's satisfaction that an annual limit of 20mSv is impracticable for that person.

F.88. Notwithstanding dose limits, the employer responsible for the work must restrict exposure SFAIRP.

F.89. No workers in UK radioactive waste or spent fuel management facilities have exceeded this limit during the time period covered by this report.

Dose Monitoring and Record Keeping

F.90. If an employee is likely to receive a radiation dose greater than three-tenths of a relevant dose limit in a year (e.g. 6mSv in the case of whole-body exposure), the employer has to designate that employee as a classified person. The employer then has to arrange for any significant doses (internal or external) received by that person to be assessed by a dosimetry service approved by HSE (or by the ONR acting on HSE's behalf) for the measurement and assessment of doses for the relevant type of radiation.

F.91. To help the employer assess the effectiveness of the dose control measures, dosimetry services provide a written summary of the doses recorded for each classified employee at least once every three months. Each year, the dosimetry services must also send HSE summaries of all recorded doses relating to classified persons for the previous year.

F.92. Information on individuals is collated by many employers to help them understand which activities are giving the highest radiation doses. Summary information is publicly available via the Central Index of Dose Information (CIDI) (Reference 77) which demonstrates that UK employers have achieved considerable dose reductions over the past 20 years.

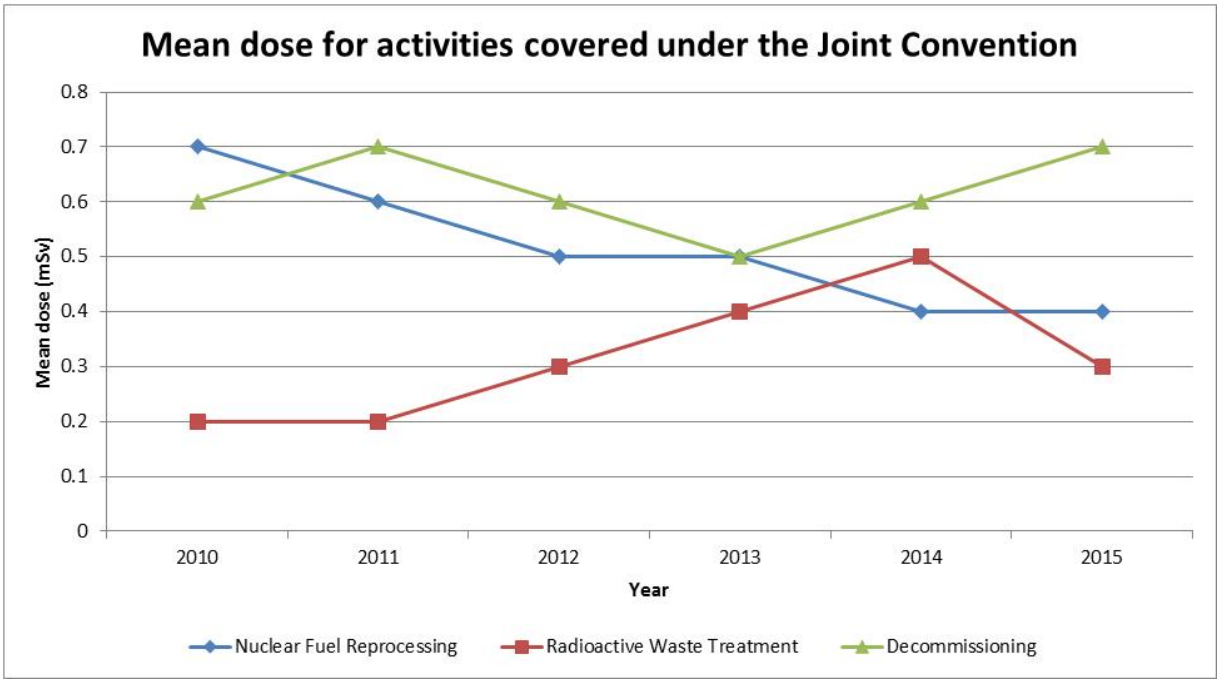
F.93. Dose information for nuclear fuel reprocessing, radioactive waste treatment and decommissioning activities is summarised in Figure 12. More details are available in Section L.2 – General and Specific Safety Provisions.

Investigations

F.94. If an employee has a recorded whole-body dose greater than 15mSv (or a lower level established by the employer) for the year, the employer must carry out an investigation (under IRR99 Regulation 8). The purpose of this investigation is to establish whether or not enough is being done to restrict exposure SFAIRP.

F.95. IRR99 Regulation 25 requires employers undertaking work with ionising radiation to inform the ONR if an exposure in excess of a dose limit occurs or is suspected, whether this arises from a single incident or through an accumulated dose. In such circumstances, the employer must complete an investigation.

Figure 12: Mean Dose (mSv) to Workers for Activities Covered under the Joint Convention



Articles 24.1(iii) and 24.3 – Measures to Prevent and Mitigate Unplanned and Uncontrolled Releases of Radioactive Materials into the Environment

F.96. The UK nuclear licensing regime, as applied to spent fuel, reprocessing and radioactive waste management facilities, is designed to ensure that there is a very low probability of uncontrolled accidental releases of radioactivity into the environment. This is achieved by the requirement for licensees to demonstrate, through a safety case, that the design of any plant has taken into account the full range of reasonably foreseeable fault conditions. Accordingly, plant design should provide protection, so that if a fault condition occurs, safety systems act to ensure that radioactivity release risks meet accepted control criteria.

F.97. Corrective measures to bring back under control any unplanned releases or uncontrolled releases of radioactivity with the potential to travel outside the boundary of the licensed facility, and to mitigate their effect, are dealt with under Article 25 Emergency Preparedness for Radiological Emergencies at UK Nuclear Installations.

F.98. IRR99 Regulation 30 requires radiation employers not on nuclear licensed sites to notify HSE in the event of an uncontrolled leakage or escape of a radioactive substance that exceeds the values on quantity and concentration specified in IRR99 Schedule 8.

Article 24.2 – Radioactive Discharges

F.99. EPR16 places a duty on the EA to exercise its relevant functions to ensure that radiation exposures of the public resulting from radioactive discharges and the disposal of radioactive waste are ALARA and meet national prescriptions listed below.

Permitting and Authorisation Regime for Discharges

F.100. As described in paragraphs E.77 to E.91, operators must obtain an environmental permit under EPR16 or an authorisation under RSA93 for discharge of radioactivity to the environment under normal operations, or disposal by means of burial, incineration or transfer of waste off the site. Environmental permits and authorisations may:

- specify the disposal routes to be used, and place limits and conditions on disposal. Limits and conditions can apply exclusively to an individual disposal route;
- place a requirement to use BAT under EPR16 (England and Wales) or Best Practicable Means (BPM) under RSA93 (Scotland and Northern Ireland) to avoid or minimise waste arisings, the radioactivity discharged to the environment, and to minimise the radiological effects on the environment and on members of the public;
- require sampling and analysis to determine compliance with permit or authorisation conditions, reporting of the quantities of radioactive waste disposed of and any instance of non-compliance with limits;
- specify improvements in waste management arrangements (incl. benchmarking against industry good practice); and
- set conditions, including those relating to management systems, record keeping and provision of information to the agencies.

F.101. When the waste has sufficiently low-levels of radioactivity, it may be out of scope of the regulations (excluded) or subject to conditional exemption from EPR16 and RSA93. Exempted activities are typically not subject to the full requirements of the regulations, although may have some qualifying conditions attached (e.g. disposal of a Ltd. volume, or alongside a specified volume of non-radioactive waste).

F.102. The responsibilities of the regulatory bodies are described in paragraphs E.113 to E.120.

F.103. For environmental permits or authorisations, the ONR is consulted on the disposal of radioactive wastes from nuclear licensed sites and on the setting of limits and conditions.

F.104. The regulatory bodies carry out checks on the actual discharges made, in terms of activity and radionuclide composition, and have powers of enforcement including prosecution under EPR16 or RSA93 if the terms of an environmental permit or authorisation are breached.

F.105. The joint responsibility for regulating doses to the public requires close co-operation between the ONR and the environment agencies. Memoranda of Understanding are in place to ensure that regulatory activities are consistent, co-ordinated and comprehensive.

Optimisation of Exposure from Radioactive Waste Disposal to ALARA and Disposal Limits

F.106. Operators are not only required to comply with numerical limits on the levels of activity that may be discharged, but also to use BAT under EPR16 (England and Wales) or BPM under RSA93 (Scotland and Northern Ireland) to minimise the amount of waste generated and radioactivity discharged. Operators are required to use BAT or BPM to minimise the volume and activity of:

- radioactive waste produced, which will require ultimate disposal under the environmental permit or authorisation;
- radioactive waste disposed of to the environment; and
- radioactive waste disposed of by transfer to other premises.

F.107. These conditions provide the main basis for ensuring that the exposures of members of the public are kept ALARA. They also encourage a holistic approach to radioactive waste management and enable the agencies to exert a downward pressure on discharges.

F.108. The Environment Agency has published guidance that sets out the principles and framework for undertaking studies on optimisation and the identification of BAT (Reference 78). The Scottish Environment Protection Agency (SEPA) has issued similar guidance on BPM (Reference 79) and its role in ensuring that ionising radiation exposures to members of the public are ALARA.

F.109. The limits on radioactive discharges are set on the basis of the 'justified needs' of the practice being conducted by the licensees, i.e. they must make a case that the proposed limits are necessary to allow safe and continued operation of the plant. This takes into account a number of factors, including:

- radiological impact on the public and the environment;
- safety;
- operational need;
- operational history of the site;
- planned future operations;
- socio-economic and cost implications;
- legal requirements;
- government policy; and
- international commitments.

F.110. The annual limits on discharges of radionuclides to the environment that are included in environmental permits or authorisations are set so that doses are well below the annual dose limit (1mSv/year) for exposure of members of the public to artificial radiation, excluding medical exposure. Limits are radionuclide-specific and site-specific (Reference 80). In setting limits, the environment agencies aim to apply downward pressure on discharges.

F.111. The UK Government has issued statutory guidance to the EA that states (References 24 and 81): “Where the prospective dose to the most exposed group of members of the public from discharges from a site at its current discharge limits is below 0.01mSv/year the Environment Agency should not seek to reduce further the discharge limits that are in place, provided that the holder of the Permit continues to apply BAT. This level of dose broadly equates to the “one in a million per year” criterion (References 51 and 82). The average risk of death in the UK from naturally occurring radioactivity is estimated to be around 1 in 10,000 per year as the average background dose in the UK is around 2mSv/yr.

F.112. The Statutory Guidance to the EA does not go into detail of how it should be carried out. This is to allow the EA regulatory independence and the development of detailed guidance has been left to the EA itself. The Environment Agency’s Radioactive Substances Regulation (RSR) Environmental Principles (REPs) (Reference 70) are considered to be a suitable underpinning to the Statutory Guidance.

F.113. In Scotland and Northern Ireland, in line with current policy, SEPA and the Northern Ireland Environment Agency (NIEA) do not seek further reductions in discharges to comply with RSA93 where exposures of members of the public are optimised and less than 0.02mSv/yr.

Dose Limitation under National Prescriptions

F.114. Following an application by an operator for a permit or authorisation for radioactive waste disposal or discharge the relevant environment agency will carry out an assessment process. The assessment will include an evaluation of whether the projected discharges will be minimised in accordance with the requirement to apply BPM/BAT and hence that the public radiation exposures will be ALARA. A prospective assessment of the dose to the representative person is made by the regulator to ensure that the public's exposure through the proposed discharges would be less than the dose constraints. These constraints are set out in EPR16 and the Radioactive Substances (Basic Safety Standards) (Scotland) Direction 2000 (Reference 83), and in the Radioactive Substances (Basic Safety Standards) Regulations (Northern Ireland) 2003 in Northern Ireland (Reference 84). They are:

- a source constraint of 0.3 mSv per annum for an individual facility which can be optimised as an integral whole in terms of radioactive waste disposals;
- a site constraint of 0.5 mSv per annum for a site comprising more than one source, e.g. where two or more facilities are located together; and
- a dose limit of 1 mSv per annum from all sources of artificial radioactivity, including the effects of past discharges but excluding medical exposures.

F.115. Retrospective assessments of doses received are also performed by the regulators to ensure that the national limit to the representative person (1mSv) has not been exceeded.

F.116. Environmental permits held by nuclear site licence holders under EPR16 for the disposal of radioactive waste are reviewed periodically by the EA and Natural Resources Wales (NRW). SEPA reviews authorisations under RSA93 when it is considered appropriate to do so, although in practice this is at least once every five years. Environmental permits and authorisations for discharges are placed on public registers where they are open to inspection.

F.117. The UK Strategy for Radioactive Discharges was published in July 2009 by the UK Government and devolved administrations (Reference 85). The UK strategy describes how the UK implements its commitments under the OSPAR Convention for protection of the north-east Atlantic, in particular the Radioactive Substances Strategy. It applies to both the nuclear and non-nuclear sectors and includes aerial as well as liquid discharges from operational and decommissioning activities. It was described in the previous UK report. Progressive reduction of discharges is a central goal of the way in which radioactive discharges are controlled. The UK Government interprets 'progressive reduction' as a clear reduction over a number of years or a statistically significant difference between one period of years and a subsequent period to indicate a reduction. This approach allows for normal plant fluctuations, variations in nuclear reactor operations and the amount of reprocessing undertaken. Under statutory guidance issued by the UK Government (Reference 86), the environment agencies must have regard to the strategy when determining permits and authorisations. The box below summarises recent progress against the OSPAR Radioactive Substances Strategy.

F.118. A commitment was given in 2009 to review the UK strategy about every five years. A review began in 2015 and will be finalised in 2017.

Regulatory Environmental Radiological Surveillance

F.119. The independent monitoring and assessment carried out by the Food Standards Agency (FSA) (in England and Wales), Food Standards Scotland and the environment agencies in the UK continue to show that radiation doses to people living around nuclear sites from permitted discharges are well below the UK and EC limit of 1 mSv/year. The results of this monitoring and assessment are published annually in the Radioactivity in Food and the Environment (RIFE) reports (Reference 87).

F.120. The RIFE programme includes radioactivity measurements in foods, surface and ground water, air, radiation dose rate on beaches and public occupancy areas, sediments etc.

F.121. UK nuclear site licensees are also required to carry out their own monitoring and assessment programmes and many publish annual reports of their safety and environmental performance. Further information is available on the websites of the relevant organisations (see Section L.6 – List of Primary Website Addresses).

Radiation Exposure in Other Countries

F.122. Radiation exposure to members of the public in the UK must be less than the dose limits laid down in EPR16 and IRR99. Dose estimates for those living around nuclear sites indicate that the representative persons receive doses well below the dose limit. Therefore, this assessment indicates that the radiation exposure to the public in other countries as a consequence of UK radioactive discharges will be much less than these dose limits.

F.123. The Euratom Treaty requires compliance with measures to monitor and report radioactivity in the environment (Articles 35 and 36) and to prevent radioactive discharges or waste disposal in one member state resulting in contamination of the environment of another member state (Article 37). In this context, the European Commission (EC) decides whether any plan for the disposal of radioactive waste would result in significant contamination from a health point of view. The UK has submitted data to the EC in respect of all operations covered under Article 37, since its accession to the Euratom Treaty in January 1973. In every case, the EC's opinion has been favourable. The UK has also submitted monitoring data to the EC as required under Article 36 of the Treaty.

Article 37 Success

F.124. The UK has advanced its nuclear programme: remediation of legacy waste sites, maintaining nuclear electricity production from existing nuclear power plants, and development of projects for the construction and operation of new nuclear power plants. This has been achieved whilst continuing to fulfil the legal requirements under Article 37 of the Euratom Treaty to submit data on the disposal of radioactive waste to the European Commission for an opinion on whether a plan will result in the radioactive contamination of another Member State.

F.125. Most notably, the UK obtained a positive opinion from the EC in February 2012 on the construction of two new European Pressurised water Reactors (EPRs) at the proposed Hinkley Point C site. As a result, the nuclear new build project (operated by Nuclear New Build Generation Company (NNB GenCo)) has since obtained its nuclear site license, environmental permits and has signed a contract for electricity generation with the UK Government. Construction began in 2017 and the site is on course to begin generating electricity in 2025.

F.126. The UK has obtained the following Article 37 opinions since the last National Report for the Joint Convention in January 2015.

- Sellafield Local Sludge Treatment Plant (June 2015)
- Dounreay Site Restoration Plan (November 2015)
- Recovery of Uranium from Processed Fuel Pins at Springfields (March 2017)

F.127. Furthermore, the UK is preparing a number of additional Article 37 data submissions for opinion from the EC concerning a variety of radioactive waste operations; from legacy waste remediation operations at Sellafield to the construction of new nuclear reactors for the generation of electricity at Wylfa in Anglesey.

F.128. Obtaining an Article 37 opinion from the EC for updates to the Dounreay Site Restoration Plan has enabled continuation of work to decommission the Dounreay site, which is a critical

element of the UK's plans to clean-up legacy nuclear waste from past nuclear programmes.

F.129. The positive opinion from the EC for the introduction of a new regulatory discharge limit for airborne krypton-85 at the Springfields fuel fabrication plant in Lancashire (operated by Westinghouse) will enable the processing of fuel pins from Sellafield and the National Nuclear Laboratory. This will permit the recovery of uranium for possible re-use in the fuel cycle or conversion to a form suitable for storage, thus contributing to the UK's existing electricity generation programme, and plans for ultimate disposal of radioactive waste.

Success – Application of BAT to the Reductions in Radioactive Discharges to Sea (OSPAR Periodic Evaluations)

F.130. The UK's most recent report to OSPAR was issued in 2013 (Reference 88) (covering the period 2008-2011) and a short update was provided to OSPAR's Radioactive Substances Committee in 2015.

F.131. The UK's report concludes that procedures and techniques applied in the UK nuclear industry are consistent with BAT. What represents BAT for a particular source will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding. Measures are in place, as part of the authorisation and permit review process, to ensure that technological developments continue to be reviewed and implemented where appropriate. For example, a recent regulatory review concluded that BAT continues to be applied at operational Advanced Gas Cooled (AGR) power stations.

F.132. The 2013 Report included comparisons of the performance of UK plants with similar plants worldwide where appropriate and concluded that abatement approaches were consistent with those identified in recent international reports. The development of effluent technologies is supported by Research and Development (R and D) programmes; for example, sponsored academic research is coordinated by Sellafield Ltd.'s Centre of Expertise for effluent technology.

F.133. The 2013 Report described in some detail the technologies in use or under development in the UK such as filtration, caustic scrubbers, ion exchange and adsorption, hydrocyclone centrifuges, and electrochemical and electrophysical processes. Developments in the application of BAT since the period covered in the 2013 Report include:

- Robust fuel to reduce fuel failure rates continues to be implemented at operational AGR stations and secondary neutron sources have been removed at the Sizewell B Pressurised Water Reactor in order to reduce tritium discharges.
- Hydrocyclone technology continues to be used to remove particulates during pond de-sludging at the Magnox decommissioning power stations at Hinkley Point A and Bradwell, and submersible ion exchange filters have helped reduce discharges at Hinkley Point A and Chapelcross.
- Magnox Ltd. no longer plans to use dissolution for treatment of the Fuel Element Debris stored at Hinkley Point A, Sizewell A and Oldbury. Fuel Element Debris will instead be packaged as solid waste further decreasing liquid discharges from the decommissioning of Magnox sites.
- Operational discharges from Sellafield will decrease when the Magnox and Thorp reprocessing programmes are completed. Meanwhile discharges associated with reprocessing operations continue to be minimised by the application of BAT. For example, spent fuel storage conditions at the Sellafield Fuel Handling Plant (FHP) and the operation of the Site Ion eXchange Effluent Plant (SIXEP) continue to be optimised.

- Significant progress is being made with the retrieval of fuels and wastes from a number of Sellafield legacy facilities which will ultimately remove a significant source of discharges.
- At former R and D sites that are being decommissioned the Replacement Effluent Treatment Plant at Harwell began operation in 2014 while the greater use of ion exchange has helped reduce caesium-137 discharges from Dounreay.

F.134. The OSPAR Commission has recently completed the Fourth Periodic Evaluation (Reference 89) of progress against its Radioactive Substances Strategy (RSS) focussing on permitted discharges of radioactive substances to the North-East Atlantic waters by Contracting Parties including the UK.

F.135. The developments highlighted above helped the UK to be part of the progress reported in the Fourth Periodic Evaluation which confirmed that, in relation to discharges from the nuclear sector, OSPAR Contracting Parties:

- are continuing to make good progress in meeting the objectives of the OSPAR RSS; and
- have achieved substantial reductions in discharges in many cases including in the UK, as required by the OSPAR RSS.

F.136. Details on the UK's nuclear industry environmental performance can be found in Section L.2 – General and Specific Safety Provisions.

Article 25 – Emergency Preparedness

Article 25:

6. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.

7. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F.137. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changes since the fifth UK national report. The Article has been updated to demonstrate the UK's capability with respect to emergency preparedness and response.

Emergency Preparedness for Radiological Emergencies at UK Nuclear Installations

F.138. The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) (Reference 90) provide the legal framework for off-site emergency arrangements and is enforced by the ONR on nuclear licensed sites. It defines the steps required to be taken in the event of a radiation emergency. The regulation requires off-site plans to be produced by the local authority in consultation with emergency responders and the site operators, for those sites where a radiation emergency is considered to be reasonably foreseeable. Responsibilities for preparation, reviewing and testing off-site emergency plans are also covered by REPPIR. These regulations are in the process of being revised under work undertaken to implement the revised BSSD 2013 (Reference 20).

F.139. The ONR provides assurance of the off-site arrangements through the assessment of the local authorities' off-site emergency plans against the requirements set within REPPIR and through the assessment of off-site emergency exercises.

National Programme

F.140. BEIS co-ordinates emergency preparedness policy at national level, as the lead government department for the UK's arrangements for response to any emergency with off-site implications from a civil nuclear site in England and Wales. In the event of an emergency at a civil nuclear site in Scotland, the lead government department responsibility and the main national coordinating role would fall to the Scottish Government. BEIS would still be responsible for briefing the Westminster Parliament and the UK's international partners.

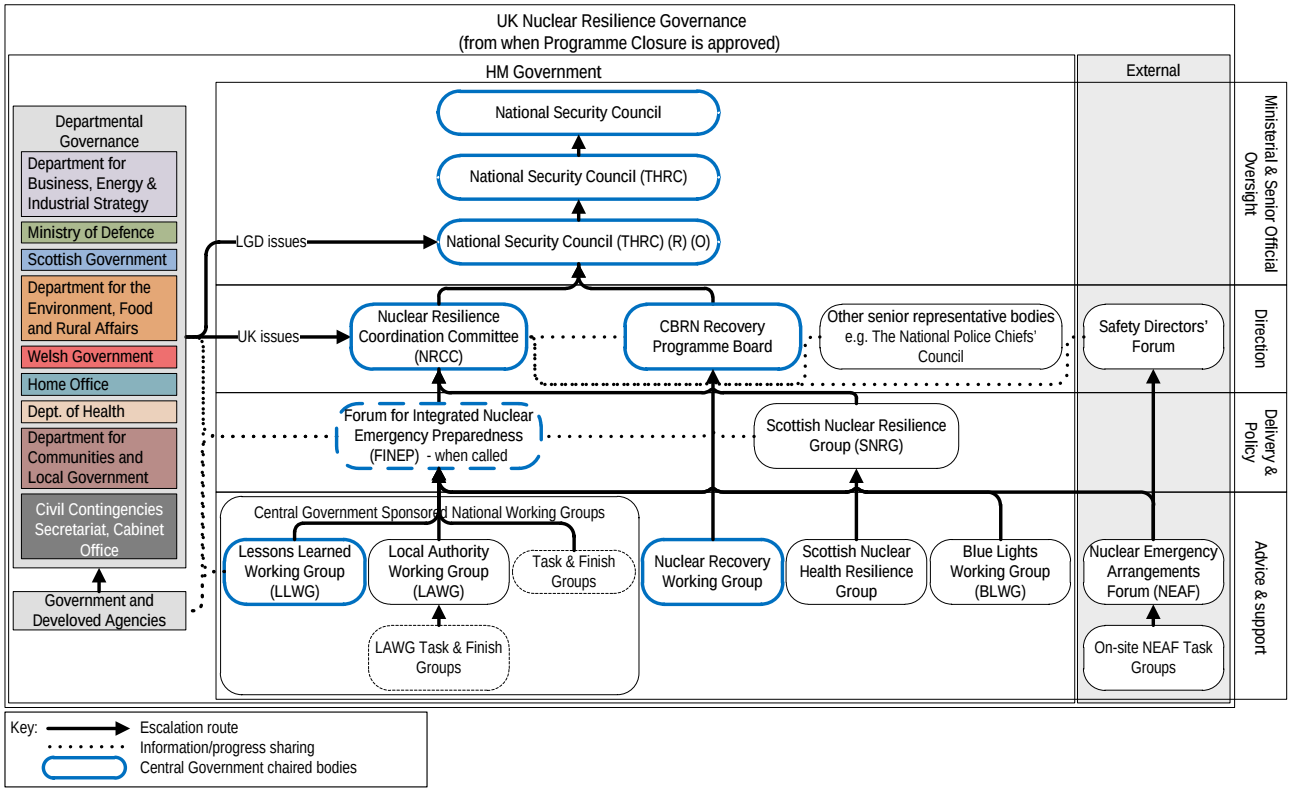
F.141. BEIS's strategy is to transpose the requirements of the BSSD 2013, to identify areas for improvement, and to strengthen the UK's capability to respond to a nuclear emergency at home and overseas, and to transition from response to recovery from the incident. National arrangements are based on generic civil contingency arrangements as far as possible with the approach to ensure that the response is seamless at each level and across the UK.

F.142. BEIS issues National Nuclear Emergency Planning and Response Guidance, to all organisations that may be involved in planning for a civil nuclear emergency. The guidance describes the arrangements that have been developed for responding to an emergency in the UK over a number of years and aims to harmonise the UK response to a nuclear emergency.

F.143. The Nuclear Resilience Coordination Committee (NRCC) is the national programme set up to direct the UK's approach to responding to a nuclear emergency. The NRCC aims to ensure that the UK's planning for response to a nuclear emergency at home or overseas is effective, proportionate and sustainable.

F.144. Reporting to the NRCC there are a number of key working groups that provide advice and support in setting the national direction. The structure of the UK Nuclear Resilience Governance, including the NRCC and working groups, can be seen in Figure 13.

Figure 13: National Programme structure of the NRCC



On-Site Emergency Arrangements

F.145. Under the site licence conditions, the licensee is required to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and its effects. All nuclear licensees are required to prepare, in consultation with local authorities, the police, and other organisations, emergency plans for any nuclear and non-nuclear emergency which may occur on their site. Licensees must submit to the ONR for approval their high-level emergency arrangements for each site, usually known as the Emergency Plan, which includes:

- A description of the organisation that is set up on the site to manage the emergency;
- Responsibilities of personnel in the emergency organisation;
- Training requirements for personnel;
- Equipment for use in an emergency;
- Arrangements for liaison with emergency services on the site;
- Radiological monitoring of the environment on and around the site; and
- Communications with organisations off the site.

F.146. Licensees are also required to rehearse their arrangements to ensure their effectiveness. This is achieved by the licensee holding training exercises and the ONR agreeing to a programme of demonstration emergency exercises that the ONR inspectors observe; they then judge the adequacy of their effectiveness and the ONR may request the licensee to repeat elements of an emergency exercise that have not been deemed adequate. In 2015, the ONR introduced additional assurance to the licence conditions' arrangements through the application of on-site emergency planning and response capability maps. These capability maps assess both the security and safety aspects of each site's emergency response.

F.147. Incorporating security in the capability map process and encouraging joint safety and security exercises demonstrates an ability to deal with an emergency regardless of the initiating event. The ONR's assessment of emergency arrangements takes account of this approach and considers the coherence of the arrangements prepared under the site licence conditions and those prepared under security legislation.

F.148. Emergency arrangements must be reviewed regularly to reflect the current operational status of the installation (including decommissioning).

Off-Site Emergency Arrangements

F.149. Where there is the potential for radiation emergency that would result in a radiation dose to a member of the public above levels set in REPPIR, detailed emergency planning areas are set around nuclear installations. The extent of these zones is assessed by the operator, as part of a hazard identification and risk evaluation, and is based on the most significant radiation doses arising from an accident that can be reasonably foreseen. The ONR determines the adequacy of the technical argument supporting the operators assessed zone, then considers how this zone might be modified to secure confidence in protection of the public by consideration of other relevant practical and strategic factors (based on guidance from IAEA GS.G.2.1 (Reference 91) such as:

- Local geographic, demographic and practical implementation factors;
- Avoidance of bisecting local communities;
- Inclusion of immediately adjacent vulnerable groups;
- International standards and guidance;
- Credibility and confidence in the extent of the off-site emergency planning area;
- Benefits and dis-benefits of countermeasures; and
- Other site-specific factors of which the ONR is aware.

F.150. In the event of an accident going beyond a reasonably foreseeable event, the Statutory Guidance to the Civil Contingencies Act 2004, Emergency Preparedness, defines the requirements for preparing general emergency response plans for use when extending the off-site response to include a much larger geographical area. BEIS continues to support research and development into extendibility arrangements with support from the local authorities. In late 2015, the local authorities started a programme of extendibility workshops based on principles and guidance provided by BEIS. The aim of these extendibility workshops is to strengthen outline planning for more severe nuclear emergencies at a local level and identify any improvements at national level that would support extendibility.

F.151. The declaration of an off-site nuclear emergency at a site is the responsibility of the operator in accordance with previously approved arrangements. This would be followed immediately by notification of the emergency services and local and national authorities. A cascade notification mechanism is in place so the operator can focus on dealing with the nuclear emergency itself.

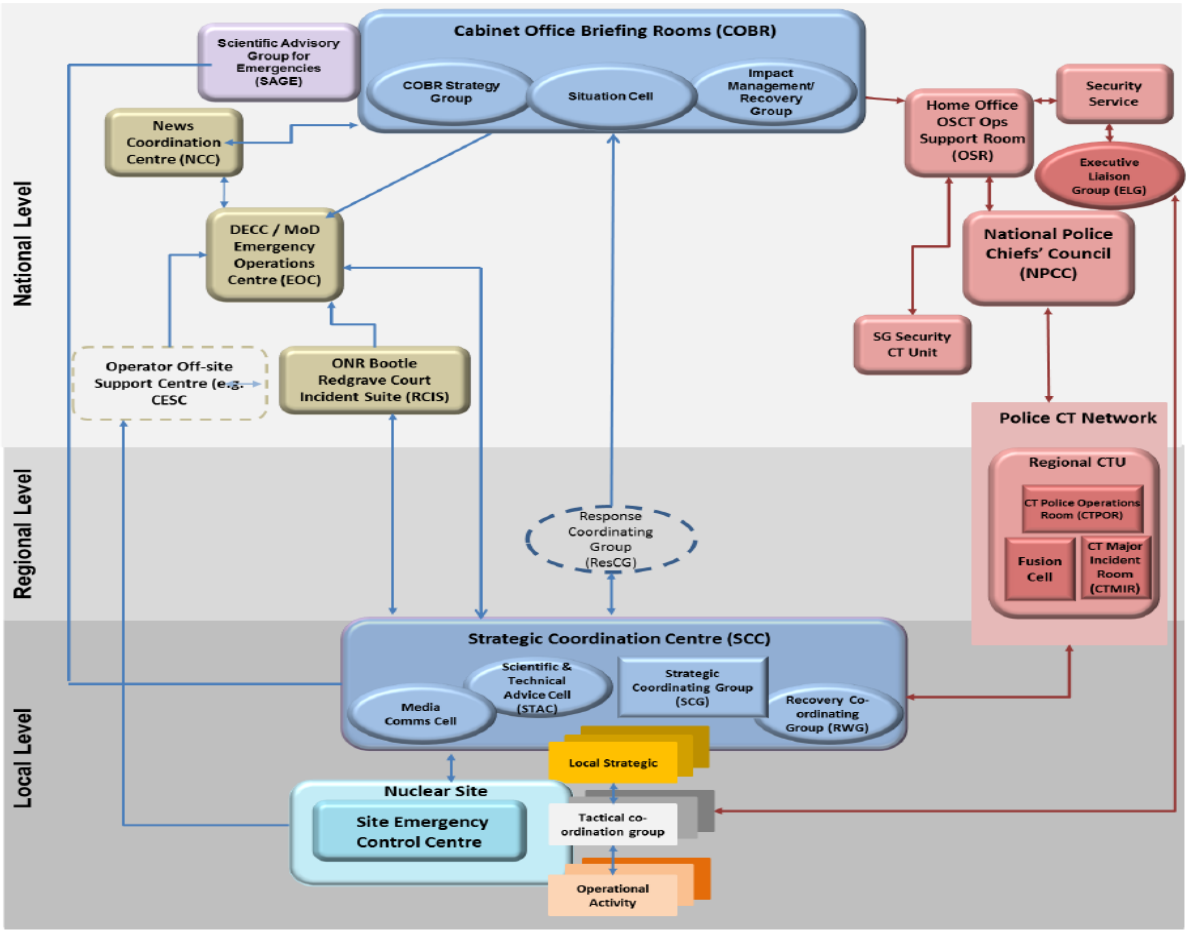
F.152. The agencies that provide a local response are located at the off-site Strategic Coordination Centre (SCC). Their prime function is to decide on and action the appropriate protection measures and mitigatory actions to be taken off-site to protect the public. The response by the SCC is led by a senior police officer and it ensures that any necessary actions are implemented effectively and ensures that authoritative information and advice on these issues is passed to the public (the facility includes media briefing centres). Each organisation with responsibilities for dealing with the emergency would be represented at the SCC. These would generally include the operator, police, local authority, national health authority, local water company and the fire and ambulance services.

In addition, government departments and agencies would also be represented. These would include BEIS (or Scottish or Welsh equivalents), Public Health England (or Health Protection Scotland), the relevant FSA, the relevant environment agencies and the ONR.

F.153. In the event of an off-site nuclear emergency, the central Government Emergency Operation Centre (EOC) and the Cabinet Office Briefing Rooms (COBR) would be activated in order to coordinate the response and decision-making at the national level. The lead for the response will remain at local level under the control of a senior police officer at the SCG, except for the most severe events. The COBR Committee would consist of representatives (Ministers or senior officials) from relevant departments and agencies. It may be chaired by the Prime Minister. Decision-making within COBR would be supported by a number of bodies and advisory groups, including a Scientific Advisory Group for Emergencies.

F.154. Whilst BEIS is the lead government department for off-site civil nuclear emergency response in England and Wales, other departments would have lead responsibility for specific elements of the off-site response, such as Department of Health for health countermeasures, Department for Communities and Local Government for sheltering and evacuation etc. The Home Office would lead on the counter terrorism response element of any nuclear emergency caused by sabotage. Figure 14 shows the arrangements for responding to off-site nuclear emergencies (accidents) at civil sites schematically for England and Wales. Note that responsibilities assigned to "DECC" are now carried out by BEIS.

Figure 14: Emergency Arrangements Structure for England and Wales



F.155. The Scottish Government Response is consistent with the England and Wales response shown with the exception that the central government response would be through the Scottish Government Resilience Room (SGoRR).

F.156. The Department of Environment, Food and Rural Affairs (Defra) is the lead government department for recovery from nuclear emergencies and would work closely with government agencies to coordinate longer-term remedial action, including decontamination.

Testing of Emergency Arrangements

F.157. On and off-site emergency arrangements are tested regularly under three categories known as levels 1, 2 and 3.

F.158. Level 1 exercises are held at each nuclear site once a year (or less frequently as agreed with the ONR) and concentrate primarily on the licensee's actions on and off the site. The ONR observes, make judgements and provide feedback on the adequacy of level 1 exercises. In addition, each site has a programme of training and exercises for all staff involved in the emergency scheme and each role has a training profile which defines the type and frequency of training. Over a period of time the site exercises test all aspects of the approved site emergency.

F.159. Level 2 exercises are aimed primarily at demonstrating the adequacy of the arrangements that have been made by the local authority to deal with the off-site aspects of the emergency, particularly the functioning of the SCC where organisations with responsibilities or duties during a nuclear emergency also exercise their functions. Level 2 exercises are performed at each nuclear site once every three years where an off-site plan is required.

F.160. From the annual programme of level 2 exercises, one is chosen as a level 3 exercise to rehearse, not only the functioning of the SCC, but also the wider involvement of central government, including the exercising of the various government departments and agencies attending the EOC/COBR (for England and Wales) in London, or the SGoRR (for Scotland) in Edinburgh. Aspects of BEIS's international liaison arrangements, including the process on notification, are routinely tested during the level 3 exercises. The decision on which exercise should be selected as the level 3 is made jointly between the licensees, the lead government departments BEIS or the Scottish Government in consultation with the ONR. The level 3 exercises for 2015 and 2016 were both based on nuclear emergencies at civil nuclear sites.

Information to the Public

F.161. REPPIR provides a legal basis for the supply of information prior to a radiation emergency to members of the public who may be affected by such an event. The requirements are placed on the operator in cooperation with the relevant local authorities.

F.162. REPPIR requires the local authorities to prepare and keep up-to-date arrangements that ensure that members of the public affected by a nuclear emergency receive prompt and appropriate information. While the agencies involved in responding to the emergency would seek to deal with any queries they received, the main channel of communication with the public outside the immediate vicinity of the affected site would be through the media.

International Notifications

F.163. For an emergency at a nuclear installation in the UK, BEIS would take the responsibility for notifying other countries and initiate requests for international assistance. Under existing early notification conventions, BEIS would inform the European Union, the IAEA, and countries with which the UK has bilateral agreements and arrangements, about the accident and its likely course and potential effects.

F.164. The UK uses the IAEA International Nuclear and Radiological Event Scale (INES) as the classification and notification system for safety significant events involving sources of radiation.

BEIS appoints the UK INES National Officer, who is an ONR inspector. The INES system is a commonly understood rating system that helps to facilitate communication of safety-significant information, in the case of nuclear accidents, to the technical community, media and public.

F.165. The UK regularly takes part in emergency exercises with other countries to test the emergency arrangements, should there be a nuclear emergency in another country that has the potential to affect the UK.

Response to Emergencies Outside the UK

F.166. BEIS is the lead government department for coordinating the response to an overseas nuclear emergency. The UK has signed a number of international agreements covering exchange of information in the event of a nuclear emergency. The UK is a member of IAEA's global assistance mechanism in the event of a nuclear emergency, Response and Assistance Network (RANET). The Radioactive Incident Monitoring Network (RIMNET) is the contact point for inward notifications under these arrangements.

F.167. The national response plan, implemented by BEIS with support from other agencies, provides arrangements for dealing with an overseas nuclear emergency. This includes BEIS maintaining contact arrangements and duty officers that ensure the UK can be notified of an emergency at any time. The RIMNET network comprises 91 gamma dose rate monitors located throughout the UK and provides a secondary alert mechanism in the event of non-notification.

Article 26 Decommissioning

Article 26: Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available;

(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and

(iv) records of information important to decommissioning are kept.

F.168. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK national report.

F.169. The following examples have been identified to illustrate the successes and challenges associated with the decommissioning of spent fuel and radioactive waste management facilities:

- the proportionate approach to regulating decommissioning activities implemented in the UK - see paragraphs F.174 to F.176; and
- long-term decommissioning challenges – see paragraphs F.177 to F.179.

F.170. In the UK, decommissioning on licensed nuclear sites takes place subject to the same legislative requirements and regulatory expectations that apply to the operational phase of a nuclear facility's lifecycle. This approach ensures continuity of the arrangements to comply with Articles 24 and 25.

F.171. The safety of decommissioning is regulated by the ONR under the NIA65 licensing regime – all 36 of the standard nuclear site licence conditions that apply during a facility's operational life continue to apply through decommissioning. Under the terms of NIA65, a nuclear licensed site cannot be de-licensed until the ONR provides written confirmation to the licensee that the ONR is satisfied there is 'no danger' from ionising radiation from any Article remaining on the site – further details on the ONR's policy for de-licensing can be found in paragraphs E.39 to E.45.

F.172. Under these licence conditions, licensees are required to make and implement adequate arrangements for the decommissioning of any plant that may affect safety, inclusive of adequate decommissioning programmes. The ONR has the power to direct a licensee to commence decommissioning, in the interests of safety. The ONR has provided guidance to assist its inspectors in their judgment of whether licensees' arrangements adequately meet the licence conditions' expectations.

F.173. The ONR's primary objective in its regulation of decommissioning is to secure a progressive and systematic reduction in radiological hazards, achieved in a manner that optimises the protection of individuals, society and the environment. As a result, the ONR expects licensees to construct coherent plans to decommission their facilities, targeted at ultimate removal of all significant radiological hazards wherever that is reasonably practicable. The relevant factors licensees should consider in determining their priorities for decommissioning are explicit in government policy and repeated in ONR's decommissioning-related SAPs and the EA's REPs.

F.174. The radioactive waste disposals, as well as wider environmental aspects of decommissioning, are regulated by the environment agencies under EPR16 and RSA93 as described in paragraphs E.77 to E.97.

F.175. The following aspects of decommissioning under Article 26 are covered in the equivalent sections under Articles 24 and 25: staff qualification, financial resources, radiological protection, discharges, unplanned and uncontrolled releases, emergency preparedness, and records.

F.176. In some circumstances decommissioning may require a temporary increase in risk in order to secure a reduction in hazard that gives an overall safety benefit in the longer term (e.g. a need to isolate protection systems in order to undertake invasive clean-up work). Such an approach requires rigorous substantiation by the licensee, including a demonstration that risks at each stage of the activity are maintained ALARP.

F.177. The advanced age of some UK nuclear facilities implies that decommissioning can require licensees to manage uncertainties, involving factors such as: the as-built status of plant or structures; incomplete radioactive inventories; and unknown effects of long-term ageing. Regulatory expectations for the management of uncertainty are based on the precautionary principle and embedded in the UK risk management framework (Reference 51).

F.178. The nature of some decommissioning tasks may necessitate a greater emphasis on administrative controls to deliver adequate margins of safety. Decommissioning may also give rise to elevated conventional safety risks, for example work in areas with restricted access, work at height, or in confined spaces. In such circumstances, the ONR expects the licensees to carry out fit-for-purpose risk assessments that recognise all relevant sources of risk and implement an adequate range of risk-reduction measures.

Long-Term Decommissioning Challenges

F.179. Dounreay decommissioning challenges revolve around the fact that the vast majority of the facilities to be decommissioned were designed and built in the 1960's and 1970's and these facilities were never designed with decommissioning in mind. This makes the task more challenging particularly as safety standards have changed over time. In addition, with time, knowledge of the facilities has the potential to be lost or degraded.

F.180. An increasingly difficult challenge is whether to spend time and money upgrading these facilities prior to decommissioning, or to tolerate the risk of undertaking decommissioning operations on degrading plants. The more decommissioning is deferred, the greater this problem becomes, potentially increasing the cost and duration of decommissioning programmes.

F.181. A specific example is decommissioning of plants with a very high alpha and plutonium burden during the operational phase. Insufficient or foreshortened Post Operational Clean Out (POCO) phase may lead to considerable alpha contamination within facilities which has to be dealt with throughout the decommissioning phases. Some facilities were handling plutonium liquors on a regular basis during reprocessing operations, leading to a considerable alpha burden, even after long term plant washouts

Section G/H – Safety of Spent Fuel, Reprocessing and Radioactive Waste Management

GH.1. The United Kingdom (UK) considers that due to the nature of the regulatory regime and the way nuclear facilities are operated, it is not necessary in the national report to separate out Section G (Safety of Spent Fuel Management and Reprocessing Management) and Section H (Safety of Radioactive Waste Management). Therefore, for this report, the two sections are combined. Where there is a difference, this is clearly indicated in the text.

Articles 4 and 11 – General Safety Requirements

Articles 4 and 11: Each Contracting Party shall take the appropriate steps to ensure that at all stages of [spent fuel] [radioactive waste] management, individuals, society and the environment are adequately protected against radiological [and other] hazards. In so doing, each Contracting Party shall take the appropriate steps to:

(v) ensure that criticality and removal of residual heat generated during [spent fuel] [radioactive waste] management are adequately addressed;

(vi) ensure that the generation of radioactive waste [associated with spent fuel management] is kept to the minimum practicable, [consistent with the type of fuel cycle policy adopted];

(vii) take into account interdependencies among the different steps in [spent fuel] [radioactive waste] management;

(viii) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(ix) take into account the biological, chemical and other hazards that may be associated with [spent fuel] [radioactive waste] management;

(x) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(xi) aim to avoid imposing undue burdens on future generations.

GH.2. Under these Articles, the only significant changes to the UK's means of complying with the Joint Convention since the fifth UK national report are the following and have been highlighted:

- Update of the Joint Guidance on the management of Higher-Activity Waste (HAW) – see paragraphs GH.12 to GH.14.

GH.3. The way that the UK ensures adequate protection of individuals, society and the environment against radiological hazards is described in detail in other parts of this report, in particular Section E – Legislative and Regulatory System and Section F - Other General Safety Provisions.

Requirements of the Nuclear Site Licence

GH.4. The licensee must make and implement arrangements to address the requirement of the conditions attached by the ONR to the site licence. In addition, the ONR has legal powers conferred on it under the site Licence Conditions (LC) (Reference 44). Those relevant to Articles 4 and 11 are listed below:

- the licensee is required to have arrangements for the production and assessment of safety cases by which the licensee justifies safety during design, construction, manufacture, commissioning, operation and decommissioning;
- the ONR has powers to exert regulatory control, as appropriate, over the construction of any facility used for the management of spent fuel or radioactive waste. Regulatory consent to the construction of any new facility will only be given when the ONR is satisfied with the licensee's safety case that must address all nuclear safety issues, including criticality, shielding, containment and the ability of the plant to remove decay heat under normal and fault conditions;
- the ONR has powers to control design changes during construction that could impact on the plant safety case;
- licensee is required to produce arrangements to safely commission new facilities: the ONR uses its powers to ensure that there are sufficient safety systems in place. If the ONR notifies the licensee then it cannot take a new plant into operation without the consent of the ONR and this will be given when the ONR is satisfied with the pre-operational safety case;
- the ONR has powers to control modifications to any existing spent fuel or radioactive waste management facility and again the licensee cannot carry out a modification which could have a significant effect on safety without the agreement of the ONR;
- spent fuel or radioactive waste management facilities are required to have an adequate safety case to demonstrate the safety of that operation and to identify the conditions and limits that ensure that the plant is kept safe; and
- licensee's operations that may affect safety, including any instructions to implement Operating Rules, must be undertaken in accordance with written operating instructions.

Criticality, Shielding, Containment and Removal of Residual Heat Generated

GH.5. Criticality, shielding, containment and residual heat removal are addressed in the licensees' safety cases, operating rules and operating instructions. Prior to granting permission for the associated work activities to take place, the ONR judges the adequacy of the totality of the licensees' arrangements, comparing them with the targets and standards expressed in the ONR's Safety Assessment Principles (SAPs).

Minimising the Generation of Radioactive Waste

GH.6. Environmental permit or authorisation holders on nuclear and non-nuclear sites are required to use Best Available Techniques (BAT) (Best Practicable Means (BPM) in Scotland and Northern Ireland – see below) to minimise the generation and disposal of radioactive waste in all of its forms (solid, gaseous and liquid) so as to reduce the impact on members of the public to a level that is as Low As Reasonably Achievable (ALARA) and to protect the environment.

GH.7. The licensee of a spent fuel management facility is required to ensure that the rate of production and total quantity of radioactive waste accumulated on the site is at all times

minimised and adequate records are made. Related requirements are found in Ionising Radiations Regulations 1999 (IRR99).

GH.8. The UK's approach to minimising radioactive discharges and the generation of radioactive waste is further described in paragraphs F.97 to F.116.

Interdependencies in Spent Fuel and Radioactive Waste Management

GH.9. The handling treatment, storage and reprocessing of spent fuel, and the management of radioactive waste are all prescribed activities under the Nuclear Installation Act 1965 (NIA65). Therefore the safety of all such activities, including, where appropriate, storage and reprocessing at Sellafield or storage at another licensed site, is regulated by the ONR. The ONR also regulates the safety of the transport of spent fuel from reactor sites to Sellafield.

GH.10. The disposal of radioactive waste in all of its forms by nuclear and non-nuclear operators is regulated by the environment agencies.

GH.11. The ONR and the environment agencies in England, Wales and Scotland have developed joint working arrangements and joint guidance to industry in order that the environmental impact and safety of the management of radioactive waste and spent fuel can be regulated in a coherent and holistic manner.

GH.12. In February 2015, the ONR the Environment Agency (EA), National Resources Wales (NRW) and Scottish Environment Protection Agency (SEPA) updated joint guidance on the management of Higher Activity Waste (HAW) on nuclear licensed sites (Reference 34). More details can be found in L.4.22 to L.4.24.

GH.13. The revised joint guidance reiterates the use of a Radioactive Waste Management Case (RWMC) as good practice. A RWMC should provide the complete demonstration of the optimised management of solid radioactive waste streams that cannot necessarily be demonstrated in a coherent way through examination of individual plant safety cases and environmental documentation. General contents of a RWMC may include, in summary form:

- a description of the waste (including the source of arising, characteristics, inventory and quantities);
- ownership of the waste;
- management strategy for the waste streams;
- proposed waste management processes;
- relevant buildings and plant involved (e.g. for conditioning or storage) and their physical state;
- relevant aspects of the facility organisation and the management of radioactive waste (e.g. the overall waste strategy for the site);
- interdependencies between all steps in generation and management of radioactive waste management;
- how the generation of radioactive waste is minimised;
- how the radioactive waste is adequately controlled and contained;
- how any applicable safeguards and security issues will be addressed;
- how the radioactive waste meets the relevant requirements to enable its transport and

disposal;

- quality assurance arrangements; and
- information and records management arrangements.

GH.14. The UK's development and application of the concept of RWMCs was commended as good practice by the 2013 Integrated Regulatory Review Service (IRRS) Mission to the UK.

Protection of Individuals, Society and the Environment

Biological, Chemical and Other Hazards

GH.15. The biological, chemical or other hazards associated with the handling, treatment, storage and, where appropriate, reprocessing of spent nuclear fuel and radioactive waste are subject to HSWA74 and associated regulations such as the Control of Substances Hazardous to Health Regulations (Reference 92), the environmental permitting regimes and the Control of Major Accident (COMAH) Regulations of which the environment agencies and the ONR are the competent authorities on licensed nuclear sites. By taking a comprehensive approach to regulation, the ONR and the environment agencies ensure that the licensee considers all hazards that could impact on the workers at the site, the public and the environment, and not simply those related to the radioactive hazard of such materials.

Impacts and Burdens on Future Generations

GH.16. It is UK government policy to ensure that the impact and burdens on future generations of today's activities are properly taken into account. This is reflected in government policy for nuclear decommissioning (Reference 93), which was updated in 2004 to reflect the creation of Nuclear Decommissioning Authority (NDA) and establishment of NDA's mission to address the major part of the UK's civil nuclear legacy.

GH.17. A fundamental principle in the regulation of radioactive substances and wastes in the UK is that they should be managed to avoid placing a burden on future generations and their environment such that it compromises their ability to meet their needs. For example the environment agencies' guidance on solid waste disposal (Reference 33 and 47) includes the following principle 1:

Solid waste shall be disposed of in such a way that the level of protection provided to people and the environment against the radiological hazards of the waste both at the time of disposal and in the future is consistent with the national standard at the time of disposal.

GH.18. The concept of inter-generational equity is also an important part of the UK's strategy for sustainable development which regulators must take into account. (Reference 94).

Articles 5 and 12 – Existing Facilities and Past Practices

Article 5: Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a

facility.

Article 12: Each Contracting Party shall in due course take the appropriate steps to review:

i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

GH.19. Under these Articles, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK report.

GH.20. The following examples have been identified to illustrate successes and challenges associated with the safety of existing facilities and past practices:

- the encapsulation of Dounreay liquid Intermediate Level Waste (ILW) – see paragraphs GH.22 to GH.24.

Existing Facilities

GH.21. All existing facilities on licensed nuclear sites have to comply with licence conditions and, in respect of the review of safety; the licensee is required to undertake periodic safety reviews for all safety-related facilities. The licensee is required to review the safety cases for its spent fuel management, radioactive waste management and reprocessing facilities regularly against an agreed programme. This is usually at least every 10 years. In addition, for those plants that requires Consent (see paragraphs E.46 to E.51) to start up following an outage for inspection and maintenance, the adequacy of the safety case is reviewed prior to the Consent for start-up being granted.

Dounreay Liquid ILW Encapsulation

GH.22. Reprocessing spent fuel at Dounreay produced a large volume of raffinate liquor which was stored in underground tanks. Dounreay reprocessed Materials Test Reactor (MTR) fuels, Dounreay Fast Reactor (DFR) metallic fuel and Prototype Fast Reactor (PFR) Mixed Oxide (MOP) fuel through their reprocessing plants, separating the raffinate liquors for future treatment.

GH.23. In 1996 the Dounreay Cementation Plant (DCP) started routine operation, encapsulating MTR raffinate liquor in cementitious grout in 500l stainless steel drums. The MTR raffinate encapsulation programme was successfully completed in November 2013 with some 840 m^3 of raffinate encapsulated into some 5000 drums, all of which are stored within the DCP complex.

GH.24. Minor modifications were made to the DCP facility to allow DFR raffinate to be processed. DSRL successfully completed processing 232 m^3 of DFR raffinate into 875 drums in July 2016. The DCP facility is currently undergoing major modifications to allow processing of PFR raffinate.

GH.25. All existing spent fuel management, reprocessing and disposal facilities also hold permits or authorisations for the disposal of radioactive waste, granted by the environment agencies. The requirements and processes for the regular review of these permits and authorisations are described in paragraphs F.112 to F.116. The UK's arrangements for radiological surveillance of the environment are described in paragraphs F.117 to F.119.

Intervention for Past Practices

GH.26. The Radioactive Contaminated Land Regulations 2006 (Reference 95) as amended in 2007 (Reference 96) were introduced to extend Part 2A of the Environment Protection Act 1990 (EPA90) to put into place certain requirements of the 1996 BSS Directive in England and Wales. The Radioactive Contaminated Land (Scotland) Regulations 2007 (Reference 97) and the Radioactive Contaminated Land (Scotland) (Amendment) Regulations 2007 (Reference 98), together with the Radioactive Contaminated Land Regulations (Northern Ireland) 2006 (Reference 99) introduced similar requirements in Scotland and Northern Ireland respectively. For land to be determined as radioactive contaminated land, a 'significant contaminant linkage' must be present. A contaminant linkage comprises a radioactive contaminant and a human receptor, with a pathway capable of linking the two. All three elements need to occur on site for a contaminant linkage to exist. The contaminant linkage becomes 'significant' if it results in harm to human

health, or there is significant possibility of such harm occurring. This has been defined as a dose that exceeds one or more of the following:

- an effective dose of 3mSv per year;
- an equivalent dose to the lens of the eye of 15mSv per year; or
- an equivalent dose to the skin of 50mSv per year.

GH.27. In addition to humans, the Radioactive Contaminated Land (Scotland) Regulations 2007 include water as a receptor and include 'significant pollution of the water environment' as part of the definition of 'radioactive contaminated land'. The Regulations also identify that radioactive contaminated land exists for:

- terrestrial biota or plants, with a dose rate from lasting exposure of more than 40microGy per hour; or
- aquatic biota or plants, with a dose rate of more than 400microGy per hour.

GH.28. If land is 'determined' as radioactive contaminated land, intervention will be carried out to remediate the land, provided this is justified, i.e. when the benefits of reducing the detriment outweigh the harm and costs (including social costs) of taking action. For an intervention to be optimised, the chosen action must maximise the difference between the benefits produced by the reduction in detriment and the harm or costs of achieving it.

GH.29. EPA90 does not apply in Northern Ireland. Parallel regulations were introduced there in 2006 and 2007 to ensure that the UK fully complies with its obligations under Articles 48 and 53 of the BSS Directive (BSSD96) (Reference 21), which lays down the basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

GH.30. The ONR has powers under NIA65 to regulate land contaminated with radioactivity within the boundaries of nuclear licensed sites. For this reason, the requirements of Part 2A of EPA90 do not apply to land contaminated with radioactivity on nuclear licensed sites (Reference 100).

Articles 6 and 13 – Siting of Proposed Facilities

Articles 6 and 13**:**

8. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed [spent fuel] [radioactive waste] management facility:

   i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   iii) to make information on the safety of such a facility available to members of the public;
   iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

9. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

GH.31. These Articles demonstrate compliance with the Joint Convention in a way that has not changed substantially since the fifth UK report (other than the reform to the planning law in England and Wales described in Section A – Introduction).

GH.32. An organisation wishing to construct any type of spent fuel management or reprocessing facility on a new site in the UK must obtain planning permission, a nuclear site licence and an environmental permit or an authorisation for radioactive waste discharges. The following text summarises the legal requirements, policy and implementation issues.

National Laws and Regulations for Planning and Licensing

Planning Permission

GH.33. Proposals for spent fuel management facilities or reprocessing facilities must be accompanied by an assessment of the environmental impact of the proposed development if required by the relevant Environmental Impact Regulations (Refs. 101, 102 and 103). The ONR provides advice to local planning authorities on any planning applications for developments around nuclear sites. The advice provided seeks to limit the radiological consequences to members of the public in the event of a nuclear emergency. (Reference 104).

Nuclear Site Licence

GH.34. NIA65 requires that a licence is granted before any site is used for installing or operating a nuclear installation, this is further described in paragraphs E.29 to E.45. The ONR will not grant a licence for a new site or sanction a new facility on an existing site unless it is satisfied with the licensee's safety case. This safety case will address siting issues to demonstrate that the proposed site is acceptable for such an installation in respect of its impact on the local population and environment (through consultation with the environment agencies). For new facilities on existing sites, the licensee's safety case is required to show that the new facility will not adversely affect the characteristics and safety of the existing site. Section 6(1) of NIA65 requires the Secretary of State for Business, Energy and Industrial Strategy to maintain a list showing every site for which a nuclear site licence has been granted, and including a map or maps showing the position and limits of each such site.

Licensing

GH.35. The site for any significant new spent fuel, reprocessing or waste management facility would normally be subject to a public inquiry. The ONR would not license such a facility until the completion of the public inquiry and a ministerial decision made under planning law. The ONR's licensing process would run concurrently with a public inquiry to avoid unnecessary delays. However, the ONR would not grant a licence in advance of a decision on planning consent. Note that radioactive waste disposal is not a prescribed activity and therefore is not currently subject to the licensing regime.

GH.36. Before granting a licence for any spent fuel, reprocessing or waste management facility (except those purely for solid waste disposal) the ONR would seek the views of the environment agencies to ensure that they were content with the radioactive waste disposal and discharge and other environmental implications.

Environmental Permits or Authorisations for Radioactive Waste Disposal

GH.37. Any new spent fuel, reprocessing or waste management facility would require prior authorisation under Environmental Permitting Regulation 2016 (EPR16) or Radioactive

Substances Regulation 1993 (RSA93) to dispose of radioactive waste, including solid waste, and aqueous and gaseous discharges. Such disposals would not be authorised unless appropriate dose limits and constraints and other requirements, such as keeping public radiation exposures ALARA were met.

GH.38. If required, the Environment Agency (EA), National Resources Wales (NRW) or Scottish Environment Protection Agency (SEPA) would give evidence to a public inquiry as to whether a proposed nuclear installation could be granted an environmental permit under EPR16 or an authorisation under RSA93.

Hazards

GH.39. For spent fuel, reprocessing or waste management sites, the licensee would be expected to submit to the ONR a safety case to demonstrate the suitability of the site and its compliance with the ONR's siting criteria. Generally, the safety case would address the impact of the facility on the surrounding area from routine operations and fault conditions. Typically, the licensee would need to consider details of present and predicted population around the site, and the local infrastructure such as housing, schools, hospitals, factories etc. The factors the ONR would assess would include: emergency planning; external hazards such as flooding; seismicity; and other geological factors. The ONR would assess this information in the safety case using the siting criteria in the SAPs.

GH.40. Consideration is also given to any undue effects the presence of the nuclear installation might have on the local environment, for example, the environmental effects of radioactive discharges.

Emergency Arrangements

GH.41. As stated above, one of the key factors in assessing the suitability of a site for a nuclear installation is the impact of a possible nuclear emergency on the population in the area. Although nuclear installations in the UK are designed and operated to high standards, it is required in law to have effective arrangements to respond to and mitigate the consequences of an emergency.

GH.42. The licensee must have an emergency plan as described under Emergency Preparedness for Radiological Emergencies at UK Nuclear Installations Article 25. The ONR must be satisfied that the size, nature and distribution of the population around the site will not prevent implementation of the emergency plan.

Topography

GH.43. The siting of the nuclear installation will require consideration of the topography of the area that might affect the dispersion of the radioactivity discharged from the site in normal operation, or released in the event of an accident. In addition, aspects of the topography of the area around the site that may affect the movement of people and goods are identified, and their effect on the safety of the plant is examined. This examination determines whether the topography and road, rail and sea could create difficulties if it became necessary to evacuate people from the area around the plant.

Information Available to the Public

GH.44. The planning application process provides an opportunity to inform and obtain views from the public in relation to any proposals for the construction and operation of a spent fuel, reprocessing or waste management facility. Similarly, the environment agencies will consult on a developer's application for the permitting or authorisation of the disposal of radioactive waste from the site. ONR, the EA, NRW and SEPA have corporate policies to ensure that public information is available in an open and transparent manner subject to the

requirements of the Freedom of Information Act 2000 (FOIA2000) (Reference 105) and the Freedom of Information (Scotland) Act 2002 (Reference 106). Regulators in England, Wales and Northern Ireland also have duties under the Environmental Information Regulations 2004 made under the FOIA2000, which implement European Commission (EC) Directive 2003/4/EC on public access to environmental information. Similar regulations are in place in Scotland.

Maintaining the Continued Acceptability of the Site

GH.45. Once the site is in operation, the ONR must be satisfied that the characteristics of the site are preserved `to ensure the continued effectiveness of the emergency plan, and that the general radiological siting criteria continue to be met. The ONR monitors this through the local authority land use planning controls. This requires the ONR to be consulted on developments within a specified radius of the site. Continued re-evaluation by the licensee of the external hazards and of the emergency plans is also required. Guidance on re-evaluation of the specific demographic requirements on siting is given to the ONR Inspectors in the SAPs.

GH.46. Circular 04/00: 'Planning controls for hazardous substances' (Reference 107) issued by the Department for Communities and Local Government, and a similar circular from the Scottish Development Department (5/1993) (Reference 108) give advice on the exercise of planning control over hazardous development and over development in the vicinity of hazardous installations.

GH.47. These circulars provide guidelines for the types of development in the vicinity of hazardous installations on which Health and Safety Executive (HSE) should be consulted. They establish HSE as a statutory consultee for development in the vicinity of hazardous installations covered by the Regulations for Control of Development (Hazardous Substances) (Reference 109). From 1 April 2014 the ONR became a statutory consultee for those hazardous installations that are also GB nuclear sites. The ONR has non-statutory arrangements, operated under the same administrative arrangements, to be consulted by local authorities in the case of planning applications in the vicinity of all other types of nuclear installations. The ONR Inspectors assess such planning applications to determine:

- whether a proposed development would raise the population to near the maximum guidelines set out in the Government's siting policy for nuclear installations;
- whether the external hazards recognised in the nuclear safety case include the hazard from a proposed hazardous installation, or alternatively whether a newly introduced hazard can be incorporated whilst continuing to demonstrate adequate safety;
- for a proposed development within the nuclear licensed site, whether the licensee has made a satisfactory safety case for the proposed development and for any existing licensable activities on the site that it would impinge upon, and whether the proposed activity is suitable for a nuclear licensed site;
- for a proposed development within the detailed emergency planning zone (where applicable), the ONR refers the application to the local authority responsible for the off-site emergency plan, who then liaises with the responsible bodies under the plan, to find out:
- whether the development can be incorporated into the emergency plan; or
- whether the emergency plan could be modified to incorporate the development.

GH.48. The ONR requires assurance that the impact of developments in the immediate vicinity of a nuclear installation is accommodated in the emergency preparedness arrangements, to satisfy Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) requirements and licence condition.

GH.49. The ONR also engages with local planning authorities with regard to the allocation of land for development as set out in their Local Plans.

GH.50. Licensees and the ONR monitor and assess any phenomena that might affect safety (for example something that may change the assumptions concerning external hazards) around each nuclear site. This is done as part of the normal regulatory process and during the Periodic Safety Reviews (PSRs). In addition, the ONR maintains a database of the estimated population around nuclear installations, based upon the most recent 10-yearly population census, updated to take account of subsequent planning applications for residential developments.

Periodic Reviews of Authorisations and Environmental Permits

GH.51. Environmental permits and authorisations for discharges and solid waste disposals are reviewed regularly, including consideration of the level of actual discharges and disposals, the margin between discharges/disposals and limits, and the application of BAT under EPR16 or BPM under RSA93 to minimise waste generation and discharges/disposals to the environment. Against a background of UK government policy of progressive reduction in discharges overall, the environment agencies may decide to vary environmental permits or authorisations, following a review, for example, to set revised limits or conditions or to require improvement programmes to be implemented.

International Obligations

GH.52. Any new spent fuel management or reprocessing management activity is likely to be subject to Article 37 of the Euratom Treaty. The UK, as a member state of the European Union, is required to provide the European Commission with such general data relating to any plan for the disposal of radioactive waste under the provisions of Article 37 of the Euratom Treaty. The information will make it possible to determine whether the implementation of such a plan is liable to result in the radioactive contamination of the water, soil or airspace of another member state – as per the Commission Recommendation of 11 October 2010 on application of Article 37 of 2010/635/Euratom (Reference 110).

GH.53. On 23 June 2016, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. Until negotiations to exit the EU are concluded, the UK remains a full member of the European Union and all the rights and obligations of EU membership remain in force. During this period the Government will continue to negotiate, implement and apply EU legislation. The outcome of these negotiations will determine what arrangements apply in relation to EU legislation in future once the UK has left the EU.

Government siting policy

GH.54. The Nuclear National Policy Statement published in 2011 includes a list of the eight sites assessed as potentially suitable for deploying new nuclear power stations by 2025. These sites are: Bradwell; Hartlepool; Heysham; Hinkley Point; Moorside in Cumbria; Oldbury; Sizewell; and Wylfa.

Articles 7 and 14 – Design and Construction of Facilities

Articles 7 and 14 - Each Contracting Party shall take the appropriate steps to ensure that:

- the design and construction of a spent fuel/radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;
- at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel/radioactive waste management facility are taken into account;
- at the design stage, technical provisions for the closure of a disposal facility are prepared;
- the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

GH.55. Under these Articles, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK report.

Pre-Application Assessment and Engagement

GH.56. The regulation of design and construction through the statutory licensing and permitting processes are summarised below. In addition to these statutory processes the regulators carry out various forms of early dialogue, oversight, assessment and engagement before site-specific applications are made.

GH.57. A key example is the regulators working together to ensure that any new nuclear power stations built in the UK meet high standards of safety, security, environmental protection and waste management, through a process called Generic Design Assessment (GDA).

GH.58. GDA is a joint process undertaken by the ONR and the Environment Agency. The regulators get involved with nuclear reactor design companies at the earliest stage where they can have the most influence. The process focuses purely on the reactor design and does not consider any site specific issues. The regulators will only conduct GDA on a new power station design following a request from the government.

GH.59. The regulators undertake a technical assessment of the submissions provided by the design companies and provide advice about any issues they identify, thus allowing issues to be resolved at the design stage. This approach increases regulatory effectiveness and efficiency and helps developers reduce their commercial risks on costs and timescales. The process is systematic and contains a number of steps, with the assessment getting increasingly detailed as the process develops.

GH.60. The process is open and transparent. The regulators publish reports at the end of each step, which provide an update on the assessment and highlight any concerns or technical issues that have been raised. This means that anyone can view the detailed design information, and have the opportunity to comment on it via the GDA comments process.

GH.61. Another example is the pre-application assessment and scrutiny by the regulators of the prospective developer of a deep geological disposal facility, see paragraph E.38.

Safety in Design

GH.62. The design and construction of spent fuel, radioactive waste management and reprocessing facilities (other than purely disposal facilities) are controlled under the conditions attached to the nuclear site licence, in particular the safety case requirements. The ONR's inspectors also use SAPs (Reference 111), together with supporting TAGs (Reference 58), to guide their regulatory judgements and recommendations when undertaking technical assessments of existing nuclear site licensee's safety submissions for spent fuel and radioactive waste facilities.

Environmental Permitting/Authorisation

GH.63. EPR16 (see paragraphs E.84 to E.87) places a duty on the EA to exercise its relevant functions to ensure that radiation exposures of the public resulting from the disposal of radioactive waste in any form are:

- as low as reasonably achievable taking social and economic factors into account; and
- do not exceed 1 mSv per year.

GH.64. The EA is also required, at the planning and design stage of radiation protection (e.g. when permits are determined), to have regard to a maximum dose constraint of 0.3 mSv per year for a single source and 0.5 mSv per year for a single site.

GH.65. Under a Direction issued to SEPA from the Scottish Ministers, SEPA has similar functions to protect the public from exposures of ionising radiation and to have regard to dose constraints when planning for radiation protection.

GH.66. Under the RSA 93 and EPR16 regimes, the environment agencies apply a number of mechanisms to ensure the above, for example the requirements, including at the design stage, to use BAT or BPM to avoid or minimise waste arisings, and to dispose of waste in ways that minimise radiological impacts (BAT or BPM).

Solid Waste Disposal

GH.67. Disposal of solid radioactive waste to a landfill, near-surface disposal facility or to a Geological Disposal Facility (GDF) would only be permitted if prior authorisation for disposal is obtained from the relevant environment agency. The environment agencies have published guidance documents on the requirements for the permitting or authorisation of near-surface facilities (Reference 33) (for England and Wales) and GDFs (Reference 47) for the disposal of radioactive wastes. The requirement for an environmental safety case relevant to safety in design is common to both guidance documents.

GH.68. Both the near-surface and GDF guidance documents are intended principally for the developers or operators of proposed disposal facilities. They both explain the requirements that the environment agencies expect a developer or operator to fulfil when they apply for an authorisation or permit to develop or operate such a facility. Both guidance documents set out the radiological protection requirements and explain the regulatory process that lead to a decision whether the relevant environment agency will authorise or permit radioactive waste disposal.

GH.69. An application under RSA93 or EPR16 relating to a proposed disposal of solid radioactive waste should be supported by an environmental safety case. The environmental safety case should include an environmental safety strategy supported by detailed arguments to demonstrate environmental safety. The environmental safety strategy should

describe the fundamental approach taken to demonstrate the environmental safety of the disposal system. It should include a clear outline of the key environmental safety arguments and say how the major lines of reasoning and underpinning evidence support these arguments. The strategy should explain, for example, how the chosen site, design for passive safety and multiple barriers each contribute to environmental safety.

Measures to Limit Radiological Impacts of Disposals

GH.70. Applications for environmental permits or authorisations to dispose of radioactive waste need to show how the design has used BAT or BPM to:

- minimise the volume and activity of the radioactive waste requiring disposal; and
- minimise the activity of gaseous and aqueous radioactive waste discharged to the environment.

GH.71. The environment agencies' guidance also sets out 5 principles and 14 requirements relevant to the design of solid waste disposal facilities. For example

- Principle 1: Level of protection against radiological hazards at the time of disposal and in the future
- Principle 2 and Requirement R8: Optimisation ALARA
- Requirement R5: Dose constraints during the period of authorisation
- Requirement R6: Risk guidance level after the period of authorisation
- Requirement R7: Human intrusion after the period of authorisation
- Requirement R8: Optimisation
- Requirement R9: Environmental radioactivity

GH.72. Measures to limit the radiological impact of uncontrolled releases are described in paragraphs F.94 to F.96.

Requirements on Reliable, Stable and Easily Manageable Operation

GH.73. Another important aspect of the design process is a detailed consideration of the role of the operator. Particular emphasis during the design stage is placed on identifying the safety actions required of the operators and specifying the user-interface design. The ONR's regulatory oversight ensures that both the design and plant operating instructions address human factor considerations to ensure safe, reliable and easily managed operation.

GH.74. The environment agencies also take into account operator capability, management systems and human factors in their assessments and permit determinations. For example, the environment agencies' guidance for solid radioactive waste disposal facilities requires that the developer / operator of a disposal facility for solid radioactive waste should foster and nurture a positive environmental safety culture at all times and should have a management system, organisational structure and resources sufficient to provide the following functions:

- planning and control of work;
- the application of sound science and good engineering practice;
- provision of information;
- documentation and record-keeping; and
- quality management.

Prevention of Accidents and their Mitigation

GH.75. The environment agencies also take into account operator capability, management systems and human factors in their assessments and permit determinations. For example, the environment agencies' guidance for solid radioactive waste disposal facilities requires that the developer / operator of a disposal facility for solid radioactive waste should foster and nurture a positive environmental safety culture at all times and should have a management system, organisational structure and resources sufficient to provide the following functions:

GH.76. A central and key element during the design process is the analysis of possible accidents on the spent fuel, radioactive waste management or reprocessing facility. This covers all significant sources of radioactivity associated with the plant and all planned operating modes. The analysis starts with a list of initiating faults, including internal and external hazards, and faults due to personnel error that have the potential to lead to any person receiving a significant dose of radiation. A radiological analysis is performed for fault sequences, which could lead to the release of radioactive materials, to determine the maximum effective dose to persons on or off the site. The fault sequences are normally grouped, and a 'bounding case' for each group is specified. These bounding cases take account of the demands made on the safety system. They have consequences at least as severe as any member of the group of fault sequences that they bound.

GH.77. The fault analysis process leads to the determination of the Design Basis Accidents (DBAs) for the nuclear installation. These accidents are drawn from the fault analysis, but do not include initiating faults that are determined to be very improbable.

GH.78. DBAs are analysed on a conservative basis and assume the worst normally-permitted configuration of equipment and unavailability for maintenance, test or repair. For each design basis fault sequence or bounding case which leads to a release of radioactive material, the radiological analysis determines the maximum effective dose to a person outside the site. The DBA establishes the minimum safety system requirements for each initiating fault and also identifies the operator's administrative requirements. It therefore provides information for:

- the performance requirements for the safety systems and safety-related equipment;
- the determination of the plant operational limits and the formulation of the operating rules; and
- the preparation of the plant operating instructions for fault conditions.

GH.79. Additional to DBA is Probabilistic Safety Analysis (PSA) this is a method of fault analysis focussed on ensuring that a nuclear facility, plant or site is adequately safe against a wide range of faults and hazards. It is complementary to other methods of fault analysis such as the Design Basis Analysis (DBA) and Severe Accident Analysis (SAA). SAA focuses primarily on quantifying levels of risk and then assessing options for reducing those risks.

Decommissioning Provisions at the Design Stage

GH.80. The safety case produced at the design stage should include at least an outline decommissioning plan to show how the design of the plant will facilitate its safe decommissioning and dismantling. This activity is controlled under the conditions attached to the nuclear site licence, in particular the safety case for decommissioning.

GH.81. The SAPs require the licensee to prepare an outline decommissioning plan to show how the design of the plant will facilitate its safe decommissioning and dismantling.

Closure of Disposal Facilities

GH.82. In relation to the consideration, at the design and construction stage of the closure of a solid waste disposal facility, the environment agencies' guidance states that unreasonable reliance on human action to protect the public and the environment against radiological and non-radiological hazards is avoided both at the time of disposal and in the future (Principle 4 – Reliance on human action). There is also a requirement (R12) on the developer / operator of a disposal facility for solid radioactive waste to ensure that the site is used and the facility is designed, constructed, operated and capable of closure to avoid unacceptable effects on the performance of the disposal system. There is also a requirement (R14) to carry out a programme to monitor for changes caused by construction, operation and closure of the facility.

GH.83. The guidance also states that the environment agencies shall not consider the disposal process complete until all the requirements of the environmental safety case have been met. At the design stage and periodically during the lifetime of the facility, the developer / operator should demonstrate that it is able to close the disposal facility satisfactorily and, where relevant, seal any preferential pathways that will or may be introduced as a result of the siting, construction and operation of the facility.

Technologies Proven by Experience or Qualified by Testing or Analysis

GH.84. Nuclear installations designed to modern standards have included the qualification of equipment for DBAs within their safety cases. This qualification often involved arduous testing, or comprehensive analysis, or both, consistent with modern national or international standards or other specific regulatory requirements.

GH.85. For older plants, there will not be evidence from the design phase to address modern requirements for equipment qualification and safety analysis. In addition, the experience of operation of earlier nuclear installations has provided operational, maintenance and inspection data. This has led to increased confidence in meeting required safety equipment performance levels or, alternatively, the need for a modification or replacement with more modern technologies meeting current safety design criteria, where appropriate.

GH.86. Furthermore, the PSR requirements of the UK nuclear site licences have meant that for many years the UK has been monitoring and improving the safety of its nuclear installations as a matter of routine. This activity will continue in the future under the legal requirements of the nuclear site licence.

GH.87. The environment agencies' guidance states that all work that supports the environmental safety case needs to follow good engineering practice, for reasons of both quality management and optimisation. The guidance makes clear that this will usually mean applying tried and tested methods, except where the technology used in the construction and operation of a disposal facility is at the leading edge of engineering practice. It also states that, in such instances, a judgment will need to be made as to whether the benefits of using a novel technology instead of a tried and tested method are sufficient to outweigh any uncertainties about the outcome of using it. Before the decision is made to use a novel technology, the environment agencies shall expect the developer / operator to have carried out trials to demonstrate that any such uncertainties are kept to a minimum.

Articles 8 and 15 – Assessment of Safety of Facilities

Articles 8 and 15: Each Contracting Party shall take the appropriate steps to ensure that:

(i) Before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out.

(ii) In addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body.

(iii) Before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

GH.88. Under these Articles, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK report.

Systematic Safety Assessments

GH.89. The safety case is the basis for much of the assessment and regulation of safety at nuclear licensed sites with spent fuel, reprocessing and radioactive waste management and disposal facilities in the UK. The assessment of the licensee's safety case starts before construction starts. The safety case consists of a tiered set of safety analysis reports covering a range of topics, from general safety principles through to detailed aspects of design and operation. This set of documents provides a written justification of the safety of the installation, for example: evidence to support the selection of the concepts and processes, detailed data used in calculations for specific components, calling as necessary on specific research and development programmes.

GH.90. The safety case is continually developed and updated as the installation progresses through design, construction, commissioning, operation and, finally, decommissioning. At various stages in the life of a nuclear installation, the licence requires the licensee to review the adequacy of its safety case to ensure it is up to date and fit for purpose.

GH.91. The conditions attached to site licences granted under NIA65 require licensees to produce adequate safety documentation. In particular, this should include arrangements relating to:

- safety documentation;
- site plans, designs and specifications;
- construction or Installation of new plant;

- modification to design of plant under construction
- commissioning;
- modification or experiment on existing plant;
- operating rules; and
- examination, inspection, maintenance and testing.

GH.92. These Licence Conditions ("LCs") ensure that the licensee produces and maintains a safety case of adequate standard throughout the life of the installation.

Safety Case Evolution

GH.93. A safety case evolves as a plant or activity moves from one phase of its lifecycle to another and should be updated or amended to take into account changing circumstances, which can include:

- developments in safety standards;
- transition from operations to decommissioning;
- changes in engineering;
- interfaces with other plants;
- operational experience feedback; and
- implications of modifications (including plant ageing effects) and emergent non-conformances.

GH.94. It is important that the safety significance of these aspects is examined and that the safety case is updated, as appropriate, to reflect the current situation. Thus, the documentation that forms the safety case is subject to appropriate quality assurance procedures, discussed under Section F - Other General Safety Provisions, Article 23, and significant changes to the safety case are controlled as modifications.

GH.95. Supplementary documents may also be used to justify an activity at a point in time. For example, a method statement may demonstrate that the integrity of plant will be maintained and quality ensured during any modifications or during the installation of new plant. Similarly, any temporary plant modification may require a temporary change to the safety case to justify operations which lie outside the normal operations described by existing rules and instructions.

Regulatory Validation Activities

GH.96. In the course of its nuclear regulatory work, the ONR scrutinises the activities of licensees, both at their licensed nuclear sites and through assessment of the licensees' written safety cases. Inspectors examine the licensees' safety cases to satisfy themselves that the safety claims of the licensees are justified or demonstrated. For site inspections, the ONR uses the safety case to help prepare inspections and to determine parameters and values against which to judge the safety of plants. Both general and specific targeted inspections are undertaken to ensure that the installation and its operation remain in accordance with its current safety case.

Systematic Environmental Assessments

GH.97. The UK recognises that any proposed new spent fuel management or reprocessing facility will be subject to the requirements of (European Union) EU Directive No 85/337/EEC (Reference 112), as amended by EU Directive No 97/11/EC (Reference 113), on the assessment of the impacts of certain projects on the environment. Where environmental assessment is required, the developer must prepare an environmental statement that

includes a description of the likely significant effects on the environment and the measures envisaged to avoid, reduce or remedy any significant adverse effects.

GH.98. Any operator who wishes to apply for a permit or authorisation to dispose of, or discharge, radioactive waste from the environment agencies must provide a radiological impact assessment in support of their application. The assessment must take into account the likely routes of potential radiation exposure resulting from the disposals and the radiation doses received by the most exposed members of the public and to non-human species. The environment agencies' principles for the prospective assessment of public doses arising from permitted discharges are set out in reference (Reference 81).

GH.99. The environment agencies also take into account the radiological protection of the environment. The European assessment tool, ERICA, is available to support decisions about radiological protection of the environment (Reference 114).

GH.100. A permit or authorisation application must also set out how the operator will minimise and monitor disposals and the presence of radionuclides in the environment that may result from the disposals in order to check that radiation exposures remain ALARA and below statutory limits. The environment agencies will not issue any permit or authorisation to dispose of radioactive wastes in any form (gaseous, liquid or solid) until they have rigorously assessed the application and supporting assessment, consulted upon it (including with members of the public) and published their conclusions.

GH.101. The environment agencies' guidance includes a number of requirements that are particularly relevant to these Articles for facilities to be used for the disposal of solid radioactive wastes (see paragraphs GH.66 to GH.68) and (Reference 31 and 45).

Articles 9 and 16 – Operation of Facilities

Articles 9 and 16: Each Contracting Party shall take the appropriate steps to ensure that:

(iv) The licence to operate a spent fuel [radioactive waste] management facility is based upon appropriate assessments as specified in Article [8] [15] and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements.

(v) Operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article [8] [15], are defined and revised as necessary.

(vi) Operation, maintenance, monitoring, inspection and testing of a [spent fuel] [radioactive waste] management facility are conducted in accordance with established procedures.

(vii) Engineering and technical support in all safety-related fields are available throughout the operating lifetime of a [spent fuel] [radioactive waste] management facility.

(viii) Procedures for characterization and segregation of radioactive waste are applied.

(ix) Incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body.

(x) Programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate.

(xi)	Decommissioning plans for a [spent fuel] [radioactive waste] management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.
(xii)	Plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

GH.102. Under these Articles, the only significant changes to the UK's means of complying with the Joint Convention since the fifth UK national report are the following and have been highlighted:

- the ONR has introduced significant changes to its Knowledge Management system – see paragraphs GH.167 to GH.169.

GH.103. Maintenance of the radioactive waste and spent fuel management infrastructure for Magnox and Sellafield are described from paragraph GH.115 to GH.130

Licensing Process and National Law

GH.104. As previously described, no one may operate a nuclear installation unless they hold a nuclear site licence granted by the Chief Nuclear Inspector (CNI), acting under delegated powers. The conditions attached to the nuclear site licence define the key activities the licensee must carry out in order to effectively manage the safety of the installation.

GH.105. The environment agencies require prior permission or authorisation, under either EPR16 or RSA93, before radioactive waste is consigned to a disposal facility, or disposals or discharges made directly to the environment. Compliance with conditions and limits set in environmental permits under EPR16 and in authorisations under RSA93 is monitored and evaluated by the environment agencies through inspection and other assessment activities, such as monitoring of wastes disposed to the facility and monitoring of discharges from the facility.

Licence to Operate Nuclear Installations

GH.106. A nuclear site licence is required prior to commencement of the construction of a nuclear installation on the site. The report on Article 15 addresses the licensing process and the safety analysis during the design, construction and commissioning phases.

GH.107. In practice, there is a transitional period for the nuclear installation as it moves from its construction to its operational phase. This period is controlled by a commissioning schedule and programme, which give details and requirements for each item of plant or equipment, and groups of plant or equipment, to be brought to a state that is acceptable for operation in the totality of the facility. Certain key stages in the commissioning programme are identified at which the ONR's Consent is required before further progress towards operation can be made. The final Consent during the commissioning phase is the Consent to move to routine operation. This is issued once the safety case has been substantiated by the results of commissioning tests, and all the necessary documents and systems are in place for the continued operation and maintenance of the plant. This final Consent is effectively an authorisation for routine operation.

GH.108. The ONR consults the environment agencies before significant decisions on Consents are made.

Operational Limits and Conditions

GH.109. The operational limits and conditions for a nuclear installation are based on its safety case and limits therein. The safety case limits are normally the measurable plant parameters that define the envelope for demonstrably safe operation and the safety conditions that are prerequisites, in terms of plant configurations and operator actions, to keep the plant within this envelope.

GH.110. Licensee's arrangements under the nuclear site licence provide for adequate control over modifications to plant operating limits or conditions. Where the limits and conditions necessary for safety are defined in the form of operating rules, the ONR may specify that, once approved by the ONR, no alteration or amendment can be made to such operating rules without ONR's prior approval following consultation as appropriate with the environment agencies.

GH.111. Environmental permits and authorisations include a range of limits and conditions associated with the operation of a facility. In addition, the permits/authorisations for radioactive waste disposal or discharge include a number of mechanisms to ensure that public dose and other statutory limits are met. These include:

- setting limits on discharges;
- requiring the use of BAT or BPM to avoid or minimise waste arisings, and to dispose of unavoidable waste in ways that minimise radiological impacts;
- carrying out prospective assessment of doses from planned discharges;
- requiring monitoring and accountancy of discharges; and

GH.112. requiring monitoring of the environment and the assessment of doses actually received by those most highly exposed. An independent monitoring and assessment programme is also carried out by the environment agencies and the Food Standards Agency (FSA).

GH.113. More detailed requirements are specified by the environment agencies in supporting documents such as the Compilation of Environment Agency Requirements (CEAR) in England and Wales.

GH.114. One consequence of the requirement to use BAT/BPM to minimise disposals and the impact of disposals is that radiation doses to the most exposed individuals can be expected to be well below the statutory dose limit and dose constraints.

GH.115. The environment agencies will periodically review environmental permits under EPR16 and authorisations under RSA93 for the disposal of radioactive waste. Reviews may lead to revision of the limits and conditions in environmental permits and authorisations.

Operation, Maintenance, Monitoring, Inspection and Testing

GH.116. Environmental permits and authorisations include conditions requiring the maintenance and testing of all equipment associated with the management and characterisation of radioactive waste.

GH.117. Operation, maintenance, monitoring, inspection and testing at nuclear installations are all covered under licence conditions attached to nuclear site licences. In particular:

- all operations that may affect safety must be undertaken in accordance with written operating instructions; and
- licensees must make and implement arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.

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Asset Care and Maintenance at Magnox Reactors

GH.118. Within the NDA Estate (see Section L.1 – Legislative and Regulatory System), the legacy sites themselves represent national assets which, subject to appropriate land remediation and management, can eventually be released for further use. On the other hand, the redundant facilities on these sites require ongoing management, decommissioning, dismantling, and demolition in order to realise this. Therefore, the facilities essentially represent liabilities. For simplicity, the terms asset and asset management are used to refer to these facilities.

GH.119. The objective of asset management within the NDA estate, which includes the Magnox sites, is to achieve reliable asset performance such as to maintain adequate safety, security and environmental performance through the significant periods of quiescence planned prior to commencement of final site clearance. The approach adopted involves a risk-based plant assessment process to determine what plant could potentially be left in-situ. A balanced business decision is then needed on whether this is appropriate when weighed against:

- any initial remedial work necessary; and
- ongoing asset management needed to assure its continued satisfactory performance.

GH.120. The aim of this approach is to reduce the initial investment needed to achieve a state of Care and Maintenance (CandM) for the sites with an aspiration to reduce the overall costs for the sites achieving their respective end states.

GH.121. The current approach to determining risk within Magnox is in two stages:

(xiii) Identify the current condition of assets and evaluate the remedial work scope and timing necessary in line with a prioritisation process.

(xiv) Identify how conditions may change with time and, based on this, address ongoing asset management measures necessary to prevent asset degradation over the longer-term programme.

GH.122. Within Magnox, many of the assets have outlived (often by some considerable margin) their functional lifetime, although their function is still often required to deliver the decommissioning mission. In such instances, the current Magnox asset management strategy is a risk-based approach focussed on maintaining performance and reliability in a proportionate manner, and delivering value for money for the taxpayer through the NDA as its owner.

GH.123. The current decommissioning strategy for the Magnox sites is to adopt a period of care and maintenance following an initial post-shutdown high hazard reduction phase achieved by means of removal of fuel from the sites and Post-Operational Clean Out (POCO) of hazardous materials (both radioactive and conventional). This strategy is designed to realise the benefits of radioactive decay and other benefits intended to ensure that the overall decommissioning, dismantling, and demolition processes are as efficient as possible.

GH.124. Having regards to current decommissioning good practice outlined in the ONR's Technical assessment Guides and in the relevant International Atomic Energy Authority (IAEA) Guidance, this strategy is currently under review to validate the underlying assumptions.

GH.125. Such an approach requires a balance of minimal spends associated with the preparation of assets Care and Maintenance (C and M) (as such spends are often nugatory in terms of achieving the decommissioning end state) whilst ensuring that an

appropriate inspection and maintenance regime is in place to provide the assurance that key components such as the building structures, cladding, etc. do not deteriorate.

GH.126. An example is the building cladding which on some sites has been replaced with a robust new weather envelope designed to protect the reactor structure during care and maintenance and prior to final site clearance (the picture below shows the new weather envelope at Bradwell). However, the effort and expenditure associated with this approach is considerable. Therefore, to minimise initial investments, a business case approach is being adopted for subsequent structures involving detailed site specific surveys. Depending upon the outcome of these, it may prove possible in some cases to retain the existing cladding following an identified programme of initial remedial work and supported by an enhanced asset care programme designed to maximise the functional lifetime of the extant cladding whilst minimising capital spends.

GH.127. In the case of Bradwell, the ONR has set several hold points in the project. The site will only be authorised to move into final CandM when the ONR is satisfied that it will be safely managed and has granted its consent to such a move.

Asset Care and Maintenance at Sellafield Ltd.

GH.128. Sellafield has played a pivotal role in the UK nuclear industry since the 1940s and many of the facilities at Sellafield are 60 to 70 years old. Many historic facilities were not built with decommissioning in mind. Additionally, a number of facilities are now operating beyond their designed lifetime and are still required to support spent fuel and radioactive waste management activities. Despite investment in asset care, some of these ageing facilities remain vulnerable and as such this a priority area for Sellafield Ltd., the NDA and the UK regulatory bodies (the ONR and the EA). The objectives of asset care at Sellafield, in relation to spent fuel and radioactive waste management, are to assure reliable asset performance to fulfil its future mission requirements and ensure compliance with legislative requirements.

GH.129. The current approach at Sellafield is to identify the condition of current assets and resolve issues via a prioritisation process. Current assets will then be assessed in terms of how conditions will change with time and, based on longer term mission/programme requirements, address asset condition through a structured review mechanism focussed on a risk-informed prioritisation process. Such an approach requires a balance between optimum spend whilst ensuring that key components, building structure and supporting infrastructure do not degrade to such an extent that a radiological, nuclear or conventional safety event or incident would occur, or where there would be a requirement of additional effort and spend before decommissioning can start.

GH.130. Regulatory guidance highlights the need for duty holders to consider and develop strategies and plans taking into account the whole life of risks in respect of physical assets. Furthermore, the guidance also sets out regulatory expectations beyond those covered by routine examination, inspection, maintenance and testing.

GH.131. In summary terms the Sellafield Ltd. asset care programme includes, but is not Ltd. to:

- continued receipt and safe storage of spent fuel and radioactive waste; and
- continuing reprocessing of spent fuels and radioactive waste;
- transition of facilities into POCO and CandM states;
- preparation for and start of waste retrievals and decommissioning;
- site-wide infrastructure essential improvements are being made to electrical and water distribution systems: a new steam generation plant, which is essential from asset maintenance as well as a personnel welfare perspective, and replacement of the analytical capability, necessary for ongoing and future site operations.

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GH.132. At the time both Oxide and Magnox reprocessing activities cease (see B.11 to B.24), any remaining spent fuel and radioactive waste at Sellafield will enter a period of storage prior to final disposal, which may be several decades away. Waste processing activities, including recovery and transfer of wastes to other facilities and processing of highly active liquors will continue.

GH.133. The Thermal Oxide Reprocessing Plant (THORP) facility is of particular interest at present as parts of the facility move into POCO, whilst some will remain operational for many years. Key considerations include:

- consideration of changes to safety case and operating limits;
- interactions between those plants in POCO and adjacent facilities;
- definition of POCO end states;

- repurposing of facilities to support Sellafield Ltd. mission; and
- asset management to ensure safe and secure continued operations.

Engineering and Technical Support and Research Programmes

GH.134. Nuclear site licences issued under NIA65 contain a number of requirements to ensure sufficient safety-related engineering and technical support is available throughout the life of a nuclear installation. In particular:

- only suitably qualified and experienced persons should perform any duties that may affect the safety of operations on the site; and
- requires the licensee to assess the safety impact of any change to its organisational structure or resources before these changes are carried out.

GH.135. Licensees commission and undertake research to support the safe operation of their nuclear installations. In addition, the Government has given the ONR responsibility to co-ordinate safety-related research to address the following objectives:

- Adequate and balanced nuclear safety research to properly address the technical issues deemed likely to emerge in the short and long term.
- The contribution research makes to securing higher standards of nuclear safety as a matter of continuous improvement is maximised.
- Results of research having implications for nuclear safety are appropriately disseminated.

There are two secondary objectives:

- Maintenance of a sufficient range of independent research capability in the UK, to ensure the primary objectives can be met on a sustainable basis.
- Proper account is taken of lessons learnt from international collaboration in research.

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GH.136. Nuclear site licences issued under NIA65 contain a number of requirements to ensure sufficient safety-related engineering and technical support is available throughout the life of a nuclear installation. This is described under Section F - Other General Safety Provisions, Article 22.

GH.137. Licensees commission and undertake a programme of research and development in support of their business needs in support of activities undertaken on their nuclear installations. Nuclear site licensees are subject to nuclear site license conditions, through which they are required to produce safety cases to demonstrate the safety of their operations; in so doing they are responsible for performing any research necessary to substantiate their safety claims.

GH.138. The Energy Act 2013 enables the ONR to carry out or commission research in connection with its purposes and therefore supports delivery of its strategic goal of being an exemplary regulator. Nuclear site licensees are responsible for managing the risks of their operations, and the designers and manufacturers of nuclear plants are responsible under the Health and Safety at Work etc. Act 1974 for undertaking the research necessary to identify and reduce these risks.

GH.139. The ONR's research needs are different as they must support its independent regulatory decision making. This needs to be based on objective scientific and technical understanding of the safety issues.

GH.140. The ONR's objectives for research are consequently:

- to test claims made in licensees' safety cases where the current knowledge base recognises there may be significant uncertainties;
- to ensure the ONR has continuing access to independent scientific and technical expertise in areas where this is scarce;
- to identify emerging technologies with the potential to provide licensees with new ways of managing and reducing existing risks;
- to identify new information and understanding that might undermine existing safety cases;
- to improve the ONR's understanding of potential safety issues associated with technologies proposed for future deployment in the UK, where government has informed ONR that it has sufficient confidence that these may proceed; and
- to enhance the efficiency and effectiveness of the nuclear regulatory system.

GH.141. This approach ensures that the ONR has continued access to the latest independent scientific and technical expertise. If appropriate, the nuclear site licensees are invited to commission research to address identified topics and share results with the ONR. If not, the ONR commissions the research itself (on nuclear safety) and publishes the results. The publication of ONR's Research Register and its outputs/deliverables ensure that stakeholders can access findings independently and conveniently.

GH.142. The ONR are represented on many wider research panels. Activities include attendance and participation at various national and international events, such as conferences, seminars and other related engagements; together with membership subscriptions for various research topic groups. This enables the ONR to improve its outreach and communications with UK and international bodies, ensuring alignment and sharing of information.

GH.143. The ONR interacts with its stakeholders, for example EA, NRW and other UK nuclear industry research boards (Nuclear Innovation and Research Advisory Board, NDA etc.), the wider nuclear industry and key research providers, to co-ordinate its research with theirs.

GH.144. The environment agencies may also commission their own research to support their regulatory assessments and decisions. For example, the Environment Agency is contributing to the Radioactivity and the Environment (RATE) programme which is a major five year UK research programme which started in 2013. The RATE programme consists of three projects being carried out by UK academic consortia with aims to:

- improve the scientific understanding of the behaviour and effects of radioactivity in the environment;
- increase the UK's environmental radiological research capability and capacity; and
- enhance environmental protection and safeguard human health from releases of radioactivity from nuclear power stations, waste repositories and legacy-contaminated sites, as well as natural radiation.

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GH.145. The programme is jointly funded by Natural Environment Research Council (NERC), Radioactive Waste Management Ltd. (RWM) and the Environment Agency.

GH.146. The environment agencies require operators of both nuclear facilities and disposal sites to demonstrate compliance with their environmental permits or authorisations at all times. Operators must be able to demonstrate that they are meeting limits and conditions by having in place appropriate organisational management systems organisational

structures and resources; this would include setting down and adhering to work procedures and having appropriate engineering and technical resources.

Operation of a Solid Waste Disposal Facility and Waste Acceptance Criteria

GH.147. Licensing of a future GDF is described in paragraphs E.35 to E.38. Disposability of waste in a GDF is assessed by RWM as described in paragraphs B.96 to B.99.

GH.148. The operation of a solid waste disposal facility is subject to the environmental permitting and authorisation regimes in the UK. For example, the environmental permit for the Low-Level Waste Repository (LLWR) in England includes a number of operational limits and conditions including limits on disposal (Reference 115).

GH.149. The environment agencies' guidance (Reference 31 and 45) states that the developer / operator of a radioactive waste disposal facility will be responsible for all information necessary to support the environmental safety case, and will need to provide it to the appropriate environment agency in a timely way within an agreed documentation structure so that its relevance to the environmental safety case is clear. The guidance also states that technical information should be submitted in an agreed form that allows the regulator to understand fully the arguments put forward in the environmental safety case and to carry out its own environmental safety assessments to support its judgments.

GH.150. The environment agencies' guidance sets out a requirement (R13) on waste acceptance criteria for radioactive waste disposal facilities. It states that the developer / operator of a disposal facility for solid radioactive waste should establish waste acceptance criteria consistent with the assumptions made in the environmental safety case and with the requirements for transport and handling, and demonstrate that these can be applied during operations at the facility.

GH.151. The guidance also states that waste characterisation, treatment and packaging are the responsibility of the consignor of the radioactive waste to the disposal facility. However, it is the responsibility of the developer / operator of the facility to make sure that the waste accepted for disposal is consistent with the environmental safety case and the operational requirements at the facility, including transport and handling.

Reporting of Incidents Significant to Safety at Licensed Nuclear Sites

GH.152. Incidents on the site requires the licensees to make arrangements to notify, record, investigate and report incidents to the ONR:

- as is required by any other condition attached to the licence;
- as the ONR may specify; and
- as the licensee considers necessary.

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GH.153. For example, the ONR requires the licensee to notify, record, investigate and report incidents arising under Operating Rules, Examination, Inspection, Maintenance and Testing, and Leakage and Escape of Radioactive Material and Radioactive Waste. Incidents to be notified etc. include those referred to in NIA65 Section 7 in the Nuclear Installations (Dangerous Occurrences) Regulations 1965 (Reference 116), and in the Ionising Radiation Regulations 1999 (IRR99) Regulations 25 and 30.

GH.154. The ONR provides guidance including incident and event reporting categories, which licensees use to notify the regulator of more significant incidents on the sites. These notifications include provision of the International Nuclear and Radiological Event Scale (INES) ratings. The ONR on behalf of the Government is responsible for making international incident and other reports through existing systems run under the auspices of IAEA/NEA, including:

- the International Nuclear and Radiological Event Scale (INES);
- Fuel Incident Notification Analysis System (FINAS); and
- International Reporting System for Operating Experience (IRS).

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GH.155. Certain incidents are deemed to meet criteria for UK ministerial reporting, and these are published by the ONR in a quarterly statement. The criteria for ministerial reporting are:

- dangerous occurrences reportable under Nuclear Installations (Dangerous Occurrences) Regulations 1965;
- confirmed exposure to radiation of individuals which exceeds or which is expected to exceed the dose limits specified in Schedule 4 to IRR99;
- examination, inspection, maintenance or test of any part of the plant that has revealed that the safe operation or condition of the plant may be significantly affected;
- a confirmed release to atmosphere or spillage of a radioactive substance which exceeds, or is expected to exceed, the limits set out in IRR99 (except where the release is in a manner specified in an environmental permit under EPR16 or an authorisation under RSA93); and
- a confirmed breach of, or discharge expected to breach quantitative limits of, an environmental permit under EPR16 or an authorisation under RSA93 for the disposal of radioactive waste.

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GH.156. The UK is a signatory to the 1986 International Atomic Energy Authority (IAEA) Convention on ‘Early Notification of a Nuclear Accident’ (Reference 117) which requires notifying the IAEA whenever ‘a release of radioactive materials occurs or is likely to occur and which has resulted or may result in an international trans-boundary release that could be of radiological safety significance for another state’. The UK competent authority and contact point for issuing and receiving notification and information on the nuclear accident is the Department for Business, Energy and Industrial Strategy (BEIS).

GH.157. Environmental permits require that the operator notifies the EA without delay about any malfunction, or any accident that has caused, is causing or may cause significant pollution or may generate significant amounts of radioactive waste. Operators are also required to notify the Environment Agency of limit breaches and any significant adverse environmental effects that could reasonably be seen to result from the operation of the facility. The same notification arrangements apply to operators who hold RSA93 Authorisations.

Programmes to Collect and Analyse Operating Experience at Licensed Nuclear Sites

GH.158. Operational matters which may affect safety and which are identified during operation or during maintenance, inspection and testing are notified, recorded, investigated and reported as required. These requirements ensure that experience gained during operation is properly considered, and that any findings or recommendations that will

improve safety are recognised and acted upon. The operational records demonstrate to the regulators compliance with site licence conditions and other regulatory requirements, but also constitute part of the plant history that operators need to make safety and commercial judgments. For example, the results of routine examinations of the plant may be used to justify a change to the intervals between maintenance, or a change from preventive maintenance to condition-based maintenance.

GH.159. The licensees' arrangements for investigation of incidents usually include any implications for other installations and operators to be considered in off-site reporting, and regular reviews of such reports to be taken into account by other nuclear installation licensees. In this way, dissemination of a plant event on one installation can be used by other installations to assess and report formally on its impact on their plant.

GH.160. The ONR has produced guidance through consultation with licensees to facilitate a consistent national approach to incident and event notification which identifies the types of incidents the ONR wishes to be notified of, and offers illustrative examples of each category. The guidance covers nuclear safety, radiation safety, safeguards, security and transport. Notifications are made to the ONR in writing on a standard proforma (called an INF1) and these are recorded on an ONR database. This database also contains information on subsequent actions taken by the operator and the ONR so that a complete picture of an incidents life-cycle is available to the ONR.

GH.161. The information collated in the ONR incident database is analysed periodically to determine any wider learning. In addition, licensees provide feedback to the ONR on their investigations into most of the incidents notified to the ONR. Trending of events along with other relevant data (inspection findings, issues from other industries, feedback on trending from licence holders) is used to identify issues for learning. Several other routes for sharing learning exist which ensure the learning is targeted to the most appropriate recipients.

Decommissioning Plan Preparation and Updating at Licensed Nuclear Sites

GH.162. The site licence requires licensees to have arrangements for the safe decommissioning of any plant or process that may affect safety. This includes arrangements for the production and implementation of decommissioning programmes and plans for each spent fuel or reprocessing facility.

GH.163. The ONR expects licensees to review and update its decommissioning plans throughout the lifetime of the facility, on a periodic basis and with increasing frequency as the facility approaches the end of its operational life. Prior to and during the operational phase, the ONR will review decommissioning plans periodically in accordance with its guidance. Once the facility enters into decommissioning there is generally a continuous regulatory oversight of the decommissioning plan and its implementation, associated arrangements and safety case documentation that should be proportionate to the hazards being managed.

GH.164. Regulatory activities may include: review or assessment of decommissioning plans and related documentation; compliance inspection; granting of permissions for activities; and, if necessary, enforcement.

GH.165. More information on the regulatory expectations for decommissioning, including expectations for decommissioning strategies, is set out under Section F - Other General Safety Provisions.

GH.166. The environmental agencies have published a consultation document on 'Guidance on Requirements for Release of nuclear sites from Radioactive Substances Regulation

(RSR)', referred to as the 'Draft Guidance on Requirements for Release of nuclear sites from radioactive substances Regulation (GRR)'. This guidance explains the requirements the environmental regulators will expect nuclear site operators to fulfil when developing their plans for the management of radioactive waste from decommissioning and how implementing these plans will leave sites in a state suitable for release from RSR (see Section E – Legislative and Regulatory System for more details).

Plans for Closure of a Facility for Solid Radioactive Waste Disposal

GH.167. The environment agencies' GRA states that the disposal process will not be regarded as complete until all the requirements of the environmental safety case have been met. This would include sealing and closure of the facility as set out in Requirement R12. Additional information can be found in Section F.34 to F35.

GH.168. The guidance states that, at the design stage and periodically during the lifetime of the facility, the developer / operator should demonstrate that it is able satisfactorily to close the disposal facility and, where relevant, seal the access tunnels, shafts and drifts, boreholes and any other potential preferential pathways for radionuclide transport that will or may be introduced as a result of the siting, construction and operation of the disposal facility. Also, in design, construction, operation and closure the developer / operator will need to take into account a number of effects that may arise from properties of the waste, including:

- gas generation through microbial, chemical, or radiolytic action, or as a result of radioactive decay;
- heat generation through microbial or chemical action, or as a result of radioactive decay; and
- criticality through concentration of fissile nuclides.

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GH.169. The guidance states that these topics will need to be considered in the environmental safety case.

Knowledge Management

GH.170. Key to improving knowledge management and the delivery of the ONR's vision, mission and strategy, is recognising the importance of its people and the need to ensure knowledge is transferred throughout a person's career, rather than captured as they leave. Each nuclear specialism within the ONR has developed a 'resilience map' that defines core knowledge areas, the specialism competencies required for inspectors to operate effectively and the level of knowledge team members have in each core knowledge area. The ONR uses these maps to identify organisational vulnerabilities and knowledge gaps, to inform the way the ONR develop and train its people and better define recruitment needs.

GH.171. The ONR's programmes have identified core knowledge areas required to effectively regulate duty-holders and have developed information maps to enable the effective storage and retrieval of information. These maps link the knowledge areas to the key documents used by the inspection teams to understand and keep up to date with developments on the programme such as regulatory strategy and the findings of regulatory interventions.

GH.172. Improvements already underway in strategic knowledge management will move the ONR to a mature knowledge management organisation. The ONR has identified six key

knowledge management activity areas, three of which focus on capturing and sharing knowledge in key parts of the organisation, specialisms, programmes and the corporate centre. The remaining activity areas focus on oversight of the knowledge management programme and creating the right environment for knowledge management, including the right organisational culture, processes and technology.

Article 10 – Disposal of Spent Fuel

Article 10: If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

GH.173. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK report.

GH.174. In the UK, spent fuel from the existing nuclear power plants has not been designated as radioactive waste for disposal. Spent fuel reprocessing is planned to cease as early as 2020. From the date that reprocessing ceases spent fuel is expected to be designated as HAW and disposed of at the planned GDF following a period of safe and secure interim storage.

Article 17 – Institutional Measures after Closure of Radioactive Waste Disposal Facilities

Article 17: Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(xv) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(xvi) (ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(xvii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

GH.175. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth UK report.

GH.176. The environment agencies' GRA for radioactive waste disposal facilities states that the developer/operator will need to set up and maintain a comprehensive system for recording information on all aspects of the project affecting the environmental safety case. The information to be recorded should include:

- decisions taken and the reasons for them;

- data and results from the site investigation and characterisation programme;
- design documents, drawings and engineering details of the facility as constructed;
- records of waste form and characterisation;
- records of waste emplacements and their location in the facility;
- details of facility closure; and
- results of monitoring and assessment at all stages of the project.

GH.177. Duplicates of the records should be kept at diverse locations and in durable form. During the period of authorisation, the records will be needed by both the organisation exercising control and by the regulators. The environment agencies also expect operators to make arrangements at the end of their period of authorisation, for the records to be included in the public archive.

GH.178. The guidance also states that the process of optimising a disposal facility requires the continuous attention of the developer / operator from the design stage through to the end of the period of authorisation. The requirement is for radiological risks to members of the public to be ALARA during both the period of authorisation and afterwards. Radiological risks during the period of authorisation are reduced by reducing exposure to radiation. Radiological risks after the period of authorisation are reduced either by reducing potential exposure, or by reducing the probability of that exposure being received.

GH.179. Disposal facility developers and operators are required to establish a strategy and programme for monitoring the facility to support the environmental safety case. This includes during any period of institutional control after closure of the facility. However, the environment agencies recognise that, in the longer term, institutional controls cannot be relied upon and the developer will be expected to assess the likelihood and consequences of possible future human actions (Requirement R7).

Period of Institutional Control for Radioactive Waste Disposal Facilities

GH.180. If an environmental safety case claims a facility will be under active institutional control for some time after closure, the GRA requires the operator to provide evidence that the proposed arrangements will be reliably implemented. Any claims placed on active institutional control need to be supported by detailed forward planning and a demonstration of funding arrangements.

GH.181. Such organisational arrangements may need to provide for:

- continued management and staffing;
- security;
- site surveillance, with scope for remedial work if needed;
- environmental monitoring;
- control of land use; and
- management of records.

GH.182. Operators are expected to provide evidence that these provisions can be relied on to remain effective throughout the claimed period of time. Because of the potential for major social changes, it is unlikely that the environment agencies would accept a claim for active institutional control lasting longer than 300 years after the end of waste emplacement.

GH.183. For any time after closure of the facility where the developer / operator does not claim, or the relevant environment agency does not accept, that there will be active institutional control, the regulatory approach will be to apply a risk guidance level (Requirement R6) and, for human intrusion to a near surface facility, a dose guidance level (Requirement R7). Note, there is no dose guidance level included in the Environment Agencies Guidance on authorising a GDF facility on the basis that human intrusion after the period of authorisation is unlikely to occur. Authorisations or permits for disposal will only be granted if it is shown that the continued isolation of the waste from the accessible environment shall not depend on actions by future generations to maintain the integrity of the disposal system.

Section I – Transboundary Movement

Article 27:

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

   In so doing:

   (xviii) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

   (xix) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

   (xx) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

   (xxi) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (c) are met prior to transboundary movement;

   (xxii) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

   (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

   (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

   (iii) the right of a Contracting Party to export its spent fuel for reprocessing;

   (iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

I.1. Under this Article, compliance with the Joint Convention is demonstrated in a way that has not substantially changed since the fifth United Kingdom (UK) national report.

I.2. The Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008 (Reference 118) transposes into UK law the requirements of Directive 2006/117/Euratom ('the Shipments Directive') (Reference 119), which was drafted specifically to ensure compliance with this Article. These regulations extended the regulatory regime for transfrontier shipments to include spent fuel shipped for reprocessing. The Directive was supplemented by the Commission

Recommendation 2008/956/Euratom of 4 December 2008 (Reference 120) on criteria for the export of radioactive waste and spent fuel to third parties.

I.3. The Shipments Directive provides a regulatory framework for supervision and control of shipments of radioactive waste and spent fuel into, out of, or through the European Community. The Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008 (Reference 118) require prior written approval by the competent authorities of all states involved (states of origin, destination and European Union (EU) states of transit) before such a shipment can be authorised. The Environment Agency (EA) is the competent authority for authorising shipments into and out of England; National Resources Wales (NRW), the Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment Agency (NIEA) are the competent authorities for their respective parts of the UK. The EA will provide a service to NRW to allow businesses to ship spent nuclear fuel and radioactive waste materials both into and out of Wales. NRW will remain accountable for all international shipments of radioactive waste and spent nuclear fuel.

I.4. Regulatory control of the import and export of radioactive wastes in accordance with the Transfrontier Shipments Regulations is achieved through the mechanisms of authorisation, consent and prohibition. The EA's International Waste Shipments team co-ordinates the sharing of authorisations between consignors and consignees, including confirmation of receipt of wastes. These arrangements allow for confirmation that wastes have been imported or exported in compliance with the authorisations and consents. Independent auditing of these arrangements by the EA (or the equivalent competent authorities in Wales, Scotland and Northern Ireland) ensures that they remain robust and effective and that, in the event of non-compliance, suitable provision for return or alternative arrangements can be secured.

I.5. On receipt of an application from the consignor of the waste or spent fuel, the relevant UK competent authority seeks the approval, in writing, of the competent authority of the country of destination (usually an environmental or nuclear regulator) in accordance with Commission Decision 2008/312/Euratom (Reference 121). It is UK practice to notify all countries of transit, whether they are EU Member States or not. In addition, before a shipment to or from the UK is authorised, the proposal will be checked for compliance with:

- The UK Government policy on the import and export of radioactive waste;
- The UK Government policy for the long-term management of solid low-level radioactive waste; and
- EU Directive 2011/70/Euratom (Reference 122) on the responsible and safe management of spent fuel and radioactive waste (in particular, Articles 2 and 4 of the Directive).

I.6. Trans-boundary movements of radioactive materials and spent fuel must comply with the national and international regulations and standards applying to the mode of transport used. For shipments by sea, safety of sea transport is governed by the Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997 (Reference 123) (see paragraphs L.1.93 to L.1.103).

I.7. There is a standing ban on shipments to destinations south of latitude 60 degrees south.

I.8. The export of radioactive waste for treatment is permitted provided it meets certain conditions, including a satisfactory options assessment and an assurance that the shipment is to facilitate the recovery of reusable materials or for treatment that will subsequently enable the waste to be more easily managed or stored when returned to the UK. In all cases where import or export of radioactive waste would add materially to the waste needing to be disposed of, the processed radioactive wastes have to be returned to the UK.

I.9. The reciprocal process applies when the relevant UK competent authority responds to a request to approve the import of radioactive waste into the UK from another EU Member State. For

the import of radioactive waste from outside the EU, the recipient of the waste must apply to the appropriate UK competent authority for authorisation of the shipment.

I.10. EU Regulation (Euratom) 1334/2000 (Reference 124), Regulation 3(1) provides that "an authorisation shall be required for the export of the dual-use items listed in Annex 1". Nuclear materials are included in Annex 1. EU Regulation 1334/2000 is implemented in the UK by the Dual Use Items (Export Control) Regulations 2000 (SI 2000/2620) (Reference 125). This usually results in an export licence application. In addition, the Nuclear Suppliers Group (NSG) Guidelines (Reference 126) are applied, as the UK is a member of the NSG and of the International Atomic Energy Authority (IAEA).

I.11. Trans-boundary movement of radioactive substances between Member States is regulated by EU Regulation (Euratom) No 1493/93 (Reference 127).

Transboundary Shipments

I.12. The shipment of high-level vitrified waste by-products from reprocessing, from the UK to overseas clients, has been occurring routinely since 2010 see paragraphs B.106 to B.109.

I.13. Since 2007, the UK has been exporting metallic wastes from nuclear decommissioning for treatment by melting. Shipments have been made to Sweden, Germany and the United States of America (USA). The metal is mostly carbon steel, but alloy steels, depleted uranium and lead have also been treated and recycled. The overseas companies engaged in these recycling processes repatriate the radioactive furnace slag and other process wastes to the UK. As a large proportion of the metals are recycled, the secured reduction in the volume of radioactive waste metal requiring disposal in the UK's is typically greater than 10:1. This is an ongoing international trade.

I.14. Small numbers of shipments have been made for other treatments and processes, including incineration. The quantities of oil and other combustible wastes involved are generally low, as most combustible wastes are dealt with at UK facilities.

I.15. All shipments are carried out in compliance with the Shipments Directive and EU Directive 2011/70/Euratom, and hence with this Article.

Radioactive Items Detected at UK Borders

I.16. Programme Cyclamen is a joint initiative between the UK Borders Agency and the Home Office. Its purpose is to detect, deter and intercept the covert importation of radioactive materials into the UK that are intended for criminal or terrorist activities. Programme Cyclamen consists of fixed portals installed at selected points of entry into the UK, complemented by a fleet of mobile radiation detection units that can be flexibly deployed on an intelligence-led basis. The UK Border Agency has also funded the installation of a Cyclamen detection system at the Coquelles terminal in France.

I.17. Screening for the presence of radioactive materials is now carried out as a matter of routine for significant volumes of imported sea and rail traffic, including containers, freight, vehicles, and passengers.

I.18. While the key driver for Programme Cyclamen has been a matter of national security, the UK has experienced a significant number of events featuring the discovery at UK borders of radioactive material within metallic items, including consumer goods. The majority of cases have concerned steel items featuring the presence of Co-60 that the consignor was not aware of. Typical doses to UK border workers from handling these packages are a few micro Sieverts, with postulated doses of below 1mSv/y if the items had been distributed into the UK public domain (Reference 128), a small number of events have involved items with more significant levels of radioactivity.

I.19. Wherever practicable, the UK has returned the discovered contaminated items to the consignor. In some cases, onward distribution in the UK has been allowed to proceed, where the discovered radioactivity was below the exemption levels prescribed in UK environmental legislation. In cases where neither of these approaches was feasible, the UK authorities have faced the challenge of managing the contaminated items as radioactive wastes, in order to secure their safe disposal in a manner that protects human health and the environment.

Section J – Disused Sealed Sources

Article 28:

2. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.

3. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J.1. Under this Article, the only significant changes to the United Kingdom's (UK's) means of complying with the Joint Convention since the fifth UK national report are:

- the incorporation of the High Active Sealed Source (HASS) regulations into the Environmental Permitting Regulations 2016 (EPR16) – see paragraph J.2; and
- a surplus source disposal programme has been implemented to deal safely and effectively with orphan sources – see paragraphs J.10 and J.11.

J.2. European Union (EU) Directive 2003/122/Euratom (Reference 129) on the control of HASS and orphan sources was originally transposed in the UK as the HASS Regulations, and as Directions from the Secretary of State and Ministers of the devolved administrations to the environment agencies. The combination of these measures provides the UK regulatory regime for management of high-activity sealed sources. In England and Wales, the provisions of the HASS Regulations have since been incorporated into the EPR16; this did not involve any change in the scope or nature of regulatory standards. In the rest of the UK, the provisions of the HASS Regulations continue to apply. Further revisions are expected as the UK transposes the Basic Safety Standards Directive 2013/59/Euratom (BSSD 2013) (Reference 20).

J.3. EPR16 (in England and Wales) and the relevant domestic legislation (in Scotland and Northern Ireland) lay out a regulatory system for the authorisation of practices involving high-activity sealed sources. Under these regulations, before issuing such an authorisation, the relevant competent authority must ensure that adequate arrangements exist for the safe management of sources, including when they become disused sources. These latter arrangements may provide for the transfer of disused sources to the supplier or to a recognised storage facility.

J.4. Financial provision must have been made to cover the cost of managing disused sources safely in the eventuality of the holder becoming insolvent or going out of business. The UK Government has developed guidance for the Environment Agency (EA) (also applicable to Natural Resources Wales (NRW)) on the acceptable arrangements companies can make to meet the requirements for such financial provision (Reference 130). Across the UK, there are approximately 420 HASS authorisations in 2017.

J.5. The UK environmental agencies also require holders of HASS to keep formal records of all HASS in their possession and have several reporting and notification arrangements. HASS users are also required to provide records to the relevant enforcing authority at periodic intervals no greater than 12 months.

J.6. On nuclear licensed sites, licence conditions ensure that the licensee carries out its responsibilities to control the entry and storage of nuclear matter (including sources) on the licensed site. In all cases, the Ionising Radiations Regulations 1999 (IRR99) Part VI applies, covering the arrangements for the control of radioactive substances, Articles and equipment. The

ONR requires the relevant licensees to provide information to the ONR to demonstrate compliance with the HASS legislation.

J.7. The Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008 (see Section I – Transboundary movement), Regulation 3 (2)(a), excludes "a shipment of disused sources to a supplier or manufacturer of radioactive sources or to a recognised installation". Therefore, the transfrontier shipment of such sources does not require prior authorisation. Shipments of sealed sources between Member States of the EU are regulated under the European Commission (EC) Regulation 1493/93 (Reference 127). The consignor of the shipment must obtain a declaration from the recipient that it has complied with the relevant provisions of the Basic Safety Standards Directive (BSSD 96) and other relevant national requirements, endorsed by the competent authority of the member state of destination. The consignor must also provide the competent authority in the state of destination with a quarterly report of such shipments. The UK competent authority under Regulation 1493/93 for shipments to or from nuclear sites is the ONR. For all other consignees / consignors, the competent authority is the relevant environmental regulator.

J.8. The environmental regulators implement a number of measures designed to ensure the identification and safe management of disused orphan sources and other forms of radioactive waste that may occasionally be found among scrap metal. As part of the implementation of the Industrial Emissions Directive (Reference 131), permits issued to metal shredding facilities now include a condition requiring that all metal waste delivered to site is monitored for radioactive substances. The EA has issued a Regulatory Position Statement (RPS) (Reference 132) for scrap metal sites in England that enables such sites to hold radioactive waste for short periods without the need to obtain a permit, subject to meeting the requirements specified in the RPS. This aims to ensure that radioactive waste in scrap metal is promptly brought under a system of control, whilst preventing the stockpiling of radioactive waste at scrap metal sites. Further measures concerning orphan sources in scrap metal are expected to be implemented following the transposition of the new BSSD 2013 (Reference 20).

J.9. The environmental regulators have also provided guidance for businesses and other organisations that have kept and used sealed sources and mobile radioactive apparatus, under the conditions of a permit or an exemption, and where those sources have now become waste (Reference 133).

Surplus Source Disposal Programme and Recognised Installations

J.10. Since the fifth UK report, the environment agencies and the UK Government have engaged with the Nuclear Decommissioning Authority (NDA) to ensure that arrangements for the safe management of orphan radioactive sources are robust and sustainable. This has included the establishment of a long term commercial arrangement to provide appropriate licensed transport containers and long term storage facilities for disused sealed sources at Sellafield from where they can be disposed of to a Geological Disposal Facility (GDF) without further handling / processing. An established framework is in place for the safe recovery of any orphan source discovered in a public place: the National Arrangements for Incidents involving Radioactivity (NAIR) scheme, which involves the police and nuclear sites or major hospitals recovering an orphan source. This scheme is replaced by an Orphan Source Recovery Plan in Northern Ireland.

J.11. Issues around the availability of an adequate storage facility ("recognised installation" under EU Directive 2003/122/Euratom) were resolved as reported in the fifth UK report. Redundant HASS are now routinely transferred to the dedicated facility at Sellafield for storage, pending disposal.

Section K – Planned Activities to Improve Safety and Feedback from the Fifth Joint Convention Review Meeting

This section provides an opportunity to give a summary of safety issues of concern identified earlier, and planned future actions to address those issues, including where appropriate measures of international co-operation.

Feedback from the Fifth Joint Convention Review Meeting

K.1. Following the Fifth Joint Convention Review Meeting held in Vienna in May 2015, the President's Report, Summary Report, the United Kingdom's (UK's) Fourth National Report and the country group Rapporteur's Report identified several challenges faced by the UK and other Contracting Parties. The Summary Report lists four overarching issues to be addressed by the Contracting Parties in their National Reports:

- staffing, staff development, reliability of funding, and other human resource areas;
- maintaining or increasing public involvement and engagement on waste management, to provide public confidence and acceptance;
- developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage; and
- management of disused sealed sources.

K.2. The Country Group 4 Rapporteur's Report listed the following challenges and issues for the UK to address; those common with the Summary Report are not repeated:

- the need for a National Integrated Waste Strategy;
- siting, design, permissioning, construction and commissioning of a proposed Geological Disposal Facility (GDF);
- maintenance of the spent fuel and radioactive waste infrastructures;
- management of 140 tonnes of separated plutonium either by reuse or by immobilisation as waste;
- management of graphite waste;
- reduction in radioactive discharges by 2020;
- update on Magnox Operating Programme and Advanced Gas Reactor (AGR) Operating Programme to manage overall safety of the fuel cycle;
- to continue to make progress on high hazard legacy facility priority programmes; and
- provide a statement on whether Naturally Occurring Radioactive Material (NORM) waste is under the scope of the Joint Convention according to Article 3.

K.3. Eight overarching issues were also identified; those overlapping with items listed above are not reproduced:

- generation and long-term preservation of information on the storage and disposal of spent fuel and radioactive waste;
- contingency planning for managing large amounts of radioactive wastes arising from radiation and nuclear accidents;
- international cooperation in finding solutions for the long-term management and disposal of radioactive wastes and/or spent fuels;
- reversibility and retrievability of waste from a repository; and
- transboundary movements of radioactive waste and contaminated materials which might be considered as radioactive waste.

K.4. Where appropriate, progress on each of these matters has been summarised within this report; the table below provides a signpost to the relevant sub-section. Challenges that have not been addressed previously are covered in the sub-section indicated in the following table:-.

Issues and Challenges	Section/Paragraph
Staffing, staff development, reliability of funding, and other human resource areas	Paragraphs F.37 to F.49
Maintaining or increasing public involvement and engagement on waste management, to provide public confidence and acceptance	Paragraphs E.144 to E.151
Developing and implementing a holistic and sustainable management strategy for radioactive waste and spent fuel at an early stage	Section B - Policies and Practices
Management of disused sealed sources	Section J – Disused Sealed Sources
The need for a National Integrated Waste Strategy	Paragraphs B.110 to B.115
Siting, design, permissioning, construction and commissioning of a proposed GDF	Section B - Policies and Practices and Section G/H – Safety of Spent Fuel, Reprocessing and Radioactive Waste Management
Maintenance of the spent fuel and radioactive waste infrastructures	See Paragraphs GH.115 to GH.125
Management of 140 tonnes of separated plutonium either by reuse or by immobilisation as waste	Paragraphs L.3.4 to L.3.16
Management of graphite waste	Paragraphs L.4.25 to L.4.29
Reduction in radioactive discharges by 2020	Paragraphs F.128 to F.134

Update on Magnox Operating Programme and AGR Operating Programme to manage overall safety of the fuel cycle	Paragraphs B.11 to B.18
To continue to make progress on high hazard legacy facility priority programmes	Paragraphs K.6 to K.20
Provide a statement on whether NORM waste is under the scope of the JoC according to Article 3	See Section C – Scope of Application
Generation and long-term preservation of information on the storage and disposal of spent fuel and radioactive waste	See Section G/H – Safety of Spent Fuel, Reprocessing and Radioactive Waste Management
Contingency planning for managing large amounts of radioactive wastes arising from radiation and nuclear accidents	See Section F - Other General Safety Provisions
International cooperation in finding solutions for the long-term management and disposal of radioactive wastes and/or spent fuels	Paragraphs K.15 to K.17
Reversibility and retrievability of waste from a repository	Paragraph B.58
Transboundary movements of radioactive waste and contaminated materials which might be considered as radioactive waste	Section I – Transboundary movement

Planned Activities to Improve Safety

K.5. Continuous improvement in safety levels over time is a fundamental objective of the nuclear safety and environmental regulators in the UK. Previous sections have explained how this objective is achieved at spent fuel management, reprocessing and radioactive waste management facilities. The main extant issues of progress and planned future actions are outlined below.

Progress with High Hazard and Risk Reduction at Sellafield

K.6. Significant inventories of highly radioactive materials and wastes in potentially mobile form have been accumulated over many years within four plants at Sellafield, collectively known as Legacy Ponds and Silos (LPandS), namely:

- Pile Fuel Storage Pond;
- First Generation Magnox Storage Pond;
- Pile Fuel Cladding Silo; and
- Magnox Swarf Storage Silo.

K.7. These were used historically either to prepare fuel for reprocessing and/or to store the resulting radioactive wastes. These plants were not built to modern engineering standards and their condition is deteriorating over time, so there is increasing urgency to reduce the risk their inventories pose.

K.8. The close co-operation engendered by the G6 group since 2014, as described in paragraphs E.107 to E.111, has had a tangible impact in reducing hazard and risk in these legacy plants. Developments on these facilities are described in the following four boxes.

Challenge: Pile Fuel Storage Pond (PFSP) - Retrieval of Fuel and Sludge and Encapsulation of Sludge

K.9. Since the last report the radioactive inventory within PFSP has been very significantly reduced through transfer of the fuel inventory to another facility for safe and secure interim storage at Sellafield. With the bulk fuel removed from the pond the radiological inventory is reduced by approximately 70%. To date over 60 drums of sludge has been removed from the pond and exported to the waste encapsulation facility at Sellafield for grouting and subsequent safe interim storage on site.

K.10. Pond dewatering is planned for 2019, which is a significantly enhanced position from previous programmes of work.

Figure 15 - The Pile Fuel Storage Pond

Success: First Generation Magnox Storage Pond (FGMSP) - Retrieval of Fuel and Sludge and Treatment of Sludge

K.11. Since the last Report the radioactive material inventory within FGMSP has been significantly reduced through transfer of part of the fuel inventory to another facility for safe and secure interim storage at Sellafield. In addition, part of the inventory of sludge (comprising corroded fuel, cladding and naturally occurring organic materials) has been transferred to a purpose-built safe and secure interim storage facility on site.

Figure 16: First Generation Magnox Storage Pond

Success: Pile Fuel Cladding Silo (PFCS) to Start Retrievals in 2019

K.12. Since the last Report significant progress has been made in preparing PFCS to begin retrieval of stored waste. By the end of September 2017, 3 out of 6 concrete monoliths were removed and work continues with the refurbishment of the external structure.

Figure 17: The Pile Fuel Cladding Silo

K.13. Removals of these monoliths are key enablers to allow access into the silos to support and enable waste removal. In addition the 6 silo doors have all been installed that provide the containment once the monoliths have been removed. The retrieval system is in an advanced stage of design. Modifications have been made to the building to enable the installation of the retrieval system. Waste routes have been identified enabling safe and secure interim storage at Sellafield, making use of purpose-built and existing facilities.

Success and Challenge: Magnox Swarf Storage Silo (MSSS) - New Strategy for Retrieval and Storage - Strategy is a Success, Implementation to Start in 2019 is a Challenge

K.14. Since the last report the strategy for retrieval and storage has been significantly simplified, bringing forward the date for sustained retrievals operations by several years. Engineering preparations are well-advanced with the installation and testing of two mobile, heavily shielded, "caves" into which waste will be retrieved before being dispatched in a shield flask. Waste routes have been identified enabling safe and secure interim storage at Sellafield, making use of purpose-built and existing facilities.

Figure 18: The Magnox Swarf Storage Silo

International Collaboration in Finding Solutions for the Management and Disposal of Radioactive Waste and/or Spent Fuel

K.15. International collaboration is an important aspect of the UK's work on geological disposal, with the aim of ensuring the UK makes best use of the existing knowledge and experience of overseas organisations, delivers its needs-based programme in a cost-effective manner and builds confidence in the programme. The UK is represented on relevant committees of the IAEA and NEA, through which it has the opportunity to contribute to the development of international work programmes and to initiate specific activities as required.

K.16. Radioactive Waste Management Ltd. (RWM) is an active participant in a number of international groups, including the International Association for Environmentally Safe Disposal of Radioactive Material (EDRAM), the Club of Agencies (a group of European radioactive waste management organisations set up to exchange information on all aspects of radioactive waste

management) and is a member of the Executive of the European Union's Implementing Geological Disposal of Radioactive Waste Technology Platform.

K.17. The Nuclear Decommissioning Authority (NDA) and RWM have a range of bilateral agreements with overseas organisations. These agreements ease the process of co-operating with other organisations by facilitating liaison and indicate the mutual respect each has for the other's capabilities and standard of work. RWM makes regular use of a number of these relationships to provide benefits such as: international benchmarking; training opportunities; and access to information which may otherwise not be available. All of these help RWM to develop its organization and the conceptual design and safety case for a GDF in the UK.

Decommissioning of the Magnox Power Stations

K.18. The fleet of first generation Magnox reactors consisted of 26 reactors on 11 sites, including 4 reactors at Sellafield. The reactors all ceased operation between 1989 and 2015. All are currently in defueling or decommissioning with an objective of going into care and maintenance for a prolonged period of years to allow time for radiation levels in reactor cores to decay naturally, prior to final dismantling.

K.19. Decommissioning is the preparation for care and maintenance and consists of removing redundant and buildings and immobilisation of any intermediate level waste on the site. The structures remaining on the site entering care and maintenance will typically consist of two or four reactor buildings, depending on the number of reactors on the site and, an intermediate level waste store. Progress is being made on all of the defueled sites, with the most advanced being at Bradwell. The most significant developments on Bradwell and the other sites is summarised in the following two case studies.

Decommissioning at Bradwell

K.20. The most advanced Magnox decommissioning site in terms of preparation for care and maintenance is Bradwell, which housed two Magnox reactors. The picture below shows Bradwell in 2015 during the installation of the weather cladding. In recent years the following has been achieved:

- all underground waste vaults on the site have now been emptied and the waste immobilised in metallic drums;
- at the spent fuel pond complex, the walls, floor and ceiling have been decontaminated over a 4 year period;
- Metallic Fuel Element Debris (FED) has been dissolved in a specially designed plant that dramatically reduces its volume prior to packaging for disposal or treatment at Low-Level Waste Repository (LLWR);
- more than 2.5km of pipework and 120-plus tonnes of metal waste were removed;
- planning permission has been granted that will enable ILW from Dungeness A and Sizewell A to be transferred for storage at Bradwell's purpose-built Interim Storage Facility (ISF). This supports the NDA's strategy of consolidating waste at regional stores rather than individual sites;
- between 2012 and 2016, the two reactor buildings were re-clad to ensure that they are weathertight; and
- preparations are ongoing for the site to be managed from the Sizewell A site, rather than having its own site management.

Figure 19: Aerial view of Bradwell in 2015

Retrieval of Fuel Element Debris at Berkeley

K.21. A complex range of mixed wastes has accumulated in a number of underground vaults at the Berkeley site. All underground waste vaults on the site have now been emptied and the waste immobilised in metallic drums. Berkeley site has 4 Intermediate Level Waste underground vaults (only vaults 1, 2 and 3 contain waste). The vaults were used to store Fuel Element Debris (FED) from fuel route activities, Sludge and Resin from the Active Effluent and Pond Water treatment plants and Miscellaneous Contaminated Items, all arising from the operational phase of Berkeley Power Station.

K.22. The Higher Activity Waste Programme scope for the Berkeley site is to provide and then operate plant and equipment to safely retrieve, process package the waste. This is then to be stored in the Interim Storage Facility, located at Berkeley until the GDF becomes available.

K.23. The FED is held in Vaults 1 and 2, with Vault 3 holding Sludge Cans and the majority of the Containerised Waste Cans.

- Vault 1 ~270Te of FED and 855 Cans of Ion Exchange Resin.
- Vault 2 ~350Te and 310 cans of Miscellaneous Contaminated Items (MCI).
- Vault 3 ~1400 Sludge cans and ~5000 cans of MCI.

Retrievals from Vault 2 by the operations team commenced in June 2016 and currently ~ 88Te of FED has been retrieved into 54 Ductile Cast Iron Containers which have been conditioned and stored in the Interim Storage Facility.

Figure 20: Berkeley Fuel Element Debris Vault 2: Beginning of Retrieval Operations and After Removal of 88 Te of FED.

UK Response to the Accident at the Fukushima Dai-ichi Power Plant

K.24. Since the last convention report, the UK has completed all the actions identified in the Chief Nuclear Inspector's report (Reference 18) and in the European Stress Tests (Reference 19). After the publication of the IAEA Fukushima Report, the Office for Nuclear Regulation (ONR) assembled a multi-disciplinary team of senior inspectors to review its findings.

K.25. In February 2016, the ONR concluded that it was content that the industry had addressed all the major findings identified in its Fukushima Implementation Report, and that remaining actions would become part of normal regulatory business. The following paragraphs show how these measures were taken forward at Sellafield; completion of these packages of work have enabled final closure of the ENSREG Stress Test findings and the ONR Chief Nuclear Inspectors (CNI) Post Fukushima recommendations that relate to Sellafield Ltd.

K.26. After the Fukushima accident, Sellafield Ltd. reviewed the expected availability and reliability of key safety systems in plants across the site to respond to an extreme event or a severe accident. Resulting from this review, Sellafield Ltd. has identified and implemented improvements to make it more resilient to such occurrences.

K.27. Sellafield Ltd. has procured a range of equipment that is designed to improve the site's resilience against a range of extreme events such as flooding, loss of power and seismic activities. This equipment has now been delivered and Sellafield Ltd. is now ensuring that this equipment is fully integrated into the site's emergency arrangements to ensure an enduring capability.

K.28. Specific examples of implemented improvements at Sellafield include, but not Ltd. to:

- installation of passive ventilation within Magnox Swarf Storage Silo to respond to hydrogen build up;
- provision of stand-alone pumps and building modifications to maintain essential cooling to numerous key facilities including Magnox Reprocessing, the Waste Vitrification Plant and Highly Active Liquor Storage and Evaporation (HALEs).

- provision of standby generators and building modifications to respond to site black out to numerous facilities across the site;
- provision of self-contained steam generators and air compressors to maintain nuclear safety during site black out for Highly Active Liquor Storage and Evaporation;
- provision of site severe accident management strategies and corresponding equipment to enable deliver of the strategies;
- enhancements to firefighting capability with specific emphasis on site wide metal fires; and
- enhancements to site wide flooding resilience.

K.29. Sellafield Ltd. continues to implement improvements to its emergency response capability. Examples of continued focus include:

- enhancing the existing incident response capability to respond to a range of extreme events;
- provision of new enhanced on-site and off-site emergency control facilities; and
- ensuring the resilience of the site's energy supplies.

K.30. The ONR will continue to maintain a regulatory oversight of Sellafield Ltd.'s progress towards completing these improvements to its emergency arrangements.

Section L - Annexes

Section L.1 – Legislative and Regulatory System

L.1.1. This section includes additional details related to Section B - Policies and Practices, Section E – Legislative and Regulatory System, and Section F - Other General Safety Provisions. It provides a fuller description of the United Kingdom's (UK's) legislative and regulatory framework, of the regulatory bodies, and of the other national organisations involved in spent fuel and radioactive waste management.

Health and Safety Regulation

The Office for Nuclear Regulation (ONR)

Mandate and Duties

L.1.2. The ONR was established under the Energy Act 2013 (TEA13). It operates the nuclear site licensing system under TEA13 and the Nuclear Installations Act 1965 (NIA65) and grants licences to corporate bodies to install or operate a nuclear installation on a particular site. It regulates for the following purposes:

- nuclear safety;
- nuclear security;
- transport of radioactive materials;
- nuclear safeguards; and
- health and safety.

Organisational Structure

L.1.3. As of 31 April 2017, the ONR was organised into divisions covering:

- regulation of Sellafield and other nuclear sites whose main business is the management of decommissioning, spent fuel and radioactive wastes, (for example shut-down Magnox power stations, shut-down research sites and the planned Geological Disposal Facility (GDF));
- regulation of operating facilities including civil nuclear power plants and sites associated with the Ministry of Defence's nuclear programme;
- regulation of new and proposed nuclear power stations;
- regulation of civil nuclear security;
- standards and consistency of regulation across the regulatory divisions; and
- corporate services.

Financial Resources

L.1.4. Section 24A of NIA65 enables financial charges to be imposed on the nuclear licensees to recover the expenses incurred through the ONR's regulation of nuclear installations. In addition, further expenses are recovered from licensees in respect of a programme of safety research and

studies agreed between the ONR and the industry. The ONR uses a work recording system to identify the effort and expenses of its staff attributable to each licensee.

L.1.5. Additionally, the Fees Regulations are used to recover charges for work on Generic Design Assessment (GDA). In 2016/17, the ONR's total expenditure was £70.7 million, of which total nuclear safety expenditure was £68.3 million ("charged to industry") (Reference 134).

Human Resources

L.1.6. As of 31 July 2017, the ONR had 372 Technical Specialists (i.e. Nuclear Safety, Nuclear Security, Conventional Health and Safety, Fire Safety and Safeguards specialists). The ONR has sufficient inspectors in post to carry out its current regulatory duties but it is recognised that recruitment will need to continue at increased rate for several years to address industry developments and the demographic challenges of the workforce described in F.10. As in the wider UK nuclear industry, the ONR's age distribution is weighted towards the older end of the spectrum and it currently has a number of inspectors in post who are beyond the former retirement age of 60 (at present, 52 technical specialists are aged 60 or over). However, the Government has removed all age barriers so there is now no upper age limit to employment.

L.1.7. To address these needs, the ONR has introduced some new approaches to recruitment. The ONR now recruits at lower levels called Nuclear Associate and Equivalence, which allows for the recruitment of individuals from other high hazard industries, as well as those with slightly less experience, providing them with a structured path of development to reach the Nuclear Inspector level. The ONR is also recruiting nuclear graduates across a number of discipline areas who undertake a two-year graduate programme before joining the ONR as Nuclear Associates. The ONR is also actively exploring the potential for degree level apprenticeships to open a further pipeline into the organisation. This diverse approach has not only enabled the ONR to recruit a more diverse workforce but has also lowered the inspector average age to 48 years.

L.1.8. Staffing profiles have been prepared for a number of years ahead. These are based on current and anticipated workloads and make various assumptions on the changing nuclear landscape and retention of older staff.

L.1.9. In addition, each of the ONR's divisions has identified current and anticipated staff requirements in terms of technical specialism. As well as identifying current vacancies, this work has identified potential pressure points caused by future retirements.

L.1.10. The ONR also continues to use an enhanced Technical Support Contract Framework, to provide additional expertise on a short and medium-term basis as demand arises. This is reviewed regularly to ensure that it effectively meets the organisation's requirements.

Developing and Maintaining Staff Competences

L.1.11. The intensive recruitment campaign over the last two years has necessitated a revision of the training and assimilation of new inspectors. Recruitment in excess of 30 new inspectors per year means that the ONR is now in the process of developing a new model of inspector capability covering both training courses and on-the-job learning, where assistance from internal colleagues is now more structured and supports effective outcomes. Training and assimilation is resource intensive so it has to be structured, planned, properly resourced and continually evaluated to ensure it meets all needs. The ONR has a robust learning and development team in place with more resource due to come on board shortly and also has budget to support continuing professional development within all areas of the organisation.

Training of New Inspectors

L.1.12. All inspectors joining the ONR have good academic qualifications and several years of experience in a relevant industry, thus qualifying them as technical experts in their own discipline. The purpose of the training is to expand and build on this base rather than 'convert' them to

acquire another knowledge base. It can be regarded as a 'holistic' approach to training. To achieve this, the initial training is in two main areas:

- training to be a regulator – as few new recruits have prior knowledge of regulation; and
- training to expand recruits' technical expertise to gain a working knowledge of other essential technical disciplines.

Competence Framework

L.1.13. In 2008 a new Competence Framework was developed for nuclear safety inspectors, based on the requirements of 'National Occupational Standards for Nuclear Regulators' (Reference 135). This is a high-level standard and sets out the basic requirements for all regulators involved in nuclear safety, security and transport, including nuclear regulators within the environment agencies.

L.1.14. The competence framework was trialled initially and is being refined continuously to reflect feedback. The purpose of the framework is to specify the training need for specific job functions as well as identifying the basic training needs.

Training Methods

L.1.15. A new inspector's training programme is developed on a personal basis and is based on a training needs analysis. The delivery of the programmes relies extensively on an interactive tutorial approach rather than formal lectures. Training documentation focuses on providing signposts to where information can be found rather than providing detailed training material.

L.1.16. New recruits also undergo operational training (on-the-job training) during which they carry out specific regulatory assignments under close supervision. The effectiveness of all training activities are evaluated initially and again after three months. This gives opportunities for trainees to evaluate training in the context of their job and gives better feedback to those developing the training courses.

L.1.17. During 2017, the ONR and the Environment Agency (EA) combined elements of their training on radioactive waste and decommissioning to facilitate more effective regulation of these issues on nuclear licensed sites.

Continued Professional Development

L.1.18. While considerable effort is spent on the training of new recruits, the ONR also has a refresher training programme to develop professional competencies for all staff. The ONR's policy is that this is not centrally managed but is a matter for individual inspectors to agree with their line managers with advice from senior experts in their technical field. Such training covers topics such as communication, influencing skills, change management and interpersonal skills, as well as the development of technical competencies.

Source of Funding

L.1.19. The 'expenses' recovered from licensees include the two major cost streams of expenditure associated with the ONR's own operational activity (payroll, travel and subsistence, training and other staff-related costs) and the costs of Nuclear Safety Studies (which enables the ONR to buy-in technical and scientific support in support of the regulatory function).

Environmental Regulation and Other Organisations

Summary of Organisations

L.1.20. The environmental regulators referred to in this section are the Environmental Regulators, listed below, the NDA, planning authorities, the Marine Management Organisation, amongst others.

Environment Agency (EA)

Mandate and Duties

L.1.21. The EA was created under the Environment Act 1995 (EA95) with the aim of providing a more integrated approach to protecting and improving the environment of England and Wales as a whole – land, air and water. It is a 'non-departmental public body', sponsored largely by the UK Government Department for Environment, Food, and Rural Affairs (Defra) and, until 1 April 2013, the Welsh Government. Its powers and duties relate to environmental protection, flood defence, water resources, fisheries, recreation, conservation and navigation. EA95 sets out the principal aim of the EA 'in discharging its functions so to protect or enhance the environment, taken as a whole, as to make the contribution towards attaining the objective of sustainable development'.

Structure

L.1.22. The EA's Radioactive Substances and Installations Regulation Team sets the overall strategy for regulation of radioactive substances activities in England, and leads on support to Government on national policy development and implementation, including the development of national waste strategy, as well as regulatory process development.

L.1.23. The EA's specialist Nuclear Regulation Group (NRG) carries out the day-to-day regulation of radioactive waste disposals from the nuclear industry.

L.1.24. The EA's NRG includes two assessment teams providing national support on solid waste disposal and Generic Design Assessment of new reactor designs, as well as the checking, monitoring and assessment of discharges to the environment. There is a team providing national support on radiation incident management.

L.1.25. The EA's work on regulation of the non-nuclear industry includes the accumulation and management of disused/spent radioactive sources, and the issues of TFS (see Sections I and J).

Financial Resources

L.1.26. The EA had a total annual expenditure to March 2017 of £1.3 billion, over half of which is spent on flood and coastal risk management and the balance on environment protection. The income is derived chiefly from three sources:

- income raised from charging for regulation;
- flood defence levies; and
- Government grants, which help to finance amongst other things, pollution prevention and control activities.

L.1.27. Section 41 of EA95 provides the EA with the power to impose financial charges for its regulatory activities in order to recover the expenses incurred through regulation. Such expenses

include those incurred in respect of a programme of waste and environmental monitoring carried out by the EA. The EA uses a work-recording system to identify the effort and expenses of its staff attributable to each licensee.

L.1.28. Section 37 of EA95 enables the EA to recover costs associated with advice to organisations that may not currently be licensees or permit holders, for example, to enable advice and support to RWM as part of the GDF programme, and support to the Generic Design Assessment of potential new nuclear build operators.

L.1.29. The EA charges operators for its nuclear regulatory activities on the basis of a daily rate for inspectors. This rate is reviewed periodically. The EA also recharges operators for the monitoring it carries out. Annual charges for nuclear and non-nuclear radioactive substances regulatory work and monitoring activities in the financial year 2016/17 were approximately £14.8 million.

Human Resources

L.1.30. The EA has a total of about 10,000 staff, although only a small proportion of these are involved in nuclear regulation. The NRG has a total of around 70 nuclear specialists, with additional administrative support. The other groups involved with nuclear regulatory activities, identified above, comprise approximately a further 12 nuclear specialist staff.

L.1.31. The EA currently has sufficient nuclear specialists in post to carry out its regulatory duties but is aware that it needs to actively manage this workforce to ensure that it can continue to do so. Its main challenges are the demography of its workforce, with a significant proportion of experienced staff approaching retirement; the expected growth of several major infrastructure projects that it will need to regulate, such as new nuclear build and geological disposal; and experienced nuclear skills being in short supply nationally.

L.1.32. To meet these challenges the EA is reviewing its workforce planning including recruitment and retention. For example, it has started to recruit from a wider range of backgrounds into relatively junior positions. This includes bringing in regulators from other (non-nuclear backgrounds) and graduate trainees. It is also considering the potential benefits of using a new national scheme for degree level apprenticeships.

Inspectors' Qualifications

L.1.33. Nuclear regulatory staff recruited by the EA are required to have a good honours degree in science or engineering, and often several years' experience in a technical or management role in the nuclear industry, or considerable experience in the regulation of radioactive substances within non-nuclear sectors. Recently the EA has introduced a 'development grade' to enable recruitment of people into the NRG with other kinds of regulatory experience.

Inspectors' Training

L.1.34. The EA has established standards of competency for its staff involved with the regulation of radioactive substances. Competence standards for nuclear regulation are identified separately within the overall framework.

L.1.35. The standards are used as a benchmark for all staff, but the need to undergo a structured programme depends on the individual's experience. For more experienced staff, the standards are used informally to better target professional development. For new inspectors, attainment of the competency standards is mandatory and these are used in a formal manner.

L.1.36. Developing the competences of staff is achieved by combination of structured training (such as on legal requirements) and developmental experience (such as on-site inspection or issuing Enforcement Notices). The system adopted by the EA allows for competences to be

demonstrated and the standards achieved to be recorded. More experienced staff act as mentors for new staff going through the competences programme.

Scottish Environment Protection Agency (SEPA)

Mandate and Duties

L.1.37. The Scottish Environment Protection Agency (SEPA) was formed in 1996 to deliver an integrated environmental protection service to Scotland. The Environment Act gives SEPA the statutory purpose of carrying out its functions for the purpose of protecting and improving the environment (including managing natural resources in a sustainable way). SEPA is a 'non-departmental public body' operating at arm's length from the Scottish Government but accountable through the Scottish Ministers to the Scottish Parliament.

L.1.38. SEPA plays an important role in achieving international environmental obligations and provides expert advice to the Scottish and UK Governments and to other partner organisations. As the principal environmental regulator for Scotland, SEPA contributes to formulating legislation and advises on the implementation of European Union (EU) legislation, the development of government regulations, regulatory policies and guidance and the regulation of industrial and commercial installations. SEPA is responsible for implementing and monitoring compliance with Scottish and UK environmental laws, around 90% of which originate from the EU. Comprehensive information on the laws and directives which SEPA implements can be found on the SEPA website.

L.1.39. As Scotland's environment watchdog, SEPA aims to protect the environment and human health by being an excellent environmental regulator and an effective and influential authority on the environment, limiting climate change and preparing Scotland for a sustainable future.

L.1.40. Powers under the Radioactive Substances Act 1993 (RSA93) are devolved from UK Government to the Scottish Government. Using its statutory powers, SEPA issues various permits, licences, consents, registrations and authorisations covering a wide range of commercial and institutional activities that have the potential for adverse impacts on the environment.

L.1.41. SEPA manages a monitoring programme that assesses levels of man-made radioactivity in the environment using a number of environmental indicators. The samples of water, food, soil etc., collected as part of SEPA's programme, act both as indicators of the state of the environment and to verify that the levels of radioactivity present within these commodities have low radiological significance to man.

L.1.42. Results from the environmental monitoring programme are used as the basis for dose calculations to members of the public from consumption of food and exposures of members of the public from waste disposals.

L.1.43. In Scotland, the Food Standards Agency (FSA) and SEPA liaise closely to ensure that the environmental monitoring programme for radioactivity is appropriate.

Structure

L.1.44. Legally, the Board constitutes SEPA. The members of the Board are appointed by Scottish Ministers and, as well as appointing the Chairman of SEPA, the Scottish Ministers appoint a member as Deputy Chairman. The Chairman is personally responsible to Scottish Ministers. The Board has responsibility for ensuring that SEPA fulfils the aims and objectives set by Scottish Ministers and membership of the Board includes a Chief Executive to whom is delegated the day-to-day management of SEPA.

L.1.45. The Board has ultimate responsibility for the organisation. It meets regularly and is specifically concerned with:

- establishing the overall strategic direction of SEPA within the policy and resources framework agreed with the responsible Minister;
- overseeing the delivery of planned results by monitoring performance of the organisation against agreed objectives and targets;
- demonstrating high standards of corporate governance at all times; and
- ensuring that statutory requirements for the use of public funds are complied with.

L.1.46. SEPA has one specialist team that deals with radioactive waste disposals from nuclear sites in Scotland. The Nuclear Regulation and Radioactive Substances Policy Unit (RS Unit) covers the day-to-day regulatory activities such as issuing authorisations, inspection, enforcement etc., and also more strategic matters such as liaison with government or other bodies and influencing the development of forthcoming policy or legislation. This unit is also responsible for managing part of the Radiation Incident Monitoring Network (RIMNET) in Scotland, and leads on environmental monitoring such as the collection and assessment of samples. In all, around 20 technical staff to deal with radioactive substances, the majority of whom have some involvement in matters relating to nuclear sites.

Financial Resources

L.1.47. SEPA's income is derived chiefly from three sources:

- income raised from charging operators for regulation;
- government grant-in-aid, which helps to finance work that is not cost-recoverable through charging schemes; and
- other sources (like financial agreements with the Nuclear Decommissioning Authority (NDA)).

L.1.48. In the financial year 2016/17, SEPA's total income was £78.6 million, of which £33.3 million was grant-in-aid from the Scottish Government. SEPA charges operators for its nuclear regulatory activities on the basis of a daily rate for an inspector, which includes an appropriate overhead allowance. SEPA's income from all charging schemes totalled £39 million in 2016/17.

Human Resources

L.1.49. SEPA has approximately 1,250 staff, around 20 of whom are involved directly in nuclear site regulation, either under RSA93 or other environmental regulatory regimes that apply on nuclear licensed sites governing the management of controlled and hazardous wastes.

Inspectors' Qualifications

L.1.50. Nuclear regulatory staff recruited by SEPA are required to have a degree in a relevant discipline.

Inspectors' Training

L.1.51. SEPA has established standards of competency for its staff involved with the regulation of radioactive substances. Competency standards for nuclear regulation are identified separately within the overall framework.

L.1.52. SEPA's grading structure for regulatory staff starts at either assistant or trainee Environmental Protection Officer (EPO). Trainee EPOs are required to complete a training programme in order to progress onto EPO grade. SEPA have recently introduced a separate Graduate Trainee Scheme covering a wide range of disciplines including EPO. The trainee EPO scheme includes training in general inspection techniques, evidence gathering and enforcement,

etc.. Thereafter, EPOs can progress to a more general promoted post as Senior EPOs (Specialist 2 grade), or move into a specialist area (Specialist 1 or 2 grade).

L.1.53. Specialist staff regulating nuclear facilities, who are normally recruited from outside SEPA, are required to have a minimum of three years' (Specialist 2 grade) technical or scientific professional experience on appointment, but the majority have at least five years (Specialist 1 grade). Staff who enter SEPA at specialist level will be trained in the relevant general inspection techniques, enforcement etc. and the more specialised radioactive substances courses, dependent on their existing experience and training.

Natural Resources Wales (NRW)

Mandate and Duties

L.1.54. Natural Resources Wales (NRW) is a Welsh Government sponsored organisation established on 1 April 2013, bringing together the responsibilities, assets and staff from Countryside Council of Wales, Environment Agency Wales and the Forestry Commission Wales. The role of NRW is to ensure that the environment and natural resources of Wales are sustainably maintained, sustainably enhanced, and sustainably used, now and in the future. This includes being the enforcing authority for the Environmental Permitting Regulations 2016 (EPR16) in Wales.

L.1.55. NRW is the largest Government Sponsored Body in Wales.

Nuclear Regulation

L.1.56. NRW is responsible for the regulation of radioactive substances in Wales and enforcing the requirements of the EPR16. This includes supporting the Generic Design Assessment (GDA) process, responsibility for regulating the disposal of radioactive wastes and for environmental compliance at nuclear installations.

Financial resources

L.1.57. NRW has a total budget for 2016 to 2017 of approximately £182 million. Income is derived chiefly from Government grants, regulatory charge schemes and commercial income.

L.1.58. NRW charges operators for its nuclear regulatory activities on the basis of a daily rate for inspectors. It also recharges operators for the monitoring it carries out. Annual income for nuclear and non-nuclear radioactive substances regulatory work and monitoring activities in financial year 2016/2017 were approximately £1.78 million.

Human Resources

L.1.59. NRW has approximately 1,800 staff. To ensure NRW maintains access to the right skills it has a service level agreement with the EA for specific activities relating to the undertaking of nuclear regulation compliance and environmental monitoring activity at nuclear sites in Wales. This is overseen through an intelligent client function within NRW. Permitting and enforcement responsibility lies with NRW.

Nuclear Decommissioning Authority (NDA)

L.1.60. The Nuclear Decommissioning Authority (NDA) is a 'non-departmental public body' created through the Energy Act 2004 and established in 2005. The NDA owns 17 civil nuclear legacy sites across England (12), Wales (2) and Scotland (3), some dating back to the 1940s, plus the

associated liabilities and assets. Each of these sites is managed by Site Licence Companies (SLCs). The NDA reports to the UK Government Department for Business, Energy and Industrial Strategy (BEIS). For some aspects of the NDA's work in Scotland, the NDA is responsible to Scottish ministers.

L.1.61. The NDA's role is strategic: the NDA establishes the overall approach to nuclear decommissioning and clean-up across its sites, allocates budgets, sets targets and monitors progress. The NDA does not have a hands-on role in cleaning up facilities. Instead, the mission is delivered through others, primarily SLCs.

L.1.62. The NDA is responsible for:

- decommissioning and cleaning up of 17 civil nuclear legacy sites;
- ensuring that all nuclear materials and waste products, both radioactive and non-radioactive, are safely managed;
- implementing policy on the long-term management of radioactive waste;
- developing UK-wide strategy and plans for nuclear Low-level Waste (LLW); and
- scrutinising the decommissioning plans of Electricité De France (EDF) Energy, who own the operating fleet of Advanced Gas-cooled Reactor (AGR) nuclear power stations and Sizewell B (see paragraphs F.45 to F.46).

Site Licence Companies (SLCs) and Parent Body Organisations (PBOs)

L.1.63. A SLC holds the nuclear site licence, granted by the ONR, to operate the nuclear site(s), together with other permits or authorisations issued by the relevant environment agency. The SLCs between them employ the 16,000-strong nuclear workforce across the NDA's estate. The NDA tasks these operators with carrying out the required decommissioning:

- providing staff to run the sites; and
- letting contracts needed to run and decommission the sites.

L.1.64. The NDA directly funds four SLCs:

- Dounreay Site Restoration Ltd. (DSRL);
- Low-level Waste Repository Ltd. (LLWR Ltd.);
- Magnox Limited; and
- Sellafield Limited.

L.1.65. The NDA has completed competitions for the ownership and management of the above four SLCs to improve on-site performance. The winning bidder of each competition is called a Parent Body Organisation (PBO). A PBO owns the shares in a SLC for the period of the contract. Each PBO is a consortium of private sector organisations. The PBO acts as a parent company, providing additional resource and management expertise to the SLC.

L.1.66. In 2010, the NDA granted a 150-year lease of the Springfields site to Westinghouse Electric UK Limited. In 2012, the NDA transferred the NDA-owned part of the Capenhurst site to URENCO UK. Capenhurst Nuclear Services is a URENCO Group subsidiary and tenant on the site.

L.1.67. A summary of recent developments in PBOs is provided below.

Low-Level Waste Repository (LLWR)

L.1.68. LLWR Ltd. is owned and operated by the UK Nuclear Waste Management (UKNWM) Ltd. consortium (comprising AECOM, Studsvik and Areva). UKNWM Ltd. was awarded the LLWR Ltd. contract in April 2008. The contract is coming to the end of a second five-year term and has

resulted in the NDA securing the future of the repository site and significant change in the way LLW is managed in the UK. The NDA is in the process of determining the extent and nature of a third contract term.

Sellafield Ltd.

L.1.69. Since the last report there has been a change in the management arrangements of Sellafield Ltd. This change followed a detailed review that concluded that the complex technical uncertainties at the Sellafield site were less suited to the PBO model. In 2015, the NDA decided to end the contract with Nuclear Management Partners (NMP) and Sellafield Ltd. Under the new arrangements, Sellafield Ltd. became a wholly owned subsidiary of the NDA on 1 April 2016 and will acquire the support of a strategic partner or partners from the private sector to assist in its delivery.

Dounreay Site Restoration Ltd. (DSRL)

L.1.70. The UK Atomic Energy Agency (UKAEA) Ltd. was established in April 2008 and became the PBO of the site licensee, DSRL. UKAEA Ltd. was later acquired by Babcock International Group in October 2009. The arrangements with UKAEA Ltd. expired on 31 March 2012, at which point Babcock Dounreay Partnership Ltd. took ownership of DSRL. Babcock Dounreay Partnership (now Cavendish Dounreay Partnership Ltd. since October 2013) is a consortium comprising Cavendish Nuclear, CH2M Hill International Nuclear Services Ltd. and AECOM (who took over ownership of URS International Holdings (UK) Ltd. in 2014).

Magnox Ltd. and Research Sites Restoration Ltd.

L.1.71. Following a competitive process Cavendish Fluor Partnership (CFP) became the new PBO for Magnox Ltd. and Research Sites Restoration Ltd. (RSRL) on 1 September 2014. Under the current contract, the two SLCs have been combined into one, Magnox Ltd., and the programme of work required to place the Magnox sites into a quiescent state has been significantly refined. A decision was made at the end of March 2017 to terminate the Magnox contract by mutual agreement with CFP after it became clear that there was a mismatch between the work that was specified in the contract and the work that needs to be undertaken. The contract is now planned to run until the end of August 2019. The NDA is undertaking a detailed process review to determine the approach to management of Magnox Ltd. in the future.

Budget

L.1.72. BEIS and Her Majesty's (HM) Treasury set the NDA's annual operational budget. The NDA's budget is a combination of government funding and income from commercial assets.

L.1.73. The NDA recognises that there are always competing demands on public finances. This means that the programmes of work across the NDA's estate have to be prioritised. The NDA uses a set of criteria that balance hazard reduction, value for money and making progress on a broad front.

L.1.74. The NDA also aims to maximise the commercial value of its assets. This helps to offset the costs of the decommissioning programme. As the NDA's income-generating assets come to the end of their lives, the reliance on public funds increases.

L.1.75. The NDA Business Plan is published yearly. The Business Plan sets out key activities and expected progress for all 17 of the NDA's nuclear sites over the next three years. It also outlines expected income and expenditure for the coming financial year (Reference 136).

L.1.76. The total planned expenditure for the financial year 2017 to 2018 is £3.24 billion of which:

- £2.36 billion is government grant-in-aid;
- £0.88 billion is income from commercial operations.

L.1.77. The NDA expects the annual expenditure for 2017/18 to be:

- £3.06 billion on the NDA's site programmes;
- £0.18 billion on non-site activities, including:
  - skills development;
  - socio-economic;
  - research and development;
  - insurance;
  - pension costs;
  - fees to SLCs;
  - implementing geological disposal; and
  - the NDA operating costs.

L.1.78. For more information on spending and cost of decommissioning, see Reference 137 and Reference 71, respectively.

NDA Strategy 2016–2021

L.1.79. The Energy Act (2004) requires the NDA to review and publish its strategy every five years. Following a public consultation, the third NDA Strategy was published in 2016 (Reference 15).

L.1.80. The NDA Strategy includes five strategic themes of which the ones of relevance to the Joint Convention are:

- Spent Fuel Management – which defines the NDA's approach to managing the diverse range of spent nuclear fuels for which the NDA is responsible, including Magnox, oxide and exotics. The objective of this theme is safe, secure and cost-effective lifecycle management of spent fuels.
- Nuclear Materials – which defines the NDA's approach to dealing with the inventory of uranics and plutonium currently stored at some of NDA's sites. The objective of this theme is safe, secure and cost-effective lifecycle management of the inventory of the NDA's nuclear materials.
- Integrated Waste Management – which considers how the NDA manages all forms of waste arising from operating and decommissioning the NDA's sites, including waste retrieved from legacy facilities. The objective of this theme is to ensure that wastes are managed in a manner that protects people and the environment now and in the future, and in ways that comply with government policies and provide value for money.
- Site Decommissioning and Remediation – which defines the NDA's approach to decommissioning redundant facilities and managing land quality in order that each site can be released for its next planned use. The objective is to decommission and remediate NDA's designated sites, and release them for other uses.

L.1.81. The NDA has identified Critical Enabler topics which support the NDA mission and include a number of general duties and supplemental functions placed on the NDA by the Energy Act (2004). These topics include Health, Safety, Security, Safeguards, Environment and Quality (HSSSEQ), which has the objective of reducing the inherent risks and hazards of the nuclear legacy, by proportionate application of contemporary standards and improving environment, health, safety and security performance across the NDA estate.

L.1.82. The NDA engages with the UK Government, devolved administrations, the ONR, the environment agencies and representatives of local government in the development and

implementation of its strategy through Thematic Overview Groups which advise the UK Government's Nuclear Strategy and Policy Group on matters falling within the NDA's remit.

Subsidiaries

L.1.83. A number of wholly owned subsidiary companies manage a range of business interests and logistics related to the NDA's mission.

L.1.84. The NDA's Annual Report and Accounts (Reference 138) includes highlights from:

- Radioactive Waste Management Ltd. (RWM);
- Direct Rail Services Ltd. (DRS);
- International Nuclear Services Ltd. (INS);
- Pacific Nuclear Transport Ltd. (PNTL);
- NDA Archives Ltd.;
- NDA Properties Ltd.;
- Rutherford Indemnity Ltd. (insurers);
- Sellafield Ltd. (from 1st April 2016) as explained above (Reference 139).

Radioactive Waste Management Ltd. (RWM)

L.1.85. The NDA has a responsibility for implementing geological disposal for High-Activity Waste (HAW) and has established RWM as the geological disposal delivery organisation. Reflecting its responsibilities, RWM's mission statement is to "deliver a geological disposal facility and provide waste management solutions".

L.1.86. RWM's corporate strategy 2015-2018 was published in May 2015 (Reference 16). It sets out RWM's vision, mission and values, and the factors on which RWM based their strategic approach.

L.1.87. RWM has responsibility for planning and ultimately implementing geological disposal of HAW in accordance with the UK Government policy. This includes ensuring such wastes generated throughout the UK are conditioned and packaged in a manner suitable for eventual disposal. In order to discharge this responsibility RWM is developing plans for the implementation of geological disposal using an iterative disposal system development process. In this process, the Disposal System Specification incorporates external requirements to guide the Design and Safety Assessment processes, which in turn leads to refinements and changes in the specification.

L.1.88. In advance of the availability of a geological disposal facility, RWM provides advice on the packaging of HAW for geological disposal. This is generally undertaken via the Disposability Assessment Process (also known as the Letter of Compliance (LoC) process). The primary aim of which is to minimise the risk that the conditioning and packaging of radioactive wastes results in packages incompatible with geological disposal, as far as this is possible in advance of the availability of Waste Acceptance Criteria for a Geological Disposal Facility (GDF). As such, it is an enabler for early hazard reduction on all UK nuclear sites. Disposability advice is provided to support development of strategic options for spent fuel, plutonium and uranics, as well as the generic design assessment process for new build reactors. Disposability advice is provided to the UK nuclear industry and other waste producers. The Disposability Assessment Process is supported by a suite of waste package specification and associated guidance documentation (Reference 140).

L.1.89. RWM also take on a role of HAW Integrator, providing support to the NDA strategy and supporting waste producers through the provision of technical advice, sharing relevant experience and collaborating on work to realise opportunities connected to the whole lifecycle of the waste.

Legislative and Regulatory Framework for Transportation of Spent Fuel and Radioactive Waste

L.1.90. The regulatory requirements for transportation of spent fuel and radioactive waste depend on the mode of transport and, for some modes, the country that they are being transported in. The following sections describe the regulatory requirements for the differing modes of transport:

- road, rail or inland waterway;
- sea; and
- air.

Radioactive Materials (RAM) Transport by Road, Rail or Inland Waterway

L.1.91. For road and rail transport in Great Britain, as noted in E.18, legislation for regulation of the transport of radioactive materials has been brought together with the legislation for nuclear safety under TEA13 (Reference 40). The specific principal legislation for ensuring the safety of radioactive material transport has already been summarised as follows:

- TEA13 (Reference 40), see paragraphs E.18 to E.21; and
- Health and Safety at Work Act 1974 (HSWA74) (Reference 41), see paragraphs E.22 to E.25.

L.1.92. The regulatory framework for RAM transport is based on the following regulations, which are relevant statutory provisions of TEA13:

- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (Reference 141); and
- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (Amendment) Regulations 2011 (Reference 142).

L.1.93. These regulations implement the following international agreements and regulations directly by referring to the current version as revised or reissued from time to time:

- European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR);
- Regulations concerning the International Carriage of Dangerous Goods by Rail (RID); and
- European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterway (ADN) but only sub-sections 1.8.3.7 to 1.8.3.16.

L.1.94. The regulatory body for road, rail and inland waterway transport in Great Britain is the ONR. Inspection and enforcement powers for road and rail transport derive from TEA13 and HSWA74. They are the same powers as for nuclear safety as described in paragraphs E.46 to E.51.

L.1.95. There is an analogous situation in Northern Ireland, where the regulations also implement the latest version of ADR, RID and ADN through the following regulations made under the Health and Safety at Work (Northern Ireland) Order 1978 (HSW(NI)O78), (Reference 143):

- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations (Northern Ireland) 2010 (Reference 144); and
- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (Amendment) Regulations (Northern Ireland) 2011 (Reference 145).

L.1.96. The Department of Agriculture, Environment and Rural Affairs (Northern Ireland) (DAERA) derives its inspection and enforcement powers from HSW(NI)O78 and these are broadly similar to the powers that the ONR derives from HSWA74 as described above.

RAM Transport by Sea

L.1.97. The principal legislation for RAM transport for British registered ships and all other ships while in the UK territorial waters is contained within the Merchant Shipping Act 1995 (MSA95), (Reference 146), which is enforced by the Maritime and Coastguard Agency (MCA). The MCA enforcement policy can be found at Reference 147.

L.1.98. Regulatory requirements for RAM transport by sea are based on the following:

- The Merchant Shipping (Dangerous Goods and Marine Pollutants) Regulations 1997 (Reference 123), which were made under MSA95 and HSWA74; and
- Merchant Shipping Notice (MSN) 1875 (M) The Carriage of Dangerous Goods and Marine Pollutants in Packaged Form: Amendment 38-16 to the International Maritime Dangerous Goods (IMDG) Code issued by the MCA (Reference 148).

L.1.99. These requirements implement the International Maritime Organisation's (IMO) IMDG Code Amendment 38-16 directly by referencing it from within the legislation.

L.1.100. For spent fuel, the regulatory requirements are in:

- Merchant Shipping (Carriage of Packaged Irradiated Nuclear Fuel etc.) (INF Code) Regulations 2000, SI 2000/ 3216 (Reference 149).

L.1.101. These regulations give effect to the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (the INF Code), and SOLAS chapter VII Part D, Regulation 4.

L.1.102. Under MSA95, legislation allows MCA to board ships and carry out inspections. The power of inspection is derived from the MSA95.

L.1.103. MSA95 provides the surveyors appointed by the Secretariat of State with the powers to detain ships and issue Prohibition Notices and Improvement Notices. The circumstances when they can be issued and the form of these notices are similar to those described in paragraph E.49.

L.1.104. Under the Merchant Shipping Act and the various SIs, depending upon the method of carriage, the MCA have the powers to prosecute owners/charters/Master etc. when they do not comply with any section of the applicable SI.

L.1.105. It should be noted that responsibility for the approval of the packaging or containment systems for the carriage of RAM is with the ONR so the MCA would not get involved with the failure of the packaging etc.. MCA only survey the vessels and stowage and segregation requirements to ensure they comply with the requirements of the applicable IMO Conventions.

L.1.106. The Merchant Shipping (Port State Control) Regulations 2011 (Reference 150) implement Directive 2009/16/EC. The Directive provides a regime for the enforcement, in respect of shipping using ports in Member States of the European Union and their waters, of international standards for ship safety, pollution prevention and shipboard living and working conditions. The Directive is extended to the EEA.

L.1.107. The Merchant Shipping (Survey and Certification) Regulations 2015 (Reference 151) make provisions for the inspections and surveys to be carried out on UK ships wherever they may be, and also on other ships while in UK waters. The Regulations give effect to the requirement as to surveys and the issue of certificates contained in the Safety of Life at Sea Convention 1974, as amended, and also contain similar requirements for ships not subject to the Convention.

RAM Transport by Air

L.1.108. The UK requirements for RAM transport by air, which are enforced by the Civil Aviation Authority (CAA), are specified by the following made under the Civil Aviation Act 1982 (Reference 152):

- The Air Navigation Order 2016 (Reference 153);
- The Air Navigation (Dangerous Goods) Regulations 2002 (Reference 154); and
- The Air Navigation (Dangerous Goods) (Amendment) Regulations 2017 (Reference 155).

L.1.109. They implement the Technical Instructions for the Safe Transport of Dangerous Goods by Air 2017-2018 issued by the International Civil Aviation Authority's (ICAO) by referencing them directly from within the legislation.

L.1.110. Inspection and enforcement powers for air transport derive from the Civil Aviation Act 1982 (Reference 152) and associated regulations listed above. These powers enable audits and inspections concerning all activities associated with dangerous goods in air transport including acceptance, loading and carriage by the aircraft operator or its designated agent. The CAA also performs risk and performance based oversight (audits) of shippers and freight forwarders. Where necessary, the CAA works with the ONR (which has the power to enter the premises of such organisations) as a shipment suspected to be in breach of the Air Navigation (Dangerous Goods) Regulations is likely to be in breach of the regulations applicable to surface transport when carried to or from the airport. The CAA is tasked by the Department for Transport to investigate and prosecute breaches of aviation safety rules, including dangerous goods offences.

L.1.111. In response to non-compliance the CAA may issue a warning letter, audit finding or suspend/revoke a UK air operator's approval for the transport of dangerous goods by air. Serious one-off or repeated non-compliance can lead to criminal prosecution.

Section L.2 – General and Specific Safety Provisions

L.2.1. This section includes additional details related to Section F - Other General Safety Provisions.

National Nuclear Skill Base: Nuclear Skills Strategy Group (NSSG) and Universities

L.2.2. More details are provided here on the NSSG's action plan and role of the universities in developing the national nuclear skill base, as described in paragraphs F.10 to F.17.

L.2.3. Under the new NSSG operating model, interventions required to address future skills needs are grouped under five key delivery themes, each of which consists of a number of strategic actions. Each strategic action has an industry sponsor who has developed a detailed delivery plan to address the strategic action. The NSSG action plan has identified appropriate existing skills bodies to deliver the identified intervention or alternatively has commissioned new groups where no appropriate group already exists. Skills bodies already involved in the delivery plan include the National Skills Academy, Nuclear, the National College for Nuclear, and Women in Nuclear. The five themes are:

- meeting the demand;
- training infrastructure and provision;
- training standards and qualifications;
- the development of a simplified skills operating model in the UK to ensure efficiency and minimise duplication; and
- agreement on a nuclear timeline to support an increasingly clear demand picture.

L.2.4. Part of the NSSG responsibility for skills requires it to consider longer term skills requirements to enable and facilitate new areas of nuclear activity in the UK, and increase the opportunity for the UK to export its skills and capability. This includes the development of the next generation of subject matter experts, developed through funding research and university collaboration.

L.2.5. At university level, there has been a very positive response to the shortage of graduates entering the industry. A number of new postgraduate nuclear courses have been set up with an increasing number of students taking up places. The nuclear content of some undergraduate courses is being enhanced and at postgraduate level, programmes such as the Nuclear Technology Education Consortium have been developed. This is a new concept in postgraduate level training for the nuclear sector.

L.2.6. In addition, a number of doctoral programmes are available that target both decommissioning needs and next generation development. The NDA sponsors an annual PhD bursary call which targets Estate-wide R and D needs, and both SL and RWM fund PhD level research that supports their operations and future requirements; in total, the Estate currently directly supports over 150 PhD students. In addition, multi-university research consortia such as the Next Generation Nuclear and Imperial Cambridge Open Centres for Doctoral Training (CDTs), as well as the DISTINCTIVE consortium have been formed to help maintain an advanced academic nuclear skill base and a pipeline of highly qualified potential industry and supply-chain recruits with a strong nuclear background. The CDTs and DISTINCTIVE consortia are funded by a

combination of Industry, research council and university monies, with significant industry input throughout the programmes to ensure that the research stays relevant to the industry needs.

Application of As Low As Reasonably Achievable (ALARA), As Low As Reasonably Practicable (ALARP), Best Available Techniques (BAT) and Best Practicable Means (BPM) in UK Regulation

L.2.7. As described in F.76, UK health and safety law is broadly based on the concept that risks should be ALARP. This is translated into three broadly equivalent terms in various legislations:

- So Far As Is Reasonably Practicable (SFAIRP) in safety legislation (e.g. in HSWA74);
- ALARA (ALARP in the UK) in the legislation concerned with radiological protection; and
- BAT and BPM to minimise radioactive waste discharges as required by environmental permits and authorisations to ensure public doses are ALARA as a result of such disposals.

L.2.8. As a result, SFAIRP is synonymous with ALARP and ALARA.

Determining that Risk has been Reduced to ALARP

L.2.9. The Health and Safety Executive (HSE) has published five documents relevant to the management of spent fuel and radioactive wastes that provide guidance to industry and the ONR's staff. This guidance is used by the ONR to judge whether a proposal from a UK nuclear licensee will reduce risks to health and safety to a level that is ALARP:

- 'Reducing Risks Protecting People' (Reference 51) explains the basis for regulatory decisions regarding the degree and form of regulatory control of risk from occupational hazards;
- 'Policy and Guidelines to assist the HSE in its judgments that dutyholders have reduced risk as low as reasonably practicable' (Reference 156) sets out in plain terms what HSE believes the law requires;
- 'Assessing compliance with the law in individual cases and the use of good practice' (Reference 157) identifies what the HSE means by good practice;
- 'Policy and Guidance on reducing risks as low as reasonably practicable in design' (Reference 158) recognises the importance of taking account of health and safety in design; and
- 'Demonstration of ALARP' (Reference 159) is used by the ONR as guidance to its inspectors on how to apply the principle of ALARP to nuclear facilities and operations.

L.2.10. Some irreducible risks may be so serious that they cannot be permitted. At the other extreme, some risks may be so trivial that it is not worth incurring significant cost to reduce them further. Licensees must take measures to reduce risk, unless the costs in terms of time, trouble and money of taking particular actions are clearly excessive (in "gross disproportion") compared with the benefit of the risk reduction. This is the fundamental essence of a demonstration that risks have been reduced to ALARP.

L.2.11. This does not mean that a detailed analysis is necessary; the emphasis must be on an analysis that is fit for purpose. Neither does it mean that a quantitative argument based on risk estimates is always necessary, as qualitative features such as a demonstration of sound, deterministic engineering principles are often sufficient in making a case.

L.2.12. However, the ONR requires a probabilistic safety assessment, in addition to deterministic analysis for systems where there are significant hazards and complexity. Assessing an ALARP

demonstration is essentially a consideration of whether an adequate argument has been made that a reduction in risk would not be feasible at a reasonable cost, given the magnitude of the risk. However, where there are several risks that interact, whether arising from a single hazard or from different connected hazards, there may be a need for balancing between them to achieve the best overall solution.

L.2.13. Demonstration of ALARP requires the licensee to evaluate the risks and to consider whether it would be reasonably practicable to implement further safety measures beyond the initial proposals or what is currently in place. This ought to include the consideration of a number of options to identify which reasonably practicable option or collection of options will give the best safety benefit, and to make this consideration transparent. In reality, there may only be a Ltd. number of options for dealing with a particular health and safety issue. The regulators have not formulated a method that can be used to determine the proportion factor (relating to "grossly disproportionate") for a given level of risk. The extent of the bias must be argued in the light of all the circumstances. It may be possible to come to a view in particular circumstances by examining what factor has been applied in comparable circumstances elsewhere to that kind of hazard or in that particular industry.

L.2.14. Deciding what is reasonably practicable involves the exercise of judgment and enforcing authorities will generally expect relevant good practice to be followed. Where relevant good practice in particular cases is not clearly established, health and safety law effectively requires dutyholders to establish explicitly the significance of the risks (both in terms of extent and likelihood) to determine what action needs to be taken. Where it is not possible to demonstrate ALARP by good practice features and risk estimates alone, the benefits of risk-reduction measures should be compared with their costs. Sometimes it is helpful to use a common unit, which is generally money, so that the analysis may become a form of Cost Benefit Analysis (CBA). The degree of quantification is case dependent, but must be sufficient to make the case fit for purpose. In particular, a CBA alone is unlikely to be considered an adequate argument to demonstrate ALARP or ALARA.

Dose Information for Classified Persons

L.2.15. Detailed dose figures for reprocessing, radioactive waste treatment, and decommissioning activities are provided in Table 3.

Table 3: Summary of workers' dose in reprocessing, radioactive waste treatment, and decommissioning

Year	2010	2011	2012	2013	2014	2015
	Nuclear Fuel Reprocessing					
Total Classified Workers	2286	2201	2116	2091	3148	3084
Collective Dose (Man-mSv)	1620	1353	1059	1054	1328	1288
Mean dose (mSv)	0.7	0.6	0.5	0.5	0.4	0.4
6.1 to 10mSv	1	0	0	0	2	0
10.1 to 15mSv	0	0	0	0	0	0
15.1 to 20mSv	0	0	0	0	0	0

>20mSv	0	0	0	0	0	0
	Radioactive Waste Treatment					
Total Classified Workers	239	227	231	129	94	79
Collective Dose (Man-mSv)	40	48	74	53	49	26
Mean dose (mSv)	0.2	0.2	0.3	0.4	0.5	0.3
6.1 to 10mSv	0	0	0	0	0	0
10.1 to 15mSv	0	0	0	0	0	0
15.1 to 20mSv	0	0	0	0	0	0
>20mSv	0	0	0	0	0	0
	Decommissioning					
Total Classified Workers	3252	3323	3443	3829	4302	3785
Collective Dose (Man-mSv)	1816	2306	1913	1843	2326	2675
Mean dose (mSv)	0.6	0.7	0.6	0.5	0.6	0.7
6.1 to 10mSv	28	33	28	63	31	37
10.1 to 15mSv	0	0	0	1	0	0
15.1 to 20mSv	0	0	0	0	0	0
>20mSv	0	0	0	0	0	0

Environmental Performance

L.2.1. There has been an overall reduction in discharges in the UK over the past two decades which followed the major reductions made in the 1970s and 1980s in the reprocessing sector, noting that discharges from this sector in the UK include arisings from legacy management activities including decommissioning. In summary:

- Alpha: Overall alpha discharges have reduced in the decade up to 2014 by about 60%. The majority of alpha discharges arise from the reprocessing sector (about 90% in 2014), which are now about 0.1% of the peak seen in the 1970s. Since 2011, annual discharges from Sellafield have increased from 0.12 TBq to 0.19 TBq in 2015, mainly related to operational reprocessing activities.
- Beta/gamma (excluding tritium): Discharges are now less than 10% of what they were in 2004 and since 2011 have reduced from around 24 TBq per year to around 16 TBq per

year; this is less than 1% of the peaks seen in the 1970s. In 2014 about 60% of discharges arose from the reprocessing sector with the remainder split mainly between power generation and fuel fabrication/enrichment.

- Tritium: Discharges are now about 40% lower than they were a decade ago and since 2011 have reduced to around 3,200 TBq per year. Discharges are dominated by the power generation (approx. 60%) and reprocessing sectors.
- Technetium-99: Discharges from the reprocessing sector are about 1% of their peak in the late 1990s. Since 2011 the annual discharge has been 1.3 TBq - 1.7 TBq. Magnox reprocessing operations have played a significant role in this reduction as a result of process changes such as diverting the technetium-99 isotope into a waste stream for vitrification and the use of a chemical process using Enhanced Actinide Removal Plant.

Section L.3 – Spent Fuel and Radioactive Materials Policies and Practices

L.3.1. Spent fuel policies are described in full in Section B - Policies and Practices.

L.3.2. Additional background on management practices for Magnox and AGR spent fuel as well as for radioactive materials is provided below.

Spent Fuel Management and Reprocessing Practices

Spent Magnox fuel

L.3.3. Following its removal from a reactor, spent Magnox fuel is initially stored on the power station site. At most UK Magnox power stations this storage takes place in water-filled cooling ponds, the exception being Wylfa which is equipped with a dry store. Initial storage for a minimum of 90 days allows for radioactive decay of short-lived isotopes within the spent fuel. Splitter blades (external thin metallic vanes which form part of the fuel cladding) are removed before the spent fuel is dispatched to Sellafield in purpose designed flasks, initially by road to a railhead local to each power station, and then by rail. The flasks laden with spent Magnox fuel are then received into the Fuel Handling Plant (FHP) at Sellafield. The fuel is stored under water in the FHP to allow further radioactive decay, prior to removal of the remaining cladding. The bare uranium metallic fuel rods are then loaded into heavily shielded containers for transfer across the Sellafield site to the Magnox reprocessing facilities.

Management of Nuclear Materials

Plutonium Disposition

L.3.4. On completion of reprocessing operations there will be around 140 tonnes of civil separated plutonium stored safely and securely in the UK. The NDA manages all of the civil separated plutonium in the UK. The vast majority of this material is held at Sellafield, with a relatively small amount currently held at Dounreay arising from historic activities at this site.

L.3.5. The UK stocks of civil separated plutonium are contained in custom built stores that ensure safe and secure storage. Over the past five years NDA and Sellafield have continued to retrieve materials from older stores and consolidate them in state of the art facilities such as the Sellafield Product and Residue Store (SPRS).

L.3.6. The priority for UK Government policy (Reference 160 and 17) is to provide a solution that puts the vast majority of UK held plutonium beyond reach.

L.3.7. The future management options for the UK's civil plutonium include its possible use in reactors via a completed fuel cycle. However, up to 5% of the stock may be so contaminated that, even though it may also be technically possible to treat and use this amount for fuel, it might prove uneconomic to do so. In order to advise the UK Government, the NDA undertook a study of the possible options for the management of UK-owned civil stocks. In 2011, informed by this strategic options work, the UK Government proposed a preliminary policy view to pursue reuse of UK civil separated plutonium as Mixed Oxide fuel (MOX). This would see the vast majority of UK plutonium converted into fuel for use in civil nuclear reactors. Any remaining plutonium unsuitable for conversion into MOX would be immobilised and treated as waste for disposal.

L.3.8. In addition, the UK Government decided that overseas owned plutonium in the UK, which remains the responsibility of the owners, could be managed alongside UK plutonium or transferred to UK ownership subject to acceptable commercial terms. This policy was the subject of a written Ministerial Statement in July 2012 (Reference 161).

L.3.9. Whilst reuse of plutonium is the preferred policy position there is currently an insufficient understanding of the options to confidently move into implementation. In the meantime, the strategy for plutonium stocks is to continue to safely and securely store them on NDA sites in suitable facilities in line with regulatory requirements.

L.3.10. In 2014, the NDA published an update detailing the progress on approaches to the management of separated plutonium which included plans for significant future work with three potential suppliers of reuse technologies (Reference 162). Since then, the NDA has further developed understanding of the reuse options as well as immobilisation of plutonium and provided additional advice to government.

L.3.11. The NDA's advice concluded the right approach in the near-term is to continue to work with technology suppliers, developers and UK Government to establish how the re-use option could be secured and implemented. Additionally, the UK should continue to fund technology development for the immobilisation of plutonium.

L.3.12. The schedule for developing, selecting and implementing the preferred option depends on many factors including the nuclear new build programme and the availability of a GDF. The NDA will work with the UK Government to understand the relevant conditions that need to be met so that a decision can be made with confidence and at the right time.

L.3.13. More generally, the UK Government urges the other owners of these materials, on a voluntary basis, to put in hand procedures now that would allow them to identify those materials that may not be reusable economically.

L.3.14. The Committee on Radioactive Waste Management (CoRWM) has consulted widely on whether some or all of these materials may be classified as wastes in the future, and what impact that would have on the long-term management plans for them. CoRWM has concluded that such materials could be disposed of with HAWs via geological disposal.

Uranics

L.3.15. The NDA owns a range of materials containing uranium (termed 'uranics') arising from fuel cycle operations. The management options for these materials are continued safe and secure storage, sale to a third party for recycling and reuse or conditioning to an appropriate form for disposal. Owing to the diverse nature of the materials there is no single preferred management option for the whole inventory; an appropriate option will need to be determined on a group-by-group basis. For example:

- The NDA will de-convert its depleted uranium hexafluoride (UF6), to an oxide form, U3O8, which is amenable to long-term passive storage and disposal;
- The NDA has begun to transfer excess Highly Enriched Uranium (HEU) from Dounreay to the United States of America (USA) where it will be down-blended to Low Enriched Uranium (LEU). This transfer is part of an exchange between the EU and the USA under which the USA will send to the EU HEU which is suitable for the production of medical isotopes used to diagnose and treat cancer.

L.3.16. For a significant part of the inventory, such as the depleted uranium arising from enrichment and reprocessing, there is currently very Ltd. opportunity to sell this material. Through RWM, the NDA has completed an initial evaluation of potential approaches to the disposal of uranics conditioned to an oxide form in a GDF in the event that these materials were to be declared waste should they have no foreseeable resale value. This work will inform a future UK Government decision on UK uranics policy.

Section L.4 – Radioactive Waste Policies and Practices

L.4.1. This section provides additional details on the aspects covered under Section B - Policies and Practices.

Definition of Radioactive Waste

L.4.2. Radioactive waste in the UK is defined in Schedule 23 of EPR16 and Section 1 of RSA93. The approach taken is that for a substance to be classed as radioactive waste it first has to fall within the definition of waste, which is as follows:

> *"….. 'waste' includes any substance which constitutes scrap material or an effluent or other unwanted surplus substance arising from the application of any process, and also includes any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoilt."*

L.4.3. If waste contains artificial radionuclides or naturally occurring radionuclides used for their radioactive, fertile or fissile properties it is categorised as radioactive waste if the concentration of these radionuclides exceeds radionuclide-specific threshold values published in the legislation. Threshold values are specified for solids and certain liquids and are the same as those published in the EC Document RP122 (Refs. 163 and 164), which are based on a dose criterion of 10µSv per year to members of the public. For aqueous liquids and gases there are no threshold values and all such liquids and gases are considered to be radioactive waste, irrespective of the radionuclide concentration.

L.4.4. There are separate criteria for wastes containing naturally occurring radionuclides that are not used for their radioactive, fertile or fissile properties. These are that the waste must originate from a specified Naturally Occurring Radioactive Material (NORM) industrial activity and the concentrations of radionuclides in the waste must be greater than specified values. Values are specified for solids, aqueous liquids and gases; the values are based on a dose criterion of 300µSv per year to members of the public.

L.4.5. Substances containing only 'background' levels of artificial radionuclides and those that are contaminated as a result of authorised discharges are excluded from the definition of radioactive waste.

L.4.6. Radioactive waste is defined in the Transfrontier Shipment of Radioactive Waste and Spent Fuel Regulations 2008 as:

> *"radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the countries of origin and destination, or by a person whose decision is accepted by these countries, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the countries of origin and destination".*

L.4.7. Further information on the definition of radioactive waste is available in detailed government guidance on the scope of the radioactive substances legislation in England and Wales (Reference 165).

Categorisation of Radioactive Waste

L.4.8. In the UK, historically, radioactive waste has been classified under the following broad categories, according to its heat-generating capacity and activity content:

High-Level Waste

L.4.9. High-Level Waste (HLW) is waste in which temperature may rise significantly as a result of its radioactivity, so that this factor has to be taken into account in designing storage or disposal facilities.

Intermediate-Level Waste

L.4.10. Intermediate-Level Waste (ILW) is waste with radioactivity levels exceeding the upper boundaries for Low-Level Waste (LLW), but which does not require heating to be taken into account in the design of storage or disposal facilities.

Low-Level Waste

L.4.11. Within the UK, LLW is now defined as radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha and/or 12 GBq/te of beta/gamma activity. This general definition does not directly equate to the waste acceptance criteria in place at specific disposal sites for LLW.

Very Low-Level Waste

L.4.12. Very Low-level Waste (VLLW), a sub-category of LLW is defined as (Reference 27):

- in the case of low volumes ('dustbin loads') – low-volume VLLW:

  "Radioactive waste which can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste ('dustbin' disposal), each 0.1m3 of waste containing less than 400kilobecquerels (kBq) of total activity or single items containing less than 40kBq of total activity."

- for wastes containing carbon-14 or hydrogen-3 (tritium):
  - in each 0.1m3, the activity limit is 4,000kBq for carbon-14 and hydrogen-3 (tritium) taken together; and
  - for any single item, the activity limit is 400kBq for carbon-14 and hydrogen-3 (tritium) taken together.

L.4.13. Controls on disposal of this material, after removal from the premises where the wastes arose, are not necessary.

- or, in the case of bulk disposals – high-volume VLLW:

  "Radioactive waste with maximum concentrations of 4megabecquerels per tonne (MBq/te) of total activity which can be disposed of to specified landfill sites. For waste containing hydrogen-3 (tritium), the concentration limit for tritium is 40MBq/te. Controls on disposal of this material, after removal from the premises where the wastes arose, will be necessary in a manner specified by the environmental regulators."

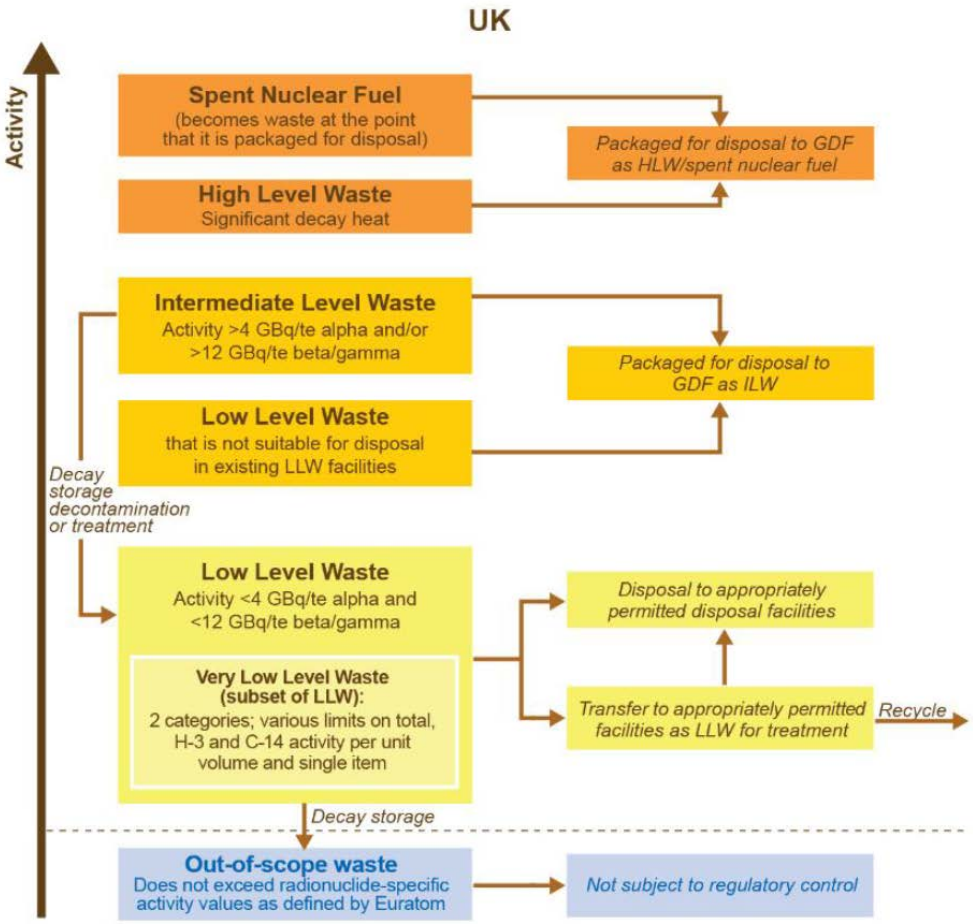
L.4.14. The principal difference between the two definitions of VLLW is the need for controls on the total volumes of VLLW in the second (high-volume) category being deposited at any one particular landfill site.

Higher-Activity Waste

L.4.15. In the UK, HAW is defined by the UK Government as the collection of: HLW, ILW, and the relatively small proportion of LLW that is not currently suitable for disposal in existing LLW disposal facilities (due to some chemical, physical or radiological property that is incompatible with the extant waste acceptance criteria).

L.4.16. These categories are summarised in Figure 21 (Reference 166).

Figure 21: Summary of UK radioactive waste classification



Background on HAW Policies and Geological Disposal

L.4.17. This sub-section provides some additional background on the development of the 2014 White Paper “Implementing Geological Disposal”.

L.4.18. In October 2006, the UK Government accepted CoRWM’s recommendation that the best approach for long-term management of HAW was deep geological disposal preceded by safe and secure interim storage (Reference 167). The White Paper Managing Radioactive Waste Safely – A Framework for Implementing Geological Disposal. (Reference 10) was published in June 2008; the siting process set out in this White Paper operated for five years. A number of communities engaged with the process and participated in its early stages. However, by February 2013, following withdrawal of one of the interested communities in West Cumbria, no communities were actively involved in the siting process.

L.4.19. The UK Government then considered lessons learnt from the process that ran from 2008 to 2013. Following a call for evidence and consultation, the UK Government published the 2014 White Paper, 'Implementing Geological Disposal' to update and replace (in England and Northern Ireland) the 2008 White Paper. It set out a renewed overarching policy framework for implementing geological disposal and identified 'initial actions' (see Section B - Policies and Practices) to be led by the UK Government and the intended developer RWM to support a siting process that is based on the willingness of communities to participate.

L.4.20. The UK Government has indicated a strong preference to manage the inventory for disposal in one GDF, on the basis that major cost savings and lower environmental impacts could be realised by developing one site. There is no technical reason why the development of one GDF to manage the inventory for disposal should not be possible – it largely depends on whether a large enough volume of suitable rock exists (in an area where the local community would be willing to host a GDF) in which the underground facilities can be constructed and whether the developer is able to make an acceptable safety case.

L.4.21. The UK Government will continue to progress the 'initial actions' with a view to launching the revised siting process once they are complete. This is when formal discussions between interested communities and RWM can commence

Waste Management – Regulators' Joint Guidance

L.4.22. In February 2010, the UK safety regulator and environment agencies published revised Joint Guidance on management of HAW on nuclear licensed sites. A revised and updated version of this guidance was published in February 2015 (Reference 34). The guidance applies to the whole process of managing radioactive waste from its generation to (but not including) its disposal. The main aims of the Joint Guidance are to:

- provide a comprehensive source of information that can be used by nuclear site licensees and the regulators' staff, and referred to by other stakeholders; and
- advise licensees on how to obtain regulatory acceptance of their proposals for radioactive waste management.

L.4.23. The Joint Guidance should assist licensees by providing:

- a clear and transparent regulatory process involving early dialogue between the nuclear industry, the regulators, NDA and other stakeholders;
- much greater business certainty at a time when the nuclear industry is committing significant resources to radioactive waste management; and
- a clear, auditable document trail of the basis for current regulatory decisions.

L.4.24. The joint guidance complements the ONR's existing guidance to inspectors, and is used by the ONR when dealing with nuclear safety cases (Reference 168) and radioactive waste management issues (Reference 169). The regulators are committed to undertaking regular reviews, to continuously improve the guidance in light of experience and to ensuring the guidance remains fully relevant.

Waste Graphite

L.4.25. Within the UK there are large quantities of irradiated graphite present in AGR, Magnox and test/prototype reactors. There are approximately 60,000 tonnes of graphite on Magnox sites alone.

L.4.26. The NDA's strategy for management of graphite is described in NDA's HAW Strategy (Reference 22).

L.4.27. Under the current plans for reactor care and maintenance the majority of the graphite will arise as a result of reactor decommissioning at the NDA and EDF Energy sites, although graphite wastes also arise on sites in the form of operational wastes. Graphitic operational wastes are usually in the form of intact or fragmented reactor sleeves, struts, dowels or boats and have been stored in a number of facilities, e.g. solid waste vaults or silos. Operational graphite wastes may also be associated with irradiated steel items.

- The major graphite streams covered by NDA's higher activity waste strategy include:
- Magnox reactor graphite
- Windscale pile graphite
- Graphite fuel element debris at Hunterston A and Berkeley
- AGR graphite sleeves stored at Sellafield
- It is also recognised that other smaller volume graphite waste streams will need to be dealt with, e.g. Dounreay reactor graphite.

L.4.28. The present baseline strategy is to defer reactor dismantling for a number of decades followed by decommissioning and conditioning of the waste into disposable forms. Waste will then be exported to a GDF for England and Wales or placed under long-term management in near-surface facilities in Scotland.

L.4.29. The bulk of the graphite under current reactor dismantling plans will arise from 2070 onwards and it is important to ensure that current opportunities for learning and for the development of practical waste treatment and management of wastes are considered and applied where relevant, e.g. graphite from the Windscale pile and research reactors.

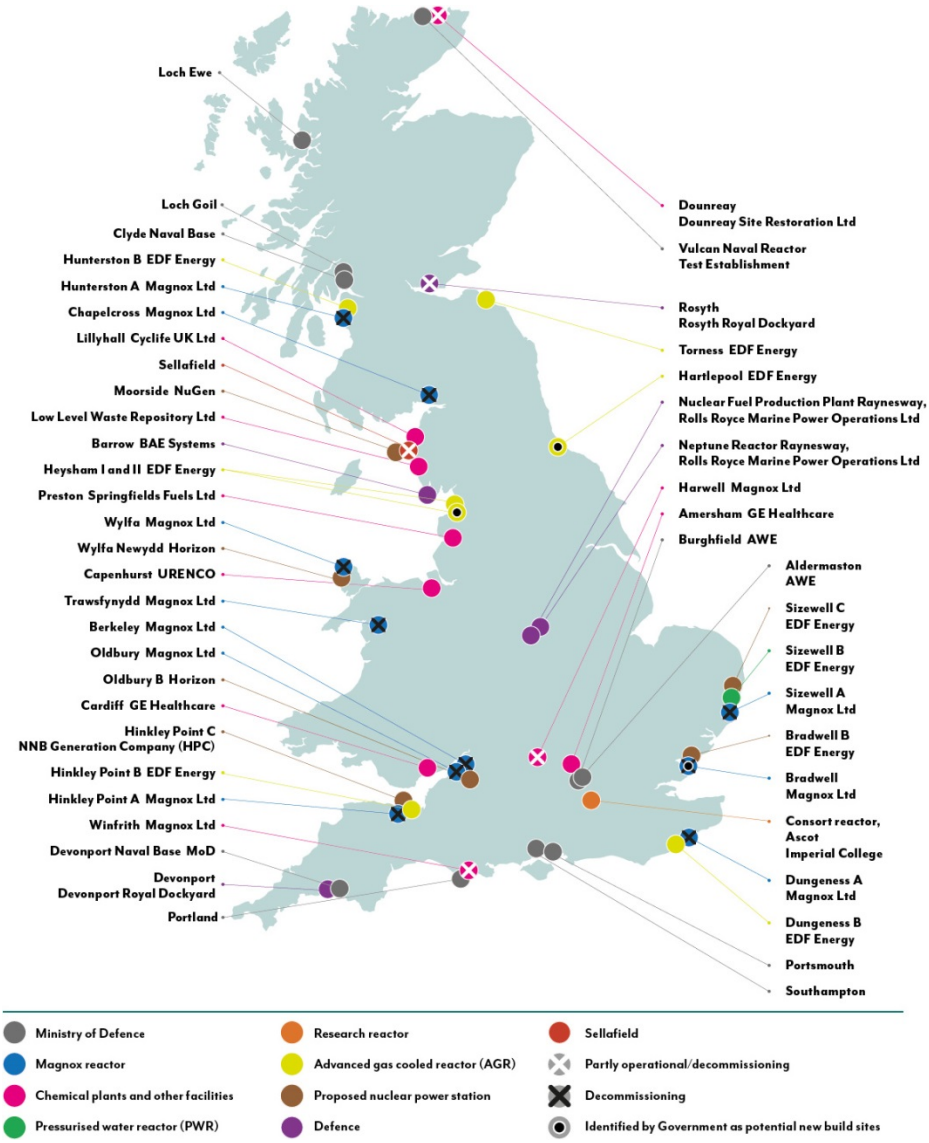
Section L.5 – Lists and Inventories

L.5.1. This section provides the following lists and inventories referred to in Section D - Inventories and Lists:

- Spent Fuel Management Facilities;
- Inventory of Spent Fuel;
- Radioactive waste Management Facilities;
- Inventory of Radioactive Waste; and
- Decommissioning facilities.

L.5.2. The map below provides a list of all the facilities regulated by the ONR, and related to the Joint Convention.

Figure 22: Map of sites regulated by the ONR in Great Britain



Spent Fuel Management Facilities

Storage of Spent Fuel at Reactor Sites

Magnox Reactor Sites

L.5.3. Other than at Wylfa and Calder Hall, the Magnox power stations had storage ponds where spent fuel was held under water for a short cooling period, before shipment to Sellafield for reprocessing. All fuel has been removed from the Magnox sites except for Wylfa and Calder Hall. At Wylfa and Calder Hall, defueling is progressing.

L.5.4. Fuel is transferred directly from Calder Hall to the Sellafield ponds. Wylfa has three primary spent fuel dry store cells, plus two secondary dry store cells. The spent fuel from Wylfa is dispatched to Sellafield for reprocessing. Wylfa Reactor 2 ceased its operational phase in April 2012, Reactor 1 ceased operation in December 2015.

AGR Sites

L.5.5. Each AGR station has one fuel storage pond. After a short period of dry storage immediately after removal from the reactor, then a cooling period under water, the spent fuel is dispatched to Sellafield for reprocessing or long-term storage.

Sizewell B

L.5.6. The spent fuel storage pond at Sizewell B does not have the capacity to accommodate lifetime spent fuel arisings. For accounting purposes Sizewell B has a lifetime of 40 years, which equates to an assumed closure date of 2035, but with the prospect of a further lifetime extension to 2055 subject to the normal regulatory approvals. To meet the shortfall in spent fuel storage capacity a Dry Store to accommodate the station's anticipated lifetime spent fuel arisings, including the spent fuel already stored in the pond, has been constructed and commissioned. Loading of spent fuel containers into the Dry Store commenced in early 2017.

L.5.7. Proprietary multi-purpose containers, designed and fabricated by Holtec, are used to store the spent fuel within the Dry Store. Each container holds 24 Pressurised Water Reactor (PWR) spent fuel assemblies. If the station's operational life is extended to 60 years approximately 150 containers will be required.

L.5.8. Each container is stored within a shielded over-pack. The containers will be progressively purchased, filled with spent fuel, and moved to the store in discrete campaigns from 2017 to 2040.

L.5.9. The transfer of the spent fuel that is initially stored in the station pond to the Dry Store is facilitated by a range of transport and handing equipment and associated ancillary components including a purpose-built flask.

L.5.10. The fuel containers maintain an inert gas atmosphere around the spent fuel assemblies for the full duration of storage in the Dry Store. Decay heat is dissipated through the external surface of the containers and cooling of the building is achieved by natural convection.

L.5.11. The station's entire lifetime arisings of spent fuel will be progressively switched to dry storage by 2040. Thereafter, the Dry Store will operate until fuel is retrieved at a date dependent on the availability of a final disposal route, which is currently planned to be the proposed national GDF. For planning purposes, the transfer of fuel to the GDF has been assumed by EDF Energy to commence in circa 2080 with decommissioning of the Dry Store over a two-year period commencing in 2100.

Storage of Spent Fuel at Other Sites

Dounreay

L.5.12. A shielded cave that was previously used for the examination of irradiated fuel is being used for handling and temporary storage of spent fuel at Dounreay, while options are being fully developed for relocation of the fuel to Sellafield.

Sellafield

L.5.13. The original Windscale reactor pond built between 1948 and 1952 was later modified to handle Magnox fuel from the Calder Hall reactors, which it did until 1960.

L.5.14. A second pond operated from 1960 until 1986 as a receipt, storage and de-canning facility for spent fuel from the Magnox power stations UK-wide. An adjacent pond has operated since 1965 for the storage of oxide fuel, comprising receipt facilities, services and storage pond with bays built between 1965 and 1982. It also stores empty high-integrity multi-element bottles used in Light Water Reactor (LWR) fuel transport and storage prior to their disposal.

L.5.15. A further separate pond has operated at Sellafield since 1982 for the storage of AGR fuel received directly from the power stations or from FHP. Fuel is stored prior to processing, after which dismantled fuel is dispatched to the Thermal Oxide Reprocessing Plant (THORP) Receipt and Storage ponds in internal transit flasks.

L.5.16. The FHP pond that opened in 1984 comprises three bays, two of which are currently used for Magnox fuel storage and one for AGR fuel. Magnox fuel is typically stored for six months to allow radioactive decay of short-lived isotopes. It is then transferred to one of two de-canning caves where the Magnox cladding is removed from the fuel rod, which is sent for reprocessing. The cladding debris (known as swarf) is transported to another plant where it is placed into drums and encapsulated in a cement matrix then placed into storage. AGR fuel is stored for some years before being sent to THORP for reprocessing. Storage arrangements are carefully designed to eliminate the potential for criticality events and to maintain the fuel's integrity.

L.5.17. The THORP Receipt and Storage ponds opened in 1988 and act as a temporary store for AGR fuel and LWR fuel en route to reprocessing.

Reprocessing Facilities

L.5.18. The first reprocessing plant at Sellafield operated from 1952 to 1964. This reprocessed defence fuel from the Windscale Piles and fuel from the first Magnox reactors. This plant was modified to gain experience in oxide fuel reprocessing and performed that function from 1969 to 1973 on spent fuels from the Windscale Advanced Gas-cooled Reactor (WAGR), the Steam-Generating Heavy Water Reactor (SGHWR) and foreign reactors.

Sellafield – the Magnox Reprocessing Plant

L.5.19. Commissioned in 1964, the Magnox Separation Plant is where the separation of Magnox fuel rods into basic chemical components takes place.

L.5.20. Liquid effluents from the stages of reprocessing are treated in separate plants according to their level of radioactivity. Fission products are concentrated by evaporation, then interim stored and vitrified.

Sellafield – Thermal Oxide Reprocessing Plant (THORP)

L.5.21. Commissioned in 1994 THORP reprocesses irradiated oxide fuel, primarily from AGR and LWR reactors. After a cooling period in the main storage pond, the fuel is monitored and sheared

into short pieces that are dissolved in nitric acid using a batch dissolution process. Insoluble stainless steel or Zircalloy fuel cladding pieces (hulls) are removed from the fuel solution and transferred to another plant for encapsulation within drums in a cement matrix.

L.5.22. The remaining fuel solution contains two types of particulate materials: cladding fines (resulting from the mechanical shearing action), and the insoluble fission products. The fines settle in the base of the THORP dissolver, are extracted and packed together with the hulls. The insoluble fission products and any remaining fines are separated. Solvent extraction is then used to separate the clarified liquid solution into a uranium-bearing stream, a plutonium-bearing stream and the waste fission products.

L.5.23. The effluents from the various stages of the reprocessing operation are treated in separate plants according to their level of activity. Fission products from the fuel are concentrated by evaporation, interim stored and then vitrified. Metal cladding 'hulls', fines, barium carbonate and centrifuge cake are encapsulated in cement.

Radioactive Waste Management Facilities

Article 32.2: This report shall also include:

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

Sellafield (including Calder Hall)

L.5.24. The radioactive waste management facilities at Sellafield are the most extensive of any site in the UK, the most important of which are:

Waste Monitoring and Compaction Plant (WAMAC)

L.5.25. WAMAC is a high force compaction plant designed to receive, process and compact solid LLW from the Sellafield Site and from other organisations within the UK. After compaction, the waste is placed into product containers for despatch to LLWR. In addition, the facility provides a service for the receipt of uncompactable waste which is then consigned to LLWR. Monitoring is conducted to demonstrate conformance with conditions for acceptance at LLWR.

Waste Treatment Complex (WTC)

L.5.26. WTC processes Plutonium Contaminated Material (PCM), including historical legacy wastes and arisings from ongoing work activities at Sellafield and Harwell. Drums with a capacity of 200 litres are filled with PCM and super-compacted. Typically an average of six of the resulting compacted 'pucks' are placed in larger, 500-litre capacity stainless steel drums, which are then in-filled with a cement grout, before being transported to a dedicated store. More effective and efficient characterisation of PCM has allowed some PCM to be re-categorised as LLW.

Magnox Encapsulation Plant (MEP)

L.5.27. MEP receives metallic cladding debris (swarf) produced during the de-canning of Magnox fuel at Sellafield. It has also received legacy Magnox cladding material that had previously been stored in bulk underwater in large silos elsewhere on the Sellafield site. Cladding from either source is tipped into 500-litre capacity stainless steel drums, which are then in-filled with a cement grout matrix and placed in HAW stores.

Waste Encapsulation Plant (WEP)

L.5.28. WEP encapsulates waste fuel cladding and slurries that arise from the reprocessing of oxide fuels in THORP. In addition, WEP has recently started to encapsulate sludges from the Pile Fuel Storage Pond (PFSP) in support of the Sellafield decommissioning and clean-up programme. Similar to the process employed in MEP, the waste cladding is placed in 500-litre capacity stainless steel drums, then in-filled with cement grout and subjected to in-drum mixing, prior to being placed in HAW stores.

Waste Processing and Encapsulation Plant (WPEP)

L.5.29. Flocs generated by the actinide liquid effluent clean-up plant are encapsulated in WPEP using the same in-drum mixing technique used in WEP and a similar 500-litre drum design.

Sellafield Liquid Effluent Treatment Plants

L.5.30. The management of radioactive liquid effluents at Sellafield takes place in a suite of treatment plants including; the Enhanced Actinide Removal Plant (EARP), the Solvent Treatment Plant (STP), the Salt Evaporator Plant (SEP), the Separation Area Lagoon, the Medium Active Liquor Tank Farm and the Segregated Effluent Treatment Plant (SETP)

L.5.31. The Site Ion Exchange Plant (SIXEP) uses a combination of filtration and ion exchange beds to remove suspended fine solids, soluble radioactive caesium and strontium from pond water prior to discharge. SIXEP has dedicated stores for the solid waste generated from its own processes and also helps maintain the thermal conditions of the pond water in the Fuel Handling Plant.

L.5.32. Future plans include:

- the development of a SIXEP Contingency Plant, which is ultimately expected to replace SIXEP's capability, as the site's effluent treatment requirements change; and
- diversion of effluent streams to EARP (away from SETP) following the cessation of reprocessing, allowing abatement of these discharges.

Future Sellafield Treatment Plants

L.5.33. A number of new treatment and storage plants have been built or are under construction at Sellafield, principally to support the retrieval of legacy wastes from the Legacy Ponds and Silos (LP and S) plant. These include:

- Local Sludge Treatment Plant (LSTP) which is now being used to support the export of sludge from PFSP to WEP for conditioning;
- Sludge Packaging Plant which is now being used for the interim storage of sludge retrieved from the First Generation Magnox Storage Pond (FGMSP);
- Self-Shielded Box Interim Store Facility, which is to be used to interim store legacy ponds solids
- Box Encapsulation Plant which is being constructed to treat HAW from LP and S; and
- Box Encapsulation Plant Product Stores (BEPPS) which is being constructed to store retrieved and conditioned waste from LPandS.

Engineered Storage for Conditioned Wastes

L.5.34. Sellafield features a series of modern stores for conditioned PCM wastes, miscellaneous solids, vitrified HAL, encapsulated Magnox swarf, THORP hulls and sludges, and encapsulated

waste from the on-site effluent treatment plants. Further additions to this suite of stores are being provided as required as above.

Interim PCM Drum Storage, Unconditioned Waste

L.5.35. A significant quantity of unconditioned PCM is currently stored in modern standard stores at Sellafield pending conditioning in a waste treatment plant and transfer to the engineered drum stores described above.

Ponds (excluding fuel storage)

L.5.36. The earlier fuel ponds at Sellafield contain, in addition to any remaining fuel and fuel debris, sludges and solid waste accumulated over the years. Plans have been developed and are being implemented to recover this waste and to store it in engineered interim storage facilities, pending the provision of future treatment plants and final disposal routes (see above).

ILW Silos

L.5.37. Two silos on the site have been used to store cladding material from Magnox and Pile fuel and other miscellaneous solid waste. Plans are being developed to recover this waste and to store it in engineered stores. Conditioning of this waste remains under consideration.

ILW Tanks

L.5.38. Liquid and sludge wastes are stored in a number of tanks and vessels on the site. These either form part of existing waste treatment processes or hold historic wastes awaiting a treatment process. In all cases, treatment plants exist or are planned to condition the waste into a solid form for storage in engineered stores.

Miscellaneous Stores

L.5.39. There are a number of other smaller-scale storage locations around the Sellafield site, typically used for radioactive wastes such as fuel assembly components, filters, sources and miscellaneous scrap.

Highly-Active Liquid (HAL) Wastes and Vitrification

L.5.40. Sellafield concentrates and stores the Highly-Active raffinates that arise from the reprocessing of nuclear fuel. New evaporative capacity is being provided to support the cessation of reprocessing and post operational clean-out activities. The ONR's regulatory strategy with regards to the HAL stocks at Sellafield is described in Section E – Legislative and Regulatory System.

Contaminated Ground and Groundwater

L.5.41. The Sellafield site has experienced serious leakage to ground of radioactive liquids in the past. An extensive programme of work has been carried out and is being supplemented further to characterise the extent of contaminated land, to model the movement of radioactivity in groundwater, and to identify appropriate remediation and treatment processes.

Calder Landfill Extension Segregated Area (CLESA)

L.5.42. CLESA is a landfill disposal site, licensed by the EA and constructed to modern standards for environmental protection, located within the Sellafield nuclear licenced site. Its purpose is to enable disposal of specified LLW and certain non-radioactive waste which otherwise would have to be disposed of at other licensed disposal sites within the UK. These wastes arise predominantly from decommissioning activities taking place at Sellafield.

Windscale

L.5.43. The Windscale portion of the Sellafield site features the following waste management facilities:

Active Handling Facility

L.5.44. The Active Handling Facility remains an operational post-irradiation examination facility for nuclear reactor fuel, which is also used for the treatment and packaging of LLW and ILW, and the handling of redundant sources.

WAGR Packaging Plant and Box Store

L.5.45. The WAGR Box Store provides interim storage for shielded boxes of waste from the decommissioning of WAGR. LLW is held pending transfer to the LLWR for disposal, and the ILW (and some LLW that is unsuitable for disposal to the LLWR) is stored pending an alternative long-term strategy or availability of a GDF. An improvement in waste packing efficiencies achieved by the WAGR project has made spare capacity available within the store. Options to utilise the available space for other types of ILW are being assessed to maximise the utilisation of this capacity.

Low-Level Waste Repository (LLWR)

L.5.46. The waste treatment, storage and disposal facilities at the LLWR comprise:

Grouting Facility

L.5.47. This plant receives ISO-freight containers laden with solid LLW from waste consignors around the UK. The containers are in-filled with a cement grout to produce a monolithic waste form, before being disposed of or stored in the LLWR vaults.

Trenches

L.5.48. LLWR features a series of seven clay-lined trenches where virtually all the UK's solid LLW arisings between the 1950s and 1988 were disposed of by tumble-tipping in a manner similar to conventional landfill. The trenches are now full to capacity and have been temporarily capped to minimise water entry. A project to install the final, multi-layer cap is about to commence.

Vaults 8 and 9

L.5.49. Since 1988 the LLW consigned to LLWR has been placed into concrete-lined surface-level engineered vaults that accept grouted ISO-freight containers laden with conditioned LLW. Both Vault 8 and Vault 9 are permitted for disposal. Historically some ad-hoc large waste items, such as redundant fuel transport flasks, were placed in Vault 8 and grouted in situ.

Magazine Retrieval and Decommissioning Facilities

L.5.50. Historically, PCM wastes were stored at the LLWR in a series of magazines, which have since been emptied and the PCM transferred to Sellafield. Five magazine retrieval facilities provided the arrangements to access the magazines to enable their decontamination, clean-up and decommissioning. These facilities are also being used to retrieve and package the secondary PCM waste that arises from the magazine decommissioning process. One of the retrieval facilities has been demolished; its associated magazine has been fully decontaminated and is awaiting demolition

PCM Assay Facility

L.5.51. This facility receives drums containing PCM waste for assay purposes and is used to store the waste drums prior to their transfer to Sellafield for long term storage.

PCM Drum Store

L.5.52. This legacy building was used to hold waste drums prior to their transfer to Sellafield for long-term storage. It was decommissioned and demolished in 2016.

Magnox Power Stations

L.5.53. Across the UK Magnox power stations, the principal waste storage facilities are:

- underground vaults;
- above-ground vaults;
- reactor voids;
- tanks; and
- packaged ILW storage facilities.

L.5.54. The wastes stored in these facilities are of three general types:

- solid (and some potentially mobile) ILW, which are activated and/or contaminated;
- wet wastes, such as sludges and resins, which are stored in tanks or in lined vaults; and
- wastes that have been encapsulated in a cementitious form.

L.5.55. Generally, the Magnox power stations are equipped with stores that have adequate capacity to contain the respective site's lifetime arisings. In some instances, where operational wastes have been conditioned into passive-safe solid forms as part of decommissioning, new regional storage facilities have been constructed to accommodate the conditioned wastes.

Dounreay

L.5.56. The main facilities for the management of radioactive wastes at Dounreay comprise:

Dounreay Cementation Plant for Immobilisation of ILW Liquors

L.5.57. This plant processes historical liquid wastes that arose from reprocessing of Materials Test Reactor fuel. These liquors are being emptied from storage tanks and immobilised in a cementitious matrix within 500-litre drums for long-term interim storage and future disposal. Options for the treatment of the remaining historical liquid waste that arose from the reprocessing of spent fuel from the Dounreay Fast Reactor and Prototype Fast Reactor are being reviewed.

Dounreay Wet Silo

L.5.58. The wet silo is an engineered store that contains long-lived solid ILW, stored under water together with the sludge resulting from operations and material degradation. The wet silo closed for the receipt of solid waste in 1998. Plans are being developed to retrieve the solid waste and sludge waste for processing for long-term interim storage.

Dounreay Shaft

L.5.59. The 65m-deep Dounreay shaft was originally excavated in order to remove spoil during the construction of a sub-sea effluent discharge tunnel. It was subsequently used for the disposal of solid ILW arisings from historical fuel-cycle operations during the period 1959 to 1977. The shaft has been isolated by a grout curtain to minimise the ingress of groundwater, in preparation for the retrieval of solid waste for encapsulation and the sludge waste for processing for long-term interim storage.

Low-Level Liquid Effluent Treatment Plant

L.5.60. This plant consists of: an underground effluent receipt tank; buffer tank; two main effluent holding tanks; and final filtration equipment. The main purpose of the plant was to adjust the pH of incoming low-active effluent and to settle the resulting sludge before discharging the effluent to sea.

Low-Level Waste Receipt Assay and Characterisation and Supercompaction Facility

L.5.61. This facility undertakes the assay and volume reduction of 200-litre drums of solid LLW. After super-compaction, the compacted drum pucks are loaded into half-height ISO containers for subsequent storage and disposal.

Unconditioned Solid Remote-Handled ILW 200-litre Drum Store

L.5.62. This facility stores arisings of solid remote-handled ILW. These arisings are being progressively transferred to the combined conditioned ILW 500-litre drum store and raw solid remote-handled ILW 200-litre drum store. Once all the waste has been treated and transferred, this store will be decommissioned.

Unconditioned Solid Contact-Handled ILW 200-litre Drum Store

L.5.63. This facility is currently used for storing arisings of plutonium-contaminated material, uranium-contaminated waste and thorium-contaminated waste, collectively known as contact-handled ILW.

Combined Conditioned ILW 500-litre Drum Store and Raw Solid Remote Handled Intermediate Level Waste (RHILW) 200-litre Drum Store

L.5.64. Used for storing immobilised liquors that arose from reprocessing of spent fuel from the Material Test Reactor and historical arisings of solid remote-handled ILW.

Liquid ILW Storage Facility

L.5.65. This facility provides tank storage for liquors from reprocessing of spent fuels from the Material Test Reactor, Dounreay Fast Reactor and Prototype Fast Reactor.

Solvents and Oil Storage Facility

L.5.66. This facility includes tanks holding ILW-contaminated solvent resulting from PFR fuel reprocessing, and bulk storage containers for low-level contaminated oils.

Dounreay LLW Disposal Facility

L.5.67. A facility for authorised disposal of solid LLW on the Dounreay licensed site was closed in 2005. All arisings of LLW at Dounreay since that date have been placed in interim storage on the site. In 2009, the SLC, DSRL, received planning permission from Highland Council for a new near-surface disposal facility for solid LLW, local to the site but outside the licensed nuclear site

boundary. Construction of the first vault began in December 2011 and was completed by spring 2014.

L.5.68. In November 2010, SEPA received an updated application under RSA93 from DSRL for an authorisation to dispose of solid LLW in the proposed new disposal facilities. SEPA undertook a formal determination process that involved a review and assessment of the application against all applicable legislation, policy and guidance. Following this determination process, SEPA issued a disposal authorisation in January 2013.

L.5.69. The new facility received its first conditioned LLW for disposal in the spring of 2015 following agreement from SEPA on its operational management systems.

Harwell

Solid Waste Complex

L.5.70. The solid waste complex provides facilities for the retrieval, processing and repacking of remote-handled ILW and a processing / packing area for contact-handled ILW and LLW operations, including decontamination. It also includes stores for remote-handled ILW, contact-handled ILW and drums of waste originally intended for sea disposal. A small effluent treatment plant has also been commissioned to deal with small quantities of active effluent arisings. A waste encapsulation plant is currently being commissioned for the purpose of processing the remote-handled ILW into a passive safe form.

Active Handling Facility

L.5.71. This facility was previously used for post-irradiation examination and consists of two concrete cell lines. The facility has undergone Post-Operational Clean Out (POCO) and is in a regime of care and maintenance.

Radiochemical Building

L.5.72. This building contains an interim store for contact-handled ILW, former radiochemical laboratories and a shielded remote handling facility. The building has undergone POCO and is currently in a regime of care and maintenance. Detailed decommissioning planning work is underway.

Liquid Effluent Treatment Plant

L.5.73. This plant originally contained several liquid effluent processing and treatment facilities as well as large below ground holding tanks. It is currently nearing the completion of Phase 1 decommissioning where all above ground structures will have been demolished. Phase 2 decommissioning has recently started in parallel and will eventually remove all below ground structures as well as complete re-mediation of the land. This will allow eventual delicensing of the area. Any active effluent arisings at Harwell (which are minimal) are now treated in a new facility in the solid waste complex.

Winfrith

L.5.74. The key waste management facilities at Winfrith (see Figure 14) are:

Treated Radioactive Waste Store

L.5.75. This store is a shielded engineered store providing long-term storage for the waste encapsulated in 500-litre drums. There is an opportunity to re-categorise the encapsulated sludge for disposal to the LLWR currently being progressed by Magnox.

Steam-Generating Heavy Water Reactor (SGHWR)

L.5.76. SGHWR is undergoing decommissioning. Parts of the facility have been used in the processing of legacy solid decommissioning wastes generated from across the Winfrith site. Processing activities include size-reduction and surface decontamination using abrasive cleaning.

Tradebe Inutec

L.5.77. Tradebe Inutec currently operates a complex of facilities dedicated to the management of radioactive wastes from a broad selection of UK nuclear sites, as a tenant of the Winfrith site licensee, Magnox. Amongst other specialist waste management services, Tradebe Inutec offers treatment of contaminated metals as part of the LLWR framework, which includes a link to the smelter at Siempelkamp in Germany accessed via transfrontier shipments.

Figure 9: Aerial View of the Winfrith Licensed Site

EDF Energy (Formerly British Energy Generation Ltd.)

L.5.78. The EDF Energy power stations feature the following principal radioactive waste storage facilities:

- vaults/voids – integral to the AGR reactor civil structures and used for storage of redundant reactor and fuel assembly components;
- wet waste storage tanks – either stainless steel or lined concrete cells used to store spent resins and sludges. At Sizewell B spent ion exchange resins are also stored in Ductile Cast Iron Containers (DCIC); and
- desiccant storage – provided by vaults at two AGRs and in-drum storage on other sites.

L.5.79. The wastes on EDF Energy sites are of the following general types:

- AGR fuel stringer debris – a product from dismantling of spent fuel assemblies prior to dispatch of elements to Sellafield. These wastes are almost all metallic and are stored in the integral voids described above.
- Other dry wastes – miscellaneous contaminated or activated components. These are significantly less radioactive than fuel stringer debris, but are still likely to remain ILW for many decades.
- Spent resins and sludges – ion exchange resins are used to manage the quality of water in fuel storage ponds. At Sizewell B resin is more extensively used than on the AGRs, due to the need to keep the primary circuit coolant water within tight chemical limits.
- Desiccants – used to minimise moisture within the primary circuits of AGRs. A process has been used to treat desiccants to remove their principal contaminant (tritium) at Winfrith, following which they are encapsulated and disposed of to the LLWR. However, washing and incinerating of desiccant is currently under consideration. This would reduce disposals to LLWR.

GE Healthcare

L.5.80. GE Healthcare Ltd. produces isotopes for use in medical diagnostics and scientific research.

L.5.81. The company previously managed three nuclear licensed sites in the UK, but ceased operations on its section of the Harwell site, decommissioned its facilities there and surrendered its site licence in 2012. The vacated plot is now subject of Magnox's nuclear site licence – GE Healthcare has no remaining nuclear liabilities on the Harwell site.

L.5.82. GE Healthcare has radioactive wastes stored at its two remaining UK licensed sites: the Grove Centre near Amersham and the Maynard Centre near Cardiff.

L.5.83. The Grove Centre has a long history of handling radioactive materials in numerous facilities since around 1940. The site manufactured radiopharmaceutical products, but throughput has reduced significantly in recent years as a result of a high proportion of the company's manufacturing business being transferred overseas. Many of the facilities at the Grove Centre have consequently been decommissioned, with resultant ILW placed within a purpose-built on-site store mainly inside 500-litre stainless steel drums. The store has sufficient capacity for all anticipated operational and decommissioning wastes. The site is implementing a decommissioning plan that will result in further generation of ILW for on-site storage pending ultimate disposal options. The strategy for radioactive wastes at Amersham is based on: treatment and prompt disposal wherever possible; decay storage (for later disposal via authorised routes); and long-term on-site storage to await availability of the proposed GDF.

L.5.84. The Maynard Centre was opened in 1980 for the manufacture of radiochemical products featuring Carbon-14 and Tritium. Manufacturing at the site ceased in 2010, since when the facilities have been substantially decommissioned and removed. The site will continue to manage and store ILW, making use of disposal routes to reduce the stored inventory over the coming years. The approach to dealing with some of the legacy wastes was determined following options studies and development of Radioactive Waste Management Cases as follows:

- disposal of carbon-14-bearing wastes via incineration; and
- decay storage of tritium-bearing wastes, followed by disposal via incineration and/or landfill.

Cyclife Metal Recycling Facility (MRF)

L.5.85. The MRF (formerly owned by Studsvik) was brought into operation in September 2009. All nuclear licensed sites in England and Wales are able to consign metallic waste for recycling to the MRF. Sites in Scotland can also apply to SEPA for an authorisation to have their metallic wastes treated at the MRF. The purpose of the facility is to reduce the volumes of metallic waste needing disposal at the LLWR, while recovering valuable uncontaminated metal for recycling. The site processes low-level radioactive metals using a range of techniques including size reduction and shot blasting. Cyclife can also co-ordinate trans-frontier shipment of radioactive metallic wastes to facilities in Sweden for treatment by melting.

National Nuclear Laboratory (NNL)

L.5.86. NNL provides services covering the complete nuclear fuel cycle from fuel manufacture and power generation, through reprocessing and waste treatment to disposal. It includes defence, new nuclear build and security, supported by a range of links with international research organisations, academia and other national laboratories. It has laboratory facilities at Sellafield, Windscale, Springfields and Workington, together with office locations elsewhere.

L.5.87. The UK Government undertook a strategic review of NNL in 2012. This recommended that the NNL's mission be amended and re-stated, with renewed emphasis on its primary function of carrying out R and D to support UK national programmes, particularly the decommissioning of the UK's nuclear legacy.

L.5.88. NNL's role was clarified and restated in the UK Government's Nuclear Industrial Strategy in March 2013, with NNL's work to support major Government nuclear programmes explicitly recognised as a key part of its mission. NNL then published a new mission statement, highlighting support to the UK's decommissioning programme alongside electricity generation from existing nuclear power stations. NNL is now a Government-owned, Government-operated organisation (GoGo).

L.5.89. In relation to the future development of nuclear energy, the Government announced a £250 million programme of research in 2015, with a key element being focused on the development of Small Modular Reactors (SMRs). Other key areas to be funded – in line with the recommendations of the Nuclear Innovation and Research Advisory Board – include nuclear fuels; advanced nuclear manufacturing; reactor design; and recycling technology. NNL has a science and technology strategy that focuses on key research areas (including those listed), which are important for the organisation's future growth, and that provides a focus for the maintenance and development of critical nuclear skills, which is a Government objective.

Decommissioning Facilities

Article 32.2: This report shall also include:

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

L.5.90. A list of the main UK nuclear facilities that are in the process of being decommissioned, and the status of decommissioning activities at those facilities, is shown below.

Sellafield

Facility	Date of Closure	State of Decommissioning
First reprocessing plant	1973	In progress. Priority is being given to removal of the redundant ventilation stack on top of this facility. This stack supported Magnox reprocessing but has now been replaced by a new stack and ventilation system.
Solvent purification plant	1973	Plant and equipment removed.
Analytical facilities	c.1960s	Plant and equipment being removed from redundant laboratories.
Pilot reprocessing plant	1980s	Removed.
Fast reactor fuel plant	1988	Most plant and equipment removed.
MOX fuel demonstration plant	2003	In progress.
Calder Hall power station	2003	Reactors undergoing defueling.
Solid waste store	c.1970s	Material being recovered and repacked for modern stores.
Windscale Advanced Gas cooled Reactor (WAGR)	1981	Reactor has been decommissioned. Only the bioshield, the external clad sphere and some ancillary plant remains.
Windscale Piles (including chimneys)	1957	Reactors have been defueled with the exception of the fire affected zone. Plant supporting the reactors has been removed or disconnected. One chimney has been significantly reduced in height. Work on the second chimney is underway.
Plutonium purification plants (several)	Various	Most plant and equipment removed, some buildings removed. Removal of a contaminated ventilation ducting is progressing.
Uranium purification plant.	1990s	Plant, equipment and building removed.
Floc Storage tanks	1994	Flocs arising from liquid effluent treatment are being retrieved, encapsulated and placed in HAW stores.

Magnox sludge settling facility	1984	Sludge removed, plant and equipment being removed.
Pile Fuel Storage Pond (PFSP)	1960	The nuclear fuel has been removed and is now stored in modern engineered storage facilities. Pond sludge is being retrieved and encapsulated in the Waste Encapsulation Plant.
Pile Fuel Cladding Silo (PFCS)	1967	Construction work continues to allow waste retrievals operations to commence in the next few years.
First Generation Magnox Storage Pond (FGMSP)	1990	The transfer of sludge to sludge buffer tanks has commenced. The transfer of Magnox fuel to more modern storage facilities is planned to start in 2016/17.
Magnox Sludge Storage Silo (MSSS)	1990	Some swarf was retrieved and encapsulated in the 1990s. Successful transfers of silo liquor are now routine and are transferring soluble mobile inventory to the SIXEP plant for capture on ion-exchange media. The first of three waste retrieval machines is currently being installed at the facility and is expected to start to retrieve waste over the next couple of years.

Dounreay

Facility	Date of Closure	State of Decommissioning
Materials Test Reactor (MTR)	1969	Reactor Stage 2 decommissioning complete and now in care and maintenance. Associated pond emptied and decommissioned. Associated cave for post-irradiation examination activities ready for final demolition. ILW packages have all been removed from the remote-handled ILW storage area and this is ready for final demolition.
Experimental Dounreay Fast Breeder Reactor (DFR)	1977	Destruction of the liquid metal coolant from the primary circuit was completed in 2012. Development is continuing of techniques for removal of sodium potassium residues from the internal surfaces of the reactor and associated equipment. The Breeder Fuel Removal facility has been constructed and is going through a full commissioning schedule prior to operations.
Prototype Fast Reactor (PFR)	1994	Stage 1 decommissioning is in progress. The bulk sodium from the core, secondary circuits and irradiated fuel cell has been removed and destroyed. The secondary circuits have completed Stage 3 decommissioning. Plant design for removal of residual sodium from the internal surfaces of the reactor and associated equipment is underway.

Range of analytical and metallurgical laboratories and fuel examination facilities	Part operational	Decommissioning of the fume cupboard and glove-box shielded labs has been completed. Decommissioning of the remaining shielded labs will commence at the cessation of operations in 2014.
Facility for handling and examination of irradiated fuel	2006	Stage 2 decommissioning completed on the redundant cells and currently progressing through Stage 3 decommissioning.
Post-irradiated examination (PIE) facility	1993	Stage 2 decommissioning completed on redundant cells and now prepared for commencement of Stage 3 decommissioning.
Plutonium-handling building	1963	Decommissioned and demolished.
Shaft and Silo disused ILW storage facilities	1977 and 1999 respectively	The shaft has been hydraulically isolated from surrounding bedrock by cementitious grouting via a matrix of boreholes. Design work being progressed on the retrieval facility. Waste will be retrieved from the ILW Shaft and Silo at the earliest practicable date.
Plants for the reprocessing of mixed-oxide fuels, and associated facilities	2001	Stage 1 decommissioning underway.
Fuel reprocessing plant	1998	Stage 1 decommissioning completed and currently undergoing Stage 2 decommissioning.
MTR fuel fabrication facility	2005	Facility now decommissioned and demolished.
Uranium processing facility	2006	Redundant areas have completed Stage 2 decommissioning. Stage 1 decommissioning of the remaining plant has commenced.
LLW treatment plant	2004	Decommissioned and demolished.

Harwell

Facility	Date of Closure	State of Decommissioning
Low-energy, graphite reactor	1990	Reactor fully decommissioned. Graphite core incinerated at an off-site facility.

Experimental graphite reactor	1968	Stage 2 decommissioning complete. Reactor in care and maintenance. Decommissioning due to start in 2017.
Materials testing reactors	1990	Stage 2 decommissioning largely complete. Reactors in care and maintenance.
Radiochemistry laboratory	Facility largely in a state of care and maintenance	The majority of former operational areas cleared and decontaminated. Facility is in a state of care and maintenance. The facility is used to store CHILW drums. Decommissioning project activities are underway.
PIE concrete-shielded cells	Facility largely in a state of care and maintenance	Stage 1 decommissioning complete. Facility in a state of care and maintenance.
PIE lead-shielded cells	Progressive closure completed in 1995	Fully decommissioned.

Low-Level Waste Repository

Facility	Date of Closure	State of Decommissioning
Magazine 4	2007	All decontamination, decommissioning and clean-up activities complete. Waiting to be demolished.
Magazines 3, 5, 9 and 10	2007	Undergoing decontamination, decommissioning and clean-up activities prior to demolition.

Windscale

Facility	Date of Closure	State of Decommissioning
Air-cooled, graphite reactor	1957	Pile 1 is currently in surveillance and maintenance. Work to remove fuel and isotopes from the fire-damaged area of the reactor core has been deferred to focus funding on higher-hazard facility decommissioning.
Air-cooled, graphite reactor	1957	Pile 2 is currently in care and maintenance.
Windscale advanced gas-cooled reactor	1982	Facility is moving into surveillance and maintenance.

(WAGR)		
Fuel examination facility	1995	Facility is moving into surveillance and maintenance.
Lead-shielded cells, used for PIE of fuel	Part operational	Facility is currently in surveillance and maintenance.

Winfrith

Facility	Date of Closure	State of Decommissioning
Experimental high-temperature helium-cooled power reactor (DRAGON)	1976	All fuel has been removed from site. All plant and equipment removed from the secondary containment building. Work has commenced on final decommissioning.
Zero energy reactor to support fast reactor core physics (ZEBRA)	1982	Reactor now fully decommissioned.
Steam-Generating Heavy Water Reactor (SGHWR)	1990	All fuel has been removed from site. All plant and equipment in the secondary containment has been removed. Reactor is currently in care and maintenance pending Stage 3 decommissioning.
PIE facility	2001	Fully decommissioned.

Magnox Power Stations

The decommissioning strategy being implemented at each Magnox power station site comprises three stages:

- Stage 1: Preparations for care and maintenance, which involves the removal of much of the conventional plant, retrieval and packaging of the accumulated operational wastes, and decontamination and removal of the ancillary systems.
- Stage 2: Care and maintenance period (safestore), in which the reactors will be maintained in a safe enclosure while radioactive decay occurs.
- Stage 3: Final reactor dismantling and site clearance.

Station	Date of Cessation of Generation	State of Decommissioning
Berkeley	1989	• Defueled in 1992 and spent fuel transferred to

		Sellafield for reprocessing; • All 16 boilers transferred to a Swedish LLW smelting and recycling facility; • Fuel ponds drained, pond equipment removed and pond structure demolished; • Reactor buildings placed into Stage 2 (safestore) in 2010; • Construction of ILW Interim Store complete; • Retrieval, processing and packaging of ILW underway.
Trawsfynydd	1993	• Defueled in 1996 and spent fuel transferred to Sellafield for reprocessing; • Construction of ILW Store complete; • Fuel ponds drained, pond equipment removed and decontamination of the pond structure is well advanced; • Retrieval, processing and packaging of ILW underway; • Requirement for off-site emergency plan lifted.
Hunterston A	1990	• Defueled in 1995 and spent fuel transferred to Sellafield for reprocessing; • Construction of ILW Store complete; • Retrieval, processing and packaging of ILW underway; • Fuel ponds draining and cleaning progressing; • Requirement for off-site emergency plan lifted.
Chapelcross	2004	• Defueled in 2013 and spent fuel transferred to Sellafield for reprocessing; • Pond 1 drained and sealed, work underway on Pond 2; • Cooling towers demolished; • ILW Store construction commenced; • Retrieval of ILW has commenced; • Requirement for off-site emergency plan lifted.
Bradwell	2002	• Defueled in 2005 and spent fuel transferred to Sellafield for reprocessing; • Fuel ponds drained, pond furniture removed and the structure sealed;

		• Reactor building de-planting and safestore construction completed; • Construction of ILW Store complete; • ILW retrieval and packaging operations well advanced; • Requirement for off-site emergency plan lifted; • Plans to enter early care and maintenance are on target.
Hinkley Point A	2000	• Defueled in 2004 and spent fuel transferred to Sellafield for reprocessing; • Ponds drained and stabilised; • Retrieval, processing and packaging of ILW has commenced; • Requirement for off-site emergency plan lifted.
Calder Hall	2003	• Currently being defueled (55% complete).
Dungeness A	2006	• Defueled in 2012 and spent fuel transferred to Sellafield for reprocessing; • Retrieval, processing and packaging of ILW is underway; • Ponds draining in preparation; • Requirement for off-site emergency plan lifted.
Sizewell A	2006	• Defueled in in 2014 and spent fuel transferred to Sellafield for reprocessing; • Ponds draining in preparation; • Retrieval, processing and packaging of ILW is at the design stage; • Requirement for off-site emergency plan lifted.
Oldbury	2012	• Defueled in 2016 and spent fuel transferred to Sellafield for reprocessing; • Ponds draining in preparation; • Retrieval, processing and packaging of ILW is at the design stage.
Wylfa	2015	• Currently being defueled (35% complete).

Spent Fuel Inventory

Article 32.2: This report shall also include:

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

L.5.91. Spent fuel inventory in the UK as at 1 April 2016.

L.5.92. No spent fuel has been disposed of in the UK to date.

L.5.93. The UK's current stock of spent fuel consists mainly of Magnox, AGR and PWR fuels, but also includes small stocks of various spent experimental fuels. Spent fuels designated as a waste are reported alongside other waste streams in the UK Radioactive Waste Inventory. Notably, this includes GLEEP fuel, Dragon fuel and Zenith fuel, small quantities of irradiated thorium and PFR mixed breeder sections. As a result, these spent fuels are not included within the figures stated in Table 4, which account for those fuels not yet designated as a waste.

L.5.94. A summary of the inventory follows in Table 4 (Reference 170).

Table 4: UK-Owned Irradiated Fuel (Mass in Stocks 1 April 2016 and Estimated Future Arisings (tHM)

Location	Description	Stock at 1 April 2016[1]		Estimated Future Arisings
		In Reactor	In Storage	
Sellafield	Magnox fuel		750	[2]
	AGR fuel		~2,400	[3]
	SGHWR fuel		120	0
	WAGR fuel		31	0
	Other fuels [4]		~850	0
Dounreay	DFR breeder fuel	32	1	0
	PFR		10	0
	Other fuels		<1	0
Magnox power stations [5]	Magnox fuel	~1,200	49	0
AGR power stations	AGR fuel [6]	~1,600	40	~2,500
PWR power station	PWR fuel [7]	90	550	410

Others	Various		~1 [1]	0
Total		~2,900	~4,800	~2,900

1. *Fuel "in reactor" is that in reactor cores. Fuel "in storage" has been removed from reactor cores to storage facilities;*
2. *See Magnox power stations for future transfers of spent fuel to Sellafield;*
3. *See AGR power stations for future transfers of spent fuel to Sellafield;*
4. *Includes former overseas LWR fuel transferred to UK ownership and 1.6 tHM DFR breeder fuel transferred from Dounreay;*
5. *Includes Calder Hall on the Sellafield site;*
6. *From date provided by EDF Energy and from best available public domain information;*
7. *Comprises low irradiated fuels at Harwell.*

Radioactive Waste Inventory

Article 32.2: This report shall also include:

(iv) an inventory of radioactive waste that is subject to this Convention that:

- is being held in storage at radioactive waste management and nuclear fuel cycle facilities;
- has been disposed of; or
- has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

L.5.95. A summary of the 2016 UKRWI is given in Table 5 to Table 9. Full information about the UK's Radioactive Waste and Materials Inventory is publicly available in Reference 171.

Table 5: Radioactive Wastes from all Sources Stock at 1 April 2016 (Reported Volumes, Masses and Package Numbers)

Waste Type	At 1.4.2016	Reported Volume (m^3)(1)	Reported Mass (tonnes)(1)	Packaged Volume (m^3)	Number of Packages(4)
HLW	Total	1,960	3,700		
	Not yet packaged	1,100	1,400	-	-
	Already packaged	867	2,300	1,130	5,781
ILW	Total	99,000	120,000		

[1] Comprises low irradiated fuels at Harwell

	Not yet packaged[2]	67,800	62,000	-	-
	Already packaged	31,200	59,000	41,400	60,407
LLW	Total	30,100[3]	40,000		
	Not yet packaged	19,500	25,000	-	-
	Already packaged	10,600	15,000	14,300	648
VLLW	Total	935	1,100		
	Not yet packaged	935	1,100	-	-
	Already packaged	0	0	-	-

1. *Volume and mass "not yet packaged" are for untreated or partly treated waste; volume and mass "already packaged" are the conditioned volume and corresponding mass for wastes that have been encapsulated in a cement-based material, polymer or glass (i.e. waste streams with a /C in the identifier).*
2. *ILW "not yet packaged" includes 1,550 m3 reported volume that is expected to become LLW as a result of decontamination or decay storage.*
3. *LLW includes 120 m3 reported volume of mixed VLLW/LLW at Springfields.*
4. *ILW package numbers include 1,928 of 1803-type mild steel drums. These drums are expected to be over packed in larger capacity boxes (6 drums per box). LLW package numbers exclude those in short-term storage before consignment to the LLWR or other disposal routes, and include 645 packages with waste that is being stored unconditioned at Dounreay.*

Table 6: Estimated Future Arisings up to 2125 (Reported Volumes, Masses and Package Numbers)

Waste Type	Reported Volume (m^3)	Reported Mass (tonnes)	Packaged Volume (m^3)	Number of Packages
HLW[1]	See Note 2	See Note 2	366	1,870
ILW[3]	191,000	190,000	299,000	108,000
LLW[4]	1,320,000	1,600,000	1,570,000	69,600
VLLW	2,860,000	2,900,000	2,720,000	0
Total	4,360,000	4,700,000	4,580,000	180,000

1. *HLW does not include waste from reprocessing overseas spent fuel that will be exported to the country of origin, and assumes substitution arrangements are implemented (see Section 8 for further information.*
2. *From 1 April 2016 there is a net decrease in the reported volume and mass of HLW because accumulated HAL is being conditioned, which reduces its volume and mass by about two-thirds, and also because vitrified HLW is being exported to overseas customers.*

3. *ILW includes 6,030 m3 reported volume of waste that is expected to become LLW as a result of decontamination or decay storage.*

4. *LLW includes 213,000 m3 reported volume of mixed VLLW/LLW at Springfields.*

Table 7: Total Wastes in Stock at 1 April 2016 and Estimated Future waste Arisings up to 2125

Waste Type	Reported Volume (m^3)	Reported Mass (tonnes)	Packaged Volume (m^3)	Number of Packages
HLW(1)	1,150	3,000	1,500	7,650
ILW	290,000(2)	310,000	449,000	229,000
LLW	1,350,000(3)	1,700,000	1,600,000	71,600(4)
VLLW	2,860,000(5)	2,900,000	2,720,000	See Note 6
Total	4,490,000	4,900,000	4,770,000	308,000

1. *For HLW the reported volume and mass are for conditioned waste. The volume and mass do not include waste from reprocessing overseas spent fuel that will be exported to the country of origin, and assume substitution arrangements are implemented (see Section 8 for further information).*

2. *ILW includes 7,580 m3 reported volume that is expected to become LLW as a result of decontamination or decay storage.*

3. *LLW includes 214,000 m3 reported volume of mixed VLLW/LLW at Springfields.*

4. *Includes only those wastes packaged for disposal to the LLWR and Dounreay LLW vaults (packaged volume 1,360,000 m3). Excludes LLW streams and component parts of LLW streams whose characteristics make them suitable for recycling, incineration or appropriately permitted landfill disposal.*

5. *Includes 2,700,000 m3 reported volume from facility decommissioning at Sellafield. However the current best estimate, albeit based on Ltd. decommissioning experience, is that 70% of this material may be 'out of scope' of regulatory control (i.e. not radioactive for the purposes of UK legislation).*

6. *As VLLW can be disposed to appropriately permitted landfill sites no package numbers are reported for this waste category in the UK Inventory.*

Table 8: Total Annual Disposal to the Low-level Waste Repository 2006-2015

Year	Total volume (m^3)(1)
2006	12,900
2007	9,100
2008	8,600
2009	7,000
2010	4,830

2011	6,700
2012	4,820
2013	5,090
2014	3,280
2015	3,630
2016[2]	1,220

1. Volume is for waste and its primary containment.
2. *Up to 31 March 2016.*

Table 9: Total Annual Disposals to the Dounreay Low-level Waste Facility 2015-2016

Year	Total volume (m^3)[1]
2015	2,050
2016[2]	1,080

1. *Volume is for packaged waste.*
2. *Up to 31 March 2016.*

Section L.6 – List of Primary Website Addresses

Committee on Radioactive Waste Management	CoRWM	http://corwm.decc.gov.uk/
Committee on Medical Aspects of Radiation in the Environment	COMARE	www.comare.org.uk
Department for Business, Energy and Industrial Strategy	BEIS	https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy
Department for the Environment, Food and Rural Affairs	Defra	https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
Department for Transport	DfT	https://www.gov.uk/government/organisations/department-for-transport
Dounreay Site Restoration Limited	DSRL	www.dounreay.com
EDF Energy	EDF	www.edfenergy.com/
Environment Agency	EA	https://www.gov.uk/government/organisations/environment-agency
Food Standards Agency	FSA	www.food.gov.uk/
Food Standards Scotland	FSS	http://www.foodstandards.gov.scot
GE Healthcare		www3.gehealthcare.co.uk/
Health and Safety Executive	HSE	www.hse.gov.uk/index.htm
International Commission on Radiological Protection	ICRP	www.icrp.org/
LLW Repository Limited	LLWR	http://www.llwrsite.com/
Magnox Limited		https://magnoxsites.com/
Nuclear Decommissioning Authority	NDA	www.nda.gov.uk
National Nuclear Laboratory	NNL	www.nnl.co.uk
Natural Resources Wales	NRW	http://naturalresourceswales.gov.uk/?lang=en
Northern Ireland	NIEA	https://www.daera-ni.gov.uk/

Environment Agency		
Office for Nuclear Regulation	ONR	www.onr.org.uk/
OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic	OSPAR	www.ospar.org/
Public Health England	PHE	https://www.gov.uk/government/organisations/public-health-england
Scottish Environment Protection Agency	SEPA	www.sepa.org.uk/
Sellafield Ltd.	SL	www.sellafieldsites.com/
Scottish Government	SG	www.scotland.gov.uk/Home
Cyclife UK		https://www.cyclife-edf.com/en/meta-home/cyclife
Tradebe Inutec		www.inutec.co.uk
UK Nuclear Regulators – New Reactors Assessment	GDA	http://www.onr.org.uk/new-reactors/index.htm
URENCO Capenhurst Ltd.		www.urenco.com
West Cumbrian Sites Stakeholder Group		www.wcssg.co.uk/
Westinghouse Springfields Fuels		http://www.westinghousenuclear.com/springfields

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Glossary and Abbreviations

ABWR	Advanced Boiling Water Reactor
ACOP	Approved Code Of Practice
ADN	European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterway
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
AGR	Advanced Gas-cooled Reactor
AGROP	Advanced Gas-cooled Reactor Operating Plan
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
AP1000	The Westinghouse Electric Company's design of pressurised water reactor (PWR) currently being assessed by the UK's Office for Nuclear Regulation
ASN	Autorité de Sûreté Nucleaire (French Nuclear Safety Authority)
AWE	Atomic Weapons Establishment
BAT	Best Available Techniques
BEIS	The UK Government Department for Business, Energy & Industrial Strategy
BEPPS	Box Encapsulation Plant Product Store
BMS	Business Management System
BNFL	British Nuclear Fuels Ltd
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
BSO	Basic Safety Objective
BSSD 96	EC Basic Safety Standards Directive 96/29/Euratom
BSSD 2013	EC Basic Safety Standards Directive 2013/59/Euratom
C&M	Care & Maintenance
CA	Competent Authority
CAA	Civil Aviation Authority

CBA	Cost Benefit Analysis
CEAR	Compilation of Environment Agency Requirements
CFP	Cavendish Fluor Partnership
CHILW	Contact-Handled Intermediate Level Waste
CIDI	Central Index of Dose Information
CNI	Chief Nuclear Inspector
CNS	Convention on Nuclear Safety
CNS Report	UK's Fifth National Report on Compliance with the Convention on Nuclear Safety
Co-60	Cobalt 60
COBR	Cabinet Office Briefing Room
COMAH	Control of Major Accident Hazards
COMARE	Committee on Medical Aspects of Radiation in the Environment
CORE	Control of Occupational Radiation Exposure
CoRWM	Committee on Radioactive Waste Management
COSHH	Control of Substances Hazardous to Health
CRCE	Centre for Radiation, Chemical and Environmental Hazards, part of Public Health England
CRWG	Community Representation Working Group
DAERA	Department of Agriculture, Environment and Rural Affairs (Northern Ireland)
DBA	Design Basis Accident
DCIC	Ductile Cast Iron Container
DCP	Dounreay Cementation Plant
DECC	The UK Government Department of Energy and Climate Change (now BEIS)
Defra	The UK Government Department for Environment, Food and Rural Affairs
DFR	Dounreay Fast Reactor
DFS	Dry Fuel Store
DfT	The UK Government Department for Transport

DGD	Dangerous Goods Division (of DfT)
DoH	The UK Government Department of Health
DRS	Direct Rail Services (a subsidiary of the NDA)
DSRL	Dounreay Site Restoration Limited
EA	The Environment Agency
EA95	The Environment Act 1995
EARP	Enhanced Actinide Removal Plant, located at Sellafield
EC	European Commission
EDF	Électricité de France
EDRAM	Environmentally Safe Disposal of Radioactive Material
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIADR99	Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (also amended in 2006)
EMM	Enforcement Management Model
ENSREG	European Nuclear Safety Regulators Group
EOC	Emergency Operation Centre
EOC	(The UK Government) Emergency Operation Centre
EPA90	Environmental Protection Act 1990
EPD	Electronic Personal Dosimeter
EPO	Environmental Protection Officer
EPR	European Pressurised Water Reactor
EPR10	Environmental Permitting Regulations 2010
EPR16	Environmental Permitting Regulations 2016
EPS	Enforcement Policy Statement
ESC	Environmental Safety Case
EU	European Union

FDP	Funded Decommissioning Programme
FFI	Fee For Intervention
FGMSP	First Generation Magnox Storage Ponds
FHP	Fuel Handling Plant
FINAS	Fuel Incident Notification Analysis System
FLoC	Final Letter of Compliance
FOIA2000	Freedom of Information Act 2000
FSA	Food Standards Agency
FSS	Food Standards Scotland
GB	Great Britain
GDA	Generic Design Assessment
GDF	Geological Disposal Facility
gDSSC	Generic Disposal System Safety Case
GLEEP	Graphite Low Energy Experimental Pile
GLO	Government Liaison Officer
GOGO	Government-Owned, Government-Operated
Government	The UK Government and the devolved administrations of Scotland, Wales and Northern Ireland, unless stated otherwise
GRA	Guidance on Requirements for Authorisation
GRR	Guidance on Requirements for Release of nuclear sites from radioactive substances regulation
GSR	General Safety Requirements
GTA	Government Technical Adviser
HA	Highly-Active
HAL	Highly-Active Liquor
HALES	Highly-Active Liquor Evaporation and Storage plant at Sellafield
HASS	High Active Sealed Sources
HASS Regulations	High-activity Sealed Radioactive Sources and Orphan Sources Regulations 2005

HAW	HAW is defined by UK Government as the collection of: HLW, ILW, and the relatively small proportion of LLW that is not currently suitable for disposal in existing LLW disposal facilities (due to some chemical, physical or radiological property that is incompatible with the extant waste acceptance criteria).
HEU	Highly-Enriched Uranium
HLW	High-Level Waste
HPC	Hinkley Point C
HSE	Health and Safety Executive
HSSSEQ	Health, Safety, Security, Safeguards, Environment and Quality
HSW(NI)078	Health and Safety at Work (Northern Ireland) Order 1978
HSWA74	Health and Safety at Work etc. Act 1974
IAEA	International Atomic Energy Agency
ICAO	International Civil Aviation Authority
ICRP	International Commission on Radiological Protection
ILW	Intermediate-Level Waste
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organisation
IN	Improvement Notice
INES	International Nuclear and Radiological Event Scale
INF Code	Safe Carriage of Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships
INS	International Nuclear Services
IPT	Integrated Project Team
IRR99	Ionising Radiations Regulations 1999
IRRS	Integrated Regulatory Review Service
IRS	International Reporting System for Operating Experience
IRX	Inter-Reactor Fuel Transfer
ISFSI	Independent Spent Fuel Storage Installation, under construction at Sizewell B (also known as DFS)
ISO	Intermodal Shipping Container

IWS	Integrated Waste Strategy
Joint Convention	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
LC	Licence Condition under the Nuclear Installations Act 1965
LEU	Low-Enriched Uranium
LLW	Low-Level Waste
LLWR	Low-Level Waste Repository
LLWR Ltd	LLWR Limited, the Site Licensee Company for the UK Low Level Waste Repository near Drigg in Cumbria
LoC	Letter of Compliance
LP&S	Legacy Ponds and Silos, located at Sellafield
LSTP	Local Sludge Treatment Plant (Sellafield)
LTP	Lifetime Plan
LWR	Light Water Reactor
MCA	Maritime and Coastguard Agency
MCI	Miscellaneous Contaminated Items
MEP	Magnox Encapsulation Plant, located at Sellafield
MHSW99	The Management of Health and Safety at Work Regulations 1999
microGy	microGray
MoD	Ministry of Defence
MOP	Magnox Operating Programme
MoU	Memorandum of Understanding
MOX	Mixed-Oxide (fuel)
MRDU	Mobile Radiation Detection Unit
MRF	Metals Recycling Facility
MRWS	Managing Radioactive Waste Safely
MSA95	Merchant Shipping Act 1995
MSN	Merchant Shipping Notice 1875
SSS	Magnox Swarf Storage Silo

mSv	milliSievert
MTR	Materials Test Reactor (Dounreay and other locations in the UK)
NAIR	National Arrangements for Incidents involving Radioactivity (for orphan sources)
NDA	Nuclear Decommissioning Authority
NDPB	Non-Departmental Public Body
NEA	Nuclear Energy Agency
NEAF	Nuclear Emergency Arrangements Forum
NEBR	Nuclear Emergency Briefing Room
NEP&R	Nuclear Emergency Planning and Response
NEPLG	Nuclear Emergency Planning Liaison Group
NERC	Natural Environment Research Council
NESA	Nuclear Energy Skills Alliance
NIA65	Nuclear Installations Act 1965
NIEA	Northern Ireland Environment Agency
NII	Nuclear Installations Inspectorate (historically a part of HSE's Nuclear Directorate, which on 1 April 2011 became part of the Office for Nuclear Regulation)
NLF	Nuclear Liabilities Fund
NLFAB	Nuclear Liabilities Financing Assurance Board
NMP	Nuclear Management Partners
NNB	Nuclear New Build
NNL	National Nuclear Laboratory
NORM	Naturally Occurring Radioactive Material
NPS	Nuclear National Policy Statement
NRCC	Nuclear Resilience Coordination Committee
NRG	Nuclear Regulation Group (within the EA)
NRI	Nuclear Research Index
NRN	Nuclear Research Needs

NRW	Natural Resources Wales
NSA	National Skills Academy
NSG	Nuclear Suppliers Group
NSIP	Nationally Significant Infrastructure Project
NSSG	Nuclear Skills Strategy Group
OCNS	Office for Civil Nuclear Security
OECD	Organisation for Economic Co-operation and Development
OELG	Operational Experience Liaison Group
ONR	The Office for Nuclear Regulation
OPEX	Operational Experience
ORO	Offence Response Options
OSPAR	The Convention for the Protection of the marine Environment of the North-East Atlantic (the 'OSPAR Convention') was open for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris on 22 September 1992
PBO	Parent Body Organisation
PCM	Plutonium-Contaminated Material
PFCS	Pile Fuel Cladding Silo
PFR	Prototype Fast Reactor (at Dounreay)
PFSP	Pile Fuel Storage Pond
PIE	Post-Irradiation Examination
PN	Prohibition Notice
PNTL	Pacific Nuclear Transport Limited
POCO	Post Operational Clean Out
PSA	Probabilistic Safety Analysis
PSR	Periodic Safety Review
PWR	Pressurised Water Reactor
QA	Quality Assurance
R&D	Research and development

R2P2	'Reducing risks, protecting people: HSE's decision-making process'
RAM	Radioactive Materials
RANET	Response and Assistance Network
RATE	Radioactivity and the Environment
RCIS	Redgrave Court Incident Suite
RED	Restructuring Effective Date
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
REPs	Radioactive Substances Regulation Environmental Principles
RHILW	Remote-handled ILW
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
RIFE	Radioactivity in Food and the Environment
RIMNET	Radiation Incident Monitoring Network
RPS	Regulatory Position Statement
RSA93	Radioactive Substances Act 1993
RSR	Radioactive Substances Regulation
RSRL	Research Sites Restoration Ltd (now part of Magnox)
RSRL	Research Sites Restoration Limited - the Site Licensee Company for Harwell and Winfrith
RSS	Radioactive Substances Strategy
RWI	Radioactive Waste Inventory
RWM	Radioactive Waste Management Limited (a wholly-owned subsidiary of the NDA)
RWMC	Radioactive Waste Management Case
SAA	Severe Accident Analysis
SAPs	Safety Assessment Principles
SCC	Strategic Co-ordination Centre
SCG	Strategic Coordinating Group

SEP	Salt Evaporator Plant (Sellafield)
SEPA	Scottish Environment Protection Agency
SES-SSG	Site End State Strategic Steering Group
SETP	Segregated Effluent Treatment Plant
SFAIRP	So Far As Is Reasonably Practicable
SGHWR	Steam-Generating Heavy Water Reactor
SGoRR	Scottish Government Resilience Room
SIXEP	Sellafield Ion Exchange Plant
SLC	Site Licence Company
SNM	Special Nuclear Materials
SOF	Store Operations Forum
SPRS	Sellafield Product and Residue Store
SSA	Strategic Siting Assessment
SSC	Structure, System & Component
STEM	Science, Technology, Engineering and Mathematics
STP	Solvent Treatment Plant (Sellafield)
SWESC	Site Wide Environmental Safety Case
TAG	Technical Assessment Guide
TEA13	The Energy Act 2013
THORP	Thermal Oxide Reprocessing Plant, located at Sellafield
TIG	Technical Inspection Guide
TOR	Tolerability of Risk
UCP	URENCO Chemical Plant Limited, at URENCO Capenhurst
UF6	Uranium hexafluoride
UK	The United Kingdom of Great Britain and Northern Ireland
UKAEA	United Kingdom Atomic Energy Authority
UKNWM	UK Nuclear Waste Management Ltd

UKRWI	UK Radioactive Waste Inventory
USA	The United States of America
USNRC	United States Nuclear Regulatory Commission
VLLW	Very-Low-Level Waste
WAGR	Windscale Advanced Gas-cooled Reactor
WAMAC	Waste Monitoring and Compaction Plant
WENRA	Western European Nuclear Regulators' Association
WEP	Waste Encapsulation Plant, located at Sellafield
WMP	Waste Management Plan
WPEP	Waste Processing and Encapsulation Plant
WTC	Waste Treatment Complex
WVP	Waste Vitrification Plant, located at Sellafield
ZEBRA	Zero Energy Breeder Reactor Assembly