Department of Energy & Climate Change

THE UNITED KINGDOM'S SIXTH NATIONAL REPORT ON COMPLIANCE WITH THE CONVENTION ON NUCLEAR SAFETY OBLIGATIONS

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Foreword

This report has been prepared by the United Kingdom (UK) to meet the requirement of Article 5 of the Convention on Nuclear Safety (the Convention). It considers each of the Convention's obligations and explains how the UK addresses them.

The report only covers land based civil nuclear power plant as defined in Article 2 of the Convention. The safety of other UK nuclear facilities that fall outside the scope of this Convention is also regulated to the same standards, so as to ensure that they are operated in a manner that maintains a high level of safety.

The nuclear industry in the UK continues to evolve, as does the regulatory body. Of particular note are proposals for new reactor build, with developers bringing forward proposals for new nuclear power stations totalling 16 GW. Other areas of the UK nuclear industry continue to have new build projects, such as enrichment and waste management, but these will be addressed in the next UK report to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Following the accident at the Fukushima Dai-ichi nuclear power plant, the UK nuclear operators, the regulatory body and the UK Government embarked on a major review of safety systems, regulatory standards and guidance and frameworks to identify whether any corrective actions were required. The UK report to the Second Extraordinary Meeting of the Convention in 2012, provided details of the review, the measures identified by the licensees to further enhance resilience of the UK Nuclear Power Plants and the outcome of the review of the safety assessment principles by the UK regulatory body. It was concluded that within the UK nuclear safety system there have been no significant corrective actions necessary to comply with the obligations of the Convention.

The UK's nuclear safety licensing regime has proved to be effective which, together with the high priority given to safety by the UK nuclear utilities, has stood the country well in times of great change. Furthermore, the periodic safety review 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. This activity will continue in the future. This is not to say that the UK is complacent, far from it. The UK is committed to ensuring that the nuclear industry controls its hazards effectively, has a culture of continual improvement and sustains excellence across the nuclear estate. Whilst safety challenges remain, especially in dealing with the ageing of facilities, it is considered that the UK nuclear safety system being well-founded on the requirements of the Convention and the IAEA Fundamental Safety Principles, is in a strong position to meet the challenges.

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Section 1 – Introduction

Nuclear power programmes in UK

1.1. At the United Kingdom (UK) presentation to the Convention on Nuclear Safety (the 'Convention') Review Meeting in April 2011, it was reported that the UK Government had decided that nuclear power would be an integral part of the country's future energy strategy. A major programme of activity to assess the safety of new reactor designs concluded in December 2012 with issue of Design Acceptance Confirmations (Ref 1) by the UK nuclear regulatory body, Office for Nuclear Regulation (ONR). Plans are underway to begin the safety assessment of other new reactor designs in the near future. Since 2011 there has been significant progress towards implementing the new build programme including the issue of the first nuclear site licence for a nuclear power plant in 25 years (Ref 1). The decision to enable a new nuclear programme continues to influence major changes in those organisations concerned with the implementation of the new build strategy. These changes, and their implications on safety, are addressed in this report.

1.2. In the UK, nuclear power has been part of the energy mix since 1956, providing typically 15-20% of the country's electrical energy needs today. Currently, the UK has a fleet of operating gas-cooled reactors and one operating pressurised water reactor. Many of these were designed and built over 30 years ago and they continue to command the focus of attention for ONR and the UK Government. In addition, the UK has facilities that are not in the scope of this Convention but do require continuing commitment to safety. These include several decommissioning reactors, nuclear research facilities, nuclear fuel manufacture, fuel reprocessing facilities and radioactive waste storage facilities.

1.3. The UK remains committed to the Convention on Nuclear Safety. It has taken steps to ensure that safety is given a priority in the design and building of new reactors and continues to ensure that licensees regard safety as the priority for all operating reactors. Sound legislative and regulatory structures are in place and the UK participates fully in international programmes to enhance and promote nuclear safety.

Structure of the report

1.4. This report explains how the nuclear installations in the UK achieve the high safety standards required by the Convention. Each Article of the Convention is addressed separately in the main text of this, the UK's sixth, report. This report does not consider matters related to the safety of those nuclear installations that have been addressed by the UK's submissions for the review meetings of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the 'Joint Convention') or which are outside the scope of either of these Conventions.

1.5. For the purpose of this report, the term 'the Government' means the UK Government unless otherwise stated.

Basis of the report

1.6. In addition to the Convention itself and the Guidelines regarding the production of National Reports (Ref 2), the UK has used a number of other sources to inform the structure and development of this report. These include the:

- Summary Report of the President of the Fifth Review Meeting (Ref 3), regarding the key safety issues discussed at the fifth review meeting;
- Rapporteur's report for the United Kingdom from the fifth review meeting;

- The President's Report to the 2012 Extraordinary Meeting of the Convention (Ref 4) ; and the
- Written and verbal questions raised (and the answers given) on the UK's 2011 report to the Convention and on the presentation made at the review meeting in April 2011.

1.7. In general, in terms of scope, the UK report follows the guidelines provided in the International Atomic Energy Agency (IAEA) document (Ref 2). However, to ease the understanding of the reader, the following structure is adopted in this report.

- Section 2: provides a summary of recent organisational changes to the regulatory body, the UK response to the accident at the Fukushima Dai-ichi nuclear plant and other significant development since the UK report to the fifth Convention.
- Section 3: provides summary of nuclear safety issues at UK nuclear power stations as well as follow-up information on those issues that were identified in the fifth Report.
- Section 4: identifies those issues raised at the fifth Review Meeting in the President's Summary Report and in the Rapporteur's Report for UK. The Section directs the reader to the main body of the report where the specific issues are addressed.
- Section 5: provides a list of issues identified in the President's Report to the 2012 Extraordinary Meeting of the Convention with reference to the main body of the report where the issues are addressed.

In effect, therefore, Sections 2-5 together form that part of the report that is referred to as a "Summary" in the IAEA document (Ref 2).

1.8. The main body of the report addresses UK compliance with each of the Articles 6 – 19. Annexes are included where appropriate. Each Article incorporates the suggested topic areas in INFCIRC/572/Rev3 where they are considered applicable to the UK. Where compliance with the Convention is demonstrated in a way that has substantially changed since the fourth UK report the extent of the change is noted at the beginning of each Article or Annex.

1.9. It is recognised that changes are occurring rapidly in the UK and consequently some aspects of this report may also become out of date by the time that it reaches other parties. For the purposes of this Convention, the report is representative of the position on 1 May 2013. Changes occurring after this date will be reported in the UK presentation to the Convention Review Meeting in March 2014.

Section 2 - Significant developments since the report to the 2011 Convention

Changes to the Regulatory Body

Energy Bill

2.1. In November 2012, the Secretary of State for Energy and Climate Change confirmed in Parliament the Introduction of the Energy Bill. The Bill will establish a legislative framework for delivering secure, affordable and low carbon energy and includes provisions on *inter alia* Electricity Market Reform and placing the interim Office for Nuclear Regulation on a statutory footing. If enacted, the new statutory body will continue to be known as the Office for Nuclear Regulation and will continue regulating the relevant statutory functions that it is currently responsible for.

Creation of ONR as an Agency of HSE and move towards Public Corporation Status

2.2. In the Nuclear White Paper (January 2008) (Ref.5), the UK Government announced it would be working with the regulators of the nuclear industry to explore ways of enhancing further the transparency and efficiency of the regulatory regime, without diminishing its effectiveness. The Government embarked on this work in order to ensure security of electricity supply in the UK and to meet challenges of new nuclear power stations in a competitive global market. Dr Stone, an advisor to Government Ministers, was appointed to carry out the review of the nuclear regulatory environment to ensure that it is in line with the Government's ambition to make the UK a world leader in the safe, efficient use of nuclear energy, including a highly effective and efficient regulatory system. The recommendations of the review undertaken by Dr Stone were summarised in the UK report to the fifth Convention. The UK Government is currently bringing forward legislation to create a new independent nuclear regulator, the Office for Nuclear Regulation. ONR, which initially was formed on 1 April 2012 as a non-statutory Agency of the Health and Safety Executive (HSE), functions as a sector-specific regulator of the nuclear industry. It has taken on the relevant functions previously carried out by the HSE's Nuclear Directorate and the Department for Transport's Radioactive Materials Transport Team, which is responsible for the regulation of the transport of radioactive, material by road, rail or inland waterway. This move brought together civil nuclear and radioactive transport safety and security regulation into a single regulatory body. ONR is committed to a culture of continuous improvement, maintaining high standards and demonstrating regulatory good practice within the principles of transparency, accountability, proportionality, targeting and consistency while creating a modern and flexible organisation.

Creation of ONR Board

2.3. As part of the creation of ONR as an Agency of HSE, an ONR Board was appointed in April 2011. The ONR Board is made up 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.

Chief Nuclear Inspector's Advisory panel

2.4. The ONR Board acknowledged that a mechanism is needed to ensure the Chief Nuclear Inspector has access to independent strategic technological advice. A process to establish a Chief Nuclear Inspector's Advisory Panel has been initiated. Setting-up the Chief Nuclear Inspector's Advisory Panel also means that ONR has

delivered on a recommendation that arose from the House of Lord's Science and Technology Select Committee report published November 2011 (Ref 6) into Nuclear Research and Development Capabilities.

ONR's Organisational Structure

2.5. Central to delivery of ONR's core activities are effective governance arrangements and a flexible organisational structure. To achieve this, ONR has been restructured into two main functions, a Regulatory Function and an Assurance Function.

2.6. ONR's Regulatory Function is responsible for delivery of ONR's nuclear programmes. The regulation of similar sites is organised into Programmes, each headed by a Programme Director. This structure allows ONR to better focus on strategic context of the sites, it is more closely aligned with the way industry is structured and enhances the efficiency and consistency of its regulatory activities.

2.7. The Assurance Function is responsible for ONR's corporate centre which includes the Corporate Programme Management Office, Policy (domestic and international), Finance and Human Resources. A significant aspect of the Assurance Function is Regulatory Assurance. Regulatory Assurance is set-up to enhance arrangements for ensuring that ONR's regulatory decisions are robust and have been subject to independent review and challenge. The Regulatory Assurance function also secures internal compliance with ONR's own arrangements. ONR's 'Regulatory Assurance' Programme also leads on ONR's strategic regulatory themes such as emergency preparedness and response; review and development of ONR's technical standards and associated business processes; knowledge management; research and technical support activities; and special regulatory and technical projects.

2.8. Other organisational changes include establishment of:

- Regulatory Strategy Group to strengthen regulatory governance arrangements;
- Resource Review Panel to ensure alignment of organisational priorities with budget/ resource allocation
- The role of First Deputy Chief Inspector to act in the role of the Chief Nuclear Inspector when required

2.9. ONR's organisational structure is covered in more detail in Article 8.

Creation of ONR's Programme Management Office

2.10. In order to enhance its effectiveness and efficiency of regulation, ONR has established a programme management office (PMO). The PMO provides the means for clear and consistent planning and prioritisation of regulatory activities and the allocation of resources to these. The PMO also ensures that business and regulatory risks are managed consistently across ONR. The PMO achieves its objects using modern project management tools and by developing procedures and guidance for use across ONR.

2.11. The PMO is part of ONR's Finance and Corporate Services Programme and acts as the focal point for collection of business and regulatory performance information from ONR programmes and forward submission of this information to ONR's management team.

Staffing of ONR

2.12. Since gaining Ministerial agreement in 2011, ONR has successfully recruited 77 Nuclear Safety and Security specialists. A number of initiatives are being explored to enable ONR to attract specialists with appropriate skills to maintain its core capability needs, ensuring that ONR builds a resilient organisation. Further details and examples of ONR's initiatives are provided in Article 8.

IAEA Integrated Regulatory Review Service Missions

2.13. The IAEA Integrated Regulatory Review Service (IRRS) is intended to enhance and strengthen the effectiveness of a national regulatory body. UK decided in 2003 to invite a series of modular IRRS missions. The IRRS Mission in 2013 will be the third and final mission in this series.

2.14. Senior representatives from IAEA, together with the 2013 IRRS mission team leader and deputy leader, visited ONR offices on 14 and 15 February 2013 for a Preparatory Meeting following the guidelines set out by the IAEA. Prior discussions with the IAEA team had led to general agreement on the scope of the mission. The meeting involved a presentation of progress against recommendations and suggestions from previous missions and discussions on the contents of the advance reference material package which must be sent to the IAEA for consideration by the team members in preparation for the mission.

2.15. In order to prepare appropriately for the mission, and following the IAEA guidelines for the conduct of an IRRS mission, ONR conducted a thorough self-assessment regarding the themes within the scope of the 2013 mission. The themes for the 2013 Mission are decommissioning, radioactive waste and radiation protection. ONR also reviewed every finding outstanding from the previous missions in 2006 and 2009. The self-assessment and finding review process and outcomes are being subjected to Department for Work and Pensions (DWP) internal audit during June 2013. An international team of regulatory peers will also review these findings in July 2013 prior to the arrival of the IRRS mission team in October. This audit and peer review are not only to aid evaluation of ONR's readiness for the mission and the robustness of evidence to be provided, but also to capture lessons to enhance future ONR activities. This IRRS Mission provides an important international peer review and opportunity to further increase ONR's regulatory effectiveness through learning and continuous improvement.

2.16. With conclusion of the 2013 Mission, the UK will have completed a full scope Mission.

Changes to licensee organisations and the UK nuclear Installations

2.17. In 2011, EDF Energy UK Ltd, which was the licensee for the majority of the nuclear reactor sites in the UK, was renamed to EDF Energy Nuclear Generation Ltd (EDF NGL). EDF NGL established a new company for new build, NNB Generation Company Limited (NNB Genco), which was granted a nuclear site licence in November 2012 for the planned new nuclear power plant (NPP) at Hinkley Point C.

2.18. The organisational changes to Magnox Ltd were detailed in the fifth UK report to the Convention. Further details on the UK operational NPPs are provided in Article 6.

2.19. Since the fifth UK report to the Convention, The defuelling of the Magnox Station, Dungeness A, has been complete and the Station has been verified to be fuel-free.

New nuclear power plants in the UK

UK Government policy on new nuclear power plant

2.20. In July 2011, the Government published a Nuclear National Policy Statement (Ref. 7) which listed eight sites as potentially suitable for new nuclear power station construction up to the end of 2025, and set out the basis for decisions on applications for development consent to build new nuclear power stations. Decisions are to be made under the terms of the Planning Act 2008 by the Secretary of State for Energy

and Climate Change on the basis of a recommendation from the Planning Inspectorate.

Licensing of organisations for new nuclear power plants

2.21. In July 2011 EDF NGL made an application for development consent for a new nuclear power station at Hinkley Point in Somerset in the southwest of England. The Secretary of State approved the application in March 2013. This project will proceed, subject to a final investment decision by the company.

2.22. The Nuclear Decommissioning Agency (NDA) sold part of its sites at Wylfa, Bradwell, Oldbury and Sellafield, which has enabled new operators to participate in the proposed new build programme. Horizon, a company, originally established as a partnership between RWE and E.ON, was bought by Hitachi-GE in November 2012 with the intention of building at least 6 GW of new nuclear capacity in the UK at sites in Wylfa and Oldbury. A third consortium called NuGen, a partnership between GDF SUEZ SA and Iberdrola SA, has also set-out plans to build up to 3.6 GW of new nuclear capacity at a site adjacent to Sellafield (in Cumbria in the north west of England), purchased as part of the NDA's programme of asset disposals.

Planning reform

2.23. Following the change of Government in 2010, the new Government introduced a number of changes via the Localism Act 2011 (Ref. 8) to provide more democratic accountability. The responsibility for examining planning applications for nationally significant structures was transferred to the Planning Inspectorate with final decisions made by the relevant Secretary of State.

2.24. Energy National Policy Statements (NPSs) (Ref. 9) were finalised and ratified by Parliament in July 2011. They provide a basis for decisions on applications for development consent for all major energy infrastructure projects. There are two NPSs that are relevant to the development of new NPPs. These are:

- the Overarching Energy NPS, that sets out the Government's energy policy. It explains the need for new energy infrastructure and how the impacts of energy infrastructure development in general should be assessed; and
- the Nuclear NPS, that contains supplementary information specific to nuclear installations.

2.25. The draft Nuclear NPS listed sites that the Government judged to be potentially suitable for the deployment of new nuclear power stations by 2025. This was an output of the Government's Strategic Siting Assessment (SSA) process (Ref. 10). The details of the SSA criteria and process are addressed in Article 17. The regulator has an important role in securing the safety of public and the environment from design through to the decommissioning phase of an NPP and this is reflected in the NPS.

Generic Design Assessment

2.26. The UK followed a process, similar to the "design certification" approach adopted by the US regulator, to assess the generic design of NPPs used by multinational vendors which are not under the direct control of any UK organisation, and thereby not regulated by ONR. However, ONR applied its Safety Assessment Principles (SAPs), the associated Technical Assessment Guides (TAGs) and international standards and guidance during the Generic Design Assessment (GDA) process. The GDA process was described in detail in the fifth UK report to the Convention and is not repeated here. However, ONRs experience of the process and its outcomes are detailed in Article 18.

Completion of Generic Design Assessment for the UK European Pressurised Water Reactor and AP1000

2.27. In December 2011 ONR issued interim Design Acceptance Confirmations for the EDF and AREVA (UK European Pressurised water Reactor, EPR™ reactor) and Westinghouse (AP1000® reactor) designs. This indicated ONR was content with how the designers intended to resolve the GDA Issues raised during the assessment. Westinghouse chose to pause work at that time, but EDF and AREVA continued work to resolve GDA Issues on the UK EPR™. In December 2012 ONR issued a Design Acceptance Confirmation for the UK EPR™, indicating that the GDA Issues had been successfully resolved and that ONR considers this reactor design to be suitable for construction in the UK, subject to the satisfactory resolution of Assessment Findings and the production of a site specific safety case.

New generic design assessment

2.28. On the 15 January 2013, ONR and the Environment Agency received a formal request from the Minister of State for Energy to start generic design assessment work on a new nuclear reactor for the UK - the UK Advanced Boiling Water reactor (UK ABWR).

2.29. The requesting party for the UK ABWR is the Japanese company Hitachi-GE Nuclear Energy Ltd. ONR and the Environment Agency will work with Hitachi-GE during their joint assessment of the generic reactor design. ONR has begun discussions with both the Department of Energy and Climate Change and the requesting party to explore achievable safety, security and environmental deliverables as well as timescales for assessment and necessary resources.

Regulating New build

Licensing strategy for new NPPs

2.30. The process for licensing of nuclear installations for new nuclear power reactors in the UK is outlined in Office for Nuclear Regulation's (ONR) document 'Licensing nuclear installations' published in June 2012 (Ref. 11). The document addresses:

- the law and the regulatory regime;
- the nuclear licensing process; and
- delicensing.

2.31. It provides basic regulatory information and links to other reference documents that potential licensees need to be aware of. This document is subject to regular review to ensure that it remains current and that it reflects legal and policy developments and captures learning from the application of the licensing process.

New Nuclear Site Licence

2.32. In November 2012, ONR granted the first new site licence for a UK nuclear power station in 25 years. The licence was granted to NNB Generation Company (NNB GenCo), which is proposing to build a new nuclear power station at Hinkley Point in Somerset in the southwest of England. The new power station would comprise two UK European Pressurised Water Reactors (EPRs). ONR worked closely with the Environment Agency to assess the generic design of this reactor.

Radioactive waste

2.33. The Government is currently reviewing the site selection process elements of the Managing Radioactive Waste Programme, and intends to launch a public consultation in autumn 2013 on how the process for implementing geological disposal might be improved. The Government remains firmly committed to geological disposal as the right policy for the long-term and secure management of higher-activity waste. The Government also continues to hold the view that the best means

of selecting a site for a geological disposal facility is an approach based on voluntarism and partnership.

The UK response to the implications of the Japanese earthquake and tsunami for the UK nuclear industry

2.34. Following the accident in the Fukushima Dai-ichi nuclear power plant the UK participated in the processes initiated by the UK Government and following bodies:

- IAEA
- European Commission
- Convention on Nuclear Safety

2.35. In response to the Secretary of State for Energy and Climate Change's request, the Chief Nuclear Inspector of ONR initiated work to examine the circumstances of the Fukushima accident to see what lessons could be learnt to enhance the safety of the UK nuclear industry. This resulted in a number reports publised by the Chief Nuclear Inspector as summarised below.

- The Chief nuclear Inspector's Interim Report into the Implications of the Fukushima accident for the UK nuclear Industry- 18 May 2011 (Ref 12)
- The ONR Chief Nuclear Inspector's Final Report which included non-reactor facilities – 11 Oct 2011 (Ref 13)
- Japanese earthquake and tsunami: Implementing the lessons for the UK nuclear industry (Implementation Report) (Ref 14)

The UK also participated to the IAEA work and as summarised below:

- The IAEA fact-finding mission to Japan led by ONR Chief Nuclear Inspector in May 2011
- Participating and contributing in the IAEA General Conference in Sep 2011 which endorsed an IAEA Action Plan in response to the IAEA Ministerial Conference in June 2011

2.36. In addition, on 25th of March 2011, the European Commission declared that "the safety of all EU nuclear plants should be reviewed, on the basis of a comprehensive and transparent risk assessment ("stress test")." Following this, on 13th of May 2011, the European Nuclear Safety Regulators (ENSREG) agreed the technical definition of these stress tests and how these should be applied to the nuclear facilities across Europe. UK contributed to the ENSREG work as summarised below.

- Results of the stress test presented to ONR by licensees in October 2011 and the UK national report was submitted to the Commission in December 2011. The national reports were peer reviewed through a process organised and overseen by ENSREG and the peer review report was published in Apr 2012.
- ENSREG subsequently developed an action plan which was agreed on 1 Aug 2012 which included that each national regulator develop and publish its national action plan in response to their report findings.
- In April 2013 ENSREG held a workshop to peer review the content and status of implementation of the national action plans.

2.37. UK also produced a report for the second Extraordinary Meeting of the Convention on Nuclear Safety, in August 2012, which took full account of the lessons learned from the Fukushima accident.

2.38. The following Sections provide further details of UK's work in response to the Fukushima accident.

The ONR Chief Nuclear Inspector's Interim and Final Reports on the UK response to the Japanese earthquake and tsunami for the UK nuclear industry

2.39. The ONR Chief Nuclear Inspector's Interim Report (Ref. 12) was published in May 2011. Following this Interim Report further information became available from the IAEA and other nation's regulatory activities as well the Chief Nuclear Inspector's fact finding mission into the Fukushima accident. A wider Final Report (Ref. 13) was then published in October 2011 by the Chief Nuclear Inspector covering all types of nuclear installations in the UK.

2.40. As part of the Fukushima Interim and Final reports thirty six recommendations were identified by the ONR Chief Nuclear Inspector with the view to produce a follow-up report into their implementation. The general recommendations of the Final Report (Ref. 13) were principally aimed at the UK's response to civil nuclear emergencies from both an international and a national perspective. Also included in this Section were recommendations relating to UK involvement and support for global safety standards, and the adequacy of planning controls for developments near nuclear licensed sites.

2.41. As part of the Fukushima Interim and Final reports, a number of recommendations were raised on ONR which fall into the following groups:

- review of safety assessment principles;
- consideration of emergency response arrangements;
- oversight of nuclear safety research; and
- openness and transparency.

2.42. Progress with implementation of these recommendations as well as matters identified as part of the IAEA Action Plan and the European Council stress tests reviews was reported in the Chief Nuclear Inspector's Fukushima Implementation report in October 2012 (Ref. 14) and are summarised below in paragraphs 2.52 to2.62.

IAEA Fact Finding Mission to Japan following the Fukushima Dai-ichi Accident

2.43. The ONR Chief Nuclear Inspector led the first post-accident IAEA high-level team of international nuclear experts in a fact-finding mission to Japan in May 2011. The Chief Nuclear Inspector reported back to a Ministerial Conference of the IAEA in June 2011 and the mission team produced a report (Ref. 15). A crucial initial finding of the mission team was that the tsunami risk for several sites in Japan had been underestimated. It also concluded that regulatory systems should ensure that there are adequate arrangements for addressing extreme events, including periodic review of those arrangements. The IAEA subsequently developed an Action Plan on Nuclear Safety (Ref.16), which was endorsed at its General Conference in September 2011.

European Council "Stress Tests" for UK nuclear power plants

2.44. The UK lessons learnt and EC stress tests assessments shared common themes and the UK licensees and the regulatory body, ONR, used the same or similar teams to ensure the reviews were completed efficiently and effectively. As a result of the ONR's inspections and technical exchange meetings with the licensees along with a review of the licensees' submissions, ONR concluded in its report that the UK licensees had completed adequate stress tests reviews in line with ENSREG specification. Notwithstanding this, ONR was clear that, up to that point, the licensees had concentrated on demonstrating compliance with modern standards for "design basis" events.

2.45. Neither the reviews undertaken by the licensees for the stress tests, nor the earlier national reviews indicated any fundamental weaknesses in the definition of design basis events or the safety systems related to the stress tests to withstand them for UK NPPs. However, the reviews acknowledged that there are opportunities for improving methodologies used for example in the area of "beyond design basis" events to ensure greater robustness for events beyond the design basis. ONR continues to monitor the licensees' work to ensure implementation of reasonably practicable safety improvements already identified to enhance the resilience of emergency response equipment and severe accident procedures in a timely manner. To-date ONR is satisfied with the progress made by the licensees and in this area.

2.46. Given that the EC stress tests only focus on NPPs, the ONR Chief Nuclear Inspector decided to extend the stress test process to all other licensed nuclear installations within the UK. These sites are outside the scope of this report.

2.47. In response to the ENSREG Action Plan (Ref. 17) produced in response to the peer review of the stress tests performed on European NPPs, in December 2012, ONR prepared a report for ENSREG (Ref.18). The report specifically answers the request for a regulator's national action plan, associated with post-Fukushima lessons learned and stress test peer review recommendations and suggestions. The report outlined how the UK will continue to implement the lessons learnt from Fukushima.

The Second Extraordinary Meeting of the Convention

2.48. During the 5th Review Meeting of the Convention the Contracting Parties in attendance agreed to hold an Extraordinary Meeting in accordance with Article 23, taking into consideration the Fukushima Dai-ichi accident. It was agreed that "… *a short and concise National Report will be developed by each Contracting Party …*". The Extraordinary Meeting of the Convention took place in August 2012. The national reports presented to the Extraordinary Meeting concentrated on the actions, responses and new developments that were initiated or influenced by the accident at the Fukushima Dai-ichi nuclear power plants. The UK report (Ref. 19) summarised the analysis work, the main conclusions, and highlighted identified weaknesses within the current safety justifications. It also confirmed the high levels of safety of the UK NPPs and the plans to enhance this by taking into account the lessons learnt from the Fukushima accident.

2.49. The basis of the UK report presented to the Extraordinary Meeting was:

- Japanese Earthquake and tsunami: Implications for the UK nuclear industry Chief Nuclear Inspector's Interim Report (Ref. 12).
- Japanese earthquake and tsunami: Implications for the UK nuclear industry – Final Report (Ref. 13).
- European Council "Stress Tests" for UK Nuclear Power Plants. National Report (Ref. 18).

A number of actions were identified and these have been summarised in section 4 of the report (Ref. 19).

Fukushima Implementation Report

2.50. The Fukushima Implementation Report was published in Oct 2012 and covered all types of nuclear installation in the UK. In addition to considering the recommendations from the Chief Nuclear Inspector's Interim and Final Reports (Refs. 12 and 13), the Implementation Report included updates on the progress in addressing the outcomes from the European Council "Stress Tests" undertaken in the UK and the IAEA Action Plan. The Implementation report set-out the regulatory approach with regards to progress made by the UK licensees with implementation of

the recommendations as well as reporting of future progress. This report also reflected on the significance of international cooperation and ONR's part in these activities.

2.51. As anticipated, there were a range of longer term improvements or activities that need to be delivered over timeframes extending beyond those for the Fukushima Implementation report. ONR committed to securing the delivery of "Fukushima learning" oversight activities into its operational regulatory programmes (which relate to civil nuclear reactors, Sellafield, decommissioning and waste management, and relevant UK defence sites). The following sub-sections provide a summary of progress made with the recommendations.

General recommendations

2.52. The general recommendations of the "Final Report" (Ref. 13) were principally aimed at the UK's response to civil nuclear emergencies from both an international and a national perspective. Also included in this section were recommendations relating to UK involvement and support for global nuclear safety standards, the adequacy of planning controls for developments near nuclear licensed sites, and openness and transparency.

Response to Nuclear Emergencies

The UK Government is coordinating improvements to the UK's arrangements in responding to nuclear emergencies through the Nuclear Emergency Strategic Programme. The Government has confirmed that it continues to work with its partners internationally to progress work on enhancing nuclear safety standards, and to work towards improving the dissemination of information under the Convention on Early Notification of a Nuclear Accident. In addition the UK has become a member of IAEA's global Response and Assistance Network (RANET). The implementation of the recommendations in relation to the national response is covered in detail in Article 16.

Global Nuclear Safety Standards

2.53. In relation to international safety standards, ONR actively cooperates with other nuclear regulators worldwide, including under the auspices of the IAEA, the Organisation for Cooperation and Development's Nuclear Energy Agency, ENSREG and the Western European Nuclear Regulator's Association (WENRA). Furthermore licensees have also re-affirmed their support for international organisations such as IAEA, and their intentions to use their interactions with such bodies to further enhance the safety of their plants. The UK also welcomes international peer reviews of its regulatory approach, and has already agreed dates for the next IAEA Integrated Regulatory Review Service (IRRS) mission to the UK in September 2013.

Planning Controls

ONR included the specific recommendation on examining the adequacy of planning controls in its response to the Government's consultation exercise for its proposed National Planning Policy Framework for England. As planning is a devolved matter, the Government has confirmed that it will pursue the issue with the UK's Devolved Administrations (Scotland, Wales and Northern Ireland).

Openness and Transparency

2.54. The final part of the general recommendations raised in ONR's Chief Nuclear Inspector's Final Report related to delivery of more open and transparent communications with the public and other stakeholders. Significant work has been undertaken by the Government, ONR and the Industry to further enhance openness and transparency in policy development, regulation and the challenges within the industry sector. Details of the initiatives and work undertaken in this area are provided in Articles 8 and 9.

Recommendations on ONR

Review of ONR's Safety Assessment Principles and Other Guidance and Standards

2.55. ONR established a project to review and revise its Safety Assessment Principles (SAPs) and associated technical assessment and inspection guidance and their implementation. The review of ONR's technical assessment and inspection guidance is now complete however as part of a rolling programme, further work will be undertaken to maintain and review these as necessary. To date, ONR's review of the SAPs has confirmed that there are no significant gaps, although a small number of technical areas have been identified for which amplification and clarification of the principles would be beneficial, mainly related to coverage of severe accidents. The majority of the changes to be made to the SAPs are effectively to bring them up to date in terms of the six years' of operating experience that ONR has gained working with the current version and to reflect changes to the industry and ONR over this period. The review of SAPs will be completed in December 2013.

2.56. In addition to the review of its safety assessment principles and the supporting guidance, ONR has also committed to periodic review of its standard licence conditions to be completed two years following the proposed date for ONR to become a public corporation. Whilst the lack of an existing periodic review process has not caused any major issues for ONR and the licensees, a review will ensure that licence conditions remain fit for purpose. This means that learning from experience of application of licence conditions, feedback from licensees, development in technical and organisational standards and wider developments in law and the nuclear industry will be properly considered and incorporated into licence conditions where necessary.

2.57. ONR also reviewed its guidance on Periodic Safety Reviews (PSR), which are required under the licensing regime, to take account of the increased international focus on effective PSR following the Fukushima accident. ONR expects that the safety case should not be limited to design basis events, but should also consider the resilience of the plant, staff and processes to events beyond the design basis. (ONR's expectation with regards to the PSR process is detailed in Article 6).

Emergency Response Arrangements

2.58. ONR remains firmly committed to improving the effectiveness and robustness of its own emergency preparedness and response arrangements, in order that it is better placed to respond to a prolonged nuclear event either in the UK or overseas. This commitment was demonstrated a national nuclear emergency exercise carried out in February 2012. The exercise successfully tested arrangements and response capability of a UK licensee as well as other responding and advisory organisations, across the UK estate, over an extended period of 48 hours. Valuable lessons were learnt during the exercise and ONR will continue to work closely with the Government and other UK organisations to further advance UK's capability in this area.

2.59. The future nuclear emergency exercise programme for fixed nuclear installations within the UK has secured opportunities to test the on-site and off-site response for prolonged periods. Such exercises are intended to test the prolonged delivery and sustainability of the on-site, the off-site and central government responses. The exercises are also intended to highlight areas for further improvements, which will inform reviews of on site and off site emergency plans and feed into future work programmes. The findings will inform reviews of the duration of the future nuclear emergency exercises. ONR's established arrangements were shown to have been effective in responding to the Fukushima accident, and have proven effective in the few instances in which ONR had to respond to minor events in

the UK. However, the Fukushima accident highlighted some opportunities for improvement, particularly in relation to ONR's capability to provide a sustained response to a prolonged emergency. An internal review has since resulted in a proposal for improvements to ONR's response to initial notifications of nuclear emergencies (including severe accidents), and for ensuring the prompt deployment of trained staff to remote locations and to ONR's central emergency response centre - the Redgrave Court Incident Suite (RCIS). Such improvements include developing arrangements for predicting potential radioactive plumes and potential off-site doses. Details of progress made in this area is provided in Article 16 of this report.

Research

2.60. Since the nuclear accident at Fukushima, ONR has undertaken a review of its strategic oversight of nuclear safety and security related research, and its arrangements for commissioning and managing research and specialist technical support. The review will inform the development of a revised ONR Research and Technical Support Strategy, which will be published in the near future. This strategy, which is supported by a detailed implementation plan, sets out the important role research and technical support plays in underpinning our regulatory decisions, the challenges we face going forwards, and how we plan to overcome these.

2.61. The main mechanism used by ONR to take forward its research priorities is the Nuclear Research Needs process, which is part of ONR's Research and Technical Support Strategy and represents ONR's view of what research is needed to support existing nuclear facilities. This is used by the nuclear site licensees to inform the development of their own research strategies. ONR is able to commission any research areas not taken forward by the nuclear site licensees and then recover the costs from the licensees via a levy. ONR's intention is to publish a single ONR Research Needs report in late 2013 covering all of ONR's research requirements, including those in the decommissioning, fuel and radioactive waste areas.

Progress by the nuclear Industry – Recommendations and Stress Test Outcomes

2.62. A significant number of recommendations and "stress test" findings were placed on the nuclear industry and the industry also developed its own considerations developed during the undertaking of the "stress tests". ONR has and will continue to review progress against all of these, for all licensees. However, these recommendations and findings are too numerous to feature individually in this section. Instead, the outcome of work undertaken by the UK licensees and ONR's judgement have been summarised in Articles 6, 14 and 18 of this report.

European Union Nuclear Safety Directive

2.63. The European Council Directive 2009/71/Euratom of 25 June 2009 (the 'Nuclear Safety Directive') (Ref 20) establishing a Community framework for the nuclear safety of nuclear installations was adopted on 2 July 2009 by publication in the Official Journal. The Nuclear Safety Directive is intended to establish a Community framework to maintain and promote the continuous improvement of nuclear safety and its regulation, and to ensure the European Union (EU) Member States provide appropriate national arrangements for high levels of safety to protect workers and the general public. Licence conditions 17 and 36 have been amended to ensure that the Nuclear Safety Directive is fully transposed into UK legislation.

2.64. The fifth UK report to the Convention reported on how the UK complies with the Directive. The UK approach for compliance with the Directive remains unchanged and is demonstrated in the following Articles.

- Article 7- National legislative and regulatory framework including improvements made to the framework where appropriate

- Article 8- Describing the regulatory body
- Article 11- Demonstrating that the prime responsibility for safety rests with the licence holders.
- Articles 8 and 10 – Demonstrating arrangements made by all parties for education and training.
- Section 2, Articles 7, 8 and 18 – openness and transparency, demonstrating that information related to regulation of nuclear safety is made available to workers and the general public.
- Section 2 and Article 8– Self assessment and peer review of the national regulatory framework and regulatory practices

Section 3 - Nuclear Safety Issues at UK Installations

This section provides an update on the significant technical issues at UK's NPPs that were identified in the UK's fifth report to the Convention. New issues are addressed in Article 6.

Advanced Gas-cooled Reactor (AGR) boiler tubes

3.1. Since the last report to the Convention, work has been undertaken to understand and reduce creep damage through research and plant modifications. Safety case modifications for the affected reactors have enabled operation at up to 80% of full power to be justified, with ongoing monitoring.

AGR boiler closure units

3.2. All work to improve the pre-stressing system and to provide an additional engineered line of protection in the form of an external steel restraint has been completed, with ongoing monitoring in the form of routine maintenance and inspection. ONR is satisfied with the work undertaken by the Licensee to address this issue and has no further regulatory concern.

AGR top dome temperatures

3.3. Modifications have been undertaken on the affected reactors to improve gas flow within the hot box and maintain temperatures within the specified limits. Monitoring of the effect of this work is ongoing by the licensees and ONR continues to monitor the licensees' work on this issue and to-date has no regulatory concern.

Flow Accelerated Corrosion

3.4. Flow accelerated corrosion (FAC) is a significant deterioration mechanism on NPPs and can have both nuclear and conventional safety implications. It occurs in steam/condensate pipework where areas of turbulent fluid flow occur (e.g. elbows and bends). The turbulence helps to accelerate the corrosion process of the pipe material. Loss of steam containment on Surry unit 2 (1986) and Mihama unit 3 (2004) nuclear power plants, which resulted in nine fatalities, serves to illustrate the consequences of inadequate management of FAC. EDF NGL undertake FAC inspection programmes on all of their stations. Inspections have found FAC on all stations, with some deterioration sufficiently advanced to require remediation. ONR continues to engage with the licensee and is currently satisfied with progress in this area.

Carbon Deposition

3.5. Carbon Deposition is a collective term used to describe the formation of carbon deposits in the primary circuit of an AGR. There are several forms of carbon deposition which affect both the thermal efficiency of the reactor (by forming calcinated deposits on the fuel pins and boiler tubes) and the efficient working of mechanical and electrical components (by forming sticky resinous deposits on primary circuit equipment). Carbon deposition has been a continuing issue for the AGR reactors resulting in safety related issues such as increased probability of fuel pin failure as well as operational issues resulting in lost generation. It affects boilers, fuel, fuel routes, auxiliary gas plants, reactor core mechanical components and primary circuit control and instrumentation. EDF NGL have a programme of ongoing investigative and modification work with the aims of deriving and implementing the optimum control / mitigation strategy for the management of carbon deposition for the remaining lifetime of the AGR fleet. Measures currently under investigation include, *inter alia,* oxygen injection into boilers, carbonyl sulphide injection into the reactor coolant circuits, modified fuel pin clad manufacture allied to a research and a

programme of operational experience feedback. ONR continues to engage with the licensee and is currently satisfied with progress in this area.

Graphite Integrity

3.6. Earlier reports to the Convention have highlighted the potential issues of both weight loss and cracking in the graphite reactor cores in AGR and Magnox reactors. The UK licensees continue to take a multi-legged approach to managing these potential graphite issues. These are: predictions of component and core condition; assessing the tolerance of the core safety functions to any predicted damage; assessing the consequences of core damage for safety function; monitoring core condition during plant operation; and inspection and sampling during reactor outages to ensure that the core is behaving as predicted. The limit criteria that would eventually bring about an end to reactor operation would be based on an overall judgement about the strengths of the various legs of the safety case and the confidence that the ONR has in further safe operation.

Concealed systems

3.7. Earlier reports to the Convention have noted several events in recent years involving leaks from, and failures of, concealed pipework (e.g. buried pipework and cables). EDF NGL established a fleet-wide project covering all concealed systems, including cables, civil structures and pipework for systematically identifying and inspecting all concealed nuclear safety related plant in order to establish its condition and to take any remedial actions necessary. A risk based inspection strategy, based on the potential safety significance of each concealed system, is now in place and ONR continues to engage with the licensee, and is currently satisfied with progress in this area.

Section 4 - Safety issues identified in the President's Summary report and the Rapporteur's report at the 2011 Convention Review Meeting

The President's Summary report and the Rapporteur's report of the proceedings at the fifth Convention review meeting held in April 2011 identified a number of specific and general topics that had been of particular interest to Contracting Parties. This section of the UK report identifies those topics that are of relevance to the UK and shows where they are addressed in this report.

'De jure' Independence of the Regulatory Body

4.1. In the UK regulatory independence is guaranteed by law. This will remain the case when the nuclear regulator becomes a stand-alone, statutory body under the Energy Bill, which is currently passing through Parliament. The provisions in the Energy Bill ensure that the ONR will be independent of Government in its regulatory decision making. The role of the Chief Nuclear Inspector will be a statutory requirement for the ONR under the Energy Bill. This topic is covered in Articles 7 and 8.

Staffing of the Regulatory Body

4.2. ONR has implemented new measures to enable recruitment of new Inspectors, maintaining staff levels and the assimilation and training of new recruits. This topic is covered in Article 8. The general issue of competences is addressed in Article 11.

Openness and Transparency

4.3. In the UK all public bodies are bound by the Freedom of Information Act 2000 (FOI) (Ref. 21) (see Article 7). In addition, pro-active arrangements are in place to further enhance openness and transparency. This is addressed in Section 2 and Article 8 in respect of the regulatory body and Article 9 in respect of the licensees. Article 18 covers the policy of openness and transparency adopted during the generic design assessment of new reactor designs. Statutory requirements for public information during emergencies are covered in Article 16. The public consultation process with respect to siting of new NPPs is addressed in Article 17. Reporting of incidents at nuclear installations is addressed in Article 19.

Assessment of Digital instrumentation and Control

4.4. ONR believes that the effective implementation of defence-in-depth is dependent upon appropriate implementation of a number of other general principles and related measures, including safety classification and categorisation. ONR applies the international standard IEC 61226 to the process of categorisation. This topic is covered in Articles 14 and 18.

Learning from Operational Experience

4.5. ONR uses feed-back in order to focus its regulatory activities. This is covered in Articles 8 and 19. The licensees have a range of measures in place to learn from operational feedback. This is addressed in Article 19.

Emergency Preparedness

4.6. The precautions taken in the design and construction of nuclear installations in the UK, and the high safety standards in their operation and maintenance, reduce to an extremely low level the risk of accidents that might affect the public. However, all nuclear installation operators prepare emergency plans for the protection of the public and their workforce. These are regularly tested in exercises, some of which are observed and evaluated by ONR. Article 16 addresses this topic in detail.

Periodic Safety Reviews

4.7. One of the key parts of the UK nuclear safety regime is that of Periodic Safety Review. ONR and its predecessors have for some decades required nuclear site licensees to perform PSRs at least every 10 years. The requirements and enhancements made to these to reflect lessons learned from the Fukushima accident are described in Article 6 and 18. Article 6 also provides information on the status of Periodic Safety Reviews at UK NPPs.

Harmonisation of National Safety Standards with IAEA standards

4.8. The UK has an established process for adoption of IAEA standards and WENRA reference levels. These are embedded in ONR's Safety Assessment Principles and the supporting Technical Assessment Guides. Information on this topic is provided in Article 18.

Peer Reviews of Regulator and Licensees

4.9. ONR participates in international peer reviews such as the IAEA IRRS missions as well as staff secondment schemes with other regulatory bodies to share and capture best regulatory practices. The UK licensees openly share information with other nuclear operators across the globe through international organisations such as the World Association of Nuclear Operators (WANO). Further detail on this topic is provided in Article 8 for the regulator and in Article 9 for the licensees.

Regulatory oversight of construction and commissioning of new plant.

4.10. Details of ONR's oversight of construction and commissioning of all plant are provided in Article 18 of this report.

Regulator's Transformation (Change) Programme

4.11. ONR, is undergoing significant organisational changes. These are described in detail in Articles 7 and 8.

Regulator's Plan-on-a-Page

4.12. ONR developed a simple and succinct overview of its strategy which is supported by a detailed regulatory strategy document and ONR's operating plan.

Lessons from Fukushima

4.13. The UK presented a full report to the Second Extraordinary Meeting of the Convention in 2012, concentrating on actions, responses and new developments that have been initiated or influenced by the accident at the Fukushima Dai-ichi nuclear power plant. The related topics are covered in Section 5 and discussed in further detail in Articles, 6, 14, 16 and 18 of this report.

Skills for the Nuclear Industry

4.14. This topic is addressed in Article 8 for the regulatory body and in Article 11 for the licensees.

Supply Chain for New and Existing Plant

ONR recognises the international nature of the UK industry and the challenges this presents to selection and procurement of components required for nuclear safety. This topic is covered in detail in Article 18 of this report.

Loss of Corporate Knowledge in the Regulatory Body

The topic is related to Staffing for the Regulatory Body (see above) and Knowledge Management and is covered in Article 8 of this report.

Section 5 - Safety Issues identified in the President's report at the 2012 Extraordinary Meeting of the Convention

Following the Second Extraordinary Meeting of the Convention in 2012, a number of topics were identified. These have been summarised below with reference to these areas of the report where detailed discussion on these topics is presented.

- Progress on the re-evaluation of hazards posed by external events (Article 14);
- Results of the above reassessments for existing plant (Article 14);
- Identified upgrading of safety systems for existing plant that are necessary to withstand unexpected events (Articles 14 and 18);
- Re-evaluation of designs of new plant that are required as a result of reassessment of external events (revisiting the GDA) (Article 18);
- Review and upgrade of accident management measures (Articles 14 and 16);
- Actions taken or planned to cope with accidents beyond the design base (Articles 14 and 18);
- Review and upgrade of emergency preparedness (Article 16);
- Report on the review of the legislative framework and responsibilities of regulatory body (Articles 7 and 8);
- Measures taken or planned to ensure effective independence of the Regulatory Body (Articles 7 and 8);
- Steps taken to enhance openness and transparency (Article 8 for regulator and in Article 9 for the licensees);
- Demonstration of how IAEA standards are used (Articles 14 and 18)
- Report on how the regulator ensures that licensees have adequate resources to fulfil their responsibilities for safe operation (Article 14);
- Outcome of peer reviews of regulators, licensees, and the nuclear infrastructure (Articles 8 and 9)
- Human factors with respect to accident management (Article 12)

Article 6 - Existing Nuclear Installations

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonably practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shutdown may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations).

General observations

6.1. The UK has an ageing fleet of reactors and this inevitably gives rise to safety related ageing issues that need to be managed. Some ageing issues can be controlled and managed by maintenance and replacement of components. Other issues, such as the degradation of the graphite core, affect items that cannot be replaced and therefore need to be closely scrutinised to ensure safety is maintained and, when appropriate, to determine when ageing could lead to the end of life of a reactor.

6.2. The UK has no nuclear installations where significant corrective actions were necessary to comply with the requirements of this Convention. This is because of the UK's nuclear safety licensing regime, the high priority given to safety by the UK nuclear utilities and the safety culture of the industry. Furthermore, the Periodic Safety Review 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.

Nuclear installations in the UK

6.3. The UK's nuclear licensed sites with NPPs that fall within the scope of the Convention are listed below. This includes those sites with reactors that have shut down, are de-fuelling, but excludes those that are fully defuelled and are decommissioning. With the exception of Sizewell B, which is a Pressurised Water Reactor (PWR), all the UK's nuclear power plants use gas-cooled technology. The first generation ('Magnox' reactors) used natural or slightly enriched uranium with magnesium alloy cladding (currently, only one Magnox reactor is operating). The second generation, Advanced Gas-cooled Reactors (AGR), use enriched uranium dioxide fuel with stainless steel cladding. All Magnox reactors having steel pressure vessels were safely shut down by the end of 2006.

(i) Magnox Ltd. and Sellafield Ltd.:

Calder Hall	4 Reactors (Magnox)	Shut Down and De-fuelling
Oldbury	2 Reactors (Magnox)	Shut Down and De-fuelling
Sizewell A	2 Reactors (Magnox)	Shut Down and De-fuelling
Wylfa	2 Reactors (Magnox)	1 Operational & 1 Shut Down

(ii) EDF Energy Nuclear Generation Ltd.:

Dungeness B	2 Reactors (AGR)	Operational
Hartlepool	2 Reactors (AGR)	Operational
Heysham 1	2 Reactors (AGR)	Operational
Heysham 2	2 Reactors (AGR)	Operational
Hinkley Point B	2 Reactors (AGR)	Operational
Hunterston B	2 Reactors (AGR)	Operational
Torness	2 Reactors (AGR)	Operational
Sizewell B	1 Reactor (PWR)	Operational

Further details and key parameters for the operational and de-fuelling nuclear installations are given in Annex 1.

6.4. In addition, there are two fast breeder reactors at Dounreay, the Dounreay fast reactor (DFR) and the prototype fast reactor (PFR), which are currently subject to decommissioning activities. These both used liquid metal to remove heat from their respective cores during operation. Both of these reactors are now essentially empty of fuel. However, they are mentioned in this report as the DFR reactor currently has some breeder elements and one stuck fuel assembly to be removed, and the empty PFR reactor currently has spent fuel and breeder elements stored in its associated storage facilities. These reactors will not be discussed further in this report.

6.5. The UK's first nuclear installations, the Magnox reactors, started operation between 1956 and 1971. These were carbon dioxide gas-cooled, graphite moderated reactors that used natural (or in some cases very slightly enriched) uranium metal fuel in a magnesium alloy cladding. The first nine installations had steel reactor pressure vessels, but the last two stations at Oldbury and Wylfa had pre-stressed concrete reactor pressure vessels. These later designs had significant safety advantages over the steel pressure vessels since a sudden and unexpected failure of the main pressure vessel boundary was deemed to be virtually impossible. However, the use of natural uranium with magnesium alloy cladding limited the development of the Magnox technology regarding increasing power density and gas outlet temperature.

6.6. The licensee for the Magnox sites at Oldbury, Sizewell A and Wylfa is Magnox Limited. Calder Hall, which is currently defuelling, is part of the Sellafield site, which is principally a reprocessing complex and the licensee for this is Sellafield Limited. The majority of the Sellafield site is covered in the UK report to the Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. For the Magnox reactors, the focus of this report is on Magnox Ltd.

6.7. The second generation of gas-cooled reactors were the AGRs. Seven stations were commissioned between 1976 and 1988 each with 2 reactors. AGRs use enriched uranium oxide fuel in stainless steel cladding. This, together with the pre-stressed concrete pressure vessel, allowed gas outlet temperatures of over 600 degrees centigrade and gas pressures of over 30 bar.

6.8. The UK's gas-cooled reactors do not require secondary containment to control design basis accidents. For design basis loss of coolant accidents, the reactor transient does not initiate large scale fuel failure. The plant is designed to be capable of retaining the bulk of the radioactive material that might be released from the fuel for the entire range of accidents considered in the design. In contrast, containment buildings are required for PWR and Boiling Water Reactors because a design basis loss of coolant accident results in significant fuel failure and release of radioactive fission products.

6.9. The most recent NPP to be built in the UK is the PWR at Sizewell B. This became operational in 1995. This reactor uses enriched uranium oxide fuel clad in Zircaloy and pressurised water as the coolant.

6.10. The above paragraphs demonstrate that UK has a wide range of nuclear plant with a range of designs that span nearly 50 years. Although not specifically an issue for this Convention, the unique designs of the UK plant have required the development of fuel manufacture and reprocessing facilities as well as research organisations. It was essential therefore that the UK had regulatory processes in place to ensure that all plants continued to be safe and were upgraded as necessary to meet current safety standards, as well as fulfilling the requirements of Article 6 of this Convention. The following paragraphs demonstrate how UK meets the requirement of this Article.

Safety reviews and upgrading of nuclear installations in UK

6.11. The safety of the UK's NPPs is assured by the process of routine integrated interventions (assessment and inspection, as addressed under Article 14) and by the process of Periodic Safety Reviews (PSRs).

6.12. The major PSRs are carried out every 10 years. However, intermediate reviews are carried out at more frequent intervals and any identified necessary upgrading measures must be implemented. Additionally, licensees are looking to better integrate the periodic review into enhanced continuous improvement programmes that will deliver improvements throughout the station life.

6.13. Each operating nuclear power reactor is required to undertake a periodic shutdown for purposes of examination, maintenance, inspection and testing in accordance with LC30 (Periodic shutdown). For AGR reactors this corresponds to an operating period of up to 36 months. In the case of the PWR design, the operating period is typically 18 months. After these shutdowns, the licensee must apply for a Consent (see Article 7) to restart the reactor. Consents are granted by ONR following a satisfactory review of the licensee's inspection and maintenance programme, the operational performance of the station since the previous start-up Consent and a satisfactory review of the safety case. These start-up reviews give the ONR the opportunity to review specific aspects known to have safety significance. In addition, Consent for start up is not granted until the ONR is satisfied that the reactor is safe to operate for the period up to the next shut down for inspection and maintenance.

6.14. Any safety concern on one reactor may have implications for other reactors on the site or indeed for the family of reactors with similar features. If such concerns are raised, either during a maintenance outage or during normal operation, the ONR has powers to require the operator of the reactor, and any similarly affected reactors, to take remedial action including shutting down if this is appropriate. In this latter situation the operator must seek ONR's permission to restart. Further information concerning the statutory requirements and the operation of the ONR are given in Article 7.

6.15. In addition to the continual integrated regulatory interventions that include inspection and assessment of licensees' activities and the shutdowns, PSRs are required. These reviews require that reappraisals are undertaken not only to confirm continued safe operation but also to examine plant safety in the foreseeable future. The review should also identify emerging gaps between standards achieved on site and modern standards. The UK approach to PSRs is covered in the following section.

Periodic safety reviews

6.16. The UK has been undertaking safety reviews of its civil nuclear installations for many years as part of the regulatory process. There has been a requirement for

PSRs since the introduction of the standard nuclear site licence in 1990. All nuclear installations are required to undertake a major safety review every 10 years.

6.17. The rationale for selecting ten years as the review period was chosen on the basis of experience, as striking a balance between a period long enough to capture significant developments important to safety and any longer period where the loss of experienced staff by the operating and regulating organisations would lead to loss of continuity. This rationale is elucidated in the IAEA Safety Guide 'Periodic Safety Reviews of Nuclear Power Plants', SSG-25. The legal basis for PSRs in the UK is embodied in the conditions that are attached to the nuclear site licence. LC 15 (Periodic Review) requires licensees to "make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases".

6.18. The programme for the UK's nuclear installations' PSRs is given in Table 6.1 below. The second round of PSRs for the EDF NGL AGR stations was completed in 2009. The findings for each station have been published on the ONR website (Ref. 1).

6.19. Although all Magnox steel pressure vessel stations were closed down by 2006, the requirement for a PSR still remains to cover post-operational safety in a graded approach. The second operational stage PSRs for the concrete pressure vessel Magnox reactors at Oldbury and Wylfa were carried out in 1998 and 2004. Wylfa has extended its previous date for the end of generation, which was September 2010 and the validity of the PSR conclusions has been reconfirmed for a further 4 years. Since its last PSR, Oldbury has ceased generation and shutdown.

Table 6.1 - Status of Periodic Safety Reviews

	STATION STARTED OPERATION	**FIRST REVIEW**	**SECOND REVIEW**	**THIRD REVIEW**
Magnox Installations				
Calder Hall	1956 - 1959	1982	1996	Closed
Sizewell A	1966	1994	1996	Closed
Oldbury	1968	1995	1998	2008 (now Closed)
Wylfa	1971	1996	2004	Current closure plan - 2014.
AGR/PWR Installations				
Hinkley Point B	1976	1996	2006	Planned for 2016
Hunterston B	1976	1996	2006	Planned for 2016
Dungeness B	1982	1997	2007	Planned for 2017
Heysham 1	1983	1998	2008	Planned for 2018
Hartlepool	1984	1998	2008	Planned for 2018
Heysham 2	1989	1999	2009	Planned for 2019
Torness	1989	1999	2009	Planned for 2019
Sizewell B	1995	2005	Planned for 2014	Planned for 2024

Note: The first safety reviews were called Long Term Safety Reviews and were undertaken at about 25 years of operational life. These were followed by PSRs, which are now undertaken at approximately 10 yearly intervals.

6.20. Prior to any new nuclear installation being authorised to operate, the licensee must have a valid safety case, which is essentially a written demonstration that the intended operation of the plant will be adequately safe. The safety case therefore confirms that all credible hazards have been identified, appropriate standards have been set and met, adequate safety features are in place, all significant assumptions have been identified, verified and validated, and that all instructions, limits and conditions required to maintain operations within specified margins for safety have been identified.

6.21. As an installation matures, modifications are made to the plant, ageing effects take place, some components may become obsolete and need replacing and plant operating instructions may be changed as a result of experience. During all this time the safety case must remain valid and, before significant changes, it must be updated and revalidated. Additional to this ongoing process, the PSR process is designed to ensure that a thorough and comprehensive review is made of the safety case at regular intervals throughout a nuclear power station's life. The reviews have become a well-established feature in the licensing requirements for nuclear plant, and are intended to be more wide ranging than a restatement of the safety case. They complement the normal day-to-day operational monitoring of safety and assessment of the impact of proposed changes, which is further underpinned by thorough inspections and assessment of the condition of the plant during normal maintenance and testing, as well as during the planned periodic reactor shutdowns.

6.22. The objectives of the PSRs are to:

- review the total current safety case for the station and confirm that it is adequate against the original intent;
- compare against current standards for new plant, evaluate any deficiencies and implement any reasonably practicable improvements to enhance plant safety taking the expected future life of the plant into account;
- identify any ageing process which may limit the life of the plant; and to
- revalidate the safety case until the next PSR, subject to the outcome of routine monitoring by the licensee and regulation by ONR.

6.23. In reviewing the totality of its existing safety case, which is the first objective, the licensee reaffirms the validity of the original safety case, reflecting on factors such as the:

- original safety standards to which the plant was built;
- various engineering improvements introduced during the operational lifetime which have enhanced safety; and the
- numerous safety assessments undertaken during the station's life.

6.24. The second objective, to compare against current standards for new plant, is not straightforward. Advances in scientific and engineering knowledge, coupled with experience during operation of all types of plant, generally contribute to improvements in safety standards and practices. In many cases, this will be beneficial to existing plant. For example, advances in scientific knowledge may be used to provide greater confidence in the continued safe operation of a plant. Therefore the review addresses all relevant advances in safety standards and practices. Any significant shortcomings should be identified and any improvements which are reasonably practicable should be introduced taking the expected future life of the plant into account.

6.25. Another essential element of the review is for all structures, systems, or components susceptible to ageing or degradation to be reviewed, and failure mechanisms, together with any life-limiting features, identified. These various factors then have to be evaluated, particularly for aspects that may eventually result in

unacceptably reduced levels of safety, and ultimately dictate the safe working life of the nuclear installation.

6.26. Finally, the PSRs confirm that the safety case will remain valid until the time of the next review, which is normally set at ten years. As stated above, the PSRs complement the normal operational monitoring of safety, which is also regulated by ONR. Therefore, although the PSRs may conclude that the safety case is adequate for another ten years, this will be dependent upon continuing satisfactory results from routine inspections. Should any safety related factor emerge in the interim period that may throw doubt upon the continuing validity of the safety case, this would require the licensee to resolve the matter to ONR's satisfaction.

6.27. The PSRs review the analysis of faults that could evolve into accidental sequences (initiating faults) and the defences available at the plant to mitigate the consequences. The analysis includes the two complementary approaches of deterministic and probabilistic assessment. A comprehensive fault schedule, which includes both internal initiating events as well as internal and external hazards, is the starting point of both deterministic and probabilistic safety analyses (PSA). The deterministic approach is used in the analysis of design basis accidents (DBAs) to demonstrate the capability of the safety systems. Analyses are also undertaken of more severe faults outside the design basis, which could lead to large releases of radioactivity. This includes: analysis of the potential failures of the physical barriers to the release of radioactivity; analysis of the magnitude and characteristics of the releases; identification of the accident management strategies to reduce the risk, together with the necessary equipment, instrumentation and accident management procedures. PSAs were produced as part of the first PSRs (where PSAs did not already exist). Whilst regulatory decisions will not be made on the basis of probabilistic analysis alone, PSAs provide an important aid to judging the relative importance of identified potential engineering shortcomings.

6.28. The results of the PSRs have produced, and continue to produce, worthwhile improvements to safety. So far, for the current operating fleet the PSR process has not revealed no factors seriously prejudicial to the continued operation in the foreseeable future of any operating nuclear installation. However, the first reviews identified many areas where improvements were both necessary and practical. In some cases the licensees chose to close down the plant rather than invest in an upgrading programme. The continuing programme of reviews is however a vital part of ONR's monitoring of an operator's performance, and an essential input to any agreement by the ONR to the continued operation of any nuclear installation. In some cases the licensees decided not to continue with operation in the light of PSR findings.

6.29. Following the Fukushima event, ONR revised its guidance on production of PSRs. The new guidance emphasises that the safety case should not be limited to design basis events, but should also consider the resilience of the plant, staff and processes to events beyond the design basis and cliff-edge conditions.

6.30. EDF NGL plans to extend the operating lifetimes of their AGR sites over and above their original design intent. Each extension will be subject to an assessment of the site's continuing safety by EDF NGL. Continued operation will be subject to submission of satisfactory PSRs; and confirmation that the results from routine maintenance, inspection and testing continue to support the agreed plant safety case. The regulatory controls on continued operation are by Consent to start-up following a periodic shutdown.

Status of UK nuclear power plants

6.31. The following paragraphs summarise the key issues that have arisen at each of the UK's nuclear power stations since the UK's fifth report to the Convention. Technical details on the operational reactors at each site are shown in Annex 1.

Progress on the significant AGR ageing issues identified in Section 3 of previous reports to the Convention is described either in reactor-specific sections below or generically at the end of this article.

Reactors outside the scope of the Convention

6.32. At the time of the UK's fifth report to the Convention, the reactors at Bradwell, Berkeley, Trawsfynydd, Hunterston A and Hinkley Point A Magnox reactors were de-fuelled and were being decommissioned. As such, they were no longer nuclear installations for the purposes of the Convention.

6.33. Since the fifth report, Dungeness A has completed defuelling and has been verified as fuel-free, and hence is outside the scope of this report. Chapelcross has also completed defuelling, but has yet to be fully verified as fuel free (The verification process is due for completion in September 2013.). Nonetheless, it is considered to be outside the scope of this report.

Reactors de-fuelling

Calder Hall (four Magnox reactors)

6.34. This station permanently ceased generation in March 2003. De-fuelling has started and preparations are in hand for the "care and maintenance" phase of decommissioning prior to final site clearance. The rate of de-fuelling is determined by the availability of reprocessing facilities at Sellafield. There were approximately 10,000 fuel elements in each of the four reactors at the time of the last report. So far, approximately 3,000 fuel elements have been removed from Reactor 4.

Oldbury (two Magnox reactors)

6.35. This station permanently ceased generation in February 2012. De-fuelling has started and preparations are in hand for the "care and maintenance" phase of decommissioning prior to final site clearance. The rate of de-fuelling is determined by the availability of reprocessing facilities at Sellafield. There are approximately 24,300 fuel elements in one reactor and 19,200 in the other. The expected end date for de-fuelling is February 2018 as declared in the licensee's decommissioning programme.

Sizewell A (two Magnox reactors)

6.36. This station permanently ceased generation in December 2006. De-fuelling has started and preparations are in hand for the "care and maintenance" phase of decommissioning prior to final site clearance. The rate of de-fuelling is determined by the availability of reprocessing facilities at Sellafield. There were approximately 30,000 fuel elements in each of the two reactors. There are approximately 11,800 fuel elements remaining in one reactor and 11,400 in the other. The expected end date for de-fuelling is October 2016 as declared in the licensee's decommissioning programme.

Operating reactors

6.37. Overall, UK NPPs have operated reliably and to programme. However, some events have caused disruptions to normal operation. The more significant ones are summarised in the remaining paragraphs of this article. More information about some of the significant events can be found on the ONR web-site (Ref. 1). All aspects of operation are subject to regulatory process and oversight as described in Article 7.

Wylfa (two Magnox reactors)

6.38. Wylfa currently has one operational reactor and one that ceased generation in 2012. Reactor 2 was permanently shutdown to allow the licensee to optimise the remaining fuel in the reactors by transferring partially irradiated fuel from Reactor 2 to Reactor 1. The operational reactor is currently due to cease generation in 2014 at

which point the station will enter the de-fuelling phase, although the licensee is currently considering whether to request permission to operate beyond this date. Since the last report to the Convention, the station has operated without significant incident. The expected end date for de-fuelling of both reactors is October 2019 as declared in the licensee's decommissioning programme.

Dungeness B (two AGRs)

6.39. The two operating reactors at Dungeness B are currently scheduled to cease generation in 2018, although the licensee is actively seeking to extend the operational life of both reactors past this date.

6.40. In August 2011 an irradiated fuel assembly was loaded into the fuelling machine which had an air rather than a carbon dioxide atmosphere. This represented a breach of the Dungeness B fuel handling safety case although there were no injuries and no release of radioactive material. The event was investigated by both the licensee and by ONR and a corrective action programme was implemented prior to the fuelling machine returning to service.

6.41. In November 2012 the licensee discovered that an incorrect control rod had been loaded into Reactor 22 at Dungeness B in March 2003. The misload was identified during routine control rod maintenance after its removal from the reactor. There are a total of 57 control rods of two different types in each reactor at Dungeness B: 36 more absorbing black rods and 21 less absorbing grey rods. The issue related to a grey rod being loaded where a black rod should have been. A series of safety cases were prepared that justified in stages fuel and control rod handling and reactor operation. These were reviewed by ONR. The event was investigated by the licensee and a corrective action programme was implemented, which included a fleet-wide review of control rod misload for the other AGR reactors. ONR considered the licensee's investigation and corrective action programme to be adequate, subject to extension of the scope of a planned assessment.

6.42. In December 2012, following a post-Fukushima review of external flooding studies, the licensee notified ONR that they no longer had confidence in this aspect of the safety case for Dungeness B. A series of short term and longer term remediation measures were, and continue to be, implemented to justify continued operation of the two reactors until the external flooding Design Basis is restored. ONR continues to monitor the licensee's programme of safety improvements at Dungeness B.

Hartlepool (two AGRs)

6.43. The two operating reactors at Hartlepool are currently scheduled to cease generation in 2019, although the licensee is actively working to justify extension of the operational life of both reactors past this date.

6.44. In February 2011 flow tests revealed that an isolation valve in the water supply line to one of the diverse ways of providing cooling to the reactor, the High Pressure Back Up Cooling system, was not fully open. This represented a reduction in the diversity of the cooling systems available to the reactors, and therefore a breach of safety case requirements. The system was returned to operation after alternative cooling supplies were confirmed as available. The event was investigated and a corrective action programme implemented to prevent a recurrence.

6.45. Earlier reports to the Convention have noted issues with the boiler closure units (BCU) at Hartlepool and Heysham 1 NPPs following the discovery of corrosion and degradation of elements of the BCUs and their fixings to the pre-stressed concrete pressure vessels. A comprehensive inspection programme was initiated and a suite of remedial and strengthening works have been implemented. Since the last report to the Convention in 2011 no significant degradation in BCU condition has been identified. ONR continues to monitor the licensee's examination, maintenance,

inspection and testing regime of the BCUs in order to ensure that the units continue to deliver their required safety functions.

6.46. Earlier reports to the Convention have also highlighted an issue with increasing temperatures at the hotbox domes at Heysham 1 and Hartlepool NPPs against their design limit. EDF NGL is continuing to research the root cause of the rising temperatures, however, recent statutory outages modifications have been made to a number of control rod guide tubes to increase the gas flow in the hotbox dome area. This has had the effect of reducing the maximum, limiting temperatures seen at the hotbox domes and restoring safety margins to the point where each reactor has returned to full power operation. Further modifications continue to be made at each reactor's statutory outage to improve safety margins further.

Heysham 1 (two AGRs)

6.47. The two operating reactors at Heysham 1 are currently scheduled to cease generation in 2019, although the licensee is actively working to justify extension of the operational life of both reactors past this date.

6.48. Inspection and remedial work has been undertaken at Heysham 1 in relation to both the BCU issue and hotbox dome temperature issue, as described in the Hartlepool update above.

6.49. Since the last report to the Convention, the station has operated without any significant incidents.

Heysham 2 (two AGRs)

6.50. The two operating reactors at Heysham 2 are currently scheduled to cease generation in 2023, although the licensee is actively working to justify extension of the operational life of both reactors past this date.

6.51. On each of the four Heysham 2 and Torness reactors, there are 8 in-service inspection (ISI) plug units loaded into dedicated peripheral core standpipes. During the 2010 Heysham 2 statutory outage for Reactor 8 (R8), an ISI plug unit GH96 could not be removed, apart from a small lift, because of damage found to the standpipe. As a result in-service inspection could not be carried out on this channel during the outage. Sufficient repairs were made to the standpipe to justify return to service and operation for three years to the next planned statutory Reactor 8 outage. Since then investigation into the root cause has been carried out and valve station modifications were made at each reactor to prevent a recurrence. Standpipe inspections have taken place at each subsequent statutory outage on the four reactors to establish the extent of condition, and a long term solution has been engineered for the standpipe which will be carried out on Heysham 2 R8 in its next statutory outage.

Hinkley Point B (two AGRs)

6.52. The two operating reactors at Hinkley Point B were scheduled to cease generation in 2016, although in 2012 the licensee declared its intention to extend the operational life of both reactors to 2023.

6.53. In earlier reports to the Convention it was noted that a higher number of defects than expected were found in the Hunterston B and Hinkley Point B AGR NPP boilers. These defects were caused by service induced creep-fatigue crack growth from original weld defects. Since this discovery in 2006, the maximum operating temperature has been restricted and a programme of in-vessel inspection and repairs conducted. Further safety case and, plant and operational changes have been introduced to improve the seismic resilience of the boilers.

Hunterston B (two AGRs)

6.54. The two operating reactors at Hunterston B were scheduled to cease generation in 2016, although in 2012 the licensee declared its intention to extend the operational life of both reactors to 2023.

6.55. Since the two reactors returned to service in May 2007 after the boiler repairs described above for the Hinkley Point B reactor, they have operated without significant incident.

Torness (two AGRs)

6.56. The two operating reactors at Torness are currently scheduled to cease generation in 2023, although the licensee is actively working to justify extension of the operational life of both reactors past this date.

6.57. In February 2011 an elevated level of radioactivity was detected during routine sampling of a groundwater sampling borehole on the site. Sampling these boreholes is part of the defence-in-depth protection measures against release of radioactivity off site. The level of activity found was extremely low and well within discharge limits, and was therefore no danger to the public or the workforce. The source of the activity was identified as flange leakage from tritiated effluent discharge lines. The licensee performed a structural integrity review of its active effluent discharge systems and it has implemented the required recommendations from this review.

6.58. During the 2012 statutory outage for Reactor 2, inspection of the reactor internals revealed damage to the GH96 standpipe, similar in nature to the damage found at Heysham 2 noted in para 6.48 above. Sufficient repairs were undertaken to allow the reactor to return to service for the next 3 year operating period, after which time the effectiveness of the repair will be physically re-inspected.

Sizewell B (one PWR)

6.59. The operating PWR reactor at Sizewell B is currently scheduled to cease generation in 2035.

6.60. Current safety case requirements mean that by 2015, further spent fuel storage capacity will be required at Sizewell B. The licensee proposes to use dry fuel storage in casks. This technology has been used before elsewhere in the world, but not in the UK. A new facility will be constructed at the site with a design life of 100 years for this purpose.

6.61. Following the discovery of defects, indicative of cracking, in the reactor pressure vessel of the Doel 3 NPP in Belgium, an assessment of whether similar defects might be present in Sizewell B forgings has been undertaken by EDF NGL. No significant issues were identified during this assessment.

Generic Safety Issues

6.62. A number of issues have been identified that have the potential to affect all operating NPPs. These are

Flow Accelerated Corrosion

6.63. Flow accelerated corrosion occurs in steam/condensate pipework where areas of turbulent fluid flow occur. Further detail is provided in paragraph 3.4.

Carbon Deposition

6.64. Carbon Deposition is a collective term used to describe the formation of carbon deposits in the primary circuit of an AGR. Further detail is provided in paragraph 3.5.

Graphite Integrity

6.65. Earlier reports to the Convention have highlighted the potential issues of both weight loss and cracking in the graphite reactor cores in AGR and Magnox reactors. Further detail is provided in paragraph 3.6.

Concealed Systems

6.66. Earlier reports to the Convention have noted several events in recent years involving leaks from, and failures of, concealed pipework (e.g. buried pipework). Further detail is provided in paragraph 3.7.

Post-Fukushima Resilience Improvements

6.67. In response to the Fukushima Dai-ichi event of 11 March 2011, the UK Chief Nuclear Inspector undertook a review to establish the implications of this event for the UK nuclear industry. In parallel, the EU through ENSREG asked each member state to undertake stress tests of their nuclear facilities. The aim of these initiatives was to establish the UK nuclear industry's resilience to external naturally occurring events and identify enhancements that could provide further resilience to Design Basis and Beyond Design Basis events. Both UK NPP Licensees, EDF NGL and Magnox Ltd, have been fully involved with both of these initiatives and have completed reviews of their nuclear facilities. They have both identified a prioritised programme of resilience enhancements to the key emergency management facilities, systems and procedures necessary for an effective emergency response capability to beyond design basis (severe accident) events. ONR is monitoring delivery against this programme of work. More detail on the UK's response to the Fukushima Dai-ichi event can be found in the UK report to the second Extraordinary meeting of the Convention in 2012 (Ref 4) and the Implementation Report (Ref 14) as well as Articles, 14, 16 and 18 of this report.

Article 7 - Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.
2. The legislative and regulatory framework shall provide for:
(i) the establishment of applicable national safety requirements and regulations;
(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;
(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;
(iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations).

The following paragraphs describe the UK's nuclear safety legislative and regulatory framework applicable to those nuclear installations defined by the Convention. Its content has been informed by relevant IAEA Requirements and Standards. The UK has a full suite of primary and secondary legislation that meets international legal requirements and expectations.

National safety requirements and regulations

7.1. The Department for Energy and Climate Change (DECC) Section of the Government website (Ref. 22), under the heading of safety at UK civil nuclear sites, 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
- involvement in international work on nuclear safety.

Primary legislation

7.2. This section describes the main primary legislation that forms the nuclear regulatory regime, defines the duties of the operators of nuclear installations, and enables the development of secondary legislation.

Health and Safety at Work etc. Act 1974

7.3. Under the Health and Safety at Work etc. Act 1974 (HSWA74) (Ref. 23) 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. This Act also created a statutory body, the Health and Safety Executive (HSE). Extracts from HSWA74 relevant to this Convention are in Annex 2. An important provision of the HSWA74 is that it permits the HSE to develop secondary legislation in the form of regulations.

7.4. Pending the Government legislation, functions carried out by the ONR in respect to nuclear safety, nuclear site health and safety, security, safeguards and the

transport of radioactive materials that currently exist under HSWA74 will in future be provisions of the Energy Bill.

Nuclear Installations Act 1965, as amended

7.5. Under the Nuclear Installations Act, as amended, 1965 (NIA65) (Ref. 24) 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 HSE. Only a corporate body, such as a registered company or a public body can hold a licence and the licence is not transferable. In 1975, those parts of the NIA65 relevant to safety (sections 1, 3 to 6, 22 and 24A) became relevant statutory provisions of the HSWA74. Under the provisions to create the ONR as a statutory body, these sections of the NIA65 will be relevant statutory provisions in the Energy Bill. The parts of each of these sections relevant to the Convention are contained in Annex 3.

7.6. An important provision of the NIA65 is that it permits HSE to attach such conditions to a site licence as it sees appropriate in the interests of safety or radioactive waste management. Pending Government legislation, Regulatory responsibility for this function will transfer to the statutory ONR under the Energy Bill.

Radioactive Substances Act 1993 (RSA93) and Environmental Permitting (England and Wales) Regulations 2010

7.7. The Environment Act 1995 (EA95) (Ref. 25) establishes the Environment Agency as the environmental regulatory body for England and Wales, and the Scottish Environment Protection Agency (SEPA) as the equivalent for Scotland. EA95 also provides for the transfer of functions to the Environment Agency and SEPA, including powers and duties in relation to radioactive substances regulation. On the 1st April 2013, Natural Resources Wales, established by the Welsh Government under the Natural Resources Body for Wales (Establishment) Order 2012, took over responsibility from the Environment Agency as the body responsible for environmental protection, including radioactive substances regulation, in Wales.

7.8. Until April 2010 both the Environment Agency and SEPA regulated the disposal of radioactive waste on or from nuclear licensed sites, and the keeping and use of radioactive material by tenants on nuclear licensed sites, under the Radioactive Substances Act 1993 (RSA93) (Ref. 26). In England and Wales the permitting requirements of RSA93 have now been incorporated into the Environmental Permitting (England and Wales) Regulations 2010 (EPR10) (Ref. 27). EPR10 does not materially change the radioactive substances regulation, but aims to provide a consistent approach to permitting and compliance across various regimes including pollution prevention and control, water discharge consenting, and waste. EPR10 also makes provision for a new power to allow staged regulation of geological disposal facilities. RSA93 still applies in Scotland. Therefore, all references to RSA93 in this report should be read as RSA93 as it applies in Scotland and EPR10 in England and Wales.

7.9. Disposal of radioactive waste under EPR10 and RSA93 includes the discharge of radioactive waste to the environment, incineration of solid or liquid radioactive waste, burial of solid radioactive waste or the transfer of radioactive waste to another site. Conditions in permits issued by the Environment Agency and Natural Resources Wales and authorisations by SEPA control the types and quantities of radioactive waste that may be disposed of, the disposal routes that may be used and impose requirements to minimise radioactive waste creation. Conditions are also imposed in relation to management systems, maintenance, monitoring and record-keeping.

7.10. The permits and authorisations held by operators on nuclear licensed sites may be transferred in whole or in part. Such transfers can only be granted if the Environment Agency, Natural Resources Wales or SEPA, as appropriate, is satisfied

that the transferee will have operational control, and is willing and able to ensure compliance with the existing conditions of the permit.

7.11. The accumulation of radioactive waste, and the keeping and use of radioactive material, by the nuclear site licensee is regulated by ONR, on behalf of HSE, under NIA65. This is addressed in Article 19.

Energy Act 2004

7.12. The Energy Act 2004 (Ref. 28) established the NDA as a new non-departmental public body which came in to being in April 2005. It took over the responsibility for decommissioning, and operation via civil contracts with operators pending decommissioning, of designated civil nuclear sites, including the sites operated by Magnox Limited. The work of the NDA is described in more detail in Article 10.

Freedom of Information Act 2000

7.13. The Freedom of Information (FOI) Act 2000 (Ref. 21) establishes a general right of access to all types of recorded information held by all Government departments including HSE. It places a duty on HSE to say whether it holds the information and if so provide it to the applicant unless an exemption applies. This process must be completed within 20 working days. The Act is retrospective and therefore applies to historical documentation as well as that generated more recently. The rights to HSE information conferred by the Act apply to everyone, anywhere in the world. The Act is 'reason blind' which means that information can be requested for any purpose.

Secondary legislation

7.14. In common with all UK industries, nuclear installations must comply with all regulations made under the HSWA74. There are, however, a few regulations that are particularly relevant to nuclear installations and these are described in the following paragraphs. (Other regulations also have relevance, such as the Construction (Design and Management) Regulations 2007.) They are made using the provisions of the HSWA74 and usually address issues arising from EU Directives. Most of the requirements for nuclear safety are imposed by means of conditions attached to the nuclear site licence (see below).

Ionising Radiation Regulations 1999

7.15. The nuclear site licensing regime is complemented by the Ionising Radiations Regulations 1999 (IRR99) (Ref. 29) that provide for the protection of all workers and members of the public, whether on licensed sites or elsewhere, from ionising radiations. IRR99 implements aspects of the European Council (EC) Directive establishing Basic Safety Standards (Ref. 30) and includes the setting of radiation dose limits for employees and members of the public for all activities involving ionising radiation. IRR99 also implements EC Directive 90/641/Euratom (Ref 31) on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas. Outside workers are persons undertaking activities in radiation controlled areas designated by an employer other than their own. Further information on the application of IRR99 can be found in Article 15.

Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999

7.16. The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR99) (Ref. 32) implement the requirement for an environmental impact assessment for decommissioning nuclear power stations and nuclear reactors arising from EC Directive 85/337/EEC (as amended by EC Directive 97/11/EC) (Ref. 33) on the assessment of the effects of certain public and private projects on the environment. Before decommissioning or dismantling of a

nuclear reactor or power station can take place, a licensee must apply to HSE for Consent, undertake an environmental impact assessment and provide an environmental statement. The information to be included in an environmental statement is referred to and specified in Schedule 1 to the Regulations.

Radiation (Emergency Preparedness and Public Information) Regulations 2001

7.17. The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) (Ref. 34) implemented in Great Britain the Articles on intervention in cases of radiation emergency in EC Directive 96/29/Euratom (Ref. 35). It also partly implements EC Directive 89/618/Euratom (Ref. 36) on informing the general public about health protection measures to be applied and steps to be taken in the event of an emergency. A radiation emergency is defined as an event that is likely to result in any member of the public receiving an effective dose of 5 milliSieverts (mSv) during the year immediately following the emergency.

Management of Health and Safety at Work Regulations 1999

7.18. The Management of Health and Safety at Work Regulations 1999 (MHSWR99) (Ref. 37) are relevant as they place requirements on employers, and hence nuclear site licensees, to:

(i) make assessments of the health and safety risks of their activities;
(ii) make, give effect to and record the appropriate health and safety arrangements;
(iii) ensure that their employees are provided with appropriate health surveillance;
(iv) appoint an adequate number of competent persons to assist them in complying with health and safety legislation;
(v) establish and give effect to procedures to be followed in the event of serious or imminent danger arising;
(vi) provide employees with information concerning the:-
  (a) risks to their health and safety;
  (b) preventive and protective measures;
  (c) procedures necessary in the event of serious or imminent danger; and
  (d) persons nominated to implement evacuation procedures;
(vii) co-operate with other employers to enable statutory health and safety obligations to be met, including the provision of health and safety information; and to
(viii) ensure that employees, taking into account their capabilities, have adequate health and safety training which is repeated periodically as appropriate.

7.19. MHSWR99 is very wide-ranging. Where its requirements overlap with other health and safety regulations, compliance with the more specific regulations is normally sufficient for compliance with MHSWR99 (Ref. 37).

Health and Safety (Fees) (Amendment) Regulations 2012

7.20. The Health and Safety (Fees) Regulations 2012 (Ref. 38) provides for the charging of fees for work by ONR in relation to the assessment of a proposal for any new nuclear installation. This includes all matters relating to the installation's construction, commissioning, operation and decommissioning, which are to be assessed by ONR. The charges apply to assessment work undertaken associated with a particular design proposal prior to any application for a nuclear site licence under NIA65 (Ref. 24).

Process for developing secondary legislation

7.21. Where regulations relating to health and safety are appropriate, the process of preparing them is as follows:

- a timetable for the preparation of the regulations is agreed with lawyers acting for HSE;
- instructions are prepared and agreed with the lawyers;
- draft regulations are prepared and consulted upon. The consultation includes a regulatory impact assessment and an equality impact assessment;
- final draft regulations are developed taking account of consultation results.
- HSE (if it has responsibility for proposing the regulations), after consideration, approves the draft; and
- draft regulations and an explanatory memorandum are prepared for the relevant Minister to approve (i.e. they are signed by the Minister).

7.22. When the Energy Bill comes into force, ONR will become a public corporation (see Section 2 and Article 8 for further detail). Any secondary legislation under the Energy Bill (specific to nuclear regulation) will be proposed by ONR and taken forward by the Secretary of State for Energy and Climate Change. The arrangements for proposing secondary legislation under the HSWA74 will remain unchanged and when required will continue to be proposed by HSE.

7.23. The 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 the scrutiny by Parliamentary Committees as to the merits and the drafting accuracy of the regulations.

Obligations under international Treaties, Conventions or agreements

7.24. IRR99, made under the HSWA74, implemented most of the revised BSS Directive (EC 96/29/Euratom) (Ref. 35). IRR99 also implement European Council Directive 90/641/Euratom (Ref. 31) on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas.

7.25. REPPIR implements in Great Britain the Articles on intervention in cases of radiation emergency in EC Directive 96/29/Euratom (Ref. 35). REPPIR also partly implements EC Directive 89/618/Euratom (Ref. 36) (known as the Public Information Directive on informing the general public about health protection measures to be applied and steps to be taken in the event of an emergency). RSA93 was amended by the EA95 so that the Environment Agency is the regulatory body for authorisations in respect of premises in England and SEPA is the regulatory body for Scotland. Since 1 April 2013, Natural Resources Wales took over the responsibilities of, but remains supported by, the Environment Agency in Wales.

7.26. As part of the implementation of the BSS Directive 96/29/Euratom (Ref. 35) a number of the Agencies' existing administrative practices under RSA93 have been put into legally binding obligations.

7.27. EIADR99 (Ref. 32) implements the requirement for an environmental impact assessment for decommissioning or dismantling nuclear power stations and nuclear reactors arising from EC Directive 85/337/EEC (Ref. 30) (as amended by EC Directive 97/11/EC) (Ref. 33) on the assessment of the effects of certain public and private projects on the environment. The EC Directive is now fully transcribed.

Licensing system

Overview of the licensing system

Authority to issue licences

7.28. ONR derives its licensing authority from NIA65. This requires that a nuclear power plant is not installed or operated unless ONR has granted a site licence. The Nuclear Installation Act also allows ONR to attach conditions to the licence as it

considers necessary in the interests of safety and radioactive waste management. The Nuclear Installations Act 1965 etc. (Repeals and Modifications) Regulations 1974 (Ref. 39) made ONR the nuclear licensing authority for nuclear sites. These powers, to grant a licence or not and to attach conditions, are delegated to the post of the ONR Chief Nuclear Inspector. Failure to comply with conditions attached to a site licence is an offence.

Licence conditions

7.29. ONR has developed 36 standard conditions that together form a sound basis for good nuclear safety and radioactive waste management. These address, for example, issues such as operating rules (ORs) and instructions, maintenance, safety justifications, PSRs, reporting and following-up on events, training and qualification of staff, modification to plant and procedures, independent nuclear safety committees, emergency arrangements, organisational structures and management systems. Several relate to the licensee having adequate arrangements to manage changes that may have safety implications.

7.30. The licence conditions mainly set goals but do not prescribe how these goals are to be met. Therefore, each licensee can develop licence condition compliance arrangements that best suit its activities, whilst demonstrating that safety is being managed properly. Under the license, the licensees have a legal duty to demonstrate adequacy of these arrangements. 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. Whilst 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 conditions allow for interventions by ONR, which can for example, "Approve" arrangements or "Consent" to specific actions. Some conditions enable ONR to Direct a licensee to carry out a specific action including shutting down a reactor. Other conditions require the licensee to obtain ONR's permission before commencing an activity such as starting up a reactor after a periodic shutdown for maintenance. The licensing powers are supplemented by enforcement and investigation powers derived from HSWA74 (see paragraphs 7.54 – 7.60).

Basis for licensing

7.31. A nuclear site licence is issued on the basis of a satisfactory outcome of regulatory assessment of an applicant's case including the capability of a proposed licensee. A licence is issued for all phases of the life of the site. The issue 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. Regulatory control of activities on a licensed site is exercised using the site licence conditions. Routine regulatory inspection and assessment, and, the PSR process (see Article 6) ensure that the licensing basis is maintained.

Licensees' continuity of responsibility

7.32. Under NIA65, the nuclear installation licensing system applies throughout the lifetime of a civil nuclear site, including installation, commissioning and operation to eventual decommissioning. NIA65 allows ONR to revoke a licence, or for it to be surrendered by the licensee. However, in either event, the licensee would remain responsible for the safety of activities on the site until another licence had been granted. This "period of responsibility" can end only when a new licence has been granted for the site or ONR has given written notice that in its opinion there has ceased to be any danger from ionising radiations from anything on the site.

7.33. ONR published a policy statement in August 2005 (Ref. 40) that provides a basis for the considerations that need to be made in order to de-licence the whole or part of a nuclear licensed site, licensed by ONR under NIA65. It attempts to achieve broad consistency with current scientific thinking, relevant guidance and other published material including the RSA93 (Ref 41) (and the exemption orders made under it), and Article 5 of the BSS Directive (Ref. 35).

Appeals process

7.34. Nuclear site licensees, like all duty holders under HSWA74, have the right of appeal to an employment tribunal in respect of Improvement and Prohibition Notices (see paragraphs 7.50 to 7.51). However, Section 44 of HSWA74 precludes the right of nuclear licensees to appeal over licensing decisions made under NIA65. This reflects the nature of the hazard being regulated and the particularly complex technical arguments that underpin most key licensing decisions. A licensee who is dissatisfied with a licensing decision may raise concerns with the site inspector and the relevant management in ONR. Although the Chief Nuclear Inspector is the final arbiter of licensing decisions, a licensee may seek a review by HSE, as the governing body, of the process by which a licensing decision had been reached. ONR is putting in place administrative arrangements to allow such licensing decisions to be reviewed by its Chief Executive Officer supported by technical experts not involved in the original decision. The review will look at the process by which the decision was taken.

7.35. Within UK law, Judicial Review is always available to challenge regulatory decisions, but this applies only to a review of process and not to the final decision itself.

Involvement of public in licensing system

7.36. ONR's own arrangements require it to provide quarterly reports to local community groups on inspection and regulatory activities relating to licensed sites that it regulates.

7.37. ONR also prepares a report on UK's compliance with the obligations of the Convention on Nuclear Safety in consultation with other regulators and licensees; this is available through the ONR website.

7.38. There are specific regulations requiring sharing environmental information related to decommissioning activities:

- The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR99) (Ref. 32) - Statutory Instrument 1999 No. 2892; and
- The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) (Amendment) Regulations 2006 (Ref. 42) - Statutory Instrument 2006 No. 657.

7.39. ONR has a procedure for dealing with applications submitted to it for Consent under EIADR99 (Ref. 32). In addition to information provided to consultees, information is also sent to the ONR Head Office in Bootle.

7.40. For potential new civil reactors, as part of the GDA process, a public involvement process was launched, which allowed the public to view and comment on detailed design information published by the design companies.

7.41. The GDA process established stakeholder engagement arrangements which include non-governmental organizations such as environmental action groups. The regulator's intention is to ensure that GDA is carried out in an open and transparent manner, which allows public participation in the process. The public was given access to reports prepared for the design by the Requesting Party, without compromising commercial and security considerations.

Regulatory Interventions

Legal establishment of regulatory bodies

7.42. HSWA74 enables ONR to appoint inspectors and give them regulatory powers (see Article 8) of inspection and investigation. Extracts from HSWA74 relevant to this Convention are contained in Annex 2. Similarly, EA95 enables the environment agencies to appoint 'authorised persons' with regulatory powers to carry out similar duties and inspections.

7.43. ONR, has responsibility for the day-to-day exercise of nuclear licensing function. The Chief Nuclear Inspector has the authority to carry out certain functions under the HSWA74 and NIA65. Thus, the Chief Nuclear Inspector has the powers to grant or vary Nuclear Site Licences, and to attach, vary or revoke Conditions of the Licence. The Chief Nuclear Inspector delegates powers to the Deputy Chief Inspectors to Direct the shutdown of operations or issue Consents to allow reactors to commence operation after statutory shutdowns.

Overview of regulatory strategy

7.44. ONR carries out its regulatory activities through consistent and proportionate regulation of nuclear safety and security by focusing on 4 core activities. These core activities reflect ONR's regulatory philosophy and are:

- securing sustained compliance;
- influencing improvements in safety and security (including transport);
- making balanced judgements; and
- engaging with its stakeholders

7.45. In order to achieve these core activities, ONR carries out interventions which are broadly classified as compliance or permissioning inspections

Inspections carried out in support of permissioning activities

7.46. 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 as it is reasonably practicable" (SFAIRP). ONR assessors, who are themselves inspectors and technical experts in specific fields, will sample 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. The technical principles which ONR uses to judge safety cases are set out in its Safety Assessment Principles for Nuclear Facilities (SAPs) (Ref. 43).

Inspections carried out to verify compliance with the licence and relevant regulation

7.47. This is mainly done 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 ONR's nominated inspectors who spend about 30% of their time on site. Additionally, ONR undertakes team inspections on particular topics.

Influencing licensees

7.48. The regulator also seeks to influence licensees to further the improvement of nuclear safety and radioactive waste management. This is particularly important for those areas that impact on safety such as the safety culture of an organisation,

effective programme management and leadership, which are difficult to regulate by legal means.

Enforcement powers

7.49. There are a range of enforcement powers available to the regulatory body. These arise from both the primary laws (HSWA74), which applied to health and safety inspectors of all industries and the licence conditions, which only applies to the nuclear industry. ONR follows the HSE's Enforcement Policy (Ref. 44) that sets out the purpose of enforcement, and the principles that should be applied. Inspectors are guided by an Enforcement Management Model (Ref. 45) to assist in determining which enforcement measure is the most appropriate in a given situation.

Enforcement powers under HSWA74

Improvement notice

7.50. If an inspector is of the opinion that a relevant statutory provision has been contravened or that contravention will continue or be repeated, s/he can serve a notice that requires the contravention to be remedied. This is a power provided by Section 21 of HSWA74. ONR has chosen to put in place administrative arrangements which require a corporate decision before any such notice can be issued.

Prohibition notice

7.51. HSWA74 section 22 also provides for an inspector, if of the opinion that an activity is being or is likely to be carried out which risks causing serious personal injury, to serve a notice to prohibit the activity. In practice, this power is rarely used by ONR as there are more appropriate powers available under the licence conditions.

Prosecution

7.52. HSWA74 section 38 gives an inspector the power, in England and Wales, to institute proceedings for an offence under any of the relevant statutory provisions. In Scotland, an inspector can recommend that a prosecution is initiated to the Crown Office Procurator Fiscals Service. Again, ONR's own administrative arrangements require a corporate decision to be made for the exercise of this power.

Other regulatory interactions

7.53. NIA65 allows ONR to attach such conditions as it considers necessary in the interests of safety and radioactive waste management.

Direction

7.54. A Direction is issued by ONR when it requires the licensee to take a particular action. For example, LC31(1) gives ONR the power to Direct a licensee to shut down any plant, operation or process. Such a Direction would relate to a matter of major or immediate safety importance.

Specification

7.55. The standard licence conditions give ONR discretionary controls with regard to a licensee's arrangements and these are implemented through Specifications. For example, in LC23(2), if ONR specifies, the licensee is required to refer ORs to its Nuclear Safety Committee for consideration.

Notification

7.56. The standard licence conditions give ONR powers to request the submission of information by notifying the licensee of the requirement. For example in LC21(8) the licensee shall, if notified by ONR, submit a safety case and shall not commence operation of the relevant plant or process without the Consent of ONR.

7.57. In addition to the above, the site licence conditions identify specific interventions where ONR must give permission before a licensee can proceed with

its intended course of action. Withholding such a permission can be regarded as an enforcement power. It should be noted that a nuclear reactor should operate within the limits and conditions identified within its safety case and must therefore shutdown if this is the only way to remain within a valid safety case. This should be compared with conventional industrial plant where the default situation allows operation unless the regulator intervenes to prevent this.

Consent

7.58. A Consent is required before the licensee can carry out any activity which is specifically identified in the licence as requiring prior Consent. For example, Consent is required before a reactor is allowed to be started up again following its periodic shutdown. Before being granted Consent the licensee must satisfy ONR that the proposed action is safe and that all procedures necessary for control are in place.

Approval

7.59. An Approval is used to freeze a licensee's arrangements. Once approved, the procedures cannot be changed without a further approval from ONR, and the procedure itself must be carried out as defined; failure to do so would infringe the licence condition and would be an offence. For example, for nuclear power stations, ONR has approved Operating Rules important to safety in order to ensure that licensees cannot change these without seeking ONR's agreement to the change.

Agreement

7.60. An Agreement issued by ONR allows a licensee, in accordance with its own arrangements, to proceed with an agreed course of action. For example, LC22 requires a licensee to have adequate arrangements to control any modifications or experiment carried out on any part of the existing plant or processes which may affect safety. Such arrangements require that modifications or experiments are classified according to their safety significance and are divided into stages where appropriate. Hence, the licensee submits a safety case justifying the modification and cannot proceed until ONR has written agreeing to this proposal.

Article 8 - Regulatory Body

> ***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 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.***
> ***2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.***

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations).

Establishment of the regulatory body

Legal foundation and statute of the regulatory body

8.1 HSE was established under the Health and Safety at Work etc Act 1974 (HSWA74) with the duty to enforce the law concerning health and safety at work including the regulation of nuclear safety. Regulation of nuclear safety was originally undertaken by a directorate within HSE.

8.2 In April 2011, the Office for Nuclear Regulation (ONR), was set up as a non-statutory Agency of HSE responsible for: enforcing health and safety at work legislation in relation to nuclear installations, for the operation of the nuclear site licensing regime including the day-to-day regulation of the nuclear industry. ONR is also responsible for regulating civil nuclear security, the transport of radioactive materials and facilitating the UK's international obligations for safeguarding nuclear materials.

8.3 The UK Government is currently bringing forward legislation to create a new statutory regulator outside of Government and HSE, to regulate the nuclear industry. The new public corporation will continue to be known as the Office for Nuclear Regulation (ONR) and will continue regulating the relevant statutory functions that it is currently responsible for.

8.4 The public corporation status will establish ONR as a new independent regulator, formally responsible in law for delivering its regulatory functions. The ONR's role, responsibilities and powers will be set out in law as well as the make-up of the Board. In addition, the roles of the Chief Executive Officer and the Chief Nuclear Inspector will become statutory requirements under the Energy Bill.

8.5 This proposed change will not affect the current regulatory requirements or standards with which industry must comply, and the vast majority of the costs of the regulator will continue to be recovered from charges on the operators in the nuclear industry rather than funded by Government.

Function and responsibilities of the regulatory body

8.6 ONR is responsible for regulation of nuclear safety, security, safeguards and transport of radioactive material. This includes responsibility for operating the nuclear site licensing regime under the Nuclear Installations Act 1965.

8.7 ONR is also responsible for delivery of integrated nuclear safety regulation in partnership with the Ministry of Defence Nuclear Safety Regulator (DNSR).

8.8 In connection with its regulatory roles ONR also has responsibilities with respect to research, and provision of information.

Independence of the regulatory body

8.9 ONR's independence as a regulator is currently ensured under HSWA74, where ONR is given direct responsibility for the enforcement of the nuclear safety regulatory system. Similarly, the environment agencies are responsible for the environmental protection regulatory system under Environmental Permitting Regulation 2010 (Ref. 27) in England and Wales and Radioactive Substances Act 1993 (Ref. 41) in Scotland and Northern Ireland.

8.10 ONR's 'sponsorship' department in central government is the Department for Work and Pensions (DWP), which has no role in promoting nuclear technology or responsibilities for nuclear facilities or activities. This arrangement ensures that the sponsorship activities of DWP are concerned solely with the governance and financial arrangements of the regulator rather than wider energy or defence policy.

8.11 The Secretary of State for Energy and Climate Change is accountable to Parliament for nuclear safety in Great Britain. ONR provides assurance through factual information and advice to Ministers and Government on nuclear safety matters, but operates its regulatory functions separately from Government and ministers. Furthermore, Government cannot direct ONR with respect to regulatory functions in a particular case - ensuring that regulatory decisions are independent.

8.12 The Environment Agency (in England) is sponsored by the Department for the Environment, Food and Rural Affairs (Defra). It works closely with ONR and the Department of Health, and on radioactive substances matters with DECC.

8.13 From 1 April 2013, Natural Resources Wales (NRW) became responsible for the enforcement of environmental protection in Wales. Although NRW took over the Environment Agency's responsibilities in Wales for regulating radioactive substances, including the disposal of solid radioactive waste from nuclear licensed sites and non-nuclear premises using radioactive substances, the regulatory function in these areas will continue to be delivered in Wales for the time being by the Environment Agency on behalf of and under agreement with NRW thus ensuring continuity of effective regulation in these areas while NRW develops its own expertise. The non-nuclear regulatory function will in due course be delivered by NRW; nuclear regulation is expected to continue to be delivered in Wales by the Environment Agency on behalf of NRW for the foreseeable future. NRW is sponsored by the Welsh Assembly Government.

8.14 Scottish Environment Protection Agency (SEPA) is sponsored by the Scottish Government. On radioactive waste matters, it works closely with the Rural and Environment and Public Health Directorates of the Scottish Government.

8.15 Concordats or Memoranda of Understanding exist between the regulators and the Food Standards Agency, which would have a statutory duty to advise the Government on food safety in the event of a radiological release from a site. In addition, the Food Standards Agency acts as statutory consultee to both the Environment Agency and SEPA under RSA93. Regular liaison meetings take place between the Environment Agency, SEPA and the Food Standards Agency.

Independent advisory bodies

8.16 HSWA74 Section 13(1)(d) enables ONR to create advisory committees to provide independent advice on any of its functions. Although not a legal requirement, ONR custom and practice has been to constitute advisory committees in relation to activities in the nuclear sector. Arrangements are currently being made to establish a Chief Nuclear Inspector's advisory panel in order to ensure that the Chief Nuclear Inspector has access to independent strategic advice on new safety and security

technologies. In establishing the Chief Nuclear Inspector's advisory panel ONR will deliver on a recommendation that arose from the House of Lords' Science and Technology Select Committee report (published November 2011) into Nuclear Research and Development Capabilities (Ref. 6). The Select Committee report made several recommendations, one of which was that the "*Office for Nuclear Regulation (ONR) re-formulate an advisory committee similar to the Nuclear Safety Advisory Committee (NuSAC)".* ONR has advertised for the membership of an advisory panel to the Chief Nuclear Inspector through the Office for Commission for Public Appointments.

Financial resources of regulators

8.17 Section 24A of NIA65 enables ONR (as an agency of HSE) to charge fees to nuclear licensees to recover the expenses incurred through its regulation of the nuclear site licensing regime. Further fees regulations made under HSWA74 allow ONR to charge for other safety regulation carried out on licensed nuclear sites including the Generic Design Assessment (GDA) process. The Nuclear Industries (Fees) Regulations 2005 (Ref. 46) allows ONR to charge for the majority of its security regulation. ONR uses a work recording system to identify the effort and expenses of its staff attributable to each licensee. Where ONR cannot reclaim costs from the industry via its fees regime it receives funding from Government (currently approximately 5% of ONR's costs).

8.18 Section 41 of EA95 provides the Environment Agency and SEPA with the power to impose financial charges for 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 Environment Agency and SEPA. Both use a work recording system to identify the effort and expenses of its staff attributable to each licensee.

Organisational structure of ONR

8.19 As part of its creation as an agency of HSE, ONR Board was appointed in April 2011. The ONR Board is made up of non-executive and executive members - the non-executive members always being in the majority. The ONR Board's role 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.

8.20 Since April 2012, ONR has undergone a restructuring, moving to a programme working regime. With this restructuring, ONR is organised into Regulatory and Assurance Functions. ONR's Regulatory Function is responsible for delivery of its nuclear programmes. The regulation of similar sites is organised into Programmes, each headed by a single Programme Director. In addition to enhancing organisational flexibility, this structure allows ONR to better focus on strategic context of the sites and to improve efficiency and consistency of its regulatory activities. These Programmes are:

- Civil Nuclear Reactor Programme (operating) and proposed new build plants;
- Decommissioning, Fuel and Waste
- Sellafield Programme
- Defence Programme
- Civil nuclear Security
- Radioactive Materials Transport

8.21 The Assurance Function is responsible for ONR's corporate centre which includes the Corporate Programme Management Office, Policy (domestic and international), Finance and Human Resources. A significant aspect of the Assurance

Function (Regulatory Assurance) is to enhance arrangements for provision of assurance about ONR's regulatory decisions. ONR's 'Regulatory Assurance' Programme also leads on ONR's strategic themes such as emergency preparedness and response; review and development of ONR's technical standards and associated business processes; knowledge management; research and technical support activities; and special regulatory and technical projects.

8.22 ONR also strengthened its regulatory governance arrangements through its regulatory strategy group (RSG). The purpose of the RSG is to ensure the effectiveness of the regulatory function is maintained. In June 2012, the RSG identified a number of strategic themes and regulatory priorities and shared these with the industry through the nuclear industry's Safety Directors' Forum. Through this work, ONR highlighted UK and licensee/dutyholder issues on which it is seeking progress. The UK-wide issues are:

- Management of radioactive waste, for example 'UK consolidation', accumulation, containment, conditioning, transport, waste hierarchy, radioactive waste management case
- Long-term fuel cycle for the UK
- Decommissioning strategies for Nuclear Power Plants

The Licensee/dutyholder issues are:

- High quality safety cases (site and transport)
- Effectiveness of internal challenge processes
- Organisational learning, including effective learning from experience processes
- Organisational resilience and capability, including effective leadership and management
- Robust procurement and supply chain processes
- Lifetime management- asset management, particularly for ageing facilities, and routine management
- Adequate understanding of the non-nuclear industry of radioactive materials transport regulatory requirements
- Periodic review of safety
- Security change integration programme
- Openness and transparency

The ONR's Programme Directors are responsible for monitoring and seeking progress against these themes.

8.23 In addition, as part of its role in providing strategic direction for ONR's regulatory activities, the RSG also reviews the overall effectiveness of ONR's regulatory function through management reviews of appropriate regulatory effectiveness performance indicators. This is covered in more detail in paragraphs 8.24 to 8.28.

Effectiveness of the regulatory body

ONR's regulatory effectiveness Indicators

8.24 ONR has developed a framework for evaluating its overall performance, through a suite of key performance indicators. The indicators cover all areas of ONR's business and include key performance information relating to ONR's major strategic themes and regulatory effectiveness. This framework provides ONR Managers and the Executive with a tool to monitor performance and manage corporate and regulatory priorities.

8.25 ONR's regulatory effectiveness indicator is underpinned by intelligence gathered through ONR's core regulatory activities, namely, inspection, permissioning, effective leverage and enforcement. As part of this framework, information is gathered on activities that enable ONR achieve its regulatory objectives. These include availability of suitably qualified and experienced staff resources and appropriate training, development and knowledge management systems. ONR is currently using this framework on a trial basis and will review the outcome to make improvements where appropriate

ONR's Programme Management Office

8.26 ONR has established a Programme Management Office (PMO). The PMO facilitates the means for clear and consistent planning and prioritisation of regulatory activities and the allocation of resources to these. The PMO also ensures that business and regulatory risks are managed consistently across ONR. The PMO achieves its objectives using project management tools and by managing a central function for the development of procedures and guidance for use across ONR.

8.27 The PMO is part of ONR's Finance and Corporate Services Programme and acts as the focal point for collection of business and regulatory performance information from ONR programmes and forward submission of this information to ONR's management team.

Planning and prioritisation of work

8.28 In March 2013, ONR published its first Annual Plan (Ref. 1) which captures its priority objectives for 2013/14, including its overall budget by Programme. ONR's priorities were determined using programme management principles appropriate to its activities, developed by its Programme Management Office. The first step in the prioritisation process was to identify the key activities that ONR intended to carry out in 2013/14.

Regulatory body quality management

Business Management System

8.29 In September 2011, ONR launched a new business management system known as "HOW2". HOW2 is a web browser-based quality assurance system and provides an integrated approach to system management. HOW2 covers all ONR's business processes, including those related to regulatory activities, such as the regulatory permissioning, enforcement and investigation. Guidance relevant to each of the activities is appended to the appropriate part of the process map. The system provides the facility for the rapid production, reviewing, authorising and publishing of ONR guidance and processes.

8.30 An important part of HOW2 is a library of Technical Assessment Guides (TAGs). ONR's TAGs are primarily guidance for inspectors on the interpretation and application of the ONR's SAPs (see Article 14). The system also guidance relevant to principles underlining the enforcement of licence condition compliance. These are known as Technical Inspection Guides (TIGs). All TIGs and TAGs have been reviewed and updated during 2013.

8.31 The system administration is managed centrally, with authoring and content ownership in relevant functional areas enabling appropriate review and continuous maintenance be achieved.

Human resources

8.32 ONR sought and gained ministerial approval to undertake external recruitment campaigns to address the need to bring in highly specialist skills in a competitive market. The establishment of ONR's Cheltenham office contributed to our success in attracting new recruits and we have now significantly extended that

office. ONR is establishing a process for annual benchmarking of its total reward offer to staff so that it is able to remain competitive.

8.33 ONR has successfully recruited 77 additional Nuclear Safety and Security specialists since the last Convention report with this expected to reach around 80 by completion of the current campaign. In recent months, ONR has opened its external recruitment at more senior levels to attract high levels of skills and experience. ONR is also developing proposals for Graduate recruitment and has already introduced an "equivalence" route that enables those with sound technical knowledge but limited high-hazard or nuclear experience to undergo a development and training programme to obtain the knowledge, experience and competence required to reach Inspector standard.

8.34 Although there have been recent successes in recruitment, maintaining staff levels and the assimilation and training of new recruits will remain a challenge. ONR is implementing knowledge management processes to ensure a managed succession plan for all core capability skills and is investing significantly in the development of staff through bespoke management programmes. ONR is also looking to work more strategically with the supply chain to have better access to highly scarce technical skills and resource for limited periods to meet exceptional demands.

Developing and maintaining staff competences

8.35 The intensive recruitment campaign since 2011 has necessitated a radical revision of the training and assimilation of new inspectors. Recruitment in excess of 60 new inspectors meant that ONR can no longer just rely on external training courses and ad-hoc internal peer group assistance from experienced colleagues. Training and assimilation is resource intensive so it has to be structured, planned, properly resourced and continually evaluated to ensure it meets all needs. ONR therefore put in place a dedicated team of experienced Inspectors led by a training manager to develop specialist and core regulatory training courses and expanded its capacity to meet the increasing training needs of its expanding organisation. ONR is further developing its training and knowledge management system to ensure an effective succession plan for its core resource capability. Each of these aspects are covered independently in the following paragraphs.

Warrants for new inspectors

8.36 All inspectors are formally appointed by HSE issuing a warrant to them, which entitles them to exercise specified legal powers. For new inspectors, ONR recognised the need for managers to determine a period during which use of Health and Safety at Work etc Act 1974 powers was administratively limited, the work of Inspectors would be checked, and competence requirements would be established and completed. In order to improve the competency development of new ONR nuclear safety inspectors, and ensure consistency with established practices in the wider HSE, ONR introduced a Limited Warrant process. In order to demonstrate an adequate level of competence, all new inspectors must participate in a specific training programme, focusing on core regulatory training, before being issued with a Full Warrant following an interview process.

8.37 The purpose of limiting the warrant is to restrict full powers until such time as new inspectors have received appropriate training and assessment whilst providing them with sufficient legal powers to enable them to undertake inspection duties expected in their early months of joining ONR. The powers excluded from the Limited Warrant are ones that are broadly associated with inspectors pursuing investigation and enforcement action for which ONR mandates specific legal training.

Training of new inspectors

8.38 All inspectors joining ONR are required to have good academic qualifications and several years of experience in a relevant industry such that they can be regarded as being technical experts in their own discipline. The purpose of the training given to inspectors is to expand and build on this base rather than "convert" them to acquire another knowledge base. To achieve this, inspectors receive training in two main areas:

- The mandatory core regulatory training (including refresher training); and
- Training to expand their technical expertise and to gain a working knowledge of other essential technical disciplines.

Training methods

8.39 In addition to the mandatory core regulatory training, a new inspector's training programme is developed on a personal basis and is based on a training needs analysis. The delivery of the training relies extensively on an interactive tutorial approach as well as specific technical training courses. Training documentation provides signposts to where information can be found as well as providing detailed training material.

8.40 New recruits also undergo operational training (on-the-job training) where 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.

Continued professional development

8.41 Whilst considerable effort is spent on the training of new recruits, ONR also has a refresher training programme to ensure all staff maintain professional competencies. A wider review of inspectors' competencies is under consideration as part of ONR's move to a public statutory corporation. ONR's current policy is that further training needs are a matter for discussion between individual inspectors and their managers in consultation with the Professional Leads who have the responsibility for oversight of application of regulatory standards in their particular specialism (e.g. structural integrity). Such training covers topics such as communication, influencing skills, change management and interpersonal skills, as well as the development of technical competencies.

8.42 In addition to regulatory and technical training, ONR has agreements in place for staff exchange schemes with other regulatory bodies. In addition to development opportunities for individuals, such schemes facilitate sharing and capture of best regulatory practices. Similar arrangements are in place for secondment of staff to licensee organisations which promote better understanding of working practices between the organisations.

External support to the regulatory body

8.43 The nuclear safety regulator in the UK does not use Technical Support Organisations in the way many other regulators do. Most of the expertise to regulate nuclear safety is available to ONR through its own staff. To maintain this situation, ONR periodically reviews its expertise and its likely needs for the near and intermediate term, and adjusts its recruitment and training activities accordingly. There are occasions, however, when specialist advice and/or additional resources are needed to respond to a high workload, or the specialism is not available in ONR or the wider HSE. To accommodate this, ONR has an extramural support budget and framework agreements with some outside bodies known to be independent, to enable contracts to be placed quickly.

8.44 Currently, ONR obtains technical support through three main routes:

- from within HSE - the Health and Safety Laboratory provides technical support on a wide range of safety issues that are not specifically related to nuclear installations e.g. ventilation or protective equipment;
- purchasing consultancy advice through an ONR framework agreement with pre-tendered suppliers.
- purchasing, through normal procurement routes, a range of one-off consultancy contracts from a range of suppliers; and

8.45 This framework was set up in order to secure access to independent technical expertise at a time when the needs of the nuclear industry are increasing and in response to a recommendation of the IAEA's IRRS in 2006 which stated that ONR should have access to scientific and technical support in the same way it is available to many other nuclear regulators in other countries.

8.46 The support framework which was set up with 31 contractors from the UK and overseas operated successfully for 15 months. Approximately half of contracted technical support was commissioned through the framework. It was envisaged that the will increase in future years as work on assessment of new reactor designs begins.

Interface with other agencies/regulators

Environmental regulatory bodies

8.47 The Environment Agency is the principal environmental regulator in England and Natural Resources Wales (NRW) has this responsibility in Wales. Scottish Environment Protection Agency (SEPA) has the equivalent responsibilities in Scotland. Their regulatory responsibilities include the authorisation or permitting of the disposal of radioactive wastes and discharges from nuclear licensed sites. The Environment Agency on behalf of and under agreement with NRW is expected to deliver nuclear regulation in Wales for the foreseeable future thus ensuring continuity of effective regulation in these areas while NRW develops its own expertise.

8.48 There are no nuclear installations in Northern Ireland to which the Convention applies (Annex 5 provides more information on the environmental regulatory bodies).

8.49 ONR, the Environment Agency, SEPA and Natural Resources Wales work closely with one another to ensure the effective co-ordination of their respective regulatory activities at nuclear installations. ONR has Memoranda of Understanding with the Environment Agency and SEPA, the objective of which is to facilitate the minimisation of the overall detriment due to radioactive waste management on licensed sites, from generation to disposal. Under NIA65, ONR consults the Environment Agency, Natural Resources Wales or SEPA before:

- granting a nuclear site licence; and
- varying a nuclear site licence if the variation relates to or affects the creation, accumulation or disposal of radioactive waste.

Similarly the Environment Agency, Natural Resources Wales or SEPA consult HSE under EPR10 (Ref. 27) or RSA93 (Ref. 41) on proposed (new or varied) authorisations for disposals of radioactive waste including discharges to the environment.

8.50 In addition to their own routine inspection activities on nuclear licensed sites, the Environment Agency (including on behalf of Natural Resources Wales) and SEPA carry out planned joint inspections with ONR and co-operate in the investigation of incidents where appropriate.

Responsibilities of other agencies and bodies

8.51 On 1 April 2013, the Public Health England (PHE) was established as a non-departmental public body, replacing the Health Protection Agency and other health related organisations, with radiation protection incorporated in its remit. Its statutory functions include:

- the advancement of the acquisition of knowledge about protection from radiation risks; and
- the provision of information and advice in relation to the protection of the community (or any part of the community) from radiation risks.

8.52 PHE also provides technical services to persons concerned with radiation hazards.

Openness and transparency of the regulatory body

8.53 For ONR, openness and transparency means proactively adopting a presumption of disclosure of information on its own activities. As part of its wider Change Programme, ONR established a dedicated project to develop ideas and implement these in order to enhance openness and transparency of its activities.

8.54 One of the key outputs of this project was introduction of a process to publish all ONR's major regulatory decisions. These are now published on ONR's website with details underpinning each decision.

8.55 ONR demonstrated its commitment to openness and transparency during the Generic Design Assessment of the new reactor design throughout the process and by publication of the final assessment reports of its findings and regulatory decisions on the UK European Pressurised Reactors. The good practices on openness and transparency identified during the GDA process have been captured and transferred to the rest of ONR's programmes where appropriate.

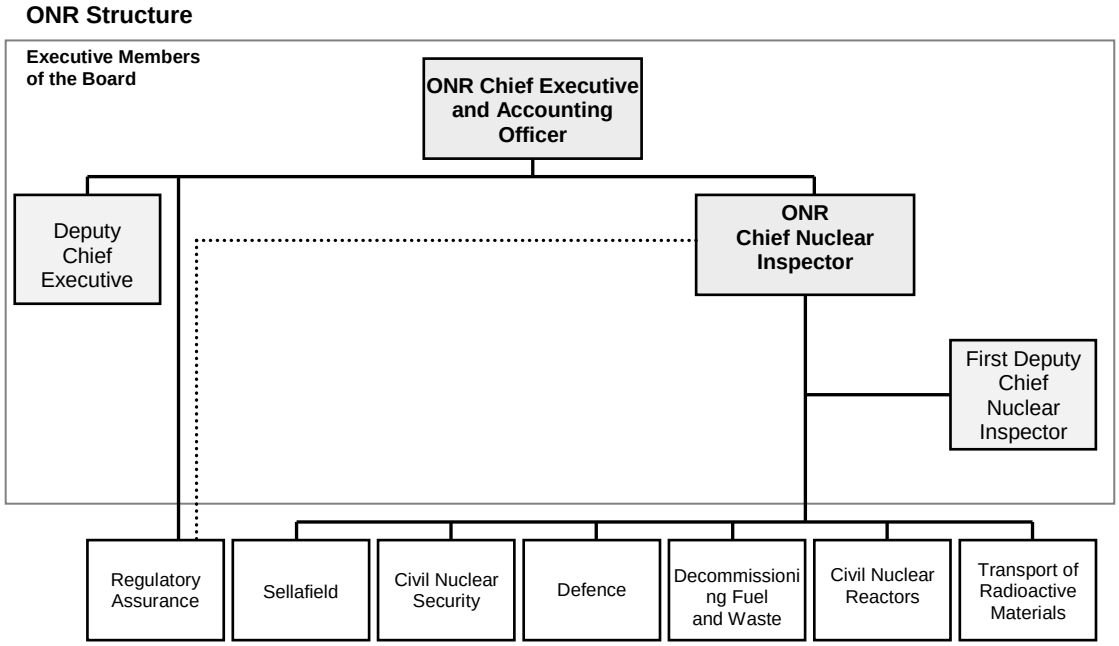
8.56 In June 2012, as part of its contribution to a cross nuclear industry forum, ONR shared its strategic themes and regulatory priorities with the industry and identified a number of licensee/dutyholder issues on which it is seeking progress.

8.57 ONR is currently piloting the publication of its intervention reports. These reports provide details of ONR's findings whilst carrying out its inspection and other regulatory activities.

8.58 Furthermore, In common with all other Government Departments, ONR must comply with the Freedom of Information (FOI) Act 2000 (see Article 7) and Environmental Information Regulations (EIR) 2004. ONR has a dedicated team to handle FOI requests.

8.59 ONR also participates in international initiatives initiated by the Organisation for Economic Cooperation and Development (OECD) Nuclear Energy Agency's (NEA) and the Western European Nuclear Regulators' Association (WENRA) to promote openness and transparency.

Figure 8.1 –ONR structure relevant to the Convention

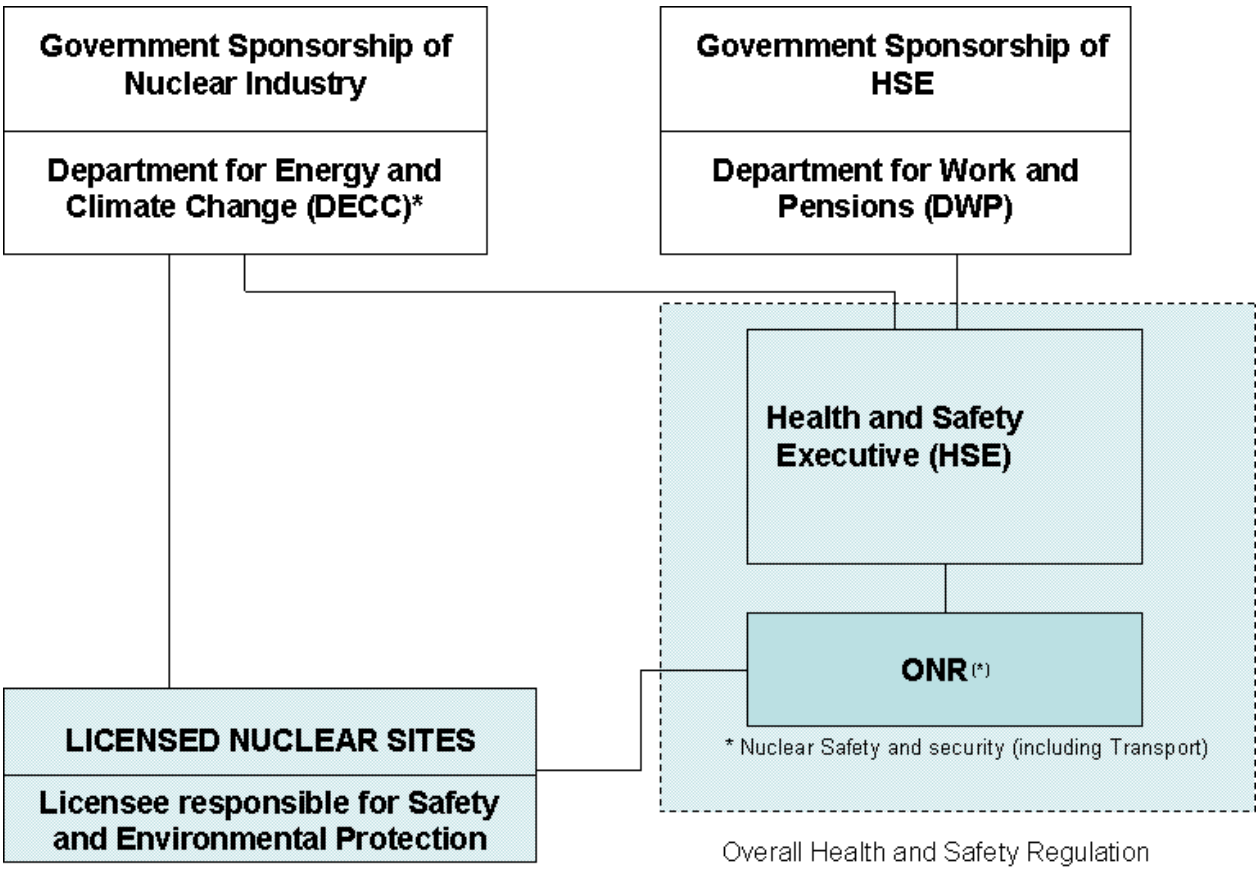


Lines of Reporting

8.60 The UK Chief Nuclear Inspector has direct lines of access, on nuclear safety and security matters, to Ministers in DECC and the Ministry of Defence (MoD), reflecting their respective responsibilities to Parliament on civil and military nuclear safety. As part of ONR's move to public Corporation, provisions are being made to define in legislation, the respective roles of the ONR Chief Executive officer and the Chief Nuclear Inspector.

8.61 The interfaces between ONR as an agency of HSE and other Government Departments are shown in Figure 8.2. The Secretary of State for Energy and Climate Change is accountable to Parliament for nuclear safety and security. The Department for Work and Pension (DWP) is accountable for the sponsorship of the Health and Safety Executive (including the ONR).

Figure 8.2 - Responsibilities for nuclear safety at nuclear installations



Article 9 - Responsibility of the Licence Holder

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations).

Operator's prime responsibility for safety

9.1. The Health and Safety at Work Act 1974 (HSWA74) (Ref 23) requires every employer so far as is reasonably practicable to:

i) ensure the health, safety and welfare at work of all their employees (HSWA74 section 2); and
ii) conduct their undertakings in such a way as to ensure that persons not in their employment who may be affected thereby are not exposed to risks to their health and safety (HSWA74 section 3).

9.2. In addition, the Nuclear Installations Act 1965 (NIA65) (Ref 24) requires that in the case of nuclear installations, no one can construct or operate such an installation without a nuclear site licence. Section 7 of this Act places duties on the licensee to prevent occurrences on the site that harm people or property.

9.3. In the UK, therefore, the holder of a nuclear site licence is responsible for the safety of its nuclear installations and also for the health and safety of those employees and members of the public that may be affected by the installation's operations.

9.4. The non-prescriptive licensing regime in the UK ensures that the licensees recognise and accept their responsibilities, whilst allowing them to determine their own methods for meeting the law, subject to the regulator being satisfied that they meet requirements. The way in which this responsibility is carried out is monitored and, if necessary, safety improvements are enforced by the HSE as described in Annex 5.

9.5. With regard to the financial responsibilities of the operator for potential damages to the public or the environment, under Section 19 of NIA65 operators are required to maintain insurance or other financial security to cover their third party liabilities. The operators' arrangements are subject to DECC approval. NDA insures the liabilities of all its site licence companies, EDF NGL insures its sites liabilities, and the Government has financial responsibilities as a Contracting Party to the Paris and Brussels Conventions. Before it issues a nuclear site licence, ONR (as an agency of HSE) seeks assurance from DECC on the licence applicant's ability to meet its potential financial liabilities as a nuclear site licensee, but does not have any review responsibilities.

9.6. None of the UK's other legislation for health and safety, e.g. HSWA74, relieves the licensee of its responsibility for the nuclear safety of its licensed sites.

Demonstration of safety

9.7. A licensee has to demonstrate the adequacy of the safety provisions for the activities it undertakes on a nuclear licensed site to the satisfaction of the regulator.

9.8. On granting a nuclear site licence, NIA65 enables ONR to attach any conditions to the licence in the interests of safety or radioactive waste management.

Currently, ONR attaches 36 standard conditions to a nuclear site licence that, in effect, envelope all the requirements for the effective management of nuclear safety. These licence conditions (LCs), cover matters such as the need to set operating limits, to provide a list of competent persons, to draw-up operating, test and maintenance activities, to manage radioactive waste, to report and investigate incidents, and to implement adequate arrangements for dealing with accidents or emergencies. ONR inspectors carry out an extensive programme of inspections to confirm that the licensee is complying with its arrangements made under each of the licence conditions and that those arrangements are adequate.

Operator's responsibility for safe operation

9.9. A particularly important aspect of a licensee's safety case is its management and safety organisation. ONR requires that the licensee's safety policy and organisational structure are documented as part of the licensing process. This document sets out the senior management structure, the health and safety responsibilities of key staff and, in particular, how health and safety performance is monitored and reviewed. Licensees' safety policies are discussed under Article 10. The licensee ensures that its organisation maintains effective control of operations that take place at the licensed sites for which it is responsible. The licensee's organisation is required to act as an 'intelligent customer' when contracting out work that could have an impact on safety. As an intelligent customer, in the context of nuclear safety, the management of the facility should know what is required, should fully understand the need for a contractor's services, should specify requirements, should supervise the work and should technically review the output before, during and after implementation.

9.10. The licensees for sites within the scope of the Convention have centrally-based staff who, for example, set safety and operational standards, carry out reviews of safety and provide specialist support for a number of licensed sites. The responsibility for compliance with some site licence conditions for a specific site may be held centrally by the licensee. All UK nuclear licensed sites have a designated site director who acts as the Agent of the Licensee. The site director is responsible for all day-to-day activities and operations. This includes responsibility for compliance with aspects of the nuclear site licence that are not covered by the centrally based organisation.

Interfaces between the regulatory body and the operator

9.11. The most frequent interfaces between the licensee and ONR arise through the assessment of safety cases and inspections at nuclear licensed sites by ONR to check the operator's compliance with licence conditions and other legal health and safety requirements. ONR nominates an inspector for each site to lead on this regulatory work. The processes of assessment and inspection provide ONR with assurance that the licensee meets its responsibilities with respect to the licence conditions and safety case.

9.12. The licensees and ONR also have a formal hierarchy for meetings to address and resolve issues arising from the regulatory processes. The interface includes meetings at different organisational levels, each based on the seniority of the representation and the breadth of the issues considered. At the top level are meetings between representatives of the Licensee Board and the Chief Nuclear Inspector and at the lowest level, meetings which while still formal in conduct, are devoted to technical discussion and clarification.

Regulatory Nuclear Interface Protocol

9.13. The Regulatory Nuclear Interface Protocol (RNIP) (Ref 47) is an agreement between nuclear licensees and nuclear safety and security regulators, which sets out a shared vision.

9.14. The protocol provides:

- a framework for more effective ways of working, covering values, behaviors and interactions;
- feedback on performance in order to improve; and
- opportunities for strategic dialogue on key issues affecting the whole nuclear industry.

9.15. RNIP brings together licensees from the nuclear sector together with their regulators, the Nuclear Directorate of HSE and the Defence Nuclear Safety Regulator (DNSR) in the Ministry of Defence. The Protocol is not regulator led but is a shared initiative with the industry, and was developed with the nuclear licensees' Safety Directors' Forum. It is intended to reinforce methods of working that secure high levels of safety and effective regulation.

Openness and transparency

9.16. Licensees adopt a policy of openness and transparency and place importance on assuring the public that they can be trusted to act to the highest professional standards. It is recognised that further work needs to be done in this area. As an example EDF NGL has a series of workstreams to further improve this area.

9.17. The openness and transparency policy requires station directors to write to local stakeholder groups regularly, providing updates on safety and operational performance and providing details of specific events reported through the recording processes.

9.18. Visitor centres have recently opened at four EDF NGL sites and the centres at all 7 locations will be open by summer 2013. Regular public community meetings are held at all EDF NGL sites to update on developments and regulators also attend to present their reports. In addition, monthly newsletters are circulated to the community and local media which are also published on the company website for all to see.

9.19. In addition, the UK nuclear industry openly shares information with other nuclear operators across the globe through international organisations such as the World Association of Nuclear Operators (WANO). Such arrangements enable the operators to learn from the experience of others. They also regularly 'peer review' other plants and operations internationally. This information is passed freely and frequently to promote behaviours throughout the organisation that support safe and reliable operation.

Article 10 - Priority to Safety

Each Contracting Party shall take the appropriate steps to ensure that all organisations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

Under this Article, compliance with the Convention is demonstrated by firstly considering the UK Government's responsibility for nuclear safety and its commitment to improving the regulatory body and then regulator's priority to nuclear safety. The response then addresses each of the reactor licensees in turn and describes their stated safety objectives and principles and the organisation and other factors that ensure that nuclear safety has due priority.

The Government's priority to nuclear safety

10.1. The Government's Department for Energy and Climate Change (DECC) is responsible for developing and implementing policy to make sure nuclear sites in the UK are safe (Ref 48). The Office for Nuclear Regulation (ONR) regulates civil nuclear sites in line with its policies. DECC is responsible for

- establishing nuclear policy and the regulatory framework
- acting on advice from the ONR about health and safety regulation for the UK nuclear industry
- representing the UK at international forums that set standards for nuclear safety

10.2. The key persons in implementing the Government's policies are (Ref 49):

- The Health and Safety Executive (HSE) has statutory responsibility for making sure there is adequate health and safety regulation across most industry sectors, including the UK nuclear industry.
- HSE's Office for Nuclear Regulation (ONR) is responsible for regulating safety at nuclear sites in the UK. The ONR's licence conditions cover all arrangements for managing safety, including emergency planning arrangements and responding to accidents, leaks and spillages of radioactive materials at individual civil nuclear sites.

10.3. At the time of the last Convention report, nuclear safety was regulated by the Nuclear Directorate of HSE. However, in 2008, the Government commissioned a major review into the UK's nuclear regulatory regime. The Government is acting on the recommendations, which includes setting up ONR as a public corporation as described in Article 8 and hence improving the regulation of nuclear safety.

The regulator's priority to nuclear safety

10.4. The Office for Nuclear Regulation's organisational structure has been described in Article 8. Its commitment to nuclear safety start at board level with the Board's vision that in all activities ONR will be "Universally respected for securing confidence in nuclear safety and security". The means to achieving this is described in the ONR strategy document (Ref 50).

10.5. ONR's business is to ensure that dutyholders properly control risks to people's health and safety from work activity. It's mission is "Securing the protection of people and society from the hazards of the nuclear industry". The means of achieving this is outlined in the ONR strategy (Ref 50) and more detail in the short term is presented in the Annual Plan for 2013/14 (Ref 51). The ONR Annual Plan identifies the organisation's aim as being to regulate the nuclear sector in a way that

commands public confidence and trust. To that end, it aspires to have a nuclear sector that:

- controls its hazards safely, securely and effectively;
- has a culture of continuous improvement and sustained excellence in operations;
- whenever possible, shares information about their activities with the public.

It contributes to achieving these outcomes by:

- influencing improvements to create a strong health, safety and security culture amongst the operators;
- ensuring compliance through proportionate, consistent and independent regulation of the nuclear sector;
- making balanced judgements through the application of consistent, transparent and evidence-based decision making processes in individual regulatory decisions;
- having a policy of presumption of disclosure which sets an example of openness and transparency.

The Annual Plan identifies how this will be done in the short term and will be further continue in future plans.

The operators' priority to nuclear safety

EDF Energy Nuclear Generation Ltd

Safety objectives and principles

10.6. The EDF NGL web site (Ref. 53) states that:

"*Nuclear safety is our overriding priority. Every one of us has a direct or indirect impact on nuclear safety and it must be in the forefront of what we do. Additionally we must ensure that radiological, environmental, industrial and fire safety are adequately controlled in support of our ambition to achieve a zero harm safety record*".

10.7. The EDF NGL nuclear safety policy states:

"Safe nuclear operation is achieved by:

1. A positive Nuclear Safety Culture that is continually fostered within the organisation, characterised by communications founded upon openness, mutual trust and shared values. This includes fostering a Safety Conscious Work Environment in which everyone openly reports and pursues safety issues or concerns without experiencing a negative reaction;
2. Plant that is well designed, operated and maintained within established safety cases to ensure they operate at a tolerable risk;
3. Processes that are robust and focused on prevention of events, problem identification and resolution;
4. People who are well trained, follow procedures, demonstrate a questioning attitude, uphold the highest standards and coach each other to improve those standards;
5. A learning organisation that strives for excellence by continuous improvement. This policy is also supported by the adoption of the following eight principles (from WANO / INPO):
    - Everyone is personally responsible for nuclear safety
    - Leaders demonstrate commitment to safety
    - Trust permeates the organisation
    - Decision making reflects safety first

- Nuclear technology is recognised as special and unique
- A questioning attitude is cultivated
- Organisational learning is embraced
- Nuclear safety undergoes constant examination".

10.8. With respect to organisation, the nuclear safety policy states further the company's responsibility for protecting the public, workers from the adverse effect of the nuclear technology. Further Details of EDF NGL's nuclear Safety Policy can be found in its website (Ref. 53)

Organisation

10.9. EDF Energy Nuclear Generation Ltd is a private limited company incorporated in England and Wales, which is ultimately owned by EDF Group, through EDF NGL and EDF NGL. The EDF Energy Nuclear Generation Group Board has as its primary function the oversight of the EDF Energy Nuclear Generation Ltd business. The EDF Energy Nuclear Generation Ltd Board (ENGLB) is the nuclear licensee. The ENGLB is responsible for overseeing health, safety and environmental performance, and the technical performance of the plant, and for providing input to the EDF Energy Executive and EDF Energy Holdings Limited Board who are in a position to ensure the licensee is properly resourced and supported.

10.10. Executive responsibility for ensuring that the company operates safely and complies with legislative and regulatory requirements lies with the ENGLB. Operational management of the business lies with the EDF Nuclear Generation (NG) Executive Team headed by the Management Director and comprising the regional Chief Nuclear Officers (CNOs), the Chief Technical Officer, the Safety and Technical Director, the Continuous Improvement and Operational Support Director, the Finance Director, the Human Resources Director and the Nuclear Synergies Director.

10.11. NG has divided its nuclear power stations into three operating regions, each led by a CNO. Technical support to the power stations is divided between the Chief Technical Officer (providing Engineering, Maintenance and Commercial services), the Safety and Technical Director (providing independent regulation, oversight and technical support in the operational areas of licensing, safety, emergency planning and health physics) and the Continuous Improvement and Operational Support Director (providing fleet management and continuous improvement support and learning).

Nuclear Safety Committee

10.12. On all matters related to nuclear safety, EDF NGL takes advice from its Nuclear Safety Committee. This committee includes independent members with extensive experience and knowledge in the field of nuclear safety.

Safety and technical division

10.13. EDF NGL has a Safety and Technical Division charged with independently scrutinising the licensee's arrangements and performance.

Peer evaluation

10.14. Peer Reviews against the Performance Objectives and Criteria set by the World Association of Nuclear Operators (WANO) take place at all UK nuclear power stations, as at the majority of nuclear power stations around the world. The Performance Objectives and Criteria provide a detailed description of the characteristics of a safe and reliable nuclear power plant under 10 general headings:

- Organisation and Administration
- Operations
- Maintenance

- Engineering support
- Training and qualification
- Radiological protection
- Chemistry
- Operating experience
- Fire protection
- Emergency preparedness.

10.15. The peer review programme identifies strengths and good practices, which are shared between the UK nuclear operators and internationally with other WANO members. It also identifies improvement areas. Peer reviews take place at each station every 3 years. Periodically, corporate peer reviews are also undertaken.

Allocation of responsibilities

10.16. The licensee's arrangements provide an effective allocation of responsibility between corporate functions and local managers. At each nuclear power station the Station Director (who reports to the appropriate CNO) is empowered to manage the Station in compliance with the Nuclear Site Licence and EDF NGL Policy. The role of the centre is to minimise risk, resolve operational issues in a timely manner, deliver services efficiently and facilitate definition of standardised methods of working and a fleet approach. To achieve this, the centre provides: specialist expertise; truly independent oversight; a framework to maximize safe operational output; and a source of resource flexibility and levelling.

10.17. The three CNOs provide a co-ordinated management system for the operation of the nuclear installations. For example, the Station Director can be responsible for: a nuclear installation or group of nuclear installations situated at one site; implementing the company's safety policy; and ensuring that safety responsibilities are effectively discharged. The CNOs ensure consistency across the plants.

10.18. The Chief Technical Officer heads a division supplying a wide range of technical services to the fleet. The main areas included are: are: Design Authority, guarding the integrity of the plant designs and safety cases; Engineering, providing specialist scientific and engineering services; Supply Chain, managing procurement of goods and services; Lifetime, Programmes and Projects, coordinating longer-term multi-site engineering developments; Fleet Critical Programmes, maintaining specialist expertise in managing the response to significant plant failures; Research and Development.

10.19. The Safety and Technical Director's division provides independent oversight of the company's operations. To reinforce this independence, the Director has an additional direct reporting line to the EDF SA Inspector General for Nuclear Safety. The division comprises: Safety and Regulation, who provide internal regulation of NG's arrangements for ensuring health, safety and environmental protection; Nuclear Fuel and Liabilities, who manage off-station aspects of the fuel cycle; Quality, who oversee the quality management arrangements; Health, Safety and Environment Support, who supply specialist expertise and guidance in emergency planning, radiological protection, environment, industrial safety, occupational health and nuclear materials transport; and Sustainability.

10.20. Continuous Improvement and Operational Support manage the company's technical training programme and provide support and guidance across a wide range of operational and executive processes. This department includes 'Fleet Managers' who monitor performance and coordinate improvement activities for fleet-wide processes including: Operational Experience, Outage Management, Operations, Maintenance, Fleet Engineering, Work Management, Organisational Learning, the

Corrective Action Programme and Nuclear Professionalism (including human performance and safety culture).

Nuclear Decommissioning Authority

10.21. Although the NDA is not an operator or a licensee, it has significant influence on the safety performance of several licensees. Its commitment to safety as a priority is therefore important.

10.22. The NDA is a non-departmental public body set up under the Energy Act 2004(Ref 28) to provide a UK-wide strategic focus on waste remediation and clean-up of nuclear sites. It has been fully operational since April 2005. Its mission is to deliver safe, sustainable and publicly acceptable solutions to the challenges of radioactive waste management and nuclear clean up of the UK's civil nuclear legacy taking account of social and environmental responsibilities, whilst seeking value for the funding provided by the UK Government. For the purposes of the Convention, it owns the sites operated by Magnox Limited and Sellafield, which includes Calder Hall. Each site is operated by a licensee, which NDA refers to as a Site Licence Company (SLC). Each SLC is owned by a Parent Body Organisation (PBO), which seconds staff into senior management positions in the SLC and hence are part of the licensee's organisation.

10.23. The Site Licence Companies are enduring entities (until the work is completed and the site de-licensed) and are responsible for nuclear safety on the sites. They hold the nuclear site licences and radioactive waste disposal authorisations and are subject to regulation by ONR, the Environment Agency, Natural Resources Wales or SEPA. The NDA uses its contracting model to pursue effectiveness through market competition for ownership of the SLCs to bring international best practice to bear on the nuclear clean up.

10.24. The NDA monitors closely the safety performance of its contractors, the SLCs, and has the option of holding them to account through contract sanctions should they fail to meet the high standards expected.

10.25. The NDA's strategy on spent Magnox fuels continues to be that it should be reprocessed at Sellafield and it works closely with its SLCs to ensure that the programme of work continues.

10.26. In respect of the only remaining operational Magnox reactor, Wylfa, the NDA continues to encourage its SLC contractor to optimise the utilisation of the remaining fuel to generate electricity, subject always to the reactors continuing to meet safety cases.

Magnox Limited.

Safety objectives and principles

10.27. Magnox Ltd. holds the nuclear site licences for ten nuclear sites, only one of which still has an operating reactor, with two more defuelling. It operates these sites (together with a headquarters function and small hydroelectric station) on behalf of the owner, the NDA. As the holder of nuclear site licences, Magnox Ltd. is responsible for nuclear safety standards on these sites. This responsibility is discharged by the Board through the Managing Director.

10.28. The Parent Body Organisation for Magnox Ltd. is Energy*Solutions*. The Energy*Solutions* web site (Ref 54) gives details of its commitment to health and safety, highlighting the company's mission to be an organisation "*the world trusts to keep it safe from radioactive and hazardous materials*". The company's vision is to achieve this by "*creating and delivering cutting-edge solutions to the world's most difficult environmental challenges"* and a committed to openness and transparency.

10.29. The Magnox Ltd. Environment Health and Safety (EH&S) policy is:

"by seeking continuous improvement, to achieve and maintain excellence in EHS and operational performance".

10.30. In support of this policy, Magnox Ltd. has adopted the principles set out below:

"Our primary goal is that no harm should result from our activities and that we will be respected and trusted by our workforce, the public and our stakeholders. In pursuing this we will work in partnership with employees and contractors at all levels in the organisation, and will strive to:

- *maintain high standards of nuclear safety;*
- *eliminate injuries and ill-health at work and minimise radiation doses;*
- *prevent accidents, but nevertheless maintain effective emergency arrangements;*
- *prevent pollution and minimise waste and the use of natural resources as part of our contribution to sustainability and environmental improvement;*
- *ensure the appropriate and safe disposal or storage of radioactive and other waste;*
- *achieve and sustain an excellent safety and environmental culture;*
- *learn the lessons from events, implement corrective actions and seek out and use good practices wherever we may find them; and*
- *ensure that its activities, products and services are in compliance with applicable legislation and meet the requirements of good practice and applicable standards of EH&S performance."*

Organisation

10.31. The Chief Nuclear Officer (CNO) reports to the Managing Director and is responsible for setting standards in Nuclear Safety. The Environment, Health, Safety, Security and Quality (EHSS&Q) Director (also reporting directly to the Managing Director) is responsible for providing independent assurance that the standards are adequate and are being appropriately implemented (as well as for setting standards in all other areas of EHSS&Q).

10.32. The board also has executive responsible for ensuring that the company's sites comply with regulatory requirements including those for nuclear safety. Again this is discharged through the Managing Director. The CNO is responsible for ensuring that the sites covered by the CNS are compliant and there are two Chief Operating Officers (COO), which perform the same function for the seven decommissioning sites, which are noted to be outside the scope of this report in Article 6. Each site has its own Site Director who reports to the CNO or appropriate COO. The Site Director acts as Agent of the Licensee for his site and is responsible for ensuring that all regulatory requirements are met on the site.

10.33. Guidance on nuclear safety issues is provided to all sites primarily through the Engineering Director, who reports to the CNO. He manages the Central Engineering Function and hence can provide any support necessary to supplement the sites' engineering expertise.

Nuclear Safety Committees

10.34. On all matters related to nuclear safety, Magnox Ltd. takes advice from its Nuclear Safety Committees. These committees include independent members with extensive experience and knowledge in the field of nuclear safety.

Assurance

10.35. A key to demonstrating that the process for delivering high standards in nuclear safety is the provision of assurance to the Board and the Executive team that

company arrangements are adequate to meet the various international, national and local standards applicable to Magnox operations and that they are adequately implemented throughout the organisation. Responsibility for this rests with the EHSS&Q Director, who discharges it through a full-time Head of Assurance. A risk-based programme of audits is carried out on each site, some by site-based staff independent of the activities being audited and some by external. This is supplemented by peer assist programmes, using international, national and in-company resource to share approaches. The Head of Assurance also has a team of inspectors, who are assigned to sites and carry out a series of programmed, reactive and ad-hoc interventions to provide an additional level of assurance. All the information produced by these various assurance activities, together with a variety of other relevant data from a number of sources is then critically reviewed on a Quarterly basis at an “Assurance Review Meeting” (ARM) that seeks to identify key trends and areas for improvement that are fed to the Executive team for implementation.

Peer evaluation

10.36. Magnox Limited makes use of international peer evaluations through the World Association of Nuclear Operators (WANO). The peer review process is outlined in paragraph 10.14. In recent years the only site that has had a full peer review is Wylfa as it is the only site with an operational reactor. Magnox also makes use of the more targeted technical support missions, with typically three per year across the sites covered by this report.

Compliance Arrangements

10.37. The nuclear site licence is just one of a number of legislative and regulatory requirements with which Magnox Ltd. is required to comply. Arrangements to achieve and demonstrate compliance are developed in broadly similar ways whatever the source of the requirement. For example, for each condition of the nuclear site licence, high level compliance principles are set down and endorsed by the Nuclear Safety Committee. For each part of each condition, these specify the approach that Magnox Ltd. will take to achieve compliance. Arrangements are then defined by relevant subject matter experts to meet the compliance principles. These arrangements are subject to consultation within the company and endorsement by relevant "peer groups". Approval of the arrangements is undertaken following review by either the EHSS&Q Director or the CNO as appropriate. For new arrangements, where deemed necessary or appropriate, implementation is then followed up by a post-implementation audit or review to determine initial levels of compliance. A regular review of the arrangements is carried out, both periodically and when requirements or processes change, to ensure that any relevant experience is incorporated and the arrangements are maintained to a high standard.

Sellafield Limited

Safety objectives and principles

10.38. Sellafield Ltd holds the nuclear site licence for the Sellafield site, which includes the Calder Hall reactors, which are currently defeulling. It operates the site on behalf of the owner, the NDA. Sellafield Ltd is the "duty holder" and as such is responsible for nuclear safety standards on these sites. This responsibility is discharged by the Board through the Managing Director.

10.39. The Parent Body Organisation for Sellafield Limited is Nuclear Management Partners (NMP). The NMP website summarises their approach "...NMP combines the global nuclear experience of US company URS, British company AMEC and French company AREVA to manage Sellafield Ltd, Its priority is to safely manage the most complex nuclear site in the world which demands a unique combination of skills. It

delivers this work in partnership with Sellafield Ltd, the supply chain and stakeholders..."

10.40. The Board of Sellafield Ltd has approved a statement of Nuclear Safety Policy: "Nuclear safety is the Sellafield Ltd principal priority. Sellafield Ltd will achieve Nuclear Safety performance excellence through a systematic approach that improves behaviours, effectiveness of processes and understanding of performance expectations and continuously reinforces standards." and supporting principles:-

"Our leadership, behaviours and processes are built around the following underlying principles of nuclear safety:

- We ensure trust permeates the organisation
- We make safety first and foremost in our decision making
- We recognise nuclear technology as special and unique
- We cultivate a questioning attitude
- We embrace organisational learning and continuous improvement
- We constantly examine nuclear safety
- We will ensure our behaviours and actions conform to our procedures and practices
- We will aggressively pursue solutions which will deliver the lowest practicable overall lifetime risk. This may require accepting more short term risks in order to achieve long term benefits."

Organisation

10.41. The Chief Nuclear Officer/Chief Operating Officer reports to the Managing Director and is responsible for standards in nuclear safety. The Director, Environment, Health, Safety and Quality (Director, EHS&Q) is responsible for providing independent assurance that the standards are adequate and are being appropriately implemented. Other direct reports to the Managing Director include the Chief Decommissioning Officer and Chief Engineering and Technical Officer.

10.42. The Board has responsibility for ensuring compliance with all regulatory requirements. This is responsibility is discharged through the Managing Director and direct reports.

10.43. Guidance on the engineering, technical and safety case aspects of nuclear safety is provided as necessary through the Chief Engineering and Technical Officer.

Nuclear Safety Committee

10.44. On all appropriate matters related to nuclear safety, Sellafield Ltd through its Managing Director or nominee, seeks advice from its Nuclear Safety Committee. This committee includes independent members with extensive relevant experience and knowledge.

Assurance

10.45. A key to demonstrating that the process for delivering high standards in nuclear safety is the provision of assurance to the Board and the Executive team that company arrangements are adequate to meet the various international, national and company standards and that they are adequately implemented throughout the organisation. Responsibility for this rests with the Director, EHS&Q who discharges it through a full-time Head of Assurance. A risk-based programme of audits is carried out by staff independent of the activities being audited. This programme is supplemented by peer assist programmes, using international, national and in-company resource to share approaches. The Head of Assurance also has a team of inspectors, who are assigned to carry out a series of programmed, reactive and ad-hoc interventions to provide an additional level of assurance. All the information produced by these various assurance activities, together with a variety of other relevant data from a number of sources is then critically reviewed so as to identify key trends and areas for improvement.

Compliance Arrangements

10.46. Compliance arrangements are defined by relevant subject matter experts ("Process Owners/Functional Performance Managers"). These arrangements are subject to consultation within the company. For new arrangements, where deemed necessary or appropriate, implementation is then followed up by a post-implementation audit or review to determine initial levels of compliance. A regular review of the arrangements is carried out, both periodically and when requirements or processes change, to ensure that any relevant experience is incorporated and the arrangements are maintained to a high standard."

Article 11 - Financial and Human Resources

1. Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.

2. Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.

Under this Article, compliance with the Convention is demonstrated by considering the changes made following the full implementation of the European Council Directive 2009/71/Euratom in the United Kingdom.

Financial resources

11.1. Under UK company law, a registered company must have sufficient assets to meet all of its liabilities to continue in business. A balance sheet of assets and liabilities is a required element of the annual accounts, which must also be audited and made available to the public.

11.2. The assets and liabilities of all l the Magnox reactors transferred to the NDA in April 2005 (see paragraph 11.12 below and Article 10 for details on the status, function and background of the NDA).

11.3. The AGR stations and the PWR station at Sizewell B are owned by EDF NGL who must comply with UK company law as described above.

11.4. Special financial provision is made for the particular liabilities relating to the reprocessing and storage of spent fuel, the storage and disposal of nuclear waste and a nuclear installation's decommissioning costs. In particular, EDF NGL's decommissioning costs are to be met from the Nuclear Liabilities Fund (NLF) established for this purpose when the company was restructured in 2005 (see paragraph 11.16 below).

11.5. With regard to the financial responsibilities of the operator for potential damages to the public or the environment, EDF NGL is insured against its liabilities and the Government has its financial responsibilities as a contracting party to the Paris and Brussels Conventions. ONR seeks assurance from DECC on the issue of liability before issuing a nuclear site licence, but does not have any review responsibilities.

11.6. When issuing a licence to an organisation for the first time, ONR seeks advice from DECC that the prospective licensee has the resources to be a nuclear site licensee for the activities envisaged. NIA65 permits only a corporate body to be a nuclear site licence holder. This provides some assurance of continuity of commitment even if that company is taken over by, or merges with, another one.

11.7. In July 2011, ONR modified the standard set of conditions that are attached to the nuclear site licence for all licensed sites to require licensees to provide and maintain adequate financial and human resources to fulfil their obligations in respect of nuclear safety. This requirement was introduced to ensure that the Council of the European Union's Nuclear Safety Directive 2009/71/Euratom (Ref 20) was fully implemented in Great Britain. Licence Condition 36 (Organisational Capability) was amended to include the requirement as LC36(1). ONR has issued guidance on how this requirement should be interpreted by its Inspectors (Ref 55). The essence of this guidance is that ONR gains confidence that licensees provide and maintain adequate

financial resources to fulfil their obligations in respect of safety by demonstrably understanding and managing the hazards and risks associated with their undertakings. This means that they are reducing risk so far as is reasonably practicable and implementing improvements in a timely manner where these are identified as ALARP; maintaining an adequate human resource capability; assessing what financial resources are necessary to continue to meet those needs; and assigning those resources accordingly. Although it has not yet happened, if a safety issue could not be resolved to the satisfaction of the Inspector, and financial resource issues were identified as a possible factor, ONR would seek appropriate external advice on the issue.

Financing safety improvements during operational life

11.8. The costs of making any necessary safety improvements during the operating life of a nuclear installation are treated as part of the installation's normal operating costs. The principal elements of operating costs comprise:

- maintaining and enhancing safety;
- fuel (including the cost of new fuel and treatment of irradiated fuel);
- materials and services (the cost of engineering, including contractors, and consumable spares for maintaining the nuclear installations, 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 the accounting life).

11.9. As with any other expenditure, the operators' internal financial control processes determine the necessary authority required before commitments are made to make safety or any other improvements. These processes examine the impact on the operators' financial accounts of any proposal for improvement work, using discounted cash flow and cost-benefit analyses. Such analyses take into account both the immediate costs of carrying out the improvements and future income through continued electricity generation.

11.10. One objective of the PSRs is to identify reasonably practicable safety improvements. In determining whether a particular improvement is reasonably practicable, the regulator will look at a number of factors including the remaining lifetime of a reactor, the safety benefit and whether there is any gross disproportion between this and the cost of the improvement (the ‘as low as reasonably practicable’ (ALARP) process).

Financing radioactive waste management at nuclear installations

11.11. The published audited accounts of UK nuclear installation operators include details of waste management costs and of the provisions made in order to meet them. However, there is currently no disposal route for intermediate level radioactive waste (ILW) and high level radioactive waste (HLW) in the UK. The costs of storing these wastes comprise:

- costs actually incurred during the operational phase; and
- liabilities associated with the management of ILW and HLW before ultimate disposal during the decommissioning phase.

11.12. The cost of managing radioactive waste during the operational phase is an operational cost spread across the materials, services and staff costs in the reported accounts. The materials and services costs in the accounts include costs associated with disposals of low level radioactive waste where the operator of the facility sets a price that reflects all operational and liability cost considerations. All disposals of

radioactive waste, including those to the environment, are undertaken in accordance with regulatory authorisations. The regulators, the Environment Agency, Natural Resources Wales or SEPA, recover costs in granting, monitoring and enforcing the authorisations or permits from the operator.

Financing decommissioning programmes

11.13. The NDA was set up under the Energy Act 2004 (Ref. 28) when it took over the liabilities and assets of the vast majority of the UK's civil nuclear decommissioning licensed sites and Magnox reactors previously owned by British Nuclear Fuels Ltd.

11.14. The funding of the operation, clean up and decommissioning of these nuclear legacy sites falls to the UK Government. Public funding is currently being maintained at around £3 billion a year, with a declining proportion being offset by the commercial income from the NDA's operations. This funding relates only to public sector nuclear sites and their associated plant and facilities. EDF is a private sector company with its own duties and responsibilities.

11.15. The Nuclear Liabilities Fund (NLF) was established in January 2005 and took over the assets of the previous Nuclear Generation Decommissioning Fund Ltd. Upon restructuring, the NLF was given the assets of the previous Nuclear Generation Decommissioning Fund and £275 million of bonds in British Energy Holdings plc. In addition, British Energy was committed to providing additional funds to the NLF as:

- an annual lump sum based on the number of remaining operating facilities, plus a fixed amount for each tonne of uranium in fuel loaded into the Sizewell B nuclear power station (these sums are subject to indexation); and
- to pay 65% of its free cash flow into the NLF annually (the "cash sweep").

11.16. The NLF provides for a larger scope of funding compared with the previous arrangements and is used solely to fund EDF's liabilities. As a result, it is ring-fenced from the funds required to clean up the NDA's sites. The NLF is managed by a board of Trustees appointed by DECC and EDF NGL.

11.17. The UK Government will underwrite the costs of decommissioning EDF NGL's nuclear power stations and the discharge of certain nuclear liabilities not covered under contract with third parties, to the extent that there might be any shortfall in the NLF.

11.18. The "cash sweep" ceased in January 2009 following the sale of British Energy to EDF NGL. However, the commitments relating to annual payments and the Sizewell B contribution remain and fall to EDF.

11.19. The arrangements for decommissioning EDF's nuclear power stations and discharging its uncontracted liabilities are contained within the Nuclear Liabilities Funding Agreement (NLFA). Under this Agreement, EDF NGL is required to produce plans on a three year ahead and lifetime basis for the decommissioning of its stations, including the necessary pre-closure planning work. These are subject to review and approval by the NDA. EDF also produces an annual report describing changes in the estimated costs of decommissioning and uncontracted liabilities over the previous financial year. This is also subject to review and approval by the NDA. The NDA must approve from a liabilities funding sufficiency viewpoint EDF's station life extensions, noting that increases in life will increase the waste which is classed as a liability.

11.20. Although EDF, as a private company and site licensee, is solely responsible for decommissioning its plants, the restructuring agreements provide for the (relevant) Secretary of State (for Energy and Climate Change)to acquire EDF's nuclear power stations for a nominal sum after they are closed, either to continue to operate them if this is safe and feasible, or to decommission them, e.g. by adding them to the NDA's portfolio of sites.

11.21. Financial details of EDF NGL's liabilities and the NLF are set out in the respective Companies' annual accounts.

Management of human resources for safety related activities

Regulatory background

11.22. HSWA74 (Ref. 23) places responsibility for safety on every employer on the licensed site. This responsibility includes the competence and training of staff with safety related roles. Specific requirements are included in the Management of Health and Safety at Work Regulations 1999 (Ref. 37), in particular Regulation 13 on Capabilities and Training.

11.23. In addition, several licence conditions set goals on training and the management of human resources. LC10 (Training) requires the licensee to make and implement adequate arrangements for suitable training of all persons on site who have responsibility for any operations which may affect safety. Licence Condition 12 Duly authorised and other suitably qualified and experienced persons) requires the licensee to make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform duties that may affect safety. This includes the appointment of duly authorised persons to control and supervise specific safety related operation.

11.24. The licensees' arrangements made under other licence conditions such as Licence Condition 22 (Modification or experiment on existing plant), Licence Condition 11 (Emergency arrangements) and Licence Condition 36 (Organisational capability) also require that the licensee should address human resource and training issues.

11.25. ONR's role is to inspect the adequacy of, and compliance with, the arrangements made under the licence conditions. Under normal circumstances, ONR does not have any specific role in the selection, training and authorisation of staff to perform safety related duties. It does, however, have powers to intervene if, in its opinion, any person is unfit to perform the duties of a duly authorised person.

11.26. Training and human resource issues are addressed by nuclear inspectors when they are reviewing safety documentation against ONR's SAPs (Ref. 43). The SAPs give inspectors guidance on whether the legal requirement of the licence conditions is being met, in particular, that provisions are made for training staff who will have responsibility for the safety of the plant. These include a management system for training on the site, analysis of jobs and tasks, development of training methods, assessment of trainees, revision training as required, and regular evaluation of training. Thus, licensees have in place a systematic approach to training and assessment of personnel with safety roles. Analysis of tasks provides an input to the specification of personnel training. Emphasis is placed on training that enables staff to implement accident management strategies, utilising appropriate instrumentation and items of plant that are qualified for operation in severe accident environments.

11.27. In order to comply with regulatory requirements, a licensee must demonstrate to ONR's satisfaction that it has:

- lines of authority leading to adequate control of the activities, whether these are carried out by the licensee's own staff or by contractors;
- adequate staff resources;
- precise definition and documentation of duties;
- integration of health and safety responsibilities into job functions;
- appropriately trained 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 peer review of the safety case, audit and review.

This demonstration is achieved by the preparation of adequate arrangements to satisfy the requirements of the relevant licence conditions.

Licensees' training programmes

Qualifications, experience and training

11.28. For all tasks undertaken on site, licensees' and contractors' staff must be shown to be competent in their duties and understand the safety implications of the work. The licensee for a site ensures that, for each role with a responsibility for safety, the duties, responsibilities and competencies for the role are identified and that the training needs of an individual to fulfil that role are met.

11.29. The assessed competence requirements for a specific role are achieved by a combination of:

- knowledge, academic and practical qualifications, assessed training and experience of the person;
- the instructions and information provided to the person; and
- the degree of control and supervision exercised in carrying out the task.

For an individual, training requirements are then identified, depending on the needs of the role and the assessed competence of the individual. Procedures for assessing competence prior to undertaking a safety related role are part of the arrangements made under LC10 (Training). Although the responsibility for evaluating an individual's suitability for a specific job rests with the licensee, ONR will, as part of its inspection programme, inspect the adequacy and implementation of the licensees' training programmes.

11.30. Licence Condition 12 (Duly authorised and other suitably qualified and experienced persons) requires that any posts on site that may affect operational safety, or that implement any actions connected with the site licence conditions, must be performed only by suitably qualified and experienced persons (SQEP).

11.31. Licence Condition 12 further provides for the appointment of Duly Authorised Persons (DAPs). DAPs are identified as individuals who are in direct control or supervision of operations or activities that impact on the safety envelope of the facility. Their appointments are therefore subject to additional management controls covering areas such as appointment and assessment. However, the general principle that persons whose activities may impact upon nuclear safety should be appropriately trained, and their competence adequately assured, is similar for SQEPs and DAPs.

11.32. ONR does not assess the competence of licensee staff directly, or authorise, (e.g., reactor desk engineers) as is the case in some regulatory regimes. ONR's approach is to seek confidence that the licensee has put in place, and is implementing, effective arrangements for training and competence assurance for all personnel whose activities may impact upon plant safety. This should cover both licensee employees and others such as contractors whose actions could impact upon nuclear safety.

11.33. Computer-based simulators are available for all operating reactors and form part of the training of plant operators. The simulators are capable of simulating a range of accident conditions.

Training of external personnel

11.34. When licensees use contractors for safety related work, they must satisfy themselves that the contractors' staff have the appropriate qualifications and training

to undertake the tasks safely. The training of contractors' staff so that they comply with Site Safety Rules is part of the contractual agreements for such work.

11.35. When safety analysis work and/or inspection work (e.g. non-destructive testing and examination) is contracted to organisations external to the licensee, ONR requires the 'intelligent customer' approach. This means that the licensee should have sufficient in-house expertise to specify, set up contracts, manage and, if necessary, challenge the work of contractors.

11.36. In the UK, licensees are responsible for ensuring the safety on the licensed site and are required under LC17 (Management systems) to establish and implement management systems that give due priority to safety. Licensees are therefore responsible for ensuring, amongst other things, that its contractors are suitable for the work that they do. ONR has guidance for its inspectors on judging whether licensees and contractors meet their safety responsibilities, and this guidance is available to licensees. It does not specifically prescribe the qualification, quality systems or performance of contractors, but it does require licensees to have appropriate quality management systems in place and ONR inspectors carry out inspection to ensure that these arrangements are to satisfactory standards. For critical components, such inspections may also involve examination of the quality management arrangements of suppliers or contractors. However it is always the licensees' responsibility to ensure that these arrangements are adequate.

Periodic review

11.37. The performance of each of the licensee's employees is assessed regularly by their line managers as part of the performance management processes. This requires periodic formal performance reviews which are recorded. These reviews will identify any corrective or development actions. Although the performance review process itself is not a requirement of LC10 (Training), these actions will then be fed into the overall training plan for sites as required by LC10.

Training programme development

11.38. The training programmes take into account changes to plant configuration, plant modifications and the corrective action needed to respond to incidents on site and on other sites. Plant modification proposals, made under the arrangements under LC22 (Modification or experiment on existing plant), identify where instructions and procedures need to be changed and the associated training needs. For large modifications that need stage Consents to be granted by ONR, evidence of satisfactory retraining may be a requirement prior to a Consent being granted to bring the modified plant into routine service.

Operational experience feedback to improve training

11.39. LC7 requires the licensee to develop adequate arrangements for the notification, investigation and reporting of incidents on site. The licensees arrangements for investigations include whether deficiencies are part of the cause and identify any necessary corrective actions to correct them.

11.40. The adequacy of all training courses is kept under review and takes account of feedback from trainees and their line managers. The training arrangements are the subject of internal audits by the licensee's staff and also routine and team inspections by ONR inspectors.

Competence of instructors

11.41. Training instructors are staff of proven competence and experience who are employed in the work area in which they provide training, as well as full-time instructors normally based at a training centre. Instructors are given training on how to present training materials to best effect. Arrangements are in place for line managers to assess the performance of instructors, and feedback is also provided by the staff receiving instruction.

Technical support resources

11.42. Licensees' engineering and technical capability comprises staff at operating NPPs and at central HQ locations. These staff provide the in-house resource available to respond to requirements for technical analyses and informed action. Where it is economic and practicable, technical services may be procured from suitably qualified and experienced specialists in other utilities or organisations, under appropriate contractual arrangements. These arrangements follow the 'intelligent customer' approach. Similarly, the technical services of the licensee may be contracted to external organisations where this does not compromise the support needs of the licensee's operating locations. In these areas, there may be technical support from, and collaboration with, other licensees.

11.43. Each licensed nuclear site has engineering and technical support staff who know and understand the nuclear safety case, its relationship to the plant, and the plant's operational characteristics. These staff are responsible, on behalf of the Station Director, for ensuring that nuclear safety cases are prepared at the location, in the central organisation, or externally. They are also responsible for the preparation, review and development of the written instructions for operational staff.

11.44. The central engineering and technical organisation provides technical support to all the licensees' locations. This includes providing specialists in key technical and safety areas which are specific to the licensee's reactors. These staff understand the design of the stations and the nuclear safety cases that underpin their operation, and they prepare and modify the nuclear safety cases. The central engineering and technical organisation also has access to specialist facilities and support staff to enable it to maintain and develop the necessary knowledge base.

11.45. The licensee's health and safety function has its own technical capability and access to other technical capability. It is therefore able to carry out independent nuclear safety assessments and peer reviews of new safety cases, and proposals for modifications, experiments and decommissioning.

Maintaining and enhancing the national nuclear skill base

11.46. The nuclear sector currently employs around 44,000 people in the UK. Existing operations, decommissioning and clean-up, together with a potential programme of new nuclear build, means the nuclear industry has a sustained recruitment demand and continued requirement for skills training and reskilling of the workforce.

11.47. Skill gaps are projected for the nuclear industry. Research led by Cogent, which is an and industry led skills council for a number of industries including nuclear, analysed the workforce requirements for new nuclear power station build and operation. This research indicated that 1,000 new apprentices and 1,000 new graduates with a science, technology, engineering or mathematics qualification are required each year to support existing operations and new build activity throughout the industry and supply chain.

11.48. Government is working closely with Cogent, the National Skills Academy for Nuclear (NSA Nuclear) (Ref. 56), and the industry to ensure that the UK has a clear, jointly shared understanding of the key skills priorities for the nuclear sector, and how skills demand can be met. NSA Nuclear was set up in January 2008 specifically to develop the capacity and capability of the UK nuclear workforce. By working with existing training providers across the UK, it provides more than 1,000 apprenticeships and 150 foundation degrees into the sector. Cogent and NSA Nuclear have been working on developing training standards that are applicable to the whole industry. NSA Nuclear has also developed a Nuclear Skills Passport which will provide all employees and contractors in the nuclear sector with a physical record

of their industry-specific training and qualifications, assisting both employers and employees.

11.49. In addition, the NDA has a statutory duty as set out in the Energy Act of 2004 to take appropriate action to ensure that adequate skills are available for it to carry out its duties and has budget allocated annually to develop the skills needed to deliver its objectives through a Skills and Capability Strategy

11.50. The National Nuclear Laboratory, based in Cumbria, demonstrates the Government's commitment to protect and grow the UK's national nuclear technology capability and skills base. The National Nuclear Laboratory holds a significant breadth of technology expertise. Some 500 staff at the £250 million purpose-built facility run a wide range of radioactive and non-radioactive experimental programmes, as well as offering a wide range of analytical services.

11.51. 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, and there has been an increase in the number of students taking up places on these courses. The nuclear content of some undergraduate courses is being enhanced, and for the first time for many years there will be the chance to obtain a degree in nuclear engineering. Also the number of students undertaking postgraduate research is also increasing. Finally, Manchester University has set up a Nuclear Centre which offers a range of courses and research on nuclear topics.

Article 12 - Human Factors

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations), However, this Article has been updated to reflect the issues raised at the fifth Review Meeting and, in particular, to provide further clarification of the regulatory body's approach to leadership and the management for safety.

Human factors in the design and assessment process

12.1. The UK's nuclear installation operators and regulators recognise that human performance plays an important role in ensuring the safety of a nuclear installation throughout every stage of its life cycle - from design, construction, commissioning and operation, through to decommissioning. Human factors are concerned with all aspects of human performance, and the factors affecting this performance, which can impact on the safe operation of a nuclear installation. Therefore human factors analyses are applied, as appropriate, to all activities and functions related to nuclear safety. The licensees, as well as the regulator, employ human factors specialists who carry out human factors assessments themselves, or who oversee work carried out by external consultancies on their behalf.

12.2. Where new nuclear installations are proposed, human factors assessments are carried out to inform the design process, and to confirm that the designs take due account of the needs of the user. It is essential to engage human factors specialists at an early stage of the design process in order that they can influence the design so that it reflects human capabilities and limitations and supports correct human action. This was done as part of the regulatory body's generic design assessment for proposed new NPPs in the UK. All nuclear installations are also re-assessed as part of the PSR process (see Articles 6 and 14), and human factors analyses form an integral part of these reviews.

12.3. As part of the safety case supporting the operation of the nuclear facility, the licensees carry out fault analyses to identify initiating events that may occur due to human error and identify operator safety actions. In general, where a plant failure or incorrect operation leads to a need for safety system operation, the plant is designed so that it is rendered safe by the action of passive or engineered features. These, in general, offer greater reliability than the human operator, especially where rapid safety system operation is needed. Where operator safety actions are identified, and it is not reasonably practicable to provide an engineered safety system, analysis of the operator actions is used to demonstrate that tasks required are feasible, and that they can be performed safely and reliably in the time available. Where the analysis indicates that improvements can improve human, and hence plant, reliability, these are considered as part of the ALARP review process. This is explained in the ONR's SAPs (Ref 43)

Application of ergonomic principles

12.4. Task analyses are carried out to identify operator actions required to monitor the plant, diagnose plant state, make decisions and implement necessary actions. These analyses take account of the physical, physiological and cognitive demands that may be placed on the operator and on teams of operators. They address the

potential consequences of failure to perform the safety actions successfully, and the potential for recovery from error. The analyses form primary inputs to inform decisions on plant staffing, and on the equipment and other facilities which are provided to support the operator. In particular, the analyses are an important input to the design of the user interface, and also provide a basis for developing procedures and the content of personnel training. They influence the way in which the job is organised, as well as being used to determine and demonstrate the feasibility of individual tasks. Ergonomics principles are applied to support reliable human performance and inform the design of the working environment, including factors such as access, noise, thermal and lighting conditions and communications facilities. Issues related to fitness for duty, such as shift working patterns and working hours (overtime) are also taken into consideration.

12.5. The design of the 'user interface' follows good human factors practice, to ensure that it is compatible with human psychological and physical characteristics, and to enable the required tasks to be performed reliably and efficiently. For new designs, a structured user interface design process is adopted and relevant standards applied. In particular, the user interface for the reactor main control room is based on a comprehensive and systematic task analysis, which identifies the operational requirements during normal, transient and fault conditions. The user interfaces of existing nuclear installations have been subject to scrutiny during the PSR processes in order to ensure that they remain fit for purpose, and that operator actions are properly supported.

12.6. The design of the reactor control room enables the operator to carry out safety functions and tasks during normal operations, postulated fault conditions and, where practicable, severe accidents. Adequate provisions are available in the control room and at emergency locations to enable the monitoring of plant state in relation to safety, and to take any necessary safety actions. Due attention is given to the specification and design of local control stations, and to the design of all equipment having the potential to impact upon plant safety (for example, maintenance and testing equipment and computer-based systems used to present operating instructions).

12.7. The Probabilistic Safety Assessments (PSAs) undertaken on the nuclear installations provide quantitative assessments of the risk to safety arising from plant designs and operations. The PSAs highlight significant contributors to risk, and take into account the impact of human actions on safety. The licensees ensure that relevant operator actions are identified and modelled in the PSAs, and suitable methods are used to assess the potential errors associated with these actions and to determine the consequent human error probabilities. In response to recommendations raised in Chief Nuclear Inspector's report on the Fukushima accident, licensees are extending their PSAs and assessments of human actions to include those included within Severe Accident Guidelines (SAGs).

12.8. The initial stage of the human reliability analysis identifies potential human errors that can impact on safety. The error identification process is rigorous and thorough. Quantitative estimates of human error probability are then produced for the significant human errors defined during the error identification process. The probabilities reflect influences on performance arising from psychological factors (e.g. stress, personal experience and knowledge) and with other task-specific factors (e.g. the physical environment, training, working practices, time constraints, adequacy of procedures and user interface etc). Dependencies between actions are identified. The potential for impact of dependencies between separate operator actions activities (either by the same or by different operators) is assessed and the results are factored into the PSA. The potential for recovery from previous errors is also examined - this is especially pertinent where long timescales are available to take corrective action.

12.9. The licensees identify potential improvements as part of this analysis and use this information to ensure that risk is reduced so that it is ALARP.

Managerial and organisational human factors issues

ONR activities

Safety Assessment Principles - leadership and management for safety

12.10. ONR SAPs (Ref 43) have explicit focus on leadership and management for safety. The principles provide guidance to inspectors on ONR's expectations of licensees regarding the foundation for the effective delivery of nuclear safety, including the development and maintenance of a positive safety culture.

12.11. The SAPs on Leadership and Management for Safety comprise four high-level interrelated principles: Leadership, Capable Organisation, Decision Making and Learning. More detailed attributes are set out for each principle. The attributes are expressed as outcomes to be achieved for effective leadership and management for safety rather than prescribing specific systems, processes and procedures required to achieve safety. Because of the interrelated nature of the principles, there is some overlap between them. They should be considered as a whole and an integrated approach will be necessary by licensees to deliver the expected attributes.

12.12. The Leadership and Management for Safety principles reflect the:

- emphasis ONR's strategy gives to leadership and management for safety, the role of directors and the involvement of workers;
- necessary emphasis on leadership and managing people and processes as well as on engineering; and the
- need to consider the management of safety throughout the whole organisation in building and sustaining a positive safety culture.

Leadership and management for safety strategy

12.13. ONR has a regulatory strategy to place more consistent and structured focus on leadership and management for safety. The strategy is based on the SAPs on leadership and management for safety and additional work to apply the organisational and cultural lessons from a range of major events world-wide (in nuclear and other sectors). This strategy embodies safety culture, rather than treating it as a separate topic. An important aspect of the strategy is to incorporate continual focus on leadership and management for safety into all regulatory interactions with licensees. Draft guidance has been developed on how to incorporate leadership and management for safety into interactions with licensees. The draft guidance is being used by groups of inspectors in different parts of ONR for a trial period. Progress in this area has been slower than anticipated due to organisational changes in ONR. The intention is to undertake a review of the strategy and guidance in 2013 and determine the best way forward.

12.14. Another important aspect of ONR's strategy on leadership and management for safety is the corporate inspection function. The purpose of corporate inspection is to look at licensees' organisations as a whole, including central/corporate functions, and ensure regular interactions with directors and senior management. Corporate inspection embodies the concept of regulatory leverage; applying regulatory effort and attention to promote improvement in the areas of the licensee's organisation where it is most likely to be effective. Corporate inspectors are in place for all power reactor licensees, and progress has also been made in putting corporate inspectors in place for larger non-reactor licensees.

12.15. ONR has established a "Corporate Discipline Group" (CDG) on leadership and management for safety. The CDG is responsible for oversight and coordination of ONR's plans and activities on leadership and management for safety. This

includes ownership of ONR guidance in related topic areas (available on the ONR web site). A new guide was issued in 2012 on Safety Advice and Challenge. A suite of other guidance has been developed since the last Convention, in part to support ONR assessment of the organisational capability of prospective new nuclear power plant licensees – see the ONR website. Members of the CDG take the lead in liaising with relevant nuclear industry working groups and encouraging licensees to share ideas and good practices to drive continual improvement.

12.16. Current areas of focus for the CDG include: nuclear safety governance (taking into account the lessons from the financial sector on failure of governance processes); organisational learning (to influence improvements in the licensees' ability to identify underlying causes of events and apply the lessons effectively); internal regulation and challenge (to support and strengthen these functions in licensees); and human performance (to emphasise the importance of organisational factors that affect individual performance).

Safety performance indicators (SPI)

12.17. ONR, in consultation with industry, developed a generic framework of Safety Performance Indicators based on IAEA TECDOC 1141, with additional factors to cover leadership and management. World-wide experience of major incidents (such as the Davis Besse vessel head corrosion event and the Texas City oil refinery explosion) reinforces the need for robust SPIs. All UK nuclear licensees agreed with ONR, suitable indicators commensurate with the SPI framework, which helped development of their arrangements for managerial oversight.

Organisational development and change

12.18. ONR recognises that a licensee's organisational capability makes a considerable contribution to assuring nuclear safety. Prospective new nuclear licensees are required to submit a Safety Management Prospectus which sets out and demonstrates how their organisational structures, resources, capabilities, governance and management arrangements are suitable to manage nuclear safety. ONR's expectations have been set out in "*Licensing Nuclear Installations*" (Ref 11) which was revised in June 2012. This document has been instrumental in informing ONR's interactions with prospective new power station licensees. ONR has further developed a suite of assessment guidance which states ONR's expectations of a licence applicant's organisational capability and the arrangements that it develops to lead and manage for safety. The guides address areas such as managing organisational change; use of contractors and intelligent customer capability; the role of licensees' own internal advice and challenge functions; procurement; training and competence; and design authority. ONR acknowledges that licensees need to evolve their organisations over time as the plant life cycle moves on, and in response to different drivers, and seeks assurance that organisational change is managed effectively in accordance with LC 36 (Organisational Capability) and underpinning technical assessment guidance.

Licensees' activities

12.19. The licensees in the UK that operate nuclear reactors are making a number of improvements to processes which impact on human and organisational factors, human performance and safety culture.

12.20. As an example, for EDF-NGL, the improvements include:

- the establishment of a core organisational function to drive continuous improvements through benchmarking and self-assessment. Many of the elements of the continuous improvement programme have been drawn from best practice in the USA;
- the development of a capability to learn from external events in both nuclear (e.g. Davis-Besse) and non-nuclear (e.g. Texas City) contexts. Specifically,

workshops have been used to promote safety culture based on the study of events at Chernobyl and Davis-Besse, as well as events internal to the licensee. The workshops have encompassed managers and staff at all levels in the organisation, at all sites and in the corporate centre;

- an increased focus on human performance through the use of error reduction tools, enhancement of leadership skills, task observation and coaching and leaders spending time in the field to reinforce desired behaviours;
- the use of an externally benchmarked and formally-accredited systematic approach to training has been adopted;
- development of practical, behavioural approach to assessing safety culture, known as the Safety Culture Assessment and Rating Tool (SCART). The approach is based on observable behaviours and gives strong emphasis to 'leadership' as a key influencer of culture. It produces quantitative ratings to help monitor progress towards the desired standards and a qualitative analysis which reviews the underlying issues;
- the development of an updated human reliability analysis tool, the Nuclear Action Reliability Assessment (NARA) method, to derive human error probabilities for use in PSA which has been subject to extensive international peer review;
- the review and update of reactor SBERGs and SAGs, and the development of Fuel Route SAGs in response to recommendations raised in HM Chief Inspector's report on the Fukushima accident.
- the training of significant numbers of staff in the use of common human error avoidance tools to support human error reduction initiatives;
- an increased focus on benchmarking, including feedback from WANO and Institute of Nuclear Power Operations (INPO) visits and comparisons with high performing nuclear sites and other types of organisation;
- setting Key Performance Indicators for completion of actions to time for each site. These rates are monitored at Executive level;
- increasing the number of focused benchmarking visits staff make to other high-performing organisations. These have included other nuclear sites both in Europe and elsewhere, and also to other organisations with a strong focus on human performance, such as air traffic control services;
- learning from other organisations via routes such as intra and inter-industry groups. Experience from events are fed into PSRs;
- carrying out management reviews of business and performance; and
- the use of external organisations to assess its safety culture.

12.21. ONR continues to monitor the work of the licensees in these and other related areas, especially lessons learned from the Fukushima accident under its leadership and management for safety theme. Information gathered through this work is used to inform ONR's wider intervention planning.

12.22. Those sites that are no longer operating and are either de-fuelling or decommissioning have developed standards and guidance that govern requirements for human factors assessment during the design and safety assessment of de-fuelling and decommissioning operations. These standards provide for an approach to human factors assessment that is proportionate to the hazard associated with the lifecycle of the site and reflect the fact that the level of engineering protection is often reduced as decommissioning proceeds.

12.23. The UK licensees have a system for reporting receipt and assessment of reports of nuclear plant events and are members of WANO, and as such, share

operating experience internationally. In addition, ONR operates the IAEA's Incident Reporting System (IRS) on behalf of the UK. Nuclear utilities co-operate in programmes of Peer Evaluation and Operational Experience Feedback (OEF). Also, they participate in the programmes of WANO, the IAEA and INPO, which give an international perspective on performance levels. As well as the professional, focused critique which a station gains from an Evaluation or an IAEA operational safety review team (OSART) mission, the many staff who help conduct such reviews bring home valuable insights and ideas, which can be applied at their own stations.

Regulator's assessment of human factors

12.24. The ONR SAPs (Ref 43) form the basis against which the regulatory assessment of human factors is carried out. They identify explicitly the need for a nuclear licensee to consider a comprehensive set of influences on human performance.

12.25. Regulatory assessment of the licensee's treatment of human factors is made throughout the life cycle of a nuclear installation. When a safety case is submitted to ONR, nuclear site inspectors, project inspectors and human factors specialists agree on the scope of any human factors assessment work that is appropriate to the case in question. By requiring that human factors is integrated into the design process, ONR has ensured that licensees place considerable emphasis on the inclusion of human factors analysis in the early stages of plant design in order to ensure that the design properly reflects the capabilities and limitations of human performance, and that reliable operator performance is adequately supported. A set of TAGs is in place to support the consistent assessment of licensees' treatment of human factors issues. These address areas such as human factors integration, allocation of function, human machine interfaces, workspaces and work environment, procedure design and administrative control staffing levels and task organisation and human reliability analysis.

12.26. Some aspects of human factors are specifically addressed by the nuclear site licence conditions, for example, LC10 (Training), LC12 (Suitably Qualified and Experienced Persons) and LC24 (Operating Instructions). Compliance with these LCs is monitored as part of each nuclear site inspector's normal duties. To ensure this is done effectively, ONR's inspectors have access to training to help them to identify human factors concerns and they are then able to discuss these with the licensee or raise them with ONR's specialist human factors inspectors. A TAG (Ref 57) is provided to support ONR's review of licensee's arrangements for training and competence assurance. This is consistent with the expectations of IAEA as described in IAEA GS-R-3 and IAEA NS-G-2.8.

12.27. ONR's human factors inspectors proactively identify areas of the licensees' operations for examination based on their awareness of issues raised from a variety of sources, including national and international operating experience, developments in human factors techniques and research, and discussions with HSE and the licensee's personnel. ONR may carry out targeted inspections of human factors-related issues. Such inspections provide confidence that the licensee's human factors analyses are implemented in practice. ONR also maintains exchange arrangements on human factors, and other technical areas, with regulatory bodies and research establishments in other countries.

12.28. With regard to assessment of safety culture, ONR considers it important that the licensees 'own' their safety culture. It is considered neither practicable nor desirable to compel a licensee to adopt a culture advocated by the regulator. The regulatory approach to this issue, therefore, is to seek information that allows ONR to make judgements about the licensee's safety culture, by reviewing indicators of plant and personnel performance, and to use these observations to encourage and support licensee initiatives to promote improvements. ONR has developed a strategic

approach to work proactively with licensees to understand and influence senior managers' awareness of licensee leadership and managing for safety. This approach includes helping inspectors to gather information about aspects of leadership and managing for safety to inform interventions.

Article 13 - Quality Assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to improve clarity, and include changes such as the variation of Licence Condition 17.

13.1. This Article has been addressed by considering the requirements in the IAEA Safety Standard GS-R-3, "The Management System for Facilities and Activities." GS-R-3 replaced IAEA 50-C-Q in 2006. 50-C-Q specified requirements for "Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations". The scope of GS-R-3 is broader and specifies management system requirements for nuclear facilities, activities using sources of ionising radiation, radioactive waste management, the transport of radioactive material and radiation protection. GS-R-3 is supported by Safety Guides: GS-G-3.1 (2006), "Application of the Management System for Facilities and Activities", which provides guidance on implementing the generic management system requirements, and GS-G-3.5 (2009), "The Management System for Nuclear Installations". This most recent document provides guidance on implementing requirements for nuclear facilities, including nuclear power stations.

13.2. The following paragraphs identify where UK organisations are meeting the new IAEA Safety Requirements documents.

13.3. The ONR's SAPs (Ref. 43) broadly reflect the new IAEA requirements. The SAPs recognise the importance of leadership and management for safety and expect quality management systems to be an integral part of this.

Management system

Regulatory requirements and expectations

13.4. In July 2011, ONR varied its standard LC17 (Management systems) in order to transpose the obligation in Article 6 paragraph 4 of European Council Directive 2009/71/EURATOM (the Nuclear Safety Directive) into UK law. The principal change is that a duty is now placed on licensees to establish and implement management systems which give due priority to safety. In recognition of this change, LC17 is now titled 'Management systems' rather than 'Quality assurance'. In addition, LC17 (2) 'quality assurance arrangements' now refers to 'quality management arrangements' to reflect modern terminology. In response to the change in emphasis to LC17, ONR revised its internal guidance to inspectors.

13.5. ONR requires that Licensee's quality management arrangements are based on current national or international quality management system standards and that the arrangements adequately address all matters which may affect safety. Licensees may choose to use an integrated management system. This approach is a requirement of GS-R-3 and is encouraged by ONR as it ensures safety is considered in all the licensee's activities and is not confined to the quality/ safety management systems.

13.6. ONR requires quality assurance arrangements for procurement to be included in LC17 and therefore inspectors are advised as part of the internal guidance to consider what arrangements the licensee has to guard against poor quality goods/

services or counterfeit material relating to safety significant items. ONR has developed guidance on procurement, TAG 077 (Ref. 58) to provide further guidance to Inspectors addressing this area.

General requirements

13.7. A licensee's management system (sometimes referred to as a quality assurance (QA) programme) is developed as part of the arrangements to meet LC17, 'Management systems' and is normally derived from the requirements of national and international quality management Codes and Standards such as GS-R-3 and ISO 9001 (Ref. 59). Furthermore, any significant changes to the licensees' organisational structures or resources are controlled by arrangements made to meet the requirements of LC36, (Organisational capability).

13.8. Collectively, these arrangements provide a description of organisational structures and detail the arrangements for such things as the control of documentation, the provision of control and supervision, the establishment and maintenance of competency, the management, control and verification of work and the audit and review of performance. GS-R-3 requires an integrated approach to achieving objectives to ensure that safety is properly taken into account in all the activities.

Safety culture

13.9. Licensees use the management system to promote a strong safety culture. They achieve this by encouraging a clear safety leadership from the management, questioning attitude, training in error prevention methods, developing methods to enhance learning, seeking to improve safety culture through learning from experience and benchmarking and by monitoring safety performance.

Graded application of management system requirements

13.10. The application of management system requirements is graded by licensees so that there is a hierarchy of controls applied to activities depending on the safety significance and the related hazards of the plant on which the activity is to be carried out. This approach ensures that appropriate levels of scrutiny, supervision, inspection, monitoring, documentation, training and audit and surveillance are applied according to the safety significance of the plant, and the potential for error leading to the possibility of severe consequences associated with ill-conceived or inadequately executed activities or equipment failures. Licensees use a well-established process that specifies the control measures to be applied to the activity according requirements in the safety case.

Documentation of the management system

13.11. Licensees typically describe the documentation of the management system in a hierarchical structure. The top tier includes policies, organisational structure, 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 and training material.

Management responsibility

Management commitment

13.12. Licensees recognise the importance of Leadership in the implementation and improvement of management systems. This has involved the development of organisational values and expected behavioural standards for individuals. To demonstrate commitment, the licensees have developed activities where senior managers actively engage with individuals and teams in the workplace to instil and promote good behaviours and practices and encourage continual improvement.

Organisational policies

13.13. Licensees develop policies on topics that are appropriate to the facilities and the range of activities carried out. Consequently, the policies will differ between licensees. The policies normally include: health and safety, the environment, quality, people and risk. Licensees develop and implement their own strategies to meet the aims of the policies they have established.

Planning

13.14. Licensees develop business plans for the various stages in the plant life cycle e.g. design, construction and operation. The licensee identifies where the achievement of business plans requires the input of other organisations. The licensee retains responsibility for the achievement and effectiveness of the plans. Where appropriate, measurable objectives and targets are set for the achievement of performance. There are frequent and structured reviews of safety performance against specified performance indicators. These review processes include the monitoring of targets and the implementation of corrective actions where required.

Responsibility and authority for the management system

13.15. Licensees' management systems are authorised for use by senior management and are mandatory on all employees. Licensee's arrangements include processes to inform senior management of the suitability, adequacy of and level of compliance with the management system. Licensees clearly identify in related documents the key responsibilities of managers and others who carry out the work.

Resource management

Provision of resources

13.16. The allocation of resources is not a requirement specifically placed on the licensee through LC17, except to the extent that licensees' arrangements for safety related activities cannot be considered to be adequate if the resources needed to undertake those activities are clearly inadequate. LC36 was introduced specifically to guard against any downward drift in the licensees' resources as a consequence of ill-considered cost cutting. However, the activities required to establish, implement, assess and continually improve the management system are a fundamental part of the licensees' arrangements. 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.

13.17. The determination of resources necessary to carry out activities is carried out by licensees during the planning of their management systems and the planning of any operation or work activity. The minimum level of competent personnel for activities that may affect safety is included in a baseline statement.

13.18. The required competence for personnel, particularly for those whose work may affect safety, is determined and documented in a post profile. Training is provided using a structured and systematic approach and is assessed to ensure that required standards are achieved. Continuing competence is assessed through supervision and appraisal and, for critical work, refresher training is provided. Increasingly, use is made of external resources, such as contractors to undertake specific projects, but it remains the licensees' responsibility to ensure the competence of contractors (see Article 11).

Process implementation

Developing processes

13.19. Licensees' Management Systems are developed as part of their arrangements to meet licence conditions. In addition, they are designed to meet the requirements of national and international quality management requirements and guides. On this basis, licensees have to implement suitable and adequate processes to meet all these requirements and to instigate assessment and review arrangements to ensure these processes remain fit for purpose and are subject to continual improvement. The management system is also the vehicle by which all other arrangements required to be made under the nuclear site licence are identified, referenced and controlled.

13.20. Historically in the UK, licensees' management systems were based on procedures. However, licensees are converting to process-based management systems to benefit from the simplification and better understanding of the interaction of activities that this brings. The processes necessary to manage licensees' activities change with the lifecycle phase of operations. As power stations are taken out of service, licensees develop decommissioning processes. With the new build programmes in the UK, licensees and potential licensees focus on processes associated with siting, design, manufacture, construction and commissioning.

Process management

13.21. In order to optimise the effectiveness of processes, licensees ensure that processes are planned, documented, assessed, reviewed and improved. Work performed under each process is carried out under controlled conditions using approved procedures, instructions and records, which are subject to periodic review. Licensees retain overall responsibility where processes are contracted to other organisations (see also paragraph 13.15).

Generic management system processes

13.22. GS-R-3 identifies generic management system processes: control of documents; control of products; control of records; purchasing; communications; and management of organisational change. Licensees' arrangements, as a matter of course, cover these processes which are basic elements of any management system. Increasing use is being made of electronic media for the control of documents and records.

13.23. All licensees have established procurement arrangements. An integral part of these arrangements is the evaluation and selection of suppliers and contractors, including the suitability of contractors to comply with the requirements of the licensees' management systems, or to provide adequate arrangements themselves that provide equivalent levels of control.

13.24. Licensees use a variety of approaches and media to communicate to internal and external stakeholders on performance and intentions.

Measurement, assessment and improvement

Monitoring and measurement

13.25. Monitoring and measurement are a fundamental element in licensees' management systems. As with plant design and operation, there is a strong element of defence-in-depth in the audit and review process. Licensees employ a multi-layered audit and review approach to self-assessment, task-independent audit and review, and independent audit and review, some of the latter being carried out by third party organisations. In addition to the audits and reviews carried out by, or on

behalf of, the licensees, ONR, as part of its regulatory activities, also carries out inspections of the licensees' arrangements.

Self audit of procedures

13.26. Audit and assessment arrangements are embedded within the business and, as explained above, take many forms including independent, external and self-audit. Self-audits are conducted by initiating a review of procedures and review of performance and measures within topic areas. Results from self audits are used to monitor overall performance and identify improvement opportunities related to the topic area. Improvement activities are communicated using existing reporting mechanisms of the organisation. Improvement actions are captured within improvement plans and the management system as required. The self-audit activities complement the process of independent assessment where collectively these arrangements form the assurance process.

Audit of vendors

13.27. The supply chain process arrangements covers the strategy, pre-qualification, tendering and award of contract and further management arrangements following award of contract. The pre-qualification and tender process requires the vendor to submit relevant information for consideration. An initial assessment is carried out for the suitability of the vendor in terms of their ability and capacity to deliver the requirements against the specifications required. Depending on the safety significance of the items or services required, a site visit/audit of the vendors' premises will be undertaken where appropriate. In line with the hierarchy of controls required under the QA grading process for the safety significance of items or services, an independent inspection body may be used to undertake an audit of the vendor against technical specifications. The inspection body will forward results to a technical specialist who will review and assess the results for acceptability against safety implications, relevant codes, standards or statutory requirements and records are maintained. The Achilles Verify system (Ref. 60) is used to access current and comprehensive audits to support monitoring and review of safety management arrangements and performance.

Independent assessment

13.28. Licensees typically employ diverse means of independent assessment. These can include:

1. audit, directed at assessing implementation of, and conformance with, the management system;
2. inspection, directed at assessing compliance with the nuclear site licence and other applicable legal requirements;
3. oversight, directed at surveillance to assess the safe and reliable performance of power plant; and
4. peer review, where subject-matter experts from other sites, licensees or operators provide a critical assessment of working practices against recognised best practice and standards.

13.29. Licensees are increasingly seeking externally accredited certification of their management systems against international management system standards such as ISO 9001 (quality), ISO 14001 (environment), OHSAS 18001 (occupational health and safety) and PAS 55-1 (asset management).

Management system review

13.30. Licensees carry out reviews of their management systems to ensure their continuing effectiveness of their arrangements and to provide a basis for continued improvement. Information from a number of sources is taken into consideration,

including the licensee's performance, performance of processes, results from all forms of assessments, non-conformances and corrective actions, lessons learned from other licensees and operators, and opportunities for improvement. The reviews identify weaknesses and obstacles to good performance and determine where changes and improvements are required to be made to policies, objectives and processes. For some licensees, a single management system review is carried out annually. For others, reviews of parts of the management system are carried out at planned intervals, ensuring that the whole management system is reviewed within a specified period.

Non-conformances and corrective and preventive action

13.31. Licensees, as part of their safety culture, encourage the identification and reporting of non-conformances. Items, services and processes that do not meet requirements are identified through a number of processes that can include receipt and in-process inspections, contract reviews, supervision and monitoring, in addition to self-assessment and independent assessment as discussed above. The level of reporting of a non-conformance typically depends on its nature, its potential effect on nuclear safety, its cost and its effect on the licensee's objectives. Appropriate correction and corrective actions to address root causes are taken and their progress to completion is monitored and tracked. Data relating to non-conformances are analysed to identify developing trends so that appropriate longer term preventive actions can be taken.

13.32. Information on events is shared between licensees and other operators as part of an operational experience programme. This operational experience is analysed to identify where preventive actions can be taken to address potential non-conformances.

Improvement

13.33. Licensees use a number of processes to support continual improvement of the management system. Once the need for improvement is identified, it is planned to ensure that it is properly resourced. Depending on the scale of the improvement, it may be included in the business plan or a specific improvement plan so that its progress is monitored to completion. This approach is compatible with ONR Safety Assessment Principle on Leadership, in showing commitment to safety and system improvement.

13.34. Licensees consider the identification of opportunities for improvement as an ongoing responsibility and activity. External influences such as changes to standards or legislation, as well as social and business pressures all provide the motivation to update business plans and therefore management systems.

Article 14 - Assessment and Verification of Safety

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

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

The process for compliance with this Article has not changed substantially since the fifth UK report. The report below has been expanded since the last report to reflect interest in the detail of the process at the fifth meeting and illustrates how the process is applied by reference to recent assessment and verification activities.

Safety assessment by the Licensee

14.1. Safety justifications to demonstrate compliance with legal requirements ('Safety Reports') are required prior to the start of construction, before commissioning, before first operation, after steady reliable operation has been achieved, before plant modification and prior to decommissioning. During the operational and decommissioning phases, the NPP safety report is updated as necessary to reflect changes to plant or procedures, new safety analysis techniques, research findings and the outcome of Periodic Safety Reviews (PSR). The purpose and process of periodic safety reviews is described, in detail in Article 6. The Licensees also have processes for recording and investigating events on site as described in detail in Articles 9 and 19. More significant issues are raised as "incidents" through reporting arrangements in place between licensees and ONR in line with the requirements of LC7 (Incidents on the site). The Condition requires the licensees to make adequate arrangements for the notification, recording, investigation and reporting of incidents on site. If appropriate, for example, as a result of an investigation into an incident, the safety case would be adjusted to reflect the findings. Further details of operational experience and learning from events are provided in Article 19.

14.2. 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. The licensee is responsible for the preparation and maintenance of the safety case, which he must fully understand and make use of at all stages of the NPP's life. Licensees' management systems, required under LC17 (Management systems), ensure that external suppliers of safety-related plant meet appropriate standards. The licensee has systems in place to ensure that the plant is operated and maintained in accordance with the requirements and assumptions of the safety case. As required by the nuclear site licence, to secure compliance with licence conditions, it is expected that comprehensive safety assessments are carried out at the time of construction of the UK's nuclear installations. These safety assessments are updated, as necessary, during the installation's lifetime.

14.3. The safety case is the totality of the documented information and arguments that substantiate the safety of the plant, activities, operations and modifications. ONR does not prescribe the format of safety cases but ONR's safety assessment principles, which are guidance to ONR inspectors, set-out what a safety case must

demonstrate. The safety case demonstrates in writing that the plant, its processes, activities and any modifications:

- meet the design safety requirements and criteria;
- conform to good nuclear engineering practice and to appropriate standards and codes of practice or, other relevant good practice (e.g. use of the concepts of "defence in depth" and "adequate safety margins");
- are adequately safe during both normal operation and fault conditions;
- are, and will remain, fit for purpose;
- give rise to a level of nuclear risk to both public and workers which is ALARP and
- have a defined and acceptable operating envelope, with defined limits and conditions, and the means to keep within the envelope (safety management).

14.4. The major licensees have developed their own Nuclear Safety Principles that set-down the deterministic and probabilistic acceptance criteria against which they judge each safety case. Some UK NPPs have recently undertaken major projects that significantly enhance the visibility, traceability and user-friendliness of their safety cases.

14.5. In addition to their nuclear safety principles, the licensees conduct their assessment in line with a range of British, European and International Standards. For example, standards used for assessment of digital instrumentation and control by NPP licensees include:

- BS EN 61508 on Functional Safety of electrical/electronic/programmable electronic safety-related systems
- BS IEC 61513 Nuclear Power Plants – Instrumentation and Control important to Safety – General requirement for systems
- BS EN 61226 Nuclear Power Plants – Instrumentation and Control important to safety – classification of instrumentation and control functions
- BS EN 60987 Nuclear Power Plants – Instrumentation and Control important to safety – Hardware design requirements for computer-based systems
- BS EN 60880 Nuclear Power Plants – Instrumentation and Control important to safety – Software aspects for computer-based systems performing category A functions.

14.6. For the majority of the UK's nuclear reactors that are already in the latter stages of their operating lives, or are undergoing defuelling and decommissioning, the current emphasis is on the PSRs and on pre-decommissioning work such as environmental impact studies.

14.7. All but one of the Magnox sites have ceased generation. To date, at each change of phase, the licensee has produced a new safety case, which reflects the changed hazard after permanent shutdown, final removal of fuel etc. These have been produced independently of the PSR cycle. Magnox Ltd. is now moving to aligning these, so that in addition to a new safety case it is also ensuring that it completes a PSR at the same time, thus setting a complete new baseline for the plant.

14.8. New guidance on the Licensing process has been published to inform potential Licensees preparing to embark on a programme of constructing new NPPs (Ref.11). The broad principle of pre-construction and pre-operation reports was retained, but the amended process recognised the international nature of possible vendors and potential licensees, and a generic approach to early assessment of the design. For the first time it allowed granting of a Nuclear Site Licence, but not

permission to start construction, prior to supply of a pre-construction safety report (PCSR).

14.9. Under the new guidance, the initial assessment and verification of the safety of a nuclear installation starts before construction commences. An outline NPP design, described in a generic PCSR, is prepared concentrating on the 'nuclear island', that portion of the NPP design that is independent of the choice of NPP geographical location. Site-specific information detailing how the generic design has been applied given the specifics of the site is added to this generic PCSR to create a site-specific PCSR. ONR carries out a generic design assessment (GDA) of the generic PCSR and a site-specific assessment of the site-specific PCSR.

Legal requirements for safety documentation

14.10. ONR's standard site licence conditions require the licensee to put in place arrangements to ensure that adequate safety documentation is produced. In particular, the intent of these LCs is as follows:

- LC14 (Safety Documentation) requires the licensee to make arrangements for the production and assessment of safety cases consisting of documentation to justify safety during the life of the nuclear installation;
- LC15 (Periodic Review) gives ONR the power to require reviews of safety documentation. Periodic Safety Reviews (PSR) are the output from this process.
- LC16 (Site Plans, Designs and Specifications) requires that the licensee provides ONR with a site plan, a schedule of buildings on the site and the description of the function of plant contained therein;
- LC19 (Construction or Installation of New Plant) requires the provision of adequate documentation to control safety during the construction and installation of new plant;
- LC20 (Modification to Design of Plant under Construction) requires the provision of adequate documentation to control safety related modifications that are found necessary or desirable during construction;
- LC21 (Commissioning) requires the provision of adequate documentation to control all commissioning activities that confirm the design intent of the plant, that activities are carried out by suitably qualified people, that records are kept and that modifications are implemented according to a change procedure;
- LC22 (Modification or Experiment on Existing Plant) requires the provision of adequate documentation to justify the safety of a modification or experiment on the plant and that this justification is subject to appropriate review;
- LC23 (Operating Rules) requires the licensee to produce an adequate safety case for any operation that may affect safety and that this safety case identifies safe limits and conditions for operation, known as operating rules;
- LC24 (Operating Instructions) requires the licensee to carry out all operations that may affect safety in accordance with written instructions;
- LC27 (Safety mechanisms, devices and circuits) requires the licensee to ensure that a plant is not operated, inspected, maintained or tested unless suitable and sufficient safety mechanisms, devices and circuits are properly connected and in good working order;
- LC28 (Examination, inspection, maintenance and testing) requires the licensee to verify that the limits and conditions identified in the safety case continue to be valid by instigating a regime for the maintenance, inspection and testing of safety-related plant.

- LC36 (Organisational capability) requires the licensee to make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety

14.11. The licensee must also have adequate arrangements for compliance with relevant statutory provisions of the Health and Safety at Work Act for example, the UK Ionising Radiation Regulations (IRR99), as well as other appropriate legislation.

Safety analysis methodology

14.12. The licensees' analyses of normal operating conditions show that resultant radiation doses due to ionising radiations, both to members of the work force and the public, are, and will continue to be, below regulatory limits and, furthermore, are ALARP (see Article 15).

14.13. The licensees prepare an analysis of faults that could initiate accident sequences (initiating faults) and the defences available at the plant to mitigate the predicted consequences. The analysis includes the two complementary approaches for design basis faults of deterministic and probabilistic assessment. A comprehensive fault schedule that includes both internal initiating events as well as internal and external hazards is the starting point of both deterministic and probabilistic safety analyses (PSA). The deterministic approach is used in the analysis of design basis accidents to demonstrate the capability of the safety systems. As part of this approach, the licensees are expected to ensure that a small change in design-basis parameters does not lead to a disproportionate increase in radiological consequences (cliff-edge effects). Analyses are also undertaken of more severe faults outside the design basis, which could lead to large releases of radioactivity. These severe accident analyses include study of the potential failures of the physical barriers to the release of radioactivity, analysis of the magnitude and characteristics of the releases, identification of the accident management strategies to reduce the risk, together with the necessary equipment, instrumentation and accident management procedures.

14.14. The PSA provides a comprehensive, systematic numerical analysis of the risk from the plant to demonstrate its acceptability. PSAs for most of the gas-cooled reactors (Magnox and the earlier AGRs) were carried out as part of the PSRs. For the later AGRs at Heysham 2 and Torness and the PWR at Sizewell B, PSA was used from the design stage. The existing PSAs for the gas-cooled reactors are Level 1 PSA's, whereas Sizewell B has an existing Level 2 PSA. As a result of the UK response to the Fukushima accident, EDF NGL is developing Level 2 PSAs for operational gas-cooled reactors. Wylfa is currently programmed to shutdown its remaining operational reactor in September 2014. It does not have sufficient remaining time to complete a full Level 2 PSA and implement improvements before then. It has therefore started a limited scope Level 2 PSA, which uses Level 2 PSA techniques to look at accident progression beyond core damage to explore the effectiveness of guidelines for beyond design basis events.

14.15. Currently, Sizewell B and the AGRs have established "Living PSA programmes". UK regulation is not prescriptive; however there is a requirement that licensees will follow good international practice when developing their safety documentation and their processes. In this regard, the living PSA programmes established by EDF NGL have been developed based on IAEA-TECDOC-1106.

14.16. Safety documentation also provides the basis for the management for safety by addressing: management and staffing levels; training requirements; maintenance requirements; operating and maintenance instructions; operating rules; and contingency and emergency instructions. The operating rules and instructions are identified from the controls and limits determined by in the safety analysis within the safety case.

14.17. The magnitude, complexity, and development of the safety case through the life of each plant has required the implementation of adequate systems to manage its development. The licensees put systems in place to manage the changes to the safety cases properly to ensure that these accurately reflect the as-built and as-operated plant. Thus the documentation that forms the safety case is subject to appropriate management systems required by LC17 (discussed in Article 13), and any changes to the safety case are regulated as modifications under LC22.

14.18. Changes in the purpose and use of a safety case at each stage can involve changes in the organisations responsible for preparing it. At the design stage, the safety case is developed mainly by a design team who eventually hand over responsibility to the operator. Management systems define how information is transferred, demonstrates that there are mechanisms in place to ensure that responsibilities are clear, and ensures that the case is fully adopted and implemented.

14.19. In order to meet the licence conditions, supplementary documents are sometimes added to the safety case to justify the safety of activities carried out at particular points in time. For example, a method statement may be prepared to demonstrate that the integrity of plant will be maintained and quality ensured during installation work. Similar types of safety case documentation are produced to demonstrate the safety of temporary plant modifications. These documents define and justify, for limited periods of time, operations that are necessary, but which may be outside the normal operating envelope described by existing rules and instructions. If there is a need to conduct a non-routine operation, test or experiment, the licensee will prepare a safety case as required by LC22.

14.20. All licensees categorise the safety significance of safety documentation and proposals to modify the safety cases. This is to ensure that the degree of assessment and verification and the choice of clearance route is commensurate with the assessed safety significance. Proposals to change the safety case for a plant are managed by the same process as proposals to modify the plant physically. Typically these require (at the highest level of safety significance) a proposal to be:

- verified in depth by suitably qualified and experienced persons who have not been involved in preparing the proposal (but may be from the same organisation or working group);
- assessed as satisfactory in terms of its category and content through an independent nuclear safety assessment (INSA) by, or to the standards established by, the licensee's health and safety function;
- considered by the Nuclear Safety Committee (required by LC13) which includes suitably qualified and experienced persons from outside the licensee's organisation, with the licensee taking due notice of the advice given by the committee; and
- formally agreed by ONR.

14.21. At the lowest level of safety significance, the Station Director may authorise and implement the proposal, but sufficient documentary evidence must be prepared to justify the category allocated, and ensure this evidence is available for auditing if needed.

14.22. Licensees in the UK also make extensive use of external international peer reviews.

Reviews of the safety case

14.23. Major Periodic Safety Reviews (PSRs) are carried out by licensees, no later than every 10 years (or when subject to a review following a major event – see the section on responses to the Fukushima event below and in Articles 6 and 18). The

current status of PSRs is described in Article 6. ONR Technical Assessment Guide (TAG) 50 (Ref. 61) sets out what ONR expects to see in the PSR.

14.24. As well as the PSRs, major reviews are undertaken every 2 or 3 years for generating sites coincident with reactor periodic shutdowns, carried out in accordance with LC30 (Periodic shutdown) for the purpose of enabling examination, inspection maintenance and testing, LC28. The review findings are used to update the NPP safety case and provide a justification for a further period of operation (usually 1.5, 2 or 3 years until the next periodic shutdown). The focus is on plant inspection results and any modifications completed during the outage, to demonstrate that adequate safety margins will continue to exist throughout the subsequent operating period. Permission from ONR for reactor start-up is required at the end of each periodic shutdown.

14.25. In addition to the programme of inspections that ONR undertakes throughout the year, a meeting is held between ONR and the Licensee at the nuclear licensed site. This is termed an annual review of safety. The purpose of the meeting is to review the plant and safety case status to maintain an overview of the position.

Licensee Safety Assessments prompted by the Fukushima accident

14.26. Since the Fifth UK Report, risks from external hazards have been reviewed by NPP Licensees as a result of the Fukushima accident. The outcome from these reviews is summarised in ONR's Implementation report (Ref. 14) and the National Action Plan (Ref. 18).

14.27. Full details of proposed and committed activities and assessment work by EDF NGL was also provided in the UK report to the second extraordinary meeting of the Convention in 2012. The following items are listed as examples of the NPP licensees' activities.

- Provision of off-site back up emergency equipment to be stored in 3 regional AGR depots and a new Sizewell B Emergency Response Centre (ERC), e.g. off-road and debris removal vehicles, diesel-driven electricity generators and treated water pumps for reactor and fuel cooling (see response to Article 16 on Emergency Preparedness for more detail).
- Enhanced external flood protection at Dungeness B NPP (see paragraph 14.28).
- Undertaking a number of modifications at the Sizewell B NPP as detailed in the UK's report to the Second Extraordinary Meeting of the Convention in 2012.
- Review and updating of reactor SBERGs (Symptom Based Emergency Response Guides) and SAGs (Severe Accident Guides).
- Review of claims falling under the heading of human capabilities and capacities.

14.28. Furthermore, EDF NGL engaged an expert consultant to recalculate the flood hazard at all EDF NGL sites. As a result at Dungeness B NPP, a number of key systems needed to be protected, for example, by damboards and cable trench sealing. The Licensee was operating the reactors under an interim safety case with additional short-term flood protection improvements. Further review of the interim safety case identified another anomaly which undermined this interim safety case and the decision was taken to shutdown one reactor and not restart the other until modifications could be implemented to allow a further appropriately categorised safety case to be produced. In the longer term, further improvements will be made with a clear plan to restore the full 1 in 10,000 year external flooding design basis by the end of 2013 by building a concrete wall around the site.

14.29. At the Magnox sites safety improvements already implemented include increased CO_2 and diesel fuel stocks on-sites, new diverse pond water emergency filling lines at some sites, backup feedwater / fire pumps to provide further defence in-

depth, improved training on accident response and additional stocks of essential equipment (e.g. basic tools, flash lights etc.) at sites stored in diverse locations. Further details of proposed and implemented safety improvements to the UK NPPs are detailed in the UK report to the Second Extraordinary Meeting of the Convention (Ref. 4).

14.30. Information on design enhancements for the new reactor designs is provided in Article 18 of this report.

Licensees' Verification by analysis, surveillance, testing and inspection

Maintenance, testing and inspection

14.31. All UK nuclear installation licensees are required to make and implement adequate arrangements for examination, maintenance, testing, surveillance and inspection of those structures, systems and components that are important to safety. LC28 (Examination, inspection maintenance and testing) requires licensees to verify the physical state of all plant that may affect safety by regular and systematic examination, inspection, maintenance and testing. A Maintenance Schedule is prepared to define the periodicity of maintenance inspection and testing, and details the scope of work to be carried out. The results are reviewed to confirm that plant meets the requirements set out in the safety case.

14.32. Whilst a significant number of maintenance, inspection and testing activities is carried out while a reactor is in operation, some work will inevitably necessitate a reactor shutdown. With the exception of Sizewell B, the UK's reactors were designed to refuel on load and not to have specific refuelling outages during which essential maintenance can be carried out although in practice only 4 of the 7 NPPs (AGRs) refuel on load and then they must reduce power to do so. Licence Condition 30 (Periodic shutdown) requires licensees to shutdown nuclear installations periodically ('periodic shutdown', sometimes incorrectly referred to as a 'statutory outage'). Periodic shutdowns are used for the purpose of examination, inspection, maintenance and testing of plant that may affect safety independently of the refuelling programme for gas-cooled reactors. Periods between periodic shutdowns are, 18 months for Sizewell B, 3 years at AGR stations and 2 years at the sole remaining operational Magnox reactor, and must be explicitly defined in the Plant Maintenance Schedule. Before the re-start of operation after a periodic shutdown, the safety case is reviewed in the light of any findings arising during the previous operational period and during the periodic shutdown. The plant must be shown to be safe to operate until the next periodic shutdown.

14.33. Licence Condition 29 (Duty to carry out tests, inspections and examinations) requires licensees, after consultation with ONR, to carry out and report the results of tests, inspections and examinations specified by ONR. This licence condition may therefore be regarded as a verification activity by the nuclear regulator or as a means to intervene to improve knowledge or secure a safety improvement.

14.34. In order to justify operation until the next statutory outage, the licensee may carry out analyses to predict that failures due to ageing processes, such as creep or fatigue, are unlikely in a defined future period of operation. Non-destructive testing, surveillance and sample testing monitoring are used widely to support these analyses.

14.35. The licensees' overall analyses, surveillance, testing and inspection strategies are to ensure that their nuclear installations are kept within the safety case and in accordance with overall requirements for their designs. Safety objectives of these overall strategies include:

- the integrity of all safety-related plant to meet plant operating conditions;
- that the reliability of plant remains within safety case assumptions;
- that plant operation within safety case assumptions can be demonstrated; and
- that sufficient safety-related plant is always available to comply with the safety case.

14.36. In the design phase, diverse and redundant systems and plant are provided to ensure that safety-related systems meet the safety performance criteria, making due allowance for active and passive failures and realistic maintenance requirements. These include issues such as the time taken to perform preventive maintenance and the time taken to correct defects. A key operational issue is that additional plant surveillance and operational constraints are imposed when an 'urgent maintenance state' arises due to limited plant availability (for testing, preventive maintenance, or as the result of plant defects).

14.37. Licence conditions require the licensees to maintain records of examination, maintenance, inspection, surveillance and testing. ONR site inspectors routinely review the availability and content of this information. The results of testing and maintenance of safety-related items and components are also reviewed by the licensees' staff, who are aware of the safety case assumptions which are preserved in a plant history. This data enables reviews of the appropriateness of the intervals and activities to be undertaken to optimise maintenance work so as to minimise plant interference, operator radiation dose, and cost.

14.38. Furthermore, given that the current fleet of UK's AGR reactors is entering its end of life cycle, EDF NGLs aspiration is to achieve the optimum generating profile for the fleet up to the point where the cessation of generation becomes necessary. To this end, EDF NGL has undertaken a wide ranging project, covering all operational stations at all levels of the organisation, to optimise the remaining generating life of the reactors. EDF NGL has therefore established a project in the lifetime management programme that combines an upfront investment programme allied to through-life management strategies for 20 key nuclear safety significant systems. The project will continue to run until all the stations have shutdown.

Surveillance of compliance with operational limits and conditions

14.39. Licence Condition 23 (Operating rules) requires the licensee to produce a safety case and to identify conditions and limits necessary for safe operation. These are referred to as operating rules. They are presented to ONR for approval and cannot then be altered without ONR's further approval. The licensees have systems for ensuring that the plant remains within the safe envelope defined by these limits and conditions. They are supported by a hierarchy of operating instructions that define the normal operating limits and conditions, required plant availabilities and plant operating procedures. These are referred to as Technical Specifications and/or Identified Operating Instructions on EDF NGL sites, and compliance with them, will ensure that the fundamental plant limits and conditions are complied with.

14.40. The licensees have systems for routine compliance monitoring to self-check that they are complying with their Technical Specifications and Identified Operating Instructions. This includes plant surveillance, maintenance and administrative checks. Each licensee also has an internal plant-focussed safety department (an 'internal regulator') which will undertake inspections at site to verify that the limits and conditions are being complied with, and that routine surveillances are conducted. Where events of non-compliance occur, these are investigated by the licensees and reported to ONR in accordance with the arrangements under LC7.

14.41. The licensees have programmes to ensure that deviations from operational limits and conditions are documented and reported. Some nuclear installations use tools to assist operators in addressing compliance with some of the station's

Operating Rules. These assist the operators by indicating whether or not the current plant configurations are compliant with the pre-determined permissible plant configurations and, in parallel, carry out a risk evaluation. They have user-friendly interfaces and present risks in a way that can be appreciated by the operators. Logs of all changes in plant configuration and the results of operating rule compliance are retained, and these are periodically reviewed to confirm satisfactory operations.

Assessment and verification by the nuclear regulator

14.42. Through a programme of planned and reactive inspections and technical assessments, ONR inspectors check that appropriate standards are developed, achieved and maintained by the licensees. ONR also:

- confirms that licensees establish, manage and maintain safety requirements for the protection of employees and members of the public;
- assesses the safety of proposed and existing sites and nuclear installation designs; and
- inspects nuclear installations for compliance with these requirements at all stages from construction to operation and eventual decommissioning.

14.43. In the course of its nuclear regulatory work, ONR scrutinises the activities of licensees both at their licensed nuclear sites and through assessment of the licensees' written safety submissions. This section describes the assessment and verification activities carried out by ONR. Special emphasis is put on describing how the SAPs are used during the assessment to judge the adequacy of safety case submissions.

Permissioning activities following regulatory assessment of safety submissions

14.44. Licensees submit requests for permission to carry out activities supported by safety submissions. ONR sets safety standards in broad terms for the reviews and assessments using the legal requirements of the licence conditions, and guidance set out in SAPs, which are based on the philosophy described in Reducing Risk, Protecting People (R2P2, Ref. 62). ONR publishes guidance to its inspectors on purpose, scope and contents of the safety cases (Ref. 63).

14.45. ONR's SAPs form a framework that is used as a reference for technical judgements on the adequacy of licensees' safety cases. They also assist ONR in applying a consistent and uniform approach to its assessment process. In carrying out an assessment, the ONR inspectors judge the extent to which the safety submission shows conformity with the relevant SAPs, noting that not all of the principles are applicable to every licensed site or to every assessed safety case submission.

14.46. The majority of the SAPs are engineering (or deterministic) principles. In creating a design, there are many choices to be made. Each choice involves, to a greater or lesser extent, the use of judgement in technical, scientific or commercial issues. Not all of these judgements are concerned directly with safety, but most will influence its achievement. The deterministic SAPs provide inspectors with guidance on what to look for when judging whether the licensee has made a case to demonstrate that risks are reduced ALARP. They represent ONR's view of good nuclear engineering practice. They point to the design features that in ONR's view would lead to a safe plant.

14.47. The SAPs also contain probabilistic targets, some of which (radiation doses to people) embody specific statutory limits. However, ONR inspectors will primarily use the engineering principles and use the PSA as a check to inform regulatory judgements and decisions. PSA is used to produce numerical estimates of the risk from the plant and thus provides an input to judgement of the adequacy the plant

safety case. It acts as a crosscheck on the level of safety provision, so that the PSA and deterministic SAPs are complementary. The numerical analysis informs, but does not in itself provide the basis for, a decision.

14.48. It is the duty of licensees to meet all statutory limits, and to reduce the risk, 'so far as is reasonably practicable' (SFAIRP). This latter phrase is a fundamental principle of UK health and safety law embodied in HSWA74, which conveys many of the same ideas as the ALARP and as low as reasonably achievable (ALARA) concepts, more familiar to international safety experts. See Annex 5 for a further discussion of these concepts.

14.49. The SAPs are aimed at the safety assessment of both proposed (new) nuclear facilities, and existing facilities. For the assessment of existing plants, there is a further point to be considered: the safety standards used in their design and construction may differ from those used in plants designed and built more recently. The existence of such differences is recognised by ONR inspectors when applying the SAPs in the assessment of modifications to old plants. The ALARP principle is of particular importance to such assessments, and the age of the nuclear installation and its projected life are important factors taken into account when making regulatory judgements on the reasonable practicability of making improvements.

14.50. A revision of the SAPs is in preparation with an anticipated publishing date of the end of 2013. Most of the revisions arise naturally because of the time interval since the last update in 2006. A review of the SAPs against the lessons learned from the Fukushima accident showed the SAPs to be fundamentally sound but some limited changes were prompted. The details of these changes can be found in Section 2 and Article 18 of this report.

14.51. The UK's goal-setting legal framework for health and safety does not apply IAEA requirements in a prescriptive manner, but they are reflected in the revised SAPs so that the SAPs benchmark status is retained. For example the text of the revised SAPs was reviewed for consistency against the individual requirements of IAEA SSR-2/1 'Safety of Nuclear Power Plants: Design' and SSR-2/2 'Safety of Nuclear Power Plants: Commissioning and Operation'.

14.52. Assessment of licensees' safety cases is undertaken by first understanding and then sampling the key aspects of a safety case using ONR's SAPs, and other national and international standards when appropriate. The technical expertise of ONR staff is used to select the issues to be pursued in depth. Guidance is provided to inspectors in the form of Technical Assessment Guides (TAGs) for a range of technical topics e.g., a number of TAGs are relevant to the assessment of digital instrumentation and control.

14.53. The output of the assessment by an Inspector from a particular technical discipline is an Assessment Report (AR). ONR project or site inspectors bring together and integrate the findings from assessment reports covering each of the relevant technical areas and provide an overall conclusion regarding the adequacy and acceptability of the assessed safety case, leading to a recommendation as to whether permission should be granted for the requested activity. This is formally documented in Project Assessment Reports (PAR). To ensure openness and transparency of regulatory decisions, PARs are now published on the ONR website (Ref. 64).

14.54. Extensive discussion between the different technical assessors and the project and site inspectors, together with face-to-face discussions and written exchanges with the technical experts of the licensee, are used to clarify and test the information used, background analyses performed and assumptions made in the safety case. The overall judgement of acceptability is based on the full range of assessment advice. The assessors make recommendations, if appropriate, on where safety can be improved. These recommendations are discussed with the

licensee and a programme to implement improvements is agreed. ONR monitors progress with implementation of these recommendations and other issues that may be raised requiring regulatory follow-up. ONR utilises a system for recording and monitoring progress made by the licensee in addressing regulatory issues and recommendations. Appropriate regulatory action is taken if the issues remain unresolved or inadequate progress is made.

14.55. The contents of safety cases may vary due to differences in design between different nuclear installations, but ONR's appraisal of the case always addresses three questions:

- are the objectives of the safety case right?
- are the details of the safety case right? and
- has enough been done?

14.56. In answering the above questions, ONR's nuclear inspectors seek certain attributes in the licensees' safety case submissions. These are:

- Completeness: All reasonably foreseeable threats to safety must be identified, and it should be shown that the plant incorporates adequate protection against these threats, or that their contribution to the risk is negligible;
- Clarity: There must be a logical presentation of the plant, system and processes and the safety justification that applies, with clear referencing of supporting information and clear identification of conclusions and recommendations;
- Rationality: The safety case should provide cohesive and logical arguments to support the conclusions;
- Accuracy: The safety case should reflect the 'as is' state of the plant, including processes and procedures;
- Objectivity: The claims in the safety case must be properly tested and checked. As far as is reasonably practicable, claims must be supported with factual evidence. The necessary understanding of the behaviour of novel systems or processes should be established from appropriate research and development. The sensitivity of the conclusions to assumptions should be visible;
- Appropriateness: Methods and codes used to demonstrate safety must be fit for purpose with adequate verification and validation.

14.57. If a safety issue is judged to be of sufficient importance, ONR may commission parallel analyses and research to allow additional input into the regulatory judgement process. In addition, if insufficient in-house expertise is available to validate a key safety case claim or if additional views are required, ONR may use external recognised independent experts in the appropriate technical field to help to inform its regulatory judgement. Such external resources, however, do not make regulatory judgements but provide expert authoritative advice to ONR inspectors.

14.58. As part of an overall permissioning project agreed with the licensee, the ONR Project Inspector may consider it necessary to carry out inspections, prior to granting permission (readiness inspections). The purpose of such inspections is to verify that safety case claims are supported by factual evidence or that the licensee has arrangements in place to meet the intent of the safety case.

14.59. Requests for permission to carry out activities (e.g. modifications) that have comparatively low nuclear safety significance are not sent to ONR for review and a permissioning decision. However, for such activities the licensee prepares sufficient information to allow ONR to decide whether the decision was justified, should ONR decide to undertake a check. Some of these activities will be examined as part of the ONR's inspection routine.

14.60. Recent examples of significant permissioning activities that took place after regulatory assessment of safety submissions include:-

- Issue of a Site Licence for the proposed NPP at Hinkley Point C in November 2012. Assessment concentrated on the suitability of the site, the capability of the licensee to act as an intelligent customer, its ability to demonstrate adequate control of activities being undertaken on the nuclear licensed site and other factors relevant to the licensee's Leadership and management for safety.
- Granting of a Design Acceptance Confirmation (DAC) in December 2012 signifying that the UK EPR™ nuclear reactor design is suitable for construction in the UK as, *inter alia*, it meets regulatory expectations on safety. Issue of the DAC followed completion by ONR of a Generic Design Assessment (GDA) for this reactor design from Electricite de France SA and AREVA NP SAS (see Article 18 for further details).
- Permissioning of the installation of enhancements to the shut-down systems at Hinkley Point B and Hunterston B reactors. Existing systems are being supplemented with the replacement of some control rods with 'super articulated control rods' (SACRs) and a seismically qualified nitrogen injection system to strengthen the safety case for the cores near the end of the their lives."
- Permissioning of an extensive project to replace degraded neoprene insulation, due to a previously unknown mechanism, from a significant number of trip units associated with reactor safety circuits. EDF NGL licensee has initiated in excess of 30 modifications across its AGR sites to upgrade a number of types of reactor safety circuit trip units and undertaken an extensive programme of repair works to eliminate degraded neoprene insulation.

Regulatory inspection of Nuclear Sites

14.61. ONR carries out planned inspections of nuclear licensed sites to monitor licensees' compliance with the LCs and the requirements of HSWA74 and other Regulations. An inspector (or team of inspectors) is allocated to the nuclear installation site from the start of construction. This means that frequent inspections and discussions take place, key tests can be witnessed and the test reports checked. In addition, ONR inspectors often visit the site and key manufacturers' works to monitor the construction of components important to safety and witness quality assurance procedures. Once the reactor is operational, the nuclear site inspectors spend about 30% of their working time on their site. In particular, they ensure that the licensee is complying with the licence conditions and the arrangements made under the licence conditions.

14.62. Team inspections that address specific or more generic aspects of the safety of the nuclear installations are also carried out at the plants and at the Utility corporate centres. For such actions, a multi-disciplinary group of inspectors will visit the site. They make their findings known to the operator, so that improvements are made, where appropriate.

14.63. Individual Site Intervention Plans are produced according to generic templates based on a matrix that includes both the LCs and relevant legislation, the important critical systems (derived from the safety case) and recent Operational Experience Feedback (OEF). Before the start of each year, the plan is modified, as necessary, to take into account OEF, regulatory issues and developments affecting the plant. Unplanned and reactive inspection work is also integrated, as necessary, into the site inspection activities throughout the year. Site inspectors are supported by other ONR Inspectors who carry out specialist assessments or inspections as

necessary. The Integrated Intervention Strategy developed by ONR embraces the site and corporate inspection processes, together with the assessment processes, (both discussed above) to help provide a consistent and integrated framework for all regulatory activities. ONR's organisational change and implementation of Programme working has brought about further consistency in regulation of similar sites and enables ONR to have better oversight of regulatory issues within the operating fleet, defueling and decommissioning plants hence, more effective targeting of its regulatory efforts.

14.64. Following inspections by the ONR inspector, the findings of the inspection are discussed with the licensee and, where appropriate, the corrective actions required from the licensee are agreed. Subsequently, an intervention report is prepared by the inspector to record appropriate details of the objectives of the visit, matters considered, conclusions drawn and any follow-up actions identified. Significant issues are recorded in ONR's Issues Database so that their resolution can be monitored. Executive summaries of all intervention reports for operating reactors are published on the ONR website.

14.65. NPP intervention plans are produced, monitored and reviewed within an Integrated Intervention Strategy (IIS) whose purpose is to ensure both that ONR focuses its resources where they are most needed and that the planning process is transparent to stakeholders. The IIS takes into account issues of local environment, priorities and changes in the industry. Within the intervention strategies for each site it is expected that a significant proportion of the planned inspections will be focused on systems or structures and processes required for nuclear safety as identified in the safety case. These are factors that contribute most to the licensee's safety management performance, and the prevention of significant nuclear events. In order to bring further consistency to disciplined delivery of these inspections, ONR inspects these factors against LC12 (Suitably qualified and experienced staff), 23 (Operating Rules), 24 (Operating Instructions), 27 (Safety Mechanisms) and 28 (Examination, Maintenance and Testing) and 34 (Leakage and escape of radioactive material and radioactive waste).

14.66. These inspections provide information on the whether safety case requirements are met. The site intervention plan is enhanced to include other factors that ONR considers to be important to the overall safety of the site. These include:

- Any site related work arising from progressing outstanding PSR requirements or other reviews of the safety case
- Emergency arrangements
- Strategic themes important for safety such as organisational resilience and supply chain
- Operational experience and organisational learning
- Leadership and management for safety

14.67. These elements will be subject to regular inspection visits against the appropriate licence condition by the 'nominated site inspector'. Further inspections may be planned as part of the integrated intervention plan to verify compliance with other licence conditions. Inspections by site inspectors provide regular updates of current site performance and operational issues, which is obtained through activities such as examination of event and operational records.

14.68. .Reactive inspections are undertaken in response to specific events; those operational matters that may affect safety. Further investigation may be undertaken by ONR inspectors and appropriate regulatory action taken, in line with the the enforcement policy statement and the regulatory strategy for the site.

14.69. A general example of the role of site inspection is the granting of consents for re-starts of reactor operation following each periodic shutdown at each NPP. These

consents are based in part on site inspections during the outage by ONR staff from a wide range of technical disciplines (e.g. civil engineering, structural integrity, mechanical engineering). More specific recent examples of significant activities that took place as a result of planned inspections of nuclear sites include:-

- influencing the licensee of the Hinkley Point B NPP not to restart a reactor whilst the sister reactor was on periodic outage until defence in depth of reactor electrical supplies had been improved. Furthermore, ONR required improved defence in depth before future periodic outages are commenced
- agreement, based on two on-site readiness inspections, to routine operation of oxygen injection equipment to remove carbon deposit at Torness NPP.

These and other permissioning decisions are published on ONR's website (Ref. 64).

Article 15 - Radiation Protection

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect current procedures.

15.1. A summary of the laws and regulations relevant to nuclear safety, environmental and radiation protection can be found in Article 7.

Protection and safety optimisation

15.2. Optimisation is the process of determining what level of protection and safety makes exposures to ionising radiations, and the probability and magnitude of potential exposures, ALARA. However, in the UK the ALARP principle is used and is fundamental to all health and safety legislation. The principle requires all nuclear site operators to follow relevant good practice and also adopt practices that could further reduce the risk if it is reasonably practicable to do so. Where relevant good practice in particular cases is not clearly established, the operator has to assess the significance of the risks (both their extent and likelihood) to determine what action needs to be taken. 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. The licensee 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. The widely used International Commission on Radiological Protection concept, ALARA (economic and social factors being taken into consideration), is equivalent to ALARP, but unlike ALARP, does not have a legal basis in UK law (see Annex 5 for a more detailed discussion of these concepts). Financial equivalent values are used in the ALARP analyses, noting that the cost benefit analysis is only one input to the ALARP decision. The values used (Value of Unit Collective Dose) are those that were recommended by the Health Protection Agency Centre for Radiation, Chemical and Environmental Hazards (HPA-CRCE). For the general public, the value is £20,000 per manSv and for occupationally exposed workers the value is £50,000 per manSv. The values may be subject to modification to take account of gross disproportion and financial inflation. Public Health England which is an executive agency of the Department of Health, has work planned to review and revise its advice on these matters. The agency was established on 1 April 2013 to bring together public health specialists from more than 70 organisations, including HPA, into a single public health service. The timescales for completion of the review is not determined yet.

15.3. The Ionising Radiations Regulations 1999 (IRR99) (Ref 29) implement the European Basic Safety Standards Directive '96/29/Euratom' (Ref 35) under the auspices of the Health and Safety at Work etc. Act 1974, and implements the recommendations of the International Commission on Radiological Protection.

15.4. To meet the IRR99 Regulation 8 and 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 limited to, the following criteria reflecting aspects of the Fundamental Principles of the SAPs:

- the duty holder must demonstrate effective understanding of the hazards and their control for a nuclear site or facility through a comprehensive and systemic process of safety assessment;
- 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.

15.5. The licensees are obliged by 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 responsible for controlling work and ensuring doses to individuals are ALARP.

15.6. A dose constraint is a prospective restriction on the individual dose delivered by a source of ionising radiation, which serves as an upper bound on the dose in optimising 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 to restrict individual exposures so far as is reasonably practicable. In general, the licensees have considerable experience in developing dose databases which provide accurate dose forecasts for planned tasks.

15.7. IRR99 does not include a notion of a dose below which optimisation is always regarded as satisfied. The duty on the radiation employer (Note: for nuclear sites this is generally the licensee, but may also include other employers having staff working at the site concerned) given in Regulation 8(1) is to restrict, so far as is reasonable practicable (SFAIRP), the extent to which his employees and other persons are exposed to ionising radiation. This requirement has no lower dose boundary and is satisfied when the radiation exposures are ALARP. ONR has published SAPs which include some lower dose targets called Basic Safety Objectives (BSO) of 1 mSv/year for employees working with ionising radiation, and 0.02 mSv/year for any person off the site. The BSO represents a dose value below which the regulator will not 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 Basic Safety Objectives if these were reasonably practicable.

Dose limitation

15.8. IRR99 Regulation 11 specifies dose limits for persons engaged in work with ionising radiation that comply with the limits in the Euratom BSS Directive (Ref. 35) and the ICRP recommendations. For example, for adult employees the normal dose limit for whole body exposure is 20 mSv/year. In practice, doses recorded for employees at nuclear installations are usually well below dose limits for normal operations and even peak doses have only been a fraction of the limits for a number of years. IRR99 also allow the dose limitation for an individual worker in specified circumstances to be based on a dose of 100 mSv averaged over a period of five consecutive calendar years, with a maximum of 50 mSv in any one year, but only if the licensee can demonstrate to ONR's satisfaction that an annual limit of 20 mSv is impracticable for that person.

15.9. Where classified individuals receive exposure from a number of sites operated by different employers, the "outside worker" provisions of the IRR99 may apply. In such cases, individuals are required to carry radiation passbooks, which

contain personal identification details together with their cumulative dose. Information in the radiation passbook enables the licensee properly to control the aggregated dose of the worker, which may have been accumulated on a number of different sites. The Approved Code of Practice (ACoP) and guidance (Ref. 65) supporting IRR99 gives practical advice on the most appropriate methods of complying with the regulatory requirements and how to ensure that exposures do not exceed any dose limit and are also ALARP. This guidance covers matters such as: restriction of exposure; information instruction and training; co-operation between employers; designation of controlled and supervised areas; personal protective equipment and its maintenance; and monitoring of designated areas.

Licensee responsibility

15.10. For the assessment of compliance with dose limits relating to members of the public (IRR99 Regulation 11, ACoP and guidance (Ref. 65), the licensee is required to derive realistic estimates of the average effective dose (and where relevant, equivalent dose) to representative members of the appropriate reference group for the expected pathways of exposure. Through IRR99 Regulation 8 covering ALARP, licensees are also required to keep their activities under review to establish whether doses from direct radiation could be reduced.

15.11. Nuclear installations require authorisations to dispose of radioactive waste, whether by discharge directly to the environment, or by burial, incineration or transfer of waste off-site. Authorisations:

- specify the disposal routes to be used and place limits and conditions on disposal;
- place a requirement to minimise:
  - waste generated;
  - the activity of radioactivity discharged to the environment; and
  - the radiological effects on the environment and on members of the public to ensure that impacts are reduced to ALARA as required by the BSS Directive.
- require sampling and analysis to determine compliance with authorisation conditions, reporting of the quantities of radioactive waste disposed of, non-compliance with limits;
- may specify improvements in waste management arrangements; and
- require operators to use best practicable means (BPM) in Scotland or best available techniques (England and Wales) to minimise discharges to reduce impacts to ALARA.

15.12. The Environmental Permitting (England and Wales) Regulations 2010 (EPR10) (Ref. 27) has introduced the concept of ‘Best Available Technology’. For all practical purposes, the application of Best Available Technology is broadly equivalent to the application of Best Practicable Means and the Best Practical Environmental Option (as described below), with essentially the same assessment and determination processes and which deliver the equivalent level of environmental protection. Further references to BPM in this document should be interpreted as:

- Best Practicable Means applied to authorisations granted under Radioactive Substances Act 1993 (RSA93) (Ref. 41) in Scotland; and
- Best Available Technology applied to authorisations granted under EPR10 in England and Wales.

15.13. The limits on radioactive discharges are set on the basis of the 'justified needs' of the licensees, i.e. licensees must make a case that the proposed limits are necessary to allow safe and continued operation of the plant. Licensees are required

to use all BAT, or in Scotland BPM, in terms of reasonably practicable measures to minimise the production and disposal of radioactive waste so as to achieve a high standard of protection for the public and the environment taken as a whole. This includes a systematic and consultative decision-making process that emphasises the protection and conservation of the environment across land, air and water, and which establishes, for a given set of objectives, the option that provides the most benefit (or least damage) to the environment as a whole, at acceptable cost in both the long and short term. This option is called the "best practicable environment option". The environment agencies have published guidance for their assessment of best practicable environmental option studies at nuclear sites (Ref. 66). In setting limits, the environment agencies use monitoring, discharge and plant performance data with suitable modelling to ensure that the radiation exposure of the public as a consequence of the discharges would be less than the dose constraints and limits set in the BSS Directive as implemented by the UK Government and devolved administrations. Currently these are a:

- source constraint of 0.3 mSv/year for an individual nuclear installation which can be optimised as an integral whole in terms of radioactive waste disposals;
- site constraint of 0.5 mSv/year for a site comprising more than one source, e.g. where 2 or more nuclear installations are located together; and a
- dose limit of 1.0 mSv/year from all sources of man-made radioactivity including the effects of past discharges, but excluding medical exposure.

15.14. In addition to the requirements placed on operators to monitor environmental radioactivity around their sites, the environment agencies undertake their own independent monitoring programmes. Radioactivity in surface and ground water, radiation dose rates on beaches and public occupancy areas, radioactivity in sediments and environmental material etc. is monitored. The results of the monitoring are published annually. The Food Standards Agency (FSA) is an independent Government body set up to protect the public and consumers interests in relation to food. The environment agencies and the FSA have published a joint report (Ref. 67) on Radioactivity in Food and the Environment (RIFE) in the UK, which also includes estimated doses to the public. Monitoring over the last three years has confirmed that, in terms of radioactive contamination, terrestrial foodstuffs and seafood produced in and around the UK are safe to eat. Exposure of consumers to artificially produced radioactivity via the food chain remains well below the UK public dose limit of 1mSv. In addition, the exposures of members of the public from all pathways resulting from aerial and liquid discharges, and exposure to direct radiation from nuclear licensed sites remains below the dose limit of 1 mSv.

Qualified experts

15.15. In the UK, the qualified expert in relation to occupational radiation protection is the Radiation Protection Adviser (RPA). At nuclear installations, the licensee is required to appoint and consult an RPA, under IRR99, to provide expert advice on compliance with those Regulations. In particular, the employer must consult the RPA on those matters set out in Schedule 5 of IRR99. The HSE has published a statement (Ref. 68) on RPAs, setting out criteria for core competences of individuals and bodies intending to give advice as RPAs. The licensee should select RPAs whose experience is appropriate to the advice required. The licensee will usually operate with an independent Health, Safety and Environment department. This will be separate from the main production departments and will be available to them to give advice on health and safety issues. The RPA will usually be a member of this department, but may, alternatively, be employed as a consultant to the operating organisation, thus giving the necessary independence from the production departments.

Local rules and procedures

15.16. IRR99 Regulation 17 requires licensees to provide written local rules to identify key working instructions intended to restrict any exposure in a controlled or supervised area. The local rules for a controlled area usually include: arrangements for restricting access into that area; dose levels; contingency arrangements; identification and description of the areas covered; and confirmation of the appointed Radiation Protection Supervisor. The guidance to IRR99 (Ref. 65) (paragraphs 278 - 281) contains advice on the essential and optional contents for local rules. To meet the requirements of IRR99 Regulation 17 covering local rules licensees have to put in place arrangements to ensure compliance. The Radiation Protection Supervisor has a major role in helping ensure that the work carried out is done in compliance with the arrangements licensees have put in place for complying with the IRR99, in particular, in supervising the arrangements set out in the local rules. The Radiation Protection Supervisor does not need to have the same depth of knowledge of the IRR99 as an RPA, but will be suitably trained and appointed in writing.

15.17. Under IRR99 Regulation 8, if an employee has a recorded whole-body dose greater than 15 mSv (or a lower dose established by the employer) for the year, the employer must carry out an investigation, usually in conjunction with the RPA. The purpose of this investigation is to establish whether or not sufficient is being done to restrict exposure to ionising radiation, so far as is reasonably practicable.

15.18. IRR99 Regulation 25 requires that where a licensee suspects or has been informed of an exposure in excess of a dose limit, ONR is notified, whether this arises from a single incident or through an accumulated dose. The employer undertaking work with ionising radiation must carry out a thorough investigation. To meet the requirements of Regulation 25 covering investigation and notification of over exposure, licensees have to put in place arrangements to ensure compliance.

15.19. Similarly, Regulation 30 requires incidents, like the release (unless in accordance with a discharge authorisation) or spillage of radioactive substances above certain quantities, to be investigated. LC34 requires that radioactive material or radioactive waste on a nuclear licensed site is adequately controlled or contained, and that any leak or escape of such material to be notified, recorded, investigated and reported in accordance with LC7 (Incidents on the site) arrangements.

Individual monitoring

15.20. If an employee is likely to receive a radiation dose greater than three-tenths of a relevant dose limit in a year (6 mSv in the case of whole-body exposure), IRR99 Regulation 20 requires the employer to designate that employee as a classified person. For non-classified employees, the ACoP and guidance to IRR99 (Ref. 65) provides guidance on the arrangements that licensees should put in place to restrict exposure. Guidance for licensees is also provided on the arrangements for entry into controlled areas by members of the public or employees who do not normally work with ionising radiation.

15.21. For classified employees, the employer has to arrange for any significant doses (internal or external) received by that person to be assessed by a dosimetry service approved by HSE for the assessment of doses for the relevant type of radiation. Such services are referred to as Approved Dosimetry Services (ADS) (assessment). HSE also approves dosimetry services to co-ordinate individual doses received from different ADS (assessment) and to produce and maintain dose records for classified persons. These services are referred to as ADS (records).

Exposure records

15.22. To help the employer assess the effectiveness of the dose control measures, the ADS (records) provides a written summary of the doses recorded for each classified employee at least once every three months. Many ADS (records) provide

monthly dose summaries. By the end of March each year, the ADS must also provide HSE with summaries of all recorded doses relating to classified persons for the previous calendar year.

15.23. Reflecting concern expressed at the Public Inquiry (Ref. 69) into the construction of Sizewell B, an additional licence condition, LC18, (Radiological protection) was attached to all nuclear site licences requiring licensees to make and implement adequate arrangements for the assessment of the average effective dose equivalent of a class or classes of persons as specified in the arrangements, and to notify the HSE if this figure exceeds the level specified by the HSE (currently 5 mSv) for any specified class of persons. The classes of persons enable differentiation between the dose received by employees and contractors and by classified and non-classified persons.

Control of exposure

15.24. HSE has a computerised Central Index of Dose Information that receives and processes the annual dose summaries for classified persons. All dose summaries and individual personal data provided to HSE by ADS (records) under IRR99 (or previously under IRR85) are treated as confidential. Various safeguards protect the computer files and the information presented in published reports maintains that confidentiality. The data in the Central Index of Dose Information are periodically analysed to identify any trends in dose uptake.

15.25. Designation of *Controlled* or *Supervised* Areas is required by IRR99 Regulation 16. The main purpose of designating controlled areas is to help ensure that routine and potential exposures are effectively prevented or restricted. This is achieved by controlling who can enter or work in such areas, and under what conditions. Normally, controlled areas will be designated because the employer has recognised the need for people entering the area to follow special procedures to restrict exposure to ionising radiation. Regulations 18 and 19 specify requirements for designated areas to ensure that, inter alia, there are appropriate arrangements for control and monitoring of radioactive contamination, including contamination of workers. Such arrangements typically include monitoring of contamination where work is being carried out, and of workers at the points of egress from the local work area, and at the exits from the designated areas.

15.26. Assessment of intakes of radioactive material by workers and the resultant doses is carried out by means of air sampling (personal and area), bio-assay, and in-vivo monitoring. IRR99 includes a number of regulations to ensure that appropriate steps are taken for the assessment of internal exposure. Regulations 20 and 21 require that relevant workers are classified, and that for these workers all significant doses are assessed and recorded. A comprehensive system exists to ensure that the assessment and recording of doses for classified workers is done accurately and reliably.

15.27. IRR99 Regulation 23 states that where any accident or other occurrence takes place which is likely to result in a person receiving an effective dose exceeding 6mSv, or equivalent dose greater than three tenths of any dose limit, the employer shall, for a classified person who is an employee who has been issued with a dosemeter or other device in accordance with contingency plan requirements (IRR99 Regulation 12 refers), and any other case having regard to the advice of the RPA, arrange for a dose assessment by an ADS. This should include in-vivo and biological monitoring as necessary to determine the extent of any exposure to internal contamination. The employer is expected to inform those affected as soon as possible, and to keep records for the durations required in IRR99 Regulation 23.

Outside workers

15.28. UK employees who are designated as classified persons (equivalent to Category A Workers) and who work in Controlled Areas (other than Controlled Areas of their own employer) are “Outside Workers”. Outside Workers are required to posses a Radiation Passbook issued by an Approved Dosimetry Service and present this to the Licensee prior to being given permission to enter Controlled Areas on the Licensed Site. The Outside Worker should wear any dosemeter issued by his own employer’s HSE Approved Dosimetry Service for all entries into Supervised and Controlled Areas during that visit. The results from this dosimetry would be entered onto the Outside Worker’s Dose Record kept by the HSE Approved Co-ordination and Record Keeping Service. The licensee would need to have an appropriate equivalent set of arrangements for foreign contractors (especially Category A workers) working on the Licensed Sites.

15.29. IRR99 Regulation 18(4) requires the employer who has designated a Controlled Area (for Nuclear Licensed Sites this is usually the licensee) to make arrangements for estimating the dose of ionising radiation received by the Outside Worker whilst in the controlled area. This employer (licensee) must enter the estimated dose into the Outside Worker’s Radiation Passbook as soon as is reasonably practicable after the Outside Worker has completed his work for that visit. Usually, the Licensee obtains an estimate of the dose of external radiation to the Outside Worker by issuing him/her with an electronic personal dosemeter. Generally, internal dose uptake estimates are obtained using the Approved Dosimetry Services’ arrangements used for the employer’s (licensee’s) own workers. Under these circumstances, the estimated dose may not be available before the Outside Worker leaves the site. In which case the employer (licensee) in whose area the Outside Worker worked would need to make arrangements to forward the estimated internal dose to the Outside Worker’s employer. The Outside Worker’s employer must arrange for the estimated dose to be entered into the Outside Worker’s Radiation Passbook.

Employer co-operation

15.30. IRR99 Regulation 15 requires employers to co-operate with each other. The aim of the co-operation should be to co-ordinate the measures they take to comply with legal requirements and inform each other of the risks to employees arising from their work. The information shared would include matters relating to controlled areas, contingency arrangements, and sharing information on the doses incurred whilst working under each employer’s control.

Controlled areas

15.31. In the UK, a *Controlled* area is an area in which specific protection measures and safety provisions are, or could be, required for controlling normal exposures or preventing the spread of contamination during normal working conditions, and preventing or limiting the extent of potential exposures. A *Supervised* area is an area, other than a controlled area, in which occupational exposure conditions are kept under review, even though specific protection measures and safety provisions are not normally needed.

15.32. Under IRR99 Regulation 16, the responsibility for designating a controlled or supervised area rests with the employer in control of that area. In the case of a nuclear licensed site, this duty is also on the licensee. An assessment undertaken by the licensee will establish whether special procedures are necessary to restrict exposure. The designation of a supervised area by the licensee will depend on the assessment of doses, and whether conditions may change. The licensee is required under IRR99 Regulation 13(1) to consult an RPA on the implementation of the requirements as to controlled and supervised areas. IRR99 Regulation 19 also

requires licensees who designate controlled or supervised areas to ensure that levels of ionising radiation are adequately monitored, and that those areas are kept under review. Advice is provided in the ACoP and guidance to IRR99 (Ref. 65) on issues for consideration and dose levels appropriate to designate a controlled or supervised area. Licensees have therefore developed arrangements to ensure the appropriate legal requirements are met and relevant good practice adopted for controlled and supervised areas on nuclear licensed sites.

15.33. Evidence from UK installations suggests that the spread of contamination beyond the boundaries of controlled areas is uncommon. This is generally achieved by applying strict controls to such activities as changing of clothing and personal monitoring at various stages within the controlled area, rather than at the boundary between controlled and other areas.

Protective equipment

15.34. IRR99 Regulations 9 and 10 require licensees to ensure that any personal protective equipment provided pursuant to Regulation 8 is appropriate and that it is subject to routine examination and maintenance. Licensees are also required, under Regulation 14, to ensure appropriate information, instruction and training is provided to workers using personal protective equipment. To meet the personal protective equipment requirements in IRR99, licensees have developed their own arrangements to ensure compliance. The ONR checks that the requirements are met as part of its inspection programme. The HSE has published guidance on the use and maintenance of respiratory equipment (Ref. 70).

Licensing requirements

15.35. In addition to the application of IRR99, the regulation of radiological hazards on nuclear licensed sites is also achieved through the licensing regime. Under LC14 on safety documentation, the licensee is required to submit to HSE written safety cases demonstrating that safety will be maintained through all phases of the installations life, from design through to the decommissioning of the installation.

15.36. The adequacy of the licensee's safety submissions is assessed by ONR against ONR's SAPs (see Annex 5). The principles relating to radiation protection are consistent with the latest recommendations in 'The 2007 Recommendations of the International Commission on Radiological Protection (Ref. 71) and ensure that the licensee makes a strenuous pursuit of the objective to keep exposures ALARP. The ONR considers that the principles in the SAPs relating to radiation protection are consistent with the recommendations of the International Commission on Radiological Protection published in 2007.

15.37. Owing to the nature of the radiological hazard presented by large nuclear installations, there is, in addition to the provisions of IRR99, the requirement for licensees to make and implement adequate arrangements for the assessment of the average effective dose equivalent (including any committed effective dose equivalent) to specified classes of person (LC18 on radiological protection). Again, enforcement of this requirement is carried out by the ONR.

Radiation doses at nuclear installations

15.38. For EDF NGL sites (which are all operational sites) data for employee and contractor doses for each year under consideration in the present report is given in Table 15.1.

15.39. The total collective dose to all persons working on EDF NGL sites during calendar year 2012 was 0.86 manSv with 0.29 manSv to employees and 0.57 manSv to contractors.

15.40. No person exceeded the statutory annual dose limit of 20 mSv specified in IRR99, nor the EDF NGL dose restriction level of 10 mSv. No worker has exceeded

the Company dose restriction level of 10 mSv per annum since 2006. The maximum individual dose received by an EDF NGL employee in 2012 was 6.47 mSv and the maximum individual dose received by a contractor was 8.18 mSv. Record information has determined that the average dose received by EDF NGL employees in 2012 was 0.052 mSv and by contractors was 0.066 mSv.

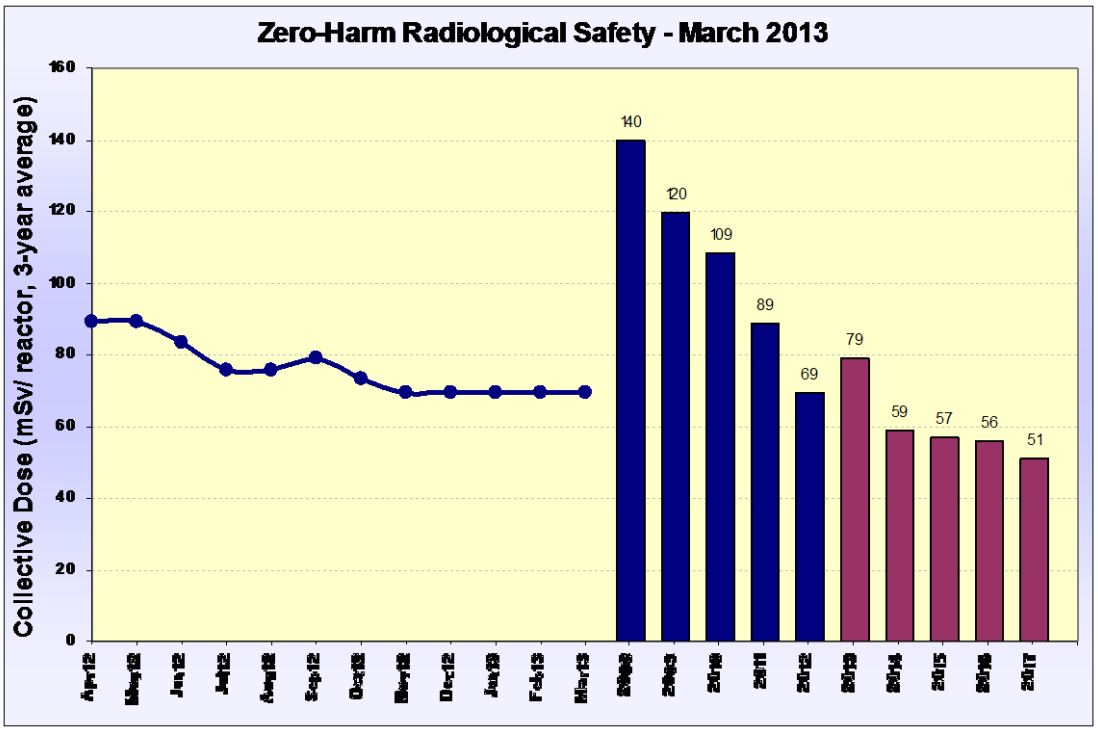
15.41. Electronic Personal Dosimeters are used at all EDF NGL sites as the legal dose meter to make assessments of individual radiation exposure.

15.42. The dose trend of radiation collective doses over the past five years and aspirations for the future five years are given in graph 15.2. This plots the rolling 3-year collective dose across all 15 reactors which is normalised for one year collective dose received by all EDF NGL employees and contractors. The benefits of this plot being that it smooth's the dose trend taking into account planned statutory reactor outage periodicity. It also shows the Company aspiration goals for collective radiation doses.

TABLE 15.1 - Doses at EDF NGL sites

Year	2008	2009	2010	2011	2012
Average dose employee and contractor mSv	0.163	0.114	0.042	0.119	0.061
Max dose employees and contractors mSv	9.096	8.709	4.388	7.621	8.179
Collective dose employees and contractors manSv	2.61	1.74	0.55	1.71	0.86

"Zero Harm" Dose Trend at EDF NGL



15.43. During the period covered by this report, Magnox North Ltd was merged with Magnox South Ltd to create Magnox Electric Ltd. The new organisation does not have a meaningful dose history for inclusion in this report.

Article 16 - Emergency Preparedness

1. ***Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.***
2. ***Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.***
3. ***Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.***

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations). However, in the light of the accident at Fukushima, the content of the section has been expanded to provide more detail and outline improvements to emergency preparedness following the Fukushima accident.

Emergency preparedness for a radiological emergency at a UK nuclear installation

National Programme

16.1. The precautions taken in the design and construction of nuclear installations in the UK, and the high safety standards in their operation and maintenance, reduce to low level the risk of accidents that might affect the public. However, all nuclear installation operators prepare, in consultation with local authorities, the police and other bodies, emergency plans for the protection of the public and their workforce, including those for dealing with an accidental release of radioactivity. These are regularly tested in exercises under the supervision of ONR.

16.2. The Department for Energy and Climate Change (DECC) 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 effects from a licensed 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. DECC would still be responsible for briefing the Westminster Parliament and the UK's international partners.

16.3. In consequence, due to its role as lead Government Department for the planning and response phase for an off-site nuclear emergency at a civil site in England and Wales, DECC chairs the Nuclear Emergency Planning Delivery Committee (NEPDC), which brings together organisations with responsibilities in off-site civil nuclear emergency planning. Members include representatives of the nuclear operators, the regulatory bodies, the police, fire service, local authority emergency planning officers and Government Departments and agencies that would

be involved in the response to an emergency. NEPDC is a forum for discussing common issues, exchanging information and experience and agreeing improvements in planning, procedures and organisation. DECC also issues Consolidated Guidance (Ref. 72), in consultation with NEPDC, 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. NEPDC and its Working Groups also review results of Level 2 and 3 emergency exercises, which are designed to specifically test the capability of the off-site agencies, to ensure that important lessons learned from those exercises are put into practice.

16.4. IAEA IRRS mission to the UK in October 2009 considered the creation of NEPDC's predecessor, the Nuclear Emergency Planning Liaison Group (NEPLG), to be 'good practice' in supporting the multi-agency response in the UK.

16.5. The Nuclear Emergency Arrangements Forum (NEAF) provides operators of nuclear licensed sites and the ONR with a best practice discussion forum relating, primarily, to the operators' on-site emergency response planning, but also including the operators' role in connection with the off-site response. NEAF is chaired by a nuclear operator representative nominated by the Nuclear Operator's Safety director's Forum (SDF).

16.6. ONR attends both NEPDC and NEAF and as part of its regulatory function for enforcing Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR) (Ref. 34) to monitor the overall planning position for both on-site and off-site aspects. The Local Authority Emergency Planning Officers' Seminar provides a forum for local authority planning officers, representatives of industry and other appropriate bodies to discuss emergency planning issues relating to the nuclear industry. ONR attends this forum. As a result of involvement in this and other forums, ONR advises DECC in respect of nuclear emergency preparedness and response.

16.7. In order to better support future developments within the multiagency response DECC's nuclear emergency preparedness programme underwent a number of changes in 2012, including the introduction of a new National Strategic Framework.

16.8. The National Strategic Framework has built upon the foundation of industry standard laws and regulations and work achieved to date by the NEAF, the NEPLG and its sub groups as well as ONR and government departments and agencies, with an overview up to government minister level. The National Strategic Framework established:

- A new programme governance structure including the addition of a new Committee and Board specifically designed to strengthen the involvement of central government and improve its coordination with all partners in local and devolved government, the regulator, agencies and industry. It has also ensured. It has also ensured greater engagement of senior government officials and Ministers in UK nuclear emergency preparedness.
- Clearer strategic direction from central government, aimed at improving the UK's nuclear emergency preparedness underpinned by a mechanism for mapping all the capabilities required in that approach, identifying key gaps and designing remedial action to reduce those gaps.
- An improved mechanism for harnessing experience and expertise across all partners, with responsibility for implementation closely involved in designing the targets and methods of delivery.

16.9. Strategic outcomes established for the National Strategic Framework help to ensure that the planning for and response to a nuclear emergency at home or overseas is:

- effective across all levels of the IAEA's International Nuclear and Radiological Event Scale (INES);
- proportional to the risks being managed;
- as comprehensive as resources allow;
- regularly tested; and
- closely co-ordinated across all partners involved.

16.10. This builds on the good points already noted by the IAEA in the multi-agency response framework provided by NEPLG and reflected in the Consolidated Guidance. The UK aims to ensure it is equipped and prepared to respond to the most unlikely event of an emergency at a civil nuclear site. The response arrangements are described in more detail in the following paragraphs.

On-site emergency arrangements

16.11. Licence Condition 11 requires the licensee to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects. The licensees must submit to ONR for approval such parts of the arrangements as ONR may specify. Once approved by ONR, no alteration or amendment can be made to the approved arrangements without ONR's formal Approval. The licensees have therefore produced an emergency plan for each site, 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.

16.12. LC11 also requires rehearsal of the arrangements to ensure their effectiveness. This is achieved by the licensee holding training exercises and ONR agreeing to a programme of demonstration emergency exercises that ONR Inspectors observe. ONR can specify that exercises cover all or part of the arrangements. This power would be used if ONR was not satisfied with an aspect of the licensee's performance and the licensee did not agree or volunteer to improve and repeat the exercise.

16.13. ONR's Consent is normally required to bring nuclear fuel onto a site for the first time. As part of the assurances that ONR requires prior to granting this Consent, the establishment of appropriate emergency and evacuation arrangements have to be demonstrated, including the approval of an on-site Emergency Plan that is in the public domain and cannot be changed without the approval of ONR. The relevant considerations are that there are sufficient trained personnel and suitable available equipment to deal with the risks from hazards on the site. Similarly, the Consent of ONR may be required at stages specified by ONR relating to key increases in hazard on the site during the active commissioning process, for example in which reactor plant is brought from initial criticality up to its full reactor power rating. At any of these stages, ONR may require a demonstration of enhanced emergency arrangements

prior to the granting of Consent to proceed to the next stage. This may be through an examination of the training records for all staff affected, or by means of a demonstration exercise that staff from ONR formally observe. Throughout the life of the nuclear installation, the emergency arrangements are subject to review and, with ONR's Approval as described above, revision as appropriate. As part of the licensee's training arrangements, all staff participate in a regular programme of emergency exercises, which requires each shift at each nuclear site to exercise the arrangements at least once a year.

Off-site emergency arrangements

16.14. REPPIR implements in Great Britain the Articles on intervention in cases of radiation emergency in Council Directive 96/29/Euratom Council Directive (Ref. 35) and 89/618/Euratom (known as the Public Information Directive) (Ref. 36) on informing the general public about health protection measures to be applied. Steps to be taken in the event of an emergency are covered in the UK by REPPIR. REPPIR place on a statutory basis, the arrangements whereby a local authority with a nuclear site or sites in its area prepares an off-site emergency plan. Responsibilities for reviewing and testing off-site emergency plans are also covered by REPPIR. The preparation and testing of off-site emergency plans is regulated by ONR.

16.15. REPPIR is the principal regulatory tool for the off-site component of the Emergency Plan. The regulation requires off-site plans to be produced by the local authority in consultation with emergency responders, for those sites where a radiation emergency is considered to be reasonably foreseeable.

16.16. The responsibilities for reviewing and testing off-site emergency plans are also covered in REPPIR. Where there is the potential for an offsite release of radioactivity that would require implementation of countermeasures, detailed emergency planning zones (DEPZ) are provided around nuclear installations. The extent of these zones is defined by ONR, based on the most significant release of radioactivity from an accident that can be reasonably foreseen. Changes to the definition of the DEPZ are in hand to take into account additional strategic factors. In the event of an accident being larger than the reasonably foreseeable event, the off-site plan outlines arrangements for extending the response. The Statutory Guidance (Ref. 73) to the Civil Contingencies Act 2004, Emergency Preparedness, defines the requirements for preparing general emergency response plans for use when extending the off-site plan response.

16.17. The declaration of an off-site nuclear emergency at a site is the responsibility of the operator in accordance with previously agreed 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.

16.18. The agencies that provide a local response are located at the off-site facility (Strategic Coordination Centre or SCC) whose prime function is to decide on and action the measures to be taken off-site to protect the public, to ensure that those actions are implemented effectively and to ensure that authoritative information and advice on these issues is passed to the public (the facility includes media briefing centres). Decisions would generally be made through regular coordinating group meetings. These are usually chaired by the Police, who are responsible for taking decisions to protect the public, and would involve all the principal organisations represented at the facility.

16.19. Each organisation with responsibilities for dealing with the emergency would be represented at the SCC. These would generally include the Operator, the Police, the Local Authority, the Health Authority, the Local Water Company and the Fire and Ambulance services. In addition, Government Departments and Agencies would also

be represented. These would include DECC, (or Scottish or Welsh equivalents), Public Health England and the ONR.

16.20. The lead Government Department would appoint a senior member of ONR (normally one of ONR's Deputy Chief Inspectors) to act as the Government Technical Advisor (GTA) at the SCC.

16.21. The GTA provides authoritative and independent advice to the Strategic Co-ordinating Group handling the off-site response to the emergency and to the press and broadcast media in the event of a civil nuclear emergency, and to advise the emergency services on actions to protect the public. To assist communications between the GTA and central government, the lead government department would also appoint a Government Liaison Officer (GLO) to support the GTA's team at the off-site facility. The GLO would be a senior departmental official and would support the GTA by providing a direct link with ministers and government departments. SEPA, in Scotland, and the Environment Agency, in England and Natural Resources Wales, in Wales, would also be represented because of their role in radioactive waste disposal and other environment protection roles, as would the Food Standards Agency (FSA) to issue advice and restrictions (if required) to ensure that food contaminated to unacceptable levels does not enter the food chain. Representatives at the SCC would be in communication with their organisations and be responsible for ensuring that adequate information and advice was available, both at the SCC and at the emergency control centres of their respective organisations. The representatives would liaise closely to ensure that a proper assessment was being made of the situation, that appropriate actions were being taken and that the public was being kept informed.

16.22. The operator has an important role in regaining plant control on site and ensuring that any radiological release is terminated. The technical information regarding plant prognosis and radiological assessments by the operator is an important aspect in the response to an emergency. The operator has two roles directly related to the off-site response, to:

- monitor the environment on and around the site for radioactivity; and to
- provide advice to the off-site organisations, prior to the appointment of the GTA, on any measure that should be taken to protect the public as a consequence of radiological effects, e.g. sheltering, taking of potassium iodate tablets or evacuation.

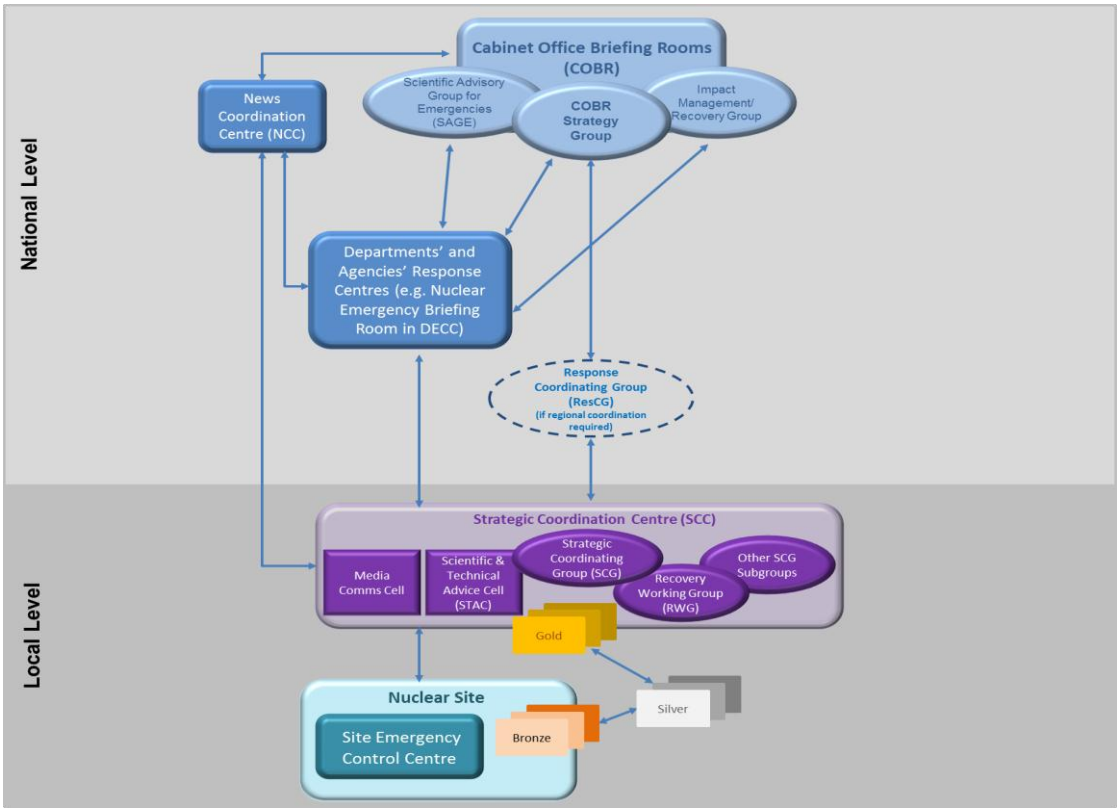
16.23. The SCC will receive this information from the operator's organisation. The operator's representatives at the SCC will have a prime function in ensuring that adequate information is available to those at the facility and to ensure that their own organisations are aware of what assistance the facility requires.

16.24. In the event of an off-site nuclear emergency, the Cabinet Office Briefing Rooms (COBR) would be activated in order to coordinate the response and decision-making at the national level, but for all but the most severe events, the expectation is that the lead for the response will remain at local level under the control of a senior police officer (GOLD Commander). The COBR Committee would consist of representatives (Ministers or senior officials) from relevant Departments and Agencies. Decision-making within COBR would be supported by a number of bodies and advisory groups, including a Scientific Advisory Group for Emergencies (SAGE).

16.25. DECC is the Lead Government Department for off-site civil nuclear emergency response in England and Wales (the lead is devolved in Scotland). During an emergency 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 16.2 shows the

arrangements for responding to off-site nuclear emergencies (accidents) at civil sites schematically.

Figure 16.2 – Emergency arrangements structure



16.26. 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, including the Environment Agency to coordinate longer-term remedial action, including decontamination.

Testing of emergency arrangements

16.27. Emergency arrangements are tested regularly under three categories known as levels 1, 2 and 3.

16.28. Level 1 exercises are held at each nuclear installation site once a year and concentrate primarily on the operator's actions on and off the site. ONR will witness, 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. As a minimum, each shift will take part in a site exercise every year when all the elements of the emergency organisation are practised.

16.29. 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.

16.30. 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 Nuclear Emergency Briefing Room (NEBR) (for England and Wales) in London, or the Scottish Government Resilience Room (SGoRR) in Edinburgh. Aspects of DECC'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 (DECC or the Scottish Government) and the Nuclear Emergency Planning Liaison Group (NEPLG), in consultation with ONR.

Provision of information to the public

16.31. REPPIR provides a legal basis for the supply of information to members of the public who may be affected by a nuclear emergency. The requirements are placed on the operator and the relevant local authorities. In addition, the various information services of the local agencies involved and of central government, together with the news media, are available to help inform the public of the facts and of the assessments being made of the course of the accident, should one occur.

16.32. REPPIR requires that members of the public within a Detailed Emergency Planning Zone (DEPZ), who would be at risk from a reasonably foreseeable radiation emergency, should receive certain prescribed information to explain what to do in the event of a nuclear emergency being declared. Such information must be distributed in advance of any emergency occurring. Site operators provide this information in a variety of forms, updated at regular intervals not exceeding three years. The operator also makes the information available to the wider public, usually by providing information on request or by placing copies in public buildings such as libraries and civic centres. Every nuclear installation licensee also has local liaison arrangements that provide links with the public in the vicinity of the site.

Information in the event of an emergency

16.33. REPPIR requires 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. The operator would also be expected to make a formal announcement as soon as possible after the emergency had been declared. 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.

16.34. The duration and extent of an emergency would depend on the scale and nature of the radioactive release. Once the release had been terminated, ground contamination would be monitored and the police would advise those who had been evacuated when they could return home. At about this stage, the acute phase of the emergency condition would be officially terminated, but the return to completely normal conditions might take place over a period of time.

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

16.36. 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.

Measures to enhance emergency preparedness programmes

16.37. The UK has a well developed programme of site, regional and national exercises of emergency plans. Lessons learned from this programme are reviewed

and any actions requiring improvement to emergency facilities, equipment, procedures, training, etc. are identified and completed. The new National Strategic Framework provides a framework for reviewing the UK Emergency Exercise Programme to ensure that a balanced programme of exercises takes place covering all types of nuclear facilities

16.38. ONR produces a report which summarises the lessons of level 2 and 3 exercises held during the previous emergency exercise planning year. This report is a statement of the overview of exercises, together with a summary of the overarching issues which need to be considered or resolved and is submitted to the National Operations Training and Exercises Working Groups in the National Strategic Framework (Fig. 16.1). Any actions required are then implemented through the new governance arrangements put in place by DECC.

16.39. Lessons learned from nuclear exercises are shared with the appropriate working groups of the National Strategic Framework

Implications of the Fukushima accident

16.40. Since the Fukushima accident the UK has produced a number of reports on the lessons it has learned and Section 2 of this Sixth UK report to the Convention of Nuclear Safety records this work. In particular it provides the link to the UK National Report to the Second Extraordinary Meeting of the Convention on Nuclear Safety (August 2012) which specifically covered in Topic 5 the position on off-Site Emergency Preparedness and Response and Post Accident Management . In summary it recognised the underlying strength of the UK's current system of emergency preparedness but made recommendations on a range of improvements at site, local and national levels. DECC as lead Government department has designed a National Strategic Framework to co-ordinate a national programme of work to address the recommendations with a particular focus on response to severe or prolonged emergencies. The following provides an updated summary in the context of Emergency Preparedness and Response.

National level

16.41. The UK Government can confirm that it continues to work with its partners internationally to progress work on the dissemination of information under the Convention on Early Notification of a Nuclear Accident. In addition the UK has become a member of IAEA's global Response and Assistance Network, RANET. In terms of the national situation, the Nuclear Emergency Planning and Liaison Group (NEPLG) has re-evaluated the UK's radiation monitoring capability and clarified requirements for delivery of data and information in the event of a prolonged incident in the UK. NEPLG has also assessed the central Government arrangements for response and, in particular, the provision of scientific and technical advice in the event of a nuclear emergency in the UK or overseas. ONR is also working towards an even more robust testing regime for emergency exercises, including more extensive testing of the extendibility arrangements. Work on characterising potential source terms associated with a wider variety of nuclear accidents is well underway with the objectives of allowing more rapid assessment of the likely dispersion of radioactive materials and the potential impact on the UK or its citizens, and information to support decisions on possible countermeasures.

Local level

16.42. The future nuclear emergency exercise programme for nuclear installations within the UK has in place plans to test the on-site and off-site response for prolonged periods as well as testing of the arrangements for management of severe accidents. Such exercises are intended to test the prolonged delivery and sustainability of the on site, the off site and central government responses. The

exercises are also intended to highlight area for further improvements which will inform reviews of on site and off site emergency plans and feed into future work programmes. The findings will inform reviews of the duration of the future nuclear emergency exercises.

Site level

16.43. There were a significant number of recommendations and stress test findings placed on the nuclear industry, see ONR Report "Japanese Earthquake and Tsunami: Implementing the lessons for the UK's Nuclear Industry" October 2012 (Ref. 14) for more details. The main outcomes of this work in the context of emergency preparedness and response can be summarised for EDF NGL and Magnox sites in the following two sections.

Summary for EDF NGL Sites

16.44. EDF NGL is a licence holder for 8 operating nuclear power plants which is enhancing its existing arrangements to respond to a severe 'beyond design basis' accident. This enhancement to capability implements the post-Fukushima Weightman recommendations and Stress Test findings that are being overseen by the Office for Nuclear Regulation.

16.45. The enhanced response capability will enable its nuclear plants to withstand and recover from an extreme natural event. It has three components and will be substantially complete by early to mid 2014.

16.46. The first component is a programme to enhance the resilience of the existing EDF NGL emergency response facilities and critical safety plant. This includes:

- Construction of new hardened emergency control centres for Sizewell B and for the Heysham 1 and 2 multi-reactor sites.
- Further reasonably practicable seismic and flood protection enhancements to emergency management facilities at the other EDF NGL reactor sites.
- Seismic protection of buildings housing fire fighting appliances.
- Increasing the volume of existing seismically qualified essential cooling water supply tanks.

16.47. The second component is the purchase of the carefully selected back-up equipment (BUE). This will be stored at various strategic national locations. Its purpose is to enable EDF to restore or replace the critical safety and emergency response functions in the event of their complete loss due to an extreme natural. This significant programme of work is essentially a water management strategy that includes:

- Debris moving equipment and off-road vehicles capable of transporting equipment through areas subject to widespread disruption to infrastructure;
- Diesel driven water pumps to supply essential reactor and pond cooling;
- Reverse osmosis equipment to supplement 'top up' essential cooling water supplies;
- Diesel driven electricity generators;
- Temporary structures to replace emergency control centres;
- Damage repair equipment to restore containment integrity;
- On- and off-site voice and data communication equipment, independent of existing infrastructure, to manage emergency response actions and communicate essential reactor status data;
- Waste water capture and treatment facilities.

16.48. The final component is a programme to upgrade the existing site and corporate emergency response plans that includes:

- Incorporation of the BUE deployment strategy within site emergency plans;
- Use of enhanced probabilistic safety assessments to improve understanding of the progression of accidents, identify further practical accident management measures and refine existing Symptom Based Emergency Response Guidelines (SBERGs) and Severe Accident Guidance (SAGs);
- Revision of emergency management arrangements to ensure events that affect multiple reactor sites simultaneously can be managed effectively.

16.49. EDF NGL plans to conduct a series of exercises to validate the enhanced emergency plans and subsequently demonstrate their effectiveness to ONR during March 2014.

Summary for Magnox Sites

16.50. Magnox Ltd, is the licence holder for 10 nuclear power plants of which only one reactor at one site (Wylfa) is operational with a limited remaining period of operation. The Magnox response to the Fukushima recommendations is therefore proportionate to the remaining nuclear hazard, since many sites have been defuelled or are no longer dependent upon active fuel cooling. The Magnox programme of safety improvements to support emergency response includes provision of:

- Increased on-site supplies of CO2 coolant, damage repair equipment and diesel fuel stocks to increase resilience of primary circuit cooling;
- Diverse pond-water emergency filling lines;
- Back-up feed water and fire fighting pumps to provide defence in depth;
- Various mobile diesel driven electricity generators;
- An additional fire appliance for Wylfa;
- Debris clearance vehicles and tools;
- A water tanker to transport fresh water to Wylfa;
- Satellite phones to increase emergency command, control and communications resilience;
- A programme to review probabilistic safety assessments to improve SBERGs and SAGs at Wylfa and the other accident management guidelines for the remaining fuel routes;
- A programme to investigate alternative means of monitoring key reactor and pond parameters.

16.51. Magnox intends to have completed the majority of the resilience improvements during 2013 with the above programme activities described by the last two bullets, which require longer term investigation, expected to continue into 2014.

Response to emergencies outside the UK

16.52. DECC 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 Radiation Incident Monitoring Network (RIMNET) is the contact point for inward notifications under these arrangements. RIMNET is managed by the Met Office, the UK meteorological service, working in partnership with DECC and Defra (Department for the Environment, Food and Regional Affairs) on behalf of all government departments and agencies that would be involved in a radiological/nuclear accident. The National Response Plan, implemented by DECC with support from other agencies, provides arrangements for dealing with an emergency. This includes DECC maintaining contact arrangements and duty officers that ensure the UK can be

notified of an emergency at any time. The RIMNET network comprises 94 gamma dose rate monitors located throughout the UK and provides a secondary alert mechanism in the event of non-notification. RIMNET is the UK's national radiological database. DECC has established procedures including the notification and alert of organisations within the UK with responsibilities for dealing with an overseas nuclear accident. It maintains the NEBR and Technical Co-ordination Centre containing the equipment required for management of the response.

Article 17 - Siting

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

(i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;

(ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;

(iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;

(iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fourth UK report (i.e. in a way that has implications for the Convention obligations), except in paragraphs 17.1 to 17.9, below which reflect the current status of site selection now that construction of new NPPs is an integral part of the UK Government's energy policy (see Section 2). Hitherto the UK had no recent experience of site evaluation and selection since the Sizewell B and Hinkley Point C Public Inquiries (Refs. 69 and 74) in the 1980s.

Siting of new nuclear power plants

17.1. In July 2011 the Government published a Nuclear National Policy Statement, which listed eight sites as potentially suitable for new nuclear power stations up to the end of 2025. The list of sites was arrived at through a Strategic Siting Assessment. ONR provided technical support to aid the Government's decisions on the list of sites in the Nuclear NPS. Demographic assessment was judged against the Government's directions that, subject to meeting all other relevant criteria, those nominated sites which met the Semi-Urban and Remote population siting criteria would, for the purposes of the SSA, be considered strategically suitable for the development of new nuclear power stations. ONR also provided advice about the proximity to Hazardous Facilities, mainly focusing on installations subject to the Control of Major Accident Hazard Regulations 1999 (Ref. 75) (which implement the EU Seveso 2 Directive).

The evaluation of site-related factors that affect safety

General

17.2. The factors that should be considered in assessing sites cover three main aspects:

- the location and characteristics of the population around the site, and the physical factors affecting the dispersion of released radioactivity that might have implications for the radiological risk to people;
- external hazards that might preclude the use of the site for its intended purpose;
- the suitability of the site for the engineering and infrastructure requirements of the facility.

The UK laws and regulations for planning and licensing process

17.3. For electricity generating stations below 50 megawatts, an organisation wishing to construct, extend or operate any type of power generating station in the UK must obtain planning permission from the relevant Authority under the Town and Country Planning Act (1990) (Ref. 76) for England and Wales, as amended by the Planning Act 2008, and the Town and Country Planning (Scotland) Act 1997 for Scotland (Ref. 77) and the provisions of the Planning etc (Scotland) Act 2006 (Ref. 78). This includes the site-related factors relevant to the safety of the proposed nuclear installation. In some instances, an application for planning permission may be "called in" by the relevant Minister for ministerial decision. This usually reflects the fact that the development is seen as having national importance. The planning authority may suggest the "call in". Where an application for planning permission is "called in", a local Public Inquiry is set up. In England and Wales the independent Planning Inspectorate arranges for one of its inspectors to hear and receive evidence regarding the proposal. The inspector then makes a report and a recommendation to the Secretary of State for Communities and Local Government or to the Welsh Assembly Government. In Scotland where an application for planning permission is "called in", the provisions in The Town and Country Planning (Appeals) (Scotland) Regulations 2008 (Ref. 79) described in Circular 6/2009 apply. A Reporter from the Scottish Government's Directorate for Planning and Environmental Appeals will provide a recommendation before a decision is taken by the Scottish Ministers.

17.4. In England and Wales, proposals for power stations exceeding 50 megawatts, organisations must also obtain a consent under Section 36 of the Electricity Act 1989 (see in Article 7) as amended by the Planning Act 2008. In Scotland, consent must be obtained from Scottish Ministers.

17.5. Under NIA65 section 1 (1) (see Annex 3), no person (a corporate body is a legal person) can use any site for a nuclear installation unless a nuclear site licence has been granted in respect of that site by the HSE and is for the time being in force. The licensing process includes a safety evaluation of the proposed reactor design to the extent necessary for the purpose of licensing the site, noting that licence conditions require much more safety evaluation before construction, commissioning and operation.

Government siting policy

17.6. Government policy on siting new nuclear power stations was set out in the Nuclear National Policy Statement (Ref. 7) and in the Strategic Siting Assessment (Ref. 80) which led up to it. The policy is that new nuclear power stations may be sited in semi-urban areas, subject to detailed examination by ONR of any proposal and specifically of demographic criteria. This policy is intended to replace any previous requirement that new nuclear power stations must be sited in remote areas.

17.7. The 2008 White Paper (Ref. 81) announced work in progress to review the technical basis for the Government siting policy. That work was completed in July 2008 in a paper, entitled 'The Siting of Nuclear Installations in the United Kingdom' prepared by ONR (Ref. 82). Further work is being carried out to provide the technical basis for site specific demographic assessment to support consent applications submitted to the Infrastructure Planning Commission.

Evaluation of site-related factors likely to affect the safety of a nuclear installation during its lifetime

17.8. To support the request for a site licence for a new site, the licensee must provide a safety submission to justify, amongst other things, the suitability of the site for the nuclear installation. ONR assesses this as part of the process to determine whether to grant the site licence. As with all safety case assessments (see Article

14), ONR uses its SAPs for Nuclear Facilities (Ref. 43) and associated assessment guides as a framework for assessing the adequacy of the licensee's request for a licence for the site. The SAPS are not mandatory standards, but they provide ONR inspectors with a framework for making regulatory judgements. The SAPs are available to the licensees and hence they are fully aware of the principles that their safety submissions will be judged against. SAP ST.1 is that account should be taken of factors that might affect the protection of individuals and populations from radiological risk when assessing the siting of a new facility. SAPs ST.2 – ST.7 include further specific principles to consider population characteristics, local physical data, external hazards, other installations in the vicinity, and potential changes during the life of a plant.

17.9. When siting the UK's existing nuclear installations, account was taken at the time of natural and man-made hazards in the area. This was an essential part of the design safety report on which initial licensing was based, and will continue to be so in the evaluation of any new sites.

17.10. ONR's SAPs set out the principles for the design of a new nuclear installation, including the need for site-specific data. SAPs EHA.1 - EHA.7 address the general principles of hazard analysis including identification, data sources, and input to fault analysis. SAPs EHA.8 – EHA.17 address individual site-specific hazards. Earthquakes, flooding, drought, high winds and extremes of ambient temperature are examples of natural hazards that need to be considered. Man-made hazards include the possibility of an aircraft crash on the site and the storage, processing or transport of hazardous materials in the vicinity. The hazard analysis should be used in the plant design and, where appropriate, in the operation of the plant.

17.11. The Control of Major Accident Hazard (COMAH) Regulations (Ref. 75) aim to prevent and mitigate the effects of those major accidents involving dangerous substances, such as chlorine, liquefied petroleum gas, explosives etc which can cause serious damage/harm to people and/or the environment. Industries that have quantities of such substances above a prescribed threshold level must notify HSE. Under REPPIR (see under Article 7 and 16) and COMAH, the relevant local authority is required to prepare a written off-site emergency plan that brings together the emergency arrangements of all hazardous installations in the area. These emergency plans are publicly available and so the existence of hazardous materials which could affect a nuclear site can be used by the licensees in their hazard analyses.

17.12. In addition to the analysis of external hazards as initiating events that could lead to accidents, the site selection process has to consider other external factors that relate to geological suitability, the availability of external supplies and susceptibility to extreme weather.

17.13. ONR's SAPs ECE.4 and ECE.5 are that investigations should be carried out to determine the suitability of the natural site materials to support the foundation loadings specified for normal operation and fault conditions. The design of foundations should utilise information derived from geotechnical site investigation. The information should include ground-water conditions, contamination conditions, soil dynamic properties and any potential for liquefaction or cyclic mobility.

Criteria for determining the potential effects of the nuclear facility on individuals, society and environment

17.14. The initial design of an NPP will minimise, so far as is reasonably practicable, the radiation exposure to the workers and general public. This will be addressed in the PCSR. ONR SAPs NT.1 and Targets 1-3 set out guidelines for radiation exposure during normal operation. The safety case prepared by the licensee has to

convince ONR that these guidelines will be met. As the nuclear installation design develops, so too the safety case must become more developed and provide the necessary verification of the initial calculations. The pre-operational safety report will take into account all the commissioning tests and the validation of any initial assumptions. This will be reviewed during the course of the plant's life in the PSRs.

17.15. SAP ST.2 is that both plant design data and the site location are used to evaluate the radiological risk to the general public. However, in accident conditions, mitigation of radiological consequences will depend on effective emergency arrangements (see under Article 16). This is dependent upon how many people might be involved and how the appropriate counter measures, in particular the distribution of stable iodine, sheltering and evacuation, might be implemented. Key factors are the population distribution and access facilities in the area. For proposed new nuclear installation sites, the licensee will submit to ONR details of present and predicted population around the site out to 30 km. Information on nearby schools, industry, hospitals, institutions and other places where people may congregate is included, with due regard taken of vulnerable groups On multi-facility sites, the safety case must consider the site as a whole to establish that hazards from interactions between facilities have been taken into account (SAP ST.6).

17.16. SAPs Targets 4, 6 and 8 set out targets for radiation exposure in design base fault sequences for people on and off the site.

17.17. SAPs, in paragraphs 622–628 and Target 9, address societal risk. As a measure of the societal concerns that would result from a major accident, a target based on a representative accident leading to 100 or more fatalities is defined. The target does not in itself cover all the factors related to societal concerns. In making an ALARP demonstration, the consequences in terms of other societal effects must also be considered. The safety case should identify accidents that result in source terms that could cause 100 or more deaths.

17.18. SAP ST.3 is that the licensee should consider the topography and geology for the area that might affect the dispersion of the authorised 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 examined. This examination determines whether the topography and road and rail systems are such as to create difficulties if it became necessary to evacuate people from the area around the plant. SAP ST.3 also expects the dispersion of radioactive releases via the atmosphere, surface water and ground water and the potential exposure pathways to be considered.

17.19. Once a site has been accepted for a nuclear station, arrangements are made to ensure that residential and industrial developments are so controlled that the general characteristics of the site are preserved. The planning processes (see above) require that the all relevant issues are addressed and discussed. The process also facilitates inputs from the public and interested groups. ONR must be satisfied that the size, nature and distribution of the population around the site are properly taken into consideration. If planning permission is granted for the site, there will be planning controls to ensure that significant and unacceptable population growth does not occur. The UK Chief Nuclear Inspector's Final Report (Ref. 13) following the Fukushima accident found that the arrangements for these controls needed to be strengthened and this is currently being addressed.

Re-evaluation of relevant safety factors to ensure continued safety acceptability.

17.20. Continued re-evaluation of external hazards and of the emergency plans is required under LCs 15 and 11 respectively. Guidance on re-evaluation of the specific

demographic requirements on siting is given in SAPs ST.1 – ST.7. LC15 (Periodic review) also requires periodic safety review of all safety documentation to ensure that the plant design still meets its original intent and that all reasonably practicable safety improvements are implemented (see Article 6). This includes the re-evaluation of external hazards.

17.21. Local authorities consult the ONR with regard to any proposed development that might lead to an increase in population close to the site and on large developments further from the site. Limiting criteria based upon population distribution are used to provide development control advice to planning authorities, and the ONR cannot necessarily insist on rigid adherence to demographic constraint limits.

17.22. Circular 04/00: 'Planning controls for hazardous substances' issued by the Department for Communities and Local Government, and a similar circular from the Scottish Development Department (5/1993) (Ref. 83) give advice on the exercise of planning control over hazardous development and over development in the vicinity of hazardous installations.

17.23. These circulars give guidelines for the types of development in the vicinity of hazardous installations on which 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 Installations) (Ref. 84). 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 nuclear installations. ONR's inspectors assess such planning applications to determine:

- whether a proposed development would raise the population to near the constraint limits set out in the Government's siting policy for nuclear installations;
- whether the external hazards in the nuclear safety case envelope the hazard from a proposed hazardous installation to ensure that the existing safety case is not compromised, or alternatively whether the nuclear safety case can be modified and justification provided to incorporate the new hazard;
- whether, for a proposed development within the nuclear licensed site, 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 the nuclear licensed site; and
- for a proposed development within the DEPZ (where applicable), ONR refers the application to the licensee, who must in turn liaise with those bodies having responsibilities under the off-site emergency plan, to find:
    a) whether the development can be incorporated into the emergency plan; or failing that,
    b) whether the emergency plan could be modified such that the development could be incorporated into the emergency plan.

ONR requires assurances that the developments in the immediate vicinity of a nuclear installation can be accommodated by the existing emergency preparedness arrangements to satisfy REPPIR requirements.

17.24. Local authorities normally follow HSE's advice as a statutory consultee. In England and Wales, HSE will be informed if the local authority proposes not to follow HSE's advice. HSE can then, if it considers it appropriate, request the Secretary of State for Communities and Local Government to call in the application. In Scotland, any development that has been the subject of consultation with HSE, and where HSE has advised against the granting of planning permission or has recommended conditions that the planning authority does not propose to attach to the planning permission, must be notified to Scottish Ministers.

17.25. Both the licensee and 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. The PSRs described under Article 6 include requirements that the radiological risk from the nuclear installation under review will remain acceptable during the period covered by the reviews. This is done as part of the normal regulatory process and during the PSRs. In addition, ONR maintains a database of the estimated population around nuclear installations, based upon the most recent ten-yearly population census, updated to take account of subsequent planning applications for residential developments.

17.26. Discharge Authorisations are reviewed regularly, including consideration of the level of actual discharges, the margin between discharges and limits and the application of BPM to minimise waste generation and discharges to the environment. Against a background of Government policy of progressive reduction in discharges overall, the environment agencies may decide to vary authorisations, following a review, for example, to set revised limits or conditions or to require improvement programmes to be implemented.

Consulting Contracting Parties in the vicinity of a proposed nuclear installation

17.27. In the case of an application for a Section 36 consent under the Electricity Act 1989 (see paragraph 17.10 above) for a new nuclear power station. the UK Government will send a copy of the application to the Directorate General for Energy of the European Commission. The Commission will make the application known to other Member States through the Official Journal of the European Communities. Once a public inquiry is called, evidence may be submitted to the inquiry by anyone from any country.

Article 18 - Design and Construction

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

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defence in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect the current status of the Generic Design Assessment programme, and actions arising following the Fukushima accident.

General

18.1. The UK licensing system has ensured that all existing nuclear power installations were properly designed and constructed to take account of relevant good practice and extant safety standards. These requirements are also applicable to the UK new build programme.

18.2. Since the fifth UK report, progress has been made in the assessment of new reactor designs and in light of lessons learnt from the events in Fukushima, additional requirements were placed on potential future operators to demonstrate resilience of plant against severe events. As well as assessing the implications of the Fukushima event on UK nuclear industry, the Chief Nuclear Inspector also raised a number of recommendations for ONR. These fell into three groups: review of Safety Assessment Principles (see below), consideration of emergency response arrangements, and oversight of nuclear safety research (see Section 2). ONR's considerations of the events in Japan, and the possible lessons for the UK, have not revealed any significant weaknesses in the UK nuclear regulatory regime and therefore ONR's existing regulatory framework will continue to be applied to existing and future new build in the UK.

Design and construction of existing nuclear installations

Current process

18.3. The granting of a nuclear site licence depends on the submission of an acceptable outline safety case for the site. Granting a nuclear site licence does not mean that construction will be permitted; the latter is subject to licence condition requirements including providing an adequate safety case for construction, and obtaining consent to do so. Licence Condition 14 (Safety documentation) requires a licensee to make arrangements for the production of documentation to justify safety during all phases of a plant's lifecycle, including design and construction. Subsequent design and construction changes are controlled by LCs 19 (Construction or installation of new plant) and 20 (Modification to design of plant under construction). LC19 requires the licensee to make and implement adequate arrangements to control the construction or installation of a new plant. If safety-

related modifications to the design become necessary during the construction phase, their implementation is controlled by arrangements made under LC20.

18.4. In carrying out its control and regulatory function for the UK's existing NPP, ONR satisfied itself that the licensee had applied the highest reasonably practicable standards in the design, fabrication and construction of new nuclear plant available at the time.

18.5. As described under Article 9, the responsibility for safety rests with the licensee, and it is the licensee who ONR holds responsible for design safety and the management of the design and construction process once a licence is granted. For existing installations, each licensee recognised that the design safety criteria in place at the time of the original design and construction of its current plant did not necessarily fully meet modern standards and expectations. Licensees used their Guidelines to review existing designs of nuclear installations and to prepare proposals to modify them. These reviews addressed the reasonable practicability of achieving improvements in existing plant safety performance. This is one objective of PSRs and is addressed under Article 6. The outcomes of the licensees' reviews were assessed by ONR against the version of the SAPs that were current at the time. This review process will continue on existing plants and, since 2007, ONR has carried out its assessments against the 2006 revision of the SAPs (Ref. 43).

18.6. At the time the UK's existing commercial NPPs were designed and built, there were only two licensees that were operating such plants. These were the two major electricity utilities, the Central Electricity Generating Board in England and Wales, and Southern Scottish Electricity Board in Scotland. Both were UK based and state owned. The technical knowledge base of the UK's reactors (mainly UK designed gas-cooled reactors) was vested in the licensees. Design and construction companies were also of UK origin, and these worked very closely with the licensees' organisations at that time. From the regulatory perspective, the licensees were the single point of contact who accepted their responsibility for safety. The construction of Sizewell B with its international design input heralded major changes in the industry not least because ONR and licensees needed to deal with international vendors. This is now being continued by ONR in the context of the UK's new build programme.

18.7. ONR recognises that to achieve sustained high standards of nuclear safety the principle of "continuous improvement" should be applied to all nuclear installations. This principle is embedded in UK law, where there is a continuing requirement for nuclear designers and operators to reduce risks "so far as is reasonably practicable" (SFAIRP), which for assessment purposes is termed "as low as reasonably practicable" (ALARP). This is underpinned by the requirement for detailed Periodic Safety Reviews to seek further improvements. This means that, no matter how high the standards of nuclear design and subsequent operation are, the quest for improvement will never stop.

18.8. One of the key parts of the UK nuclear safety regime is that of Periodic Safety Review (PSR). ONR and its predecessors have for some decades required nuclear site licensees to perform PSRs at least every 10 years (see also paragraphs 6.17 to 6.31). This aligns with IAEA safety standard SSG-25 "Periodic Safety Review of Nuclear Power Plants" (Ref. 85) and in the UK is a legal requirement enforced through nuclear site LC 15 (Periodic review). These PSRs provide the opportunity to carry out a comprehensive study of plant safety, taking into account aspects such as its operational history, ageing factors which could lead to deterioration in safety, and the advances in safety standards since the time of construction or the previous review. They are thoroughly assessed by ONR and provide a robust means of ensuring that the adequacy of operational facilities is justified, improved, or shut down and decommissioned. Substantial plant modifications have been made as a

result of PSRs. The importance of PSRs was reinforced as a result of ONR's considerations of the Fukushima accident.

Implications of the Fukushima accident

18.9. Seeking to learn from events, new knowledge and experience, both nationally and internationally, is another fundamental feature of ONR's approach to improveme through the regulation of existing nuclear installations (see Article 19). Following the Fukushima accident, the UK Chief Nuclear Inspector produced an interim report and a final report which were published on ONR's website, and made 37 recommendations, four of which are relevant to the Regulator, 23 of which are relevant to the nuclear industry and nine of which are generally relevant to the UK Government, ONR and the nuclear industry. A final recommendation required reports of progress responding to the recommendations to be made to ONR by June 2012. ONR applied the recommendations to the UK nuclear industry through a dedicated Fukushima programme, and a further report, the Implementation report (Ref. 14) published a year after the accident, has recorded the UK Government, ONR and nuclear industry's responses to these recommendations and includes updates on the progress in addressing the outcomes from the European Council "Stress Tests" undertaken in the UK. Reports on the outcome of these stress tests were put in the public domain in December 2011 for NPPs and May 2012 for the UK's non power generating nuclear facilities.

18.10. In addition ONR has produced a National Action Plan (Ref. 18) in response to the ENSREG Action Plan that followed up the peer review of the stress tests performed on European Nuclear Power Plants. ONR's action plan was specifically to answer the request for a regulators national action plan, associated with post-Fukushima lessons learned and stress test peer review recommendations and suggestions in a form suitable for peer review by a common discussion. This report draws from, and builds upon, the work already done by ONR and others within the UK following the Fukushima accident and is especially reliant on the ONR's most recent report "Japanese earthquake and tsunami: Implementing the lessons for the UK's nuclear industry" (Ref. 14) which explains how the UK nuclear industry is implementing the lessons from Fukushima.

18.11. In these stress test reports, areas for potential improvement (known as "considerations") were identified by licensees. These considerations were augmented by Stress Test Findings identified by ONR. As with the Final Report, ONR requested an update on progress relating to considerations and stress test findings contained in the national stress test reports, recognising that in many cases such progress would be less mature given the more limited time the nuclear industry has had to develop its proposals. All licensees have provided responses to the outcomes of the UK Stress Test Reports.

18.12. Licensees have identified a wide range of improvements across all UK NPP sites, including near term and longer term programmes of work. Near term work ranges from the improvement of emergency response (e.g. provision of all terrain vehicles, stores of essential tools), improvement in NPP autonomy (e.g. increase in essential supplies on site, increase in back-up battery run-time), to improvement in off-site communications (e.g. provisions of satellite telephones and availability of remote instrumentation readings). Significant progress on these has already been achieved. Longer term work has included design reviews such as the adequacy of hardware provisions to survive external hazards (e.g. by means of qualification against extreme external hazards, storage in a safe location) and the severe accident environment (e.g. engineering substantiation and/or qualification against high pressures, temperatures, radiation levels, etc), in place, to perform the selected strategies.

18.13. Work has also been undertaken regarding the development of long-term severe accident exercises along with reviews of source terms and dose uptakes. In addition, there are other work programmes underway that will further analyse severe accident provisions and these analyses may in turn lead to additional plant enhancements. A flexibility of approach has been shown by UK nuclear licensees by making provision for mobile back up equipment in combination with hardened on-site structures to provide a degree of separation and independence.

18.14. In support of these responses, ONR's inspectors have been actively engaged with UK nuclear licensees to confirm that appropriate lessons are learnt and acted upon. This engagement has taken a number of forms, including: site inspections; technical meetings; workshops and plant "walk downs". In addition, ONR inspectors have been in regular contact with UK nuclear licensees to main good communications and to ensure that issues are progressed in an appropriate and timely manner.

18.15. ONR acknowledges the significant progress made by UK nuclear site licensees since work began to identify and learn lessons, and their commitment to deliver the more significant improvements arising from lessons learnt from Fukushima by the end of 2014. Nevertheless, ONR will continue to act to ensure that these improvements are effective, and that the more significant improvements are delivered to this timescale.

18.16. ONR will monitor and assess the adequacy of progress made by the industry over the longer term. If progress or implementation of the solutions is not satisfactory, ONR will require licensees to revisit the issue, undertake further work as appropriate, and provide further evidence to justify their proposals. In the event that ONR remains dissatisfied enforcement action will be taken to ensure an appropriate outcome is achieved.

18.17. ONR is delivering such oversight by embedding ongoing "Fukushima learning" oversight activities into its operational regulatory programme for Nuclear Power Plant. This approach offers a number of distinct benefits in that it:

- secures longer term oversight by ONR of improvements relating to the lessons learnt from the Fukushima event;
- is both effective and efficient in terms of future use of regulatory resources;
- ensures that, in the overall interests of nuclear safety, such improvements are delivered taking into account the relative significance of all activities on the site; and
- that such improvements are regulated, as appropriate, under the provisions of the licence conditions attached to each nuclear site licence.

ONR is committed to continuing to monitor and assess progress, to publish summary updates for stakeholders on our website and site stakeholder reports and to continue to advise Government on the adequacy of progress made by the industry.

18.18. One recommendation arising from the ONR Chief Nuclear Inspector Fukushima report (Ref. 13) was for ONR to review its SAPs. The SAPs provide ONR inspectors with a framework for making consistent regulatory judgements on nuclear safety cases. They also provide potential vendors and nuclear site licensees with information on the regulatory principles against which their safety provisions will be judged. However, they are not intended to be used as design or operational standards, reflecting, as they do, the non-prescriptive nature of the UK's nuclear regulatory system and the fact that they were written primarily for ONR's own use in its assessment process. To date, ONR's review of the SAPs has confirmed that there are no significant gaps in the SAPs, although a small number of technical areas have been identified for which amplification and clarification of the principles would be beneficial, mainly related to coverage of severe accidents. The majority of the

changes to be made to the SAPs are effectively to bring them up-to-date. This is to reflect the six years' of operating experience ONR has gained working with the current version, and to reflect changes to the industry and ONR over this period.

18.19. Similarly ONR has embarked on a programme that reviews the currency and applicability of its TAGs which provide ONR inspectors with guidance on specific technical areas, and help to achieve consistency of assessment across all regulatory activities. Inclusion of lessons from Fukushima into the TAGs will necessarily come after the completion of the SAPs work. ONR's review of SAPs and TAGs has paid particular attention to external hazards and severe accidents.

18.20. The UK has an established process for adoption of WENRA reference levels, including those related to severe accident management, into its national legal framework. WENRA is currently updating the reference levels in light of the Fukushima accident and on completion of that work, which is expected in late 2013, the UK will embark on the process of formally adopting these as national requirements within technical assessment guides, including (TAG) 005 "ONR Guidance on the Demonstration of ALARP (As Low As Reasonably Practicable)", (Ref. 86). This technical assessment guide details how the Health and Safety at Work Act 1974 sections 2 and 3 (which are the key legal requirements) are applied to the UK nuclear industry. In addition to including WENRA reference levels as requirements in TAG 005, ONR has a procedure for revision of all TAGs and there is a requirement on authors to include those WENRA reference levels relevant to the technical area within the TAG before they can be approved. All TAGs are published on ONR's website.

18.21. ONR has recognised a particular challenge for the UK nuclear industry – that of ageing and obsolescence of existing nuclear safety components and systems. This problem is particularly acute for C&I technologies as these often become obsolete sooner than other technologies, and the highly complex nature of systems makes component or system modifications challenging to analyse. Where nuclear qualified devices have become obsolete it is becoming increasingly common for licensees to wish to qualify commercial devices containing computer-based technologies for nuclear safety applications. ONR recognises that commercially developed components and systems have the potential to match the performance of legacy devices, and in some cases provide additional features that are beneficial to nuclear safety such as improved diagnostics, and timely reporting of faults. ONR has supported research to identify a means by which commercial devices containing computer-based technologies may be qualified for nuclear safety applications. This resulted in the generation of a computer tool called Emphasis for qualifying devices containing computer-based technologies. Emphasis consists of software that guides a competent assessor through a structured and comprehensive question set regarding the production processes used to design and manufacture a component or system (the Production Excellence (PE) leg of the safety argument). The qualification decision is recorded, along with the evidence, so that the reasons for the qualification decision can be clearly seen and any gaps identified. Over 40 devices containing computer-based technologies have so far been qualified by this practical and efficient approach. In addition to the PE argument, ONR expectation is that Independent Confidence Building Measures will also be identified and applied, according to safety classification.

Design and construction of new plant

18.22. In the past UK licensees had their own design guidelines which related to the UK regulatory approach, and which they used to negotiate with potential vendors to develop reactor designs. This has not been the case during the new build programme in that the design standards used by the multinational vendors are not under the direct control of any UK organisation or ONR. However, ONR has applied

the existing nuclear regulatory system and standards, through the GDA process, to the assessment of new plant designs, using the existing SAPs, TAGs and international standards and guidance. The GDA process was described in detail in the fifth UK report to the Convention and is not repeated here, but is available on ONR's website (Ref. 87). However, ONR's experience of the process and its outcomes are detailed below.

18.23. The GDA process ensures technical assessments are conducted before reactor construction starts. This means that regulatory questions and challenges can be addressed while the designs are still "on paper". The process therefore limits, for new construction programmes, the consequences that arise from design changes initiated by ONR's regulatory assessments. It also provides a greater opportunity to identify those changes that will result in the best safety outcome. It should be noted that performing regulatory assessments at an early stage in the design of the reactor has the potential to challenge the reactor vendor who may not at this stage have technical information in a form suitable for UK regulatory assessment.

18.24. To ensure a timely conclusion to GDA, ONR needed additional support for its specialist analytical resources, and so used the Official Journal of the European Union (OJEU) process to establish a framework agreement for the use of Technical Support Contractors (TSCs). This agreement has so far included 31 TSCs across a range of 15 technical areas, with over 150 contracts placed. The TSCs were selected by a formal process that, amongst other things, assessed their technical competence and independence. Whilst the GDA work performed by the TSCs was strongly scoped and closely supervised by ONR, TSC independence was maintained by their own peer review processes. The reports produced by the TSCs and the technical observations they raised were used by ONR to inform the regulatory process. However, ONR alone made the regulatory decision on the adequacy, or otherwise, of the reactor designs.

18.25. In December 2011 ONR issued an interim Design Acceptance Confirmation (iDAC) for the EDF and AREVA (UK EPR™ reactor) and Westinghouse (AP1000® reactor) designs. This indicates that ONR is confident that the designs are capable of being built and operated in Great Britain on a site bounded by the generic site envelope, in a way that is safe and secure. Westinghouse chose to pause work at that time, but EDF and AREVA continued work to address GDA Issues on the UK EPR™. In December 2012 ONR issued a DAC for the UK EPR™, indicating that the GDA Issues listed in the iDAC had been satisfactorily addressed.

18.26. The GDA process has proven successful both for ONR and the reactor vendors. This is because the assessment process progressed in a predictable and timely manner, and resulted in clearly defined decisions, significantly reducing the regulatory risk to the potential vendors and future licensees.

18.27. ONR conducted GDA in an open and transparent manner by regularly publishing technical reports that described progress on the assessment and identified emerging technical issues. A comprehensive set of final technical reports were published to describe our assessment and its conclusions. Emerging issues were discussed at an early stage between ONR technical specialists, the reactor vendor and the future licensee, prior to the publication of Assessment Findings. Whilst discussions have been challenging at times, ONR used the interaction to fully understand the technical merits of the design and how these align with the UK regulatory approach, and to influence improvements in the design.

18.28. A number of significant safety improvements to the UK EPR™ were identified during GDA, and these were described in a number of GDA Assessment Findings. The detailed technical discussions have meant that the nature and extent of each Assessment Finding has not been a surprise to the reactor vendor or licensee, and the means of resolving each Assessment Finding is clear. The resolution of

Assessment Findings will, in many cases, require significant further analysis and justification. ONR has allocated each Assessment Finding with a suggested completion milestone that will help the planning of future work. ONR believes this approach will substantially reduce the risk of re-work arising from the regulatory process.

18.29. Throughout GDA, ONR has published regular reports of progress on its website. Similarly EDF and AREVA published its generic Pre-Construction Safety Report (PCSR). On completion of GDA, ONR published full Assessment Reports in every technical area on its website, giving the reasons behind each regulatory decision. To demonstrate openness and transparency in decision making, ONR has written the assessment reports so that only limited redaction has been necessary. The availability of information relevant to the regulatory process has generated a very positive response from many stakeholders, and ONR believes this approach will provide confidence that the regulatory processes are sound, and show that decisions are evidence based.

18.30. The findings arising from the national and international work following the Fukushima accident have been applied to nuclear new build, and this was achieved by raising a GDA Issue specifically relating to Fukushima. This has been addressed during the close out phase of the GDA process for the UK EPR™, by the reactor vendor agreeing to a range of measures to protect against external events.

18.31. ONR also recognises the direct benefit that research can confer in informing nuclear regulation. For example during GDA, at the request of ONR, EDF and AREVA reviewed the Control and Instrumentation Nuclear Industry Forum (CINIF) research on approaches to assessing multi-tasking software systems and, as a consequence, have proposed further work to determine the feasibility of applying this.

18.32. ONR made a commitment not to further assess at the site specific stage of the project aspects of the safety case already assessed and accepted at the generic design stage. However, should the Requesting Party or operator (Licensee) later make either generic or site-specific safety significant changes that affect the basis of the GDA outcome, then those aspects of the GDA safety submission may require re-assessment by the regulator.

18.33. The generic safety case that forms the basis of the GDA submission will also inform any site-specific safety case. GDA was designed to assess the generic safety case for future reactor designs, and not the adequacy of the actual final design. It was also not intended to provide a complete assessment of the final reactor design, as there will be other issues, operator specific or site specific, that ONR would expect to be considered during the environmental permitting and site licensing stages. In some instances the safety case can inevitably only be validated following procurement or later testing or commissioning, and this is recognised in the Assessment Findings that relate to these areas. This validation process is normal regulatory business and will be subject to appropriate regulatory controls.

18.34. More consents and approvals will be required at the site-specific level, from Government and agencies including ONR and the Environment Agency, before construction can begin. The nuclear regulators will not allow nuclear safety-related construction to begin until they are satisfied that those design features that are site specific and any relevant changes to the generic design have been adequately addressed.

Supply Chain

18.35. ONR recognises that the international nature of the nuclear industry provides many challenges regarding the selection and procurement of components and systems for nuclear safety applications. Components and systems may pass through more than one organisation in more than one country in the process of manufacture

and integration, and the operations performed on them at each stage may be complex and have the potential, if not carried out properly, to compromise the capability of that component or system. Furthermore, faults or shortcomings may not be readily identifiable or testable in the delivered product (e.g. software within a Control & Instrumentation system). For this reason, it is essential that procedures are adhered to, processes undertaken on a component or a system are fully understood, deviations are identified, and appropriate documentation is provided.

18.36. Engineering practices, terminology, culture, and legal bases differ between organisations and countries, and this has the potential to impact the ability of a UK licensee to influence the quality of work being carried out for it. In the UK, it is the nuclear licensees who are legally responsible for the safety of their plant, and therefore ONR's expectation that each UK nuclear licensee can act as an intelligent customer.

18.37. The concept of "Intelligent Customer" (IC) was developed by ONR and has gained international acceptance. IC can be defined as follows, which is compatible with IAEA expectations: "*As an intelligent customer, in the context of nuclear safety, the management of the facility should know what is required, should fully understand the need for a contractor's services, should specify requirements, should supervise the work and should technically review the output before, during and after implementation. The concept of intelligent customer relates to the attributes of an organisation rather than the capabilities of individual post holders."* ONR has developed a TAG that provides guidance for inspectors on how to assess aspects of contractor selection, oversight and control. - T/AST/049 – Licensee use of contractors and intelligent customer capability (Ref. 88).

18.38. During GDA and relevant work on existing reactors, ONR's expectation is that design work and analyses will be carried out according to international nuclear standards, or where local or other standards have been used, their equivalence is demonstrated.

18.39. In order to ensure that suitable international standards are available, ONR participates in a wide range of international work. ONR's contribution to, and adoption of, international standards ensures that common and consistent systems and components, with defined attributes can be used in the UK nuclear industry. ONR has also participated in discussion with other European nuclear regulators where clarity is required on an approach to regulation in certain technical areas. An example is the Seven Party Agreement on safety critical software document (Ref. 89).

Implementation of defence in depth

18.40. In the UK, defence-in-depth is seen as a fundamental element of reactor safety. It has been a requirement for all nuclear installations since the beginning of the reactor programme, and continues to be a requirement for new build. ONR's principal expectations in regard to defence-in-depth and the physical application of this on all UK NPP reflect the five levels of defence described in IAEA Safety Requirement NS-R-1. These have not changed since the last UK report to the Convention and therefore are not repeated here.

18.41. The application of European Council Stress Tests identified a number of areas for further consideration by UK licensees aimed at improving defence in depth and hence increasing the robustness of their sites, in the case of loss of electrical power, ultimate (and alternative) heat sinks and containment integrity. The 'Considerations' are similar for each station although some are station-specific. In general terms, the key 'Considerations' include:

- Improving the robustness of reseal and re-pressurisation arrangements (gas reactors).

- Extending Control and Instrumentation (C&I) and lighting resilience.
- Improved training, planning and pre-engineering in order to improve mitigation measures.
- Extending transient analysis using the latest calculation route to determine the timescales for prevention of fuel and structural damage for a range of scenarios.
- Increasing mission time by increasing the capacity of water and fuel storage tanks on-site.
- Increasing the provision of off-site back-up equipment, including equipment to enable boiler feed: a supply of suitable inert gas for primary circuit cooling (gas reactors), electrical supplies for lighting and control and instrumentation.
- Improvements to the resilience of decay store cooling against loss of ultimate heat sink in respect of improved guidance to operators, fault recovery and understanding of credible consequences.
- Improvements to the resilience of pond cooling and make-up against the loss of ultimate heat sink in respect of improved guidance to operators, replenishment of lost pond water and standalone pond cooling facilities having no dependence on any other station supplies or systems
- Equipment to enable pressure vessel cooling.
- Supply of suitable inert gas for primary circuit cooling (gas reactors).
- Equipment to enable boiler feed.
- Extending the compressed air supply for spent fuel decay tube cooling (gas reactors).
- Extending emergency command and control facilities including communications equipment.
- Robust means for transportation of this equipment and personnel to the site post-event.
- There is already a set of emergency equipment stored off-site centrally within the UK. However, it is recognised that there is scope to further improve this both in terms of the available equipment and its location.
- The electrical resilience measures are designed to ensure that the plant operators can recover electrical supplies. This can be achieved using off-site located back-up generators to cover a period of 72 hours (after which higher-capacity generators may be deployed). The aim will be to recover critical plant operations or to assist in the accident management activities (emergency lighting, battery charging, operation of selected pumps / valves and operation of certain indications / control logic). The cooling resilience measures are designed to ensure that the plant operators can recover cooling / containment. The resilience provisions specifically for the AGRs will include; primary circuit cooling support, secondary circuit cooling support, buffer store fuel management, ponds fuel management,
- A number of areas for further consideration have been identified, aimed at increasing the robustness of the PWR in the case of loss of electric, ultimate (and alternative) heat sinks and containment integrity.

It is ONR's opinion that implementation of the majority of these measures should provide additional defence-in-depth capability to the systems for dealing with extreme beyond design basis events.

Safety classification and standards

18.42. The effective implementation of defence in depth needs support from a number of general principles and related measures, including safety classification. ONR expects that safety functions required during normal operation and during a fault or accident should be categorised, according to their significance with regard to safety, and that structures, systems and components, including systems utilising

software for instrumentation and control, are classified on the basis of their safety significance. These should be designed, manufactured, installed, and then subsequently commissioned, operated and maintained to a level of quality commensurate with their classification. ONR's SAPs (paragraphs 148 – 161) address categorisation and classification, and ONR applies the international standard IEC 61226 to the process of categorisation.

18.43. ONR's SAPs require that Nuclear-specific codes and standards be used in the design of Structures, Systems and Components SSCs, or where suitable nuclear standards don't exist, for relevant international standards from other sectors to be applied and justified. ONR's SAPs also require that appropriately designed interfaces should be provided between SSCs of different classes to ensure that any failure in a lower class item will not propagate to an item of a higher class. Auxiliary services that support components of a system important to safety should be considered part of that system, and should be classified accordingly, unless failure does not prejudice successful delivery of the safety function. SAP EKP.5 addresses the identification of safety measures to deliver required safety functions.

18.44. A qualification procedure confirms that all safety systems and safety-related equipment will perform their required safety functions throughout their operational lives under the operational, environmental and accident conditions specified in the design. The procedure, where reasonably practicable, includes a demonstration that individual items can perform their required functions under the specified conditions.

External and internal hazards

18.45. External hazards are those natural or man-made hazards to a site and facilities that originate externally to both the site and its processes, i.e. the licensee may have very little or no control over the initiating event. External hazards include earthquake, aircraft impact, extreme weather, electromagnetic interference (off-site cause) and flooding as a result of extreme weather/climate change (this list is not exhaustive). Terrorist or other malicious acts are assessed as external hazards.

18.46. Internal hazards are those hazards to plant and structures that originate within the site boundary but are, for example, external to the process in the case of nuclear chemical plant, or external to the primary circuit in the case of power reactors, i.e. the licensee has some control over the initiating event. Internal hazards include internal flooding, fire, toxic gas release, dropped loads and explosion/missiles.

18.47. ONR SAPs paragraphs 208 to 233 address external and internal hazards. For example. ONR SAP EHA.1 expects that external and internal hazards that could affect the safety of the facility should be identified and treated as events that can give rise to possible initiating faults. This identification should include consequential events and, as appropriate, combinations of consequential events from a common initiating event.

18.48. ONR's expectation detailed in the SAPs is that the layout of safety system equipment and safety-related plant and services minimises the effects of internal and external hazards and of any interactions between a failed structure, system or component and other safety-related structures, systems or components.

Design for reliable, stable and manageable operation

18.49. Engineered structures, systems and components should be designed to deliver their required safety functions with adequate reliability, according to the magnitude and frequency of the radiological hazard, to provide confidence in the robustness of the overall design. Ideally, the structures, systems and components important to safety should be fail-safe, i.e. they should have no unsafe failure modes.

18.50. The design should incorporate redundancy to avoid the effects of random failure, and diversity and segregation to avoid the effects of common cause failure (CCF). Examples of diversity are different

- operating conditions,
- working principles
- design teams,
- sizes of equipment,
- manufacturers,
- components,
- types of equipment that use different physical methods.

The design should also be tolerant of random failure occurring anywhere within the safety systems that deliver each safety function.

18.51. ONR's SAP EDR.4 is that no single random failure, assumed to occur anywhere within the safety systems provided to perform a safety function, should prevent that function being performed during any normally permissible state of plant availability. Where the single failure criterion is not appropriate (e.g. the RPV) the licensee and ONR require a special case procedure for design and construction to give confidence that failure is incredible (SAP paragraphs 238 – 279).

18.52. ONR's SAP (EDR.3) is that CCF should be explicitly addressed where a structure, system or component important to safety employs redundant or diverse components, measurements or actions to provide high reliability. CCF claims should be substantiated and, in general, claims for CCF should not be better than one failure per 100,000 demands.

Fault and accident analysis

18.53. ONR's SAPs (FA.1) is that a fault analysis should be carried out comprising design basis analysis, suitable and sufficient PSA, and suitable and sufficient severe accident analysis.

18.54. The fault analysis process leads to the determination of the DBA 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 and meet the following criteria:

- internal plant faults which have an expected frequency lower than about 10^{-5} per year;
- failures of structures, systems or components which form a principal means of ensuring nuclear safety and which have been accepted by a comprehensive examination, using relevant scientific and technical issues, to ensure an acceptable standard of integrity commensurate with the potential radioactive consequences if they fail;
- external hazards to the plants where it can be demonstrated that their frequency is less than once in 10,000 years; and
- those faults leading to unmitigated consequences which do not exceed the Basic Safety Limit for the respective initiating fault frequency in SAP Target 4 (effective doses received by any person arising from a design basis fault sequence).

18.55. Rigorous application of design basis analysis should ensure that severe accidents are highly unlikely. Nevertheless suitable and sufficient severe accident analysis is still required to ensure that risks are reduced SFAIRP. SAPs FA.15 and FA.16 address severe accidents.

18.56. The SAPs expect that licensees will analyse those fault sequences beyond the design basis that have a potential to lead to severe accidents. These analyses should determine the magnitude and radiological consequences of such an accident and demonstrate that there is not a sudden escalation of consequences just beyond design basis. The analysis will inform the preparation of accident mitigation strategies and support emergency plans.

18.57. The assessments undertaken in the UK on the impact of the Fukushima accident on the UK nuclear power generation industry have been consistent in identifying that there are no fundamental weaknesses in the definition of design basis events or the safety systems to withstand them for UK NPPs.

Use of established/proven engineering practice and technologies

18.58. The knowledge used at the time of writing the safety case needs to be supplemented by continued monitoring of the plant and data from commissioning, operation, periodic inspection and testing, as well as longer-term research or experience from other facilities. For example, Sizewell B and the more recent AGRs included the qualification of equipment for all design basis accidents within their safety cases. This qualification often involved arduous testing or comprehensive analysis or both, usually in line with modern national or international standards or other specific regulatory requirements.

18.59. SAP ECS.3 expects that structures, systems and components that are important to safety should be designed, manufactured, constructed, installed, commissioned, quality assured, maintained, tested and inspected to the appropriate standards.

18.60. The SAPs paragraphs 99 - 100 and 552 – 559 address the processes that are followed to ensure that appropriate design data and models are used. These principles also address the validation of models and the need for conservative design, in case of uncertainty in the accuracy of data. The SAPs note that the provisions should be made to review new data, scientific knowledge and operating experience.

18.61. Before any new design or feature with potentially significant safety implications is introduced, the licensee must submit a safety case to ONR to show that appropriate safety standards have been met. This can include type testing, experiments or other means to indicate clearly that the proposal is safe. ONR will only allow construction to commence when it is satisfied that the safety case is adequate.

18.62. SAPs EQU.1 and paragraphs162 – 169 address equipment qualification. The SAPs require that a qualification procedure should confirm that the equipment will perform its required function under the operational, environmental and accident conditions throughout its operational life.

18.63. SAPs EAD.3 – EAD.5 require that arrangements should be in place for the recording and retrieval of lifetime data. This is supported by LC28 that requires the licensee to make adequate arrangements for the examination, inspection, maintenance and testing of all plant that may affect safety. Spurious operation and unsafe failure modes are addressed in the fault analysis that is part of the safety case. Anticipated failure or expected lifetimes of component are taken into account as part of routine maintenance programmes.

18.64. Where there is relevant operating experience to support design assumptions, this is included in the licensees' safety case as part of the evidence to show the safety of the plant. The responses to Article 19 address operational feedback and nuclear safety research. Application of the SAPs ensures that this is incorporated in the design of a new plant.

Operability, man/machine interface

Operability

18.65. Operability is a key factor in the design of a plant. This has been reflected for existing plant by use of the licensees' design safety guidelines and assessed as necessary by the regulators using earlier versions of the SAPs. The SAPs will be

used to assess operability of new plant and upgrading the operability of existing plant.

18.66. Specifically, SAPs EHF.6 and EHF.7 expect that workspaces in which plant operations and maintenance are conducted should support reliable task performance by taking account of human perceptual and physical characteristics and the impact of environmental factors. User interfaces, comprising controls, indications, recording instrumentation and alarms, should be provided at appropriate locations, and should be suitable and sufficient to support effective monitoring and control of the plant during all plant states.

18.67. Inherent passive safety is an essential feature of design where it is reasonably practicable to include it. This is supported by specific design features that enhance operability (SAP EKP.5). Examples are:

- Safety systems are available to reduce the frequency, or limit the consequences, of fault sequences. No fault or hazard should disable the safety systems provided to safeguard against that event.
- UK nuclear installations are provided with the facility to shutdown the reactor operations should the control room becomes unavailable to operators.
- At the most recent nuclear installations in the UK and for any potential new plant, a safety system is automatically initiated and no human action should be necessary for a period following the start of the requirement for protective action. The design, however, is such that plant personnel can initiate safety system functions and can perform necessary actions to deal with circumstances that might prejudice safety, but cannot negate correct safety system action at any time.
- The layout of safety system equipment and safety-related plant and services minimises the effects of internal and external hazards and of any interactions between a failed structure, system or component and other safety-related structures, systems or components.
- Provisions are made for monitoring and inspecting safety systems, safety-related structures, and components in service, or at intervals throughout plant life commensurate with the reliability required of each item. In especially difficult circumstances where this cannot be done, either additional design measures are incorporated to compensate for the deficiency, or adequate long-term performance is achieved without such measures.

Man/machine interface

18.68. SAPs EHF.1 – EHF.10 place particular emphasis on identifying the safety actions required of the operators and specifying the user interface during the design stage of the UK's nuclear installations.

18.69. A statement of the UK approach to ensuring an adequate treatment of human factors throughout the life cycle of the plant is provided under Article 12. This also indicates how human factors have been taken into account in response to the Fukushima accident.

Article 19 – Operation

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

(i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation; (iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(iv) procedures are established for responding to anticipated operational occurrences and to accidents;

(v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;

(vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;

(viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

Under this Article, compliance with the Convention is demonstrated in a way that has not substantially changed since the fifth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect changes made in the UK to the reporting of incidents and operating experience feedback.

Safety analysis and commissioning programme

19.1. In the UK, the safety of a nuclear installation throughout its lifetime is regulated principally through the licence conditions (see Annex 4) that are attached to the nuclear site licence (see Article 7). Compliance with these conditions is monitored and enforced by ONR through inspection and assessment (see Article 14). The LCs cover all aspects of operation that have a relevance to safety, and it is an offence for a licensee to contravene the requirements of a nuclear site licence. The powers under the licence by which ONR can control the operation of UK nuclear plant are described under this Article. The relevant LCs for each requirement of Article 19 are discussed below.

19.2. Articles 14 and 18 of this report address the safety analysis undertaken during the design and prior to the initial authorisation to operate a nuclear installation. A generic design assessment (GDA) process has been adopted for new nuclear

reactor designs, to determine if they are acceptable for build in the UK. This process separates design issues from site related issues. A site licence must be granted before a new reactor can be installed and operated on a specific site and assessment work is undertaken by ONR to ensure that the site is suitable for the particular design, and that the potential operator, the licensee, can adequately control design, procurement, manufacture, construction, installation, commissioning, operation and maintenance of the plant to ensure safety. ONR has published guidance on the licensing process and the factors that ONR may take into account when reviewing a licence application. Granting a nuclear site licence does not give permission for the start of nuclear–related construction, but enables regulatory control under the conditions attached to the site licence.

19.3. The construction and commissioning of a nuclear installation is regulated by ONR in accordance with the requirements of LC19 (Construction or installation of new plant) and LC21 (Commissioning). LC19 requires the licensee to make and implement adequate arrangements to control the construction or installation of any new plant that may affect safety. Similarly, LC21 requires the licensee to make and implement adequate arrangements for the commissioning of new or modified plant or processes that may affect safety. These arrangements shall, where appropriate, require the licensee to divide the construction and commissioning into stages. Using powers under the licence ONR may specify that the licensee shall not commence nor thereafter proceed from one stage to the next without its consent (see Article 7). Such consent is dependent upon the licensee demonstrating that it is ready to proceed to the next stage and that it has justified the safety of the structures, systems and components it intends to construct, install or commission during the stage. The intended approach for new reactors in the UK, is that ONR shall require the licensee to seek consent to commence construction. Thereafter, ONR has the option to exercise powers requiring the licensee to seek consent to proceed between subsequent stages of construction and commissioning. However, ONR will exercise these powers by exception and only if routine regulatory intervention reveals issues requiring the use of formal permission via the consent. The licence also gives ONR the power to direct the licensee to stop construction.

19.4. Prior to commencing commissioning, ONR expects the licensee to update the pre-construction safety report that provided the basis for proceeding with construction, to reflect the plant as built (i.e. including modifications to the initial design, or those made during the course of construction). This updated report, referred to as the pre-commissioning safety report, provides the basis for commencing commissioning. The commissioning programme required under LC21 is produced by the licensee to ensure that all systems important to safety are tested to demonstrate that the plant complies with the design intent and is ready for operation. Properly designed commissioning testing may also allow the detection of unintended or undesirable modes of operation that the initial design had not anticipated. LC21 requires a suitably qualified person or persons to be appointed to control, witness, record and assess the result of the commissioning tests. Full and accurate records are kept for the commissioning programme. In addition to plant hardware, key management functions are established prior to commissioning and are tested during the commissioning process. LC23 requires operating limits to be derived from the safety cases, and these in turn provide the basis for operating rules and operating procedures. These are tested as part of the commissioning programme. Any changes to the plant or procedures found to be necessary during the commissioning process are implemented under the arrangements established under LC21.

19.5. Where appropriate, the licensee shall divide the commissioning into stages and the licence gives ONR the option to exercise powers to permission, i.e. consent,

stages of commissioning. A typical programme will comprise stages of inactive commissioning followed by stages of active commissioning. ONR will specify those stages of the commissioning programme it wishes to formally permission via a Consent to proceed. For new reactors in the UK, ONR shall require the licensee to seek consent to commence active commissioning, receive fuel onto the site and for the latter stages of active commissioning. Whilst ONR retains the option to require a licensee to seek its consent to permission any or all of the remaining stages of commissioning. ONR also requires the licensee to seek its Consent to proceed to routine operation. This may follow an extended period of operation during the active commissioning phase before the formal permission to operate is finally granted. This may not be issued until the commissioning tests and the test results are available to substantiate the safety case, and all the necessary documents and systems are in place to support the continued operation and maintenance of the plant.

19.6. The licensee must collect and retains all data on systems and components that are acquired during commissioning. LC6 requires that all records associated with the demonstration of any licence condition are preserved for 30 years, or for any other period which ONR may direct. Specifically, LC25 requires that records are made of the operation, inspection and maintenance of any safety related plant. These records, which can originate at the design, construction, commissioning and operation phases of the plant's lifetime, provide a significant input to safety reviews required by LC15.

Operating limits and conditions

19.7. LC23 (Operating rule) requires the licensee to produce an adequate safety case to demonstrate the safety of a plant and to identify the conditions and limits that are necessary in the interests of safety. The safety case limits are the measurable plant parameters that define the envelope for safe operation, and the conditions (plant configurations, availability and operator actions) necessary to keep plant within this envelope. These limits and conditions are referred to as the operating rules (ORs). Licensees' compliance with the ORs is mandatory. For EDF NGL, implementation of LC23 is through Technical Specifications, which form a subset of normal operating instructions and the principal means by which to demonstrate the requisite conditions and limits necessary for safety.

19.8. LC24 (Operating Instructions) requires the licensee to ensure that the safety case limits and conditions of the ORs are an integral part of the written instructions to operators. The licensee will ensure that the limits and conditions in the operating instructions have a safety margin. The safety margin is established having regard to the plant transients arising in normal operation, or in the event of a plant system breakdown, so that there is high confidence that no transgression of the OR limits will occur and safety will not be jeopardised. In order to mitigate the consequences of an accident, the operating instructions for normal operation are supplemented by emergency operating procedures (see under Article 16). ONR has agreed that, at some nuclear installations, ORs can be replaced by Technical Specifications. These serve the same function, but using internationally accepted terminology.

19.9. LC10 (Training) requires the licensee to make and implement adequate arrangements for the training of any person who has any responsibility for operations that may affect safety. Under these arrangements, the training of operations personnel includes an understanding of the basis of operating limits and conditions. An integral part of any proposed changes to the limits and conditions (operating rules) includes appropriate operator training on the changes and their effects. Training of operators is fully addressed in Article 11.

19.10. Under LC25 (Operational records), the licensee must ensure that adequate records of operation, inspection and maintenance of plant important to safety are

made and kept. Under the management systems required under LC17 (Management systems), the Licensees' safety staff periodically audit these records to ensure compliance with procedures, including operating rules and operating instructions. ONR inspectors will also routinely monitor compliance with operating rules and instructions during inspection visits. Periodic review of procedures and processes is required under LC15 (Periodic review) and is covered in more detail in Articles 6 and 14.

Operating, maintenance, inspection and testing procedures

Operations

19.11. Paragraph 19.7 above describes identification of operating limits and conditions and the subsequent derivation of operating rules and Instructions. The administrative procedures for this are controlled by the licensees' arrangements made under LC14 (Safety documentation). The arrangements under LC14 include internal peer review, discussion and endorsement by the licensee's nuclear safety committee (LC13) and, where appropriate, submission to ONR for agreement or approval. Subsequent changes to ORs and operating instructions are processed via the arrangements made under LC22 (Modification or experiment on existing plant).

19.12. When the need to change an OR is identified, LC23 requires the licensee to submit a safety case to ONR that substantiates the proposed change. Normally, ONR would only approve the limits and conditions defining the nuclear safety envelope in the form of the ORs. Once approved, no alteration or amendment can be made to such ORs unless ONR has approved the alteration or amendment.

19.13. In the particular case where the results of operation, maintenance or inspection show that the safe condition or safe operation of the plant may be affected, the licensees' arrangements ensure that ONR receives a safety case that substantiates the continued operation of a reactor, whether or not the OR limits and conditions need to be changed.

19.14. LC12 (Duly authorised and other suitably qualified and experienced persons) requires that all people who carry out safety related activities are suitably qualified and experienced. LC24 ensures that all operations that may affect safety, including any instructions to implement ORs, are undertaken in accordance with written operating instructions. In addition to these requirements, LC26 (Control and supervision of operations) requires that no operations are carried out which may affect safety, except under the control and supervision of suitably qualified and experienced persons appointed by the licensee for that purpose.

19.15. The arrangements made under LC22 (Modification or experiment on existing plant) prescribe the procedures for carrying out a non-routine operation or a test. Such activities are managed in the same way as any other change (such as a plant modification) that may affect the safety case. The arrangements will require a full justification for the non-routine operation or test, and clearly demonstrate that all safety implications have been addressed, including the development of appropriate operating procedures. Before implementation, the safety case will be internally peer reviewed and endorsed by the licensee's nuclear safety committee. The licensee will also need the agreement of ONR before the non-routine operation is carried out.

Maintenance, inspection and testing

19.16. LC28 (Examination, inspection, maintenance and testing) requires licensees to make and implement arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety. This work is set out in a maintenance schedule that details the scope and frequency of maintenance. This schedule identifies those examinations, inspections, maintenance

and tests that are required to demonstrate the continued ability of the plant to meet claims in the safety case. The intervals between maintenance schedule activities are determined by the safety case, operational experience, engineering judgement and manufacturers' recommendations. The work is carried out in accordance with schemes laid down in writing by suitably qualified and experienced persons under the control and supervision of an appropriate person specifically appointed for that task, who must sign a full and accurate report on completion of the work. Any examination, inspection, maintenance or test that shows that the safety of the plant may be affected is reported to the licensee, who takes appropriate action.

19.17. In addition to the requirements of LC28, ONR also has powers under LC29 (Duty to carry out tests and inspections). After consultation with the licensee, ONR may require the licensee to perform any tests, inspections or examinations that it may specify. This may be instigated, for example, by the findings on other reactors, by new safety analysis or by research findings.

19.18. All UK operating nuclear reactors must shut down at regular intervals for inspection and testing. These periodic shutdowns occur every 18 months to 3 years, depending on the reactor type. Once shutdown, the reactor must not be restarted without the consent of HSE. Before issuing a consent to restart a reactor, HSE will need to be satisfied that all necessary maintenance, inspection and testing has been completed and the licensee has fully evaluated the findings and that the safety case remains valid. This evaluation will identify any need for changes to the type and frequency of maintenance, inspection and testing.

19.19. UK has an ageing reactor population and inevitably some items become obsolete. At present, there is adequate support for the plants that were built to older standards. Where obsolete equipment cannot be replaced directly as part of routine maintenance (for example some of the instrumentation and control equipment), alternative equipment must be evaluated using established procedures for plant modifications. The process for modifications is prescribed in the licensees' arrangements made under LC22.

19.20. In accordance with LC22(1) the licensees have arrangements to control modifications or experiments on plant or processes which may affect safety. Also, in accordance with LC22(4), those arrangements provide for the classification of modifications according to their safety significance. Typically, the licensees classify modifications according to what could happen, in terms of a radiological release, should they be inadequately conceived or executed. Significant safety changes need to be agreed by ONR before implementation, while others can be implemented by the licensee in accordance with the licensee's LC22 arrangements and notified to ONR.

Operational occurrences

19.21. The plant protection system will ensure that, after an operational occurrence, the plant is brought back into a safe state. The safety case identifies a range of fault conditions that will generate plant alarms for operator action or automatic response. The Operating Instructions and emergency operating procedures required by LC 24 identify the necessary operator actions. Reasonably foreseeable but remote fault conditions are addressed by providing strategies and guidelines to help operators decide on their emergency response. The administrative process for development of emergency operating procedures is the same as those for other operating procedures described above in paragraphs 19.13–19.15.

19.22. ONR's SAPs specify that licensees will analyse those fault sequences beyond the design basis that have a potential to lead to severe accidents. These analyses should determine the magnitude and radiological consequences of such an accident

and demonstrate that there is not a sudden escalation of consequences just beyond design basis. These analyses will inform preparation of accident mitigation strategies and emergency plans.

19.23. The arrangements for dealing with accidents and emergencies are set out under Article 16. The licensee has key responsibilities under these arrangements and, in particular, for bringing the plant back to a safe, stable condition. To this end, the licensee, under LC11 (emergency arrangements), ensures that all persons who might be involved are properly instructed and rehearsed in the procedures.

19.24. In the event of an incident on site, arrangements made under LC7 require that the licensee notifies ONR, as well as recording, investigating and preparing a report on such incidents. If appropriate, ONR will enforce corrective action.

Engineering and technical support

19.25. The nuclear site licence requires that the licensees have access to sufficient technical expertise for all stages of a plant's life. The licensees' in-house technical resource has significantly reduced over a number of years, and the tendency has been for expertise to be bought-in, as and when required, from contractors. ONR's view is that this is acceptable, providing that the licensees retain sufficient expertise to be an 'intelligent customer'.

19.26. ONR continues to examine the safety competence of the licensees, and monitors their level of safety expertise in relation to present and future business needs. Under the LCs, there are a number of requirements aimed at ensuring that there is sufficient engineering and technical support available in all safety-related fields throughout the life of a nuclear installation. In particular, LC12 (duly authorised and other suitably qualified and experienced persons) has a general requirement that only suitably qualified and experienced persons should perform any duties that may affect the safety of operations on the site. Within this overall provision, there is the specific requirement under LC26 (control and supervision of operations) for the appointment, in appropriate cases, of persons to control and supervise operations that may affect safety.

19.27. Licensees' arrangements under LC17 (Management systems) require appropriate control and supervision of contractors' staff.

19.28. With the potential revival of the nuclear industry, the availability of adequate engineering and technical resources will remain a major challenge. The UK has recognised this and is taking steps to meet the challenge. This is fully addressed in Article 11, for the industry as a whole and in Article 8 for the regulatory body.

Research and development

19.29. There are issues associated with operating reactors that require technical substantiation. This substantiation is obtained by research and development programmes. The licensees commission and undertake research to support the safe operation of their nuclear installations. In addition, the Government has given ONR the responsibility to oversee long-term generic (i.e. not site specific) safety research with the primary objectives of ensuring that:

- adequate and balanced programmes of nuclear safety research continue to be carried out, based on issues likely to emerge both in the short and long term;
- as far as reasonably practicable, the potential contribution that research can make to securing higher standards of nuclear safety is maximised; and

- the results of the research having implications for nuclear safety are disseminated as appropriate.

19.30. There are two secondary objectives of this research programme that recognise the need to maintain technical competence. These are to:

- take account of the desirability of maintaining a sufficient range of independent technical capability to ensure the attainment of the primary objectives; and to
- ensure that proper account is taken of the advantages of international collaboration in furthering the primary objectives.

19.31. ONR influences the programme by identifying safety issues in a Nuclear Research Index and in technical strategies. It is expected that the nuclear licensees will commission research to address issues raised by ONR. ONR also commissions research (under the Levy Programme) and the costs of this are recovered from the nuclear licensees. The Levy Programme undertakes research to maintain independent technical capability, to collaborate internationally and to tackle safety issues not addressed by the licensees in their programmes. The Programme currently embraces the full range of safety issues on nuclear reactor plant and on sites that are being decommissioned and where nuclear waste is stored or treated. The scope of the programme includes the needs of ONR's generic design assessment of new civil reactors to have access to research results being generated from international programmes of the NEA and from specific developments occurring in UK universities.

Reporting of incidents to ONR

19.32. ONR's increased responsibilities now include security, safeguards and transport in addition to nuclear safety. These changes have increased the range of incidents potentially affecting nuclear safety that are notifiable to ONR. ONR uses the legal frameworks previously employed by HSE and the UK Department of Transport to ensure that all relevant types of incident are notified in a timely manner. With the formation of ONR, processes for the notification and reporting of safety incidents in the UK have developed significantly since the 2010 UK Convention Report although the legislative frameworks for transport and site safety remain the same. The interfaces and processes within ONR that provide an effective reporting system are now managed by its Regulatory Intelligence Sub-Programme.

19.33. For fixed sites, ONR requires that licensees to notify it of incidents by attaching Licence Condition 7 (Incidents on the site) to all nuclear site licences. LC7 requires that nuclear site licensees make and implement adequate arrangements for the notification, recording, investigation and reporting of such incidents on the site as:

- is required by any other condition attached to the licence;
- the HSE may specify; and as
- the licensee considers necessary.

19.34. The non-prescriptive nature of this licence condition means that each UK licensee can adopt its own reporting arrangements to meet ONR's expectations. During 2011, ONR consulted with licensees and other duty-holders over changes to the notification process with a view to demonstrating more consistent reporting arrangements. In January 2012, for the first time ONR provided written guidance to licensees and other dutyholders, which outlined all the categories of incident requiring notification and required the provision of notifications within specified timescales dependent on the safety-significance of the event. The scope of this guide covered what should be notified and when, but its publication did not otherwise

alter the arrangements previously discussed and agreed by ONR. Each site has local arrangements that establish a proportionate approach to reporting, based on the safety significance of the incident in question, supplemented by ONR's new guidance (Ref. 90). ONR continues to discuss and agree arrangements with site licensees for LC7 as the underlying licence conditions have not changed.

19.35. Licence Condition 7 compliance arrangements made by each licensee cover a wide spectrum of incidents. ONR's guidance (Ref. 90) supports the proportionate approach in these arrangements by requiring significant incidents to be notified immediately while others may be notified at a later date. Such notifications only ever contain preliminary information, and ONR now requires follow-up reports 60 days after every incident notification. The licensees include the following information in follow-up reports for incidents;

- confirmation of the factual details in the INF1;
- conclusions from the licensee's investigation of the incident including the cause of the event;
- summary of the mitigation and corrective actions taken or to be taken;
- an outline of learning from the incident with any implications for related plant; and
- confirmed INES level of the incident.

19.36. The following indicates the range of the incidents included in a licensee's reporting arrangements:

(i) Incidents prescribed by the Nuclear Installations (Dangerous Occurrences) Regulations 1965 (Ref. 91) for the purposes of section 22(1) of NIA65 (Ref. 24). These include:

- releases of radioactive or toxic substances which have, or may have caused, death or serious injury to persons on or off the licensed site;
- occurrences during the course of carriage of nuclear matter which have, or may have caused, death or serious injury to persons on or off the licensed site;
- any explosion or outbreak of fire on the licensed site that affects or is likely to affect the safe working or safe condition of the nuclear installation; and
- any uncontrolled criticality excursion.

(ii) Incidents that meet the UK Ministerial Reporting Criteria and ONR's own Public Reporting Criteria, which are identical. These include:

- occurrences on a licensed site, which are to be reported to DECC and ONR under section 4(1)(a) of the Nuclear Installations (Dangerous Occurrences) Regulations 1965;
- a confirmed exposure to radiation of individuals which exceeds, or which are expected to exceed, the dose limits specified in Schedule 4 to the Ionising Radiation Regulations 1999 (IRR99) (Ref. 29);
- examination, inspection, maintenance, test or operation of any part of the plant revealing that the safe operation may be significantly affected;
- a confirmed breach of, or discharge expected to breach quantitative limits of a Certificate of Authorisation for the disposal of radioactive waste

issued under the RSA93 (in Scotland) (Ref. 41) or the Environmental Permitting Regulations 2010 (Ref. 27) in England and Wales;

- abnormal occurrences leading to a confirmed release to atmosphere or spillage of a radioactive substance which exceeds, or is expected to exceed, the limits set out in IRR99; and
- abnormal occurrences leading to a release or suspected release or spread of radioactivity, on or off the licensed site, which requires special action or special investigation by the licensee.

(iii) Incidents graded by the licensee as being 'Nuclear' or 'Radiological' in their nature and which are of sufficient significance that they meet the agreed criteria in licensee's LC7 (1) arrangements for reporting them to HSE;

(iv) Incidents which, in themselves, may not be safety significant but which nevertheless may attract media attention, such as the attendance on site of the Emergency Services.

(v) The categories of incident that match all of the above criteria are listed in Appendix 1 of G/INS/07 (Ref. 90) which covers nuclear safety (Table 1 in Ref. 90) and radiological safety (Table 2 in Ref. 90) as well as security, safeguards and transport in other tables.

19.37. As part of its operational experience feedback (OEF) processes, ONR has made arrangements with licensees to share information on incidents covered by international reporting arrangements for which ONR is the UK reporting authority, i.e. the;

- International Nuclear and Radiological Event Scale;
- IAEA/NEA International Reporting System for Operating Experience (IRS); and the
- Fuel Incident Analysis and Notification System (FINAS).

19.38. The above 3 paragraphs illustrate the range of data that ONR has to analyse and, where necessary, challenge information provided by licensees.

19.39. The Regulatory Intelligence Sub-Programme within ONR has three strategic objectives to facilitate;

- improvements in ONR Regulatory Strategy, interventions and organisational learning.
- improvements in licensee safety performance.
- Open, honest and transparent communications with internal and external stakeholders.

19.39. ONR reports incidents to the public through two routes, both of which are available on its web site. Nationally, it publishes a quarterly statement of any incidents that meet HSE Publication Criteria, listed above. Locally, ONR includes incident reports in the quarterly reports that it makes to the Site Stakeholder Groups of each nuclear licensed site. These committees comprise members of local government, together with the emergency services and representatives of local communities. Meetings are open to the public. Such incident reports indicate, as appropriate, the circumstances of the incident, the action taken or being taken by ONR together with any remedial actions being planned or taken by the relevant licensee. The Site Stakeholder Groups reports also cover HSE's wider regulation and activities on the particular site for the quarter in question.

19.40. In response to public FOI requests, ONR has placed on its web site, the dates, relevant site names, INES ratings and descriptions of many civil incidents which have attracted INES ratings of 0 or above since 2001. ONR's last report to the Convention recorded a total of eight events from 2001 to October 2009 that were categorised at INES level 2. These included one provisional rating and three events at Sellafield. The three Sellafield INES Level 2 events plus one Level 3 event are not applicable to this Convention. Taking account of the data now available, the total number of civil reactor events at INES Level 2 or above between 2001 and December 2012 remains five, although some of these data remain under review.

19.41. The UK is a signatory to the 1986 IAEA Convention on 'Early Notification of a Nuclear Accident' which requires notifying the IAEA when "...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". DECC is the UK competent authority and provides contact points for issuing and receiving notification and information on any nuclear accidents arising from nuclear power plants.

Analysis of operating experience by Licensees

19.42. Operational matters that may affect safety on sites and which are identified during operation or during maintenance, inspection or testing are notified, recorded, investigated and reported as required by LC7. 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 by licensees. The operational records required under LC25 not only demonstrate to the regulators compliance with site licence and other regulatory requirements, but also constitute part of the plant history that operators need to make safety and commercial judgements. For example, the results of routine examinations of the plant under LC28 may be used to justify a change to the interval between maintenance, or a change from preventive maintenance to condition-based maintenance.

19.43. The licensees' arrangements for investigation of plant events include requirements for the impact on other installations and operators to be considered in off-site reporting, and regular reviews of such reports by all nuclear installation licensees. The outcome of this review could be dissemination of a plant event on one installation with a requirement on each other installation to assess and report formally on its impact on their plant.

19.44. An analysis of operating experience is a key part of the periodic safety reviews (PSRs) that are required under LC15. A major main review must be performed by the licensees every 10 years, but other reviews also take place before start-up after periodic shutdowns.

19.45. ONR is responsible for publication of the results of its regulatory activities (such as the assessment of licensees' PSRs) and international reporting of events. ONR brings to the attention of licensees any international events of significance. Licensees distribute information through the World Association of Nuclear Plant Operators (WANO) and other organisations, which also provide international experience relevant to UK operators.

19.46. Examples of well-developed performance, based on WANO performance objectives criteria, build on the incident reporting systems described above. These include:

- the establishment of high standards of performance amongst licensee staff and securing their commitment to implement an OEF programme;

- reporting incidents and near misses in a timely manner to prevent the reoccurrence of similar events; and
- appropriately screening and prioritising incidents and near misses to determine those that require action.

Radioactive waste

19.47. Licence Condition 34 (Leakage and escape of radioactive material and radioactive waste) requires radioactive material or waste to be controlled and contained so that it does not leak or escape, except in compliance with discharges granted by the environmental regulators. Licensees have to demonstrate to the satisfaction of regulator that this is the case. Any leak or escape must be notified, recorded, investigated and reported, as required by the arrangements made under LC7. Each site has a discharge authorisation issued by the appropriate environment agency. The licensee must demonstrate how it complies with such authorisations.

19.48. LC4 (Restriction of Nuclear Matter on the Site) requires that there must be adequate arrangements for the storage of nuclear matter (which includes radioactive waste generated on the site). In addition, ONR, the Environment Agency and SEPA have published relevant guidance on this topic (Ref. 92). These Arrangements are to ensure that intermediate level waste (ILW) is managed in a sustainable way, taking account of long-term environmental considerations.

19.49. LC32 (Accumulation of radioactive waste) requires that, as far as is reasonably practicable, the rate of production and the total quantity of radioactive waste on the site at any one time is minimised. The quantity, type and form of the radioactive waste accumulated or stored may be subject to limitations specified by ONR. ONR's assessment of PSRs includes consideration of radioactive waste management and associated safety cases. The regulation of such accumulation of radioactive waste is undertaken using licence conditions (see paragraph 19.50 above) at least as stringently as it would if it were subject to RSA93 and EPR10. For example, as part of its integrated intervention strategies, ONR requires and influences the licensees to reduce the volume of disposable radioactive waste stored on sites if it is judged that accumulations are excessive. ONR also requires the licensees to improve storage arrangements for radioactive wastes if the existing arrangements are not judged to be adequate.

19.50. LC33 (Disposal of radioactive waste) requires the disposal of radioactive waste to be in accordance with an Authorisation granted under RSA93 in Scotland and EPR10 in England and Wales. Hence, discharges of liquid and gaseous radioactive waste, and disposals of solid waste, are regulated by conditions and limitations attached to an Authorisation or Environmental Permit granted by the appropriate regulatory body under RSA93 and EPR10. These authorisations or permits also require that operators use Best Practicable Means (BPM) or Best Available Techniques (BAT), respectively, to minimise the creation of radioactive waste.

19.51. In the UK, regulation under RSA93 and EPR10 is a devolved matter. Therefore, there are three regulatory authorities in the UK that have responsibility for issuing authorisations under RSA93 or permits under EPR10 for disposals of radioactive wastes. These authorities are: the Environment Agency, for disposals made in, or from sites in England and in Wales, Natural Resources Wales; Scottish Environment Protection Agency, for disposals made in, or from sites, in Scotland. In addition, the Food Standards Agency is consulted with regard to the potential impact of discharges on food safety.

19.52. Authorisations or permits for nuclear licensed sites granted by the environment agencies generally set annual limits on the discharge of specific radionuclides, or groups of radionuclides. Authorisations and permits also require operators to use BPM/BAT to minimise the activity of wastes requiring disposal, the activity of wastes discharged to the environment (and their radiological impact), and the volume of wastes transferred to other premises. Notification levels, requiring operators to explain elevated discharges (that are still below the limits) are used to reinforce these requirements. Further authorisation/permit requirements include those covering monitoring of discharges and the surrounding environment plus management systems, plant maintenance and staff training relevant to the control of radioactive wastes.

19.53. The UK has a general policy of progressive and substantive reductions in radioactive discharges. In general, limits are set with minimum headroom above the level of actual discharges that would be consistent with "normal operation". In July 2009, the UK, Welsh, Scottish and Northern Ireland Governments jointly published a 'UK Strategy for Radioactive Discharges' to cover the period to 2030. In parallel, the Government published Statutory Guidance to the Environment Agency on the implementation of the Strategy. The Scottish Government published separate Guidance to SEPA in 2008. The UK's Strategy also forms its national plan for meeting its obligations under the OSPAR Convention.

19.54. Information on radioactive discharges, and on the disposal of solid radioactive waste, is provided in the UK's fourth national report for the Joint Convention.

ANNEXES

Annex 1 - UK Civil Nuclear Power Stations - Key Parameters

Nuclear Installation	Calder Hall	Wylfa	Dungeness B	Hartlepool	Heysham 1	Heysham 2
Licensee	SL	MNL	EDF NGL	EDF NGL	EDF NGL	EDF NGL
Reactor type	Magnox	Magnox	AGR	AGR	AGR	AGR
No. of reactors	4	1971	2	2	2	2
1st Power Operation	1956	1640	1983	1983	1983	1988
Reactor Thermal Power (MWth)	268	400	1500	1500	1500	1550
Electrical Gen. Power (MWe)	60	430	615	655	625	680
Sent off site (MWe)	50	475	520	595	585	615
Nuclear fuel	U metal	U metal	UO2	UO2	UO2	UO2
Fuel cladding	Magnox	Magnox	S. Steel	S. Steel	S. Steel	S. Steel
Nuclear moderator	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
Reactor core						
Fuel channels	1696	6156	408	324	324	332
Assemblies per channel	6	8	7	8	8	8
Fuel pins /assembly	-	-	36	36	36	36
Coolant	CO2	CO2	CO2	CO2	CO2	CO2
Coolant containment	Steel PV	PCPV	PCPV	PCPV	PCPV	PCPV
Coolant pressure (Bar)	7	27.6	34	42	42	43
Coolant max. temp (^{o}C)	345	370	673	675	651	635
Steam turbine inlet pressure (Bar)	15.5	35	163	163	163	159
Steam turbine inlet temp. (^{o}C)	329	320	555	538	538	538
Gross electrical power (MWe)	240	500	1230	1310	1250	1360

Key:

ML	Magnox Ltd		
EDF NGL	Electricite de France Energy Nuclear Generation Ltd		
U metal	Natural Uranium Rods	UO2	Enriched Uranium Oxide Pellet
Steel PV	Welded Steel Pressure Vessel	PCPV	Pre-stressed concrete pressure vessel

For the AGRs there is one fuel assembly per channel consisting of 8 elements; the table indicates the number of pins per element

Annex 1 - continued

Nuclear Installation	Hinkley Point B	Hunterston B	Oldbury on Severn	Sizewell A	Sizewell B	Torness
Licensee	EDF NGL	EDF NGL	ML	ML	EDF NGL	EDF NGL
Reactor type	AGR	AGR	Magnox	Magnox	PWR	AGR
No. of reactors	2	2	2	2	1	2
1st Power Operation	1976	1976	1967	1966	1995	1988
Reactor Thermal Power (MWth)	1494	1496	730	1010	3425	1623
Electrical Gen. Power (MWe)	655	644	230	245	1250	682
Sent off site (MWe)	430	430	217	210	1188	600
Nuclear fuel	UO2	UO2	U metal	U metal	UO2	UO2
Fuel cladding	S. Steel	S. Steel	Magnox	Magnox	Zr-4	S. Steel
Nuclear moderator	Graphite	Graphite	Graphite	Graphite	Water	Graphite
Reactor core						
Fuel channels	308	308	3308	3784	-	332
Assemblies per channel	8	8	8	7	193	8
Fuel pins /assembly	36	36	-	-	264	36
Coolant	CO2	CO2	CO2	CO2	Water	CO2
Coolant containment	PCPV	PCPV	PCPV	Steel PV	Steel PV	PCPV
Coolant pressure (Bar)	42	40	27	19.6	158	42.3
Coolant max. temp (^{o}C)	655	639	365	360	323	635
Steam turbine inlet pressure (Bar)	163	163	27	46.4	67	163
Steam turbine inlet temp. (^{o}C)	495	538	350	354	283	538
Gross electrical power (MWe)	1310	1288	460	490	1250	1364

Key:

ML	Magnox Ltd	SL	Sellafield Ltd
EDF NGL	Electricite de France Energy Nuclear Generation Ltd		
U metal	Natural Uranium Rods	UO2	Enriched Uranium Oxide Pellet
Steel PV	Welded Steel Pressure Vessel	PCPV	Pre-stressed concrete pressure vessel

For the AGRs there is one fuel assembly per channel consisting of 8 elements; the table indicates the number of pins per element

Annex 2 - Extracts from HSWA74 relevant to the Convention

Section 2 places the following duties on employers to their employees:

(1) It shall be the duty of every employer to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all his employees.
(2) Without prejudice to the generality of an employer's duty under the preceding subsection, the matters to which that duty extends include in particular -

(a) the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;
(b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;
(c) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of his employees;
(d) as far as is reasonably practicable as regards any place of work under the employer's control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks;
(e) the provision and maintenance of a working environment for his employees that is, so far as is reasonably practicable, safe, without risks to health, and adequate as regards facilities and arrangements for their welfare at work.

Under Section 3 employers have the following duties to persons other than their employees:

(1) It shall be the duty of every employer to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not exposed to risks to their health or safety.
(2) It shall be the duty of every self-employed person to conduct his undertaking in such a way as to ensure, so far as is reasonably practicable, that he and other persons (not being his employees) who may be affected thereby are not thereby exposed to risks to their health or safety.
(3) In such cases as may be prescribed, it shall be the duty of every employer and every self-employed person, in the prescribed circumstances and in the prescribed manner, to give to persons (not being his employees) who may be affected by the way in which he conducts his undertaking the prescribed information about such aspects of the way in which he conducts his undertaking as might affect their health or safety.

Section 7 places general duties on employees:

(a) to take reasonable care of the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and
(b) as regards any duty or requirement imposed on his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with.

Section 8 places a duty on persons not to interfere with or misuse things provided pursuant to certain provisions:

'No person shall intentionally or recklessly interfere with or misuse anything provided in the interests of health, safety or welfare in pursuance of any of the relevant statutory provisions.'

Section 14 gives powers to investigate and make a special report on any accident, occurrence, situation or other matter.

Section 15 allows health and safety regulations to be made that:

repeal or modify any existing statutory provisions;

impose requirements for approval by a specified body or person;

provide for exemptions from any requirement or prohibition imposed by or under any of the relevant statutory provisions.

Section 16: allows, for the purpose of providing practical guidance on meeting the HSWA74 Regulations made under the Act and of the relevant statutory provisions, the issuing of codes of practice.

Section 19: allows the enforcing authority to appoint as inspectors such persons having suitable qualifications as it thinks necessary for carrying into effect the relevant statutory provisions within its field of responsibility. Every appointment of a person as an inspector must be made by an instrument in writing specifying which of the powers conferred on inspectors by the relevant statutory provision are to be exercisable by the person appointed.

Section 20 gives an inspector the following powers:

(1) ……for the purpose of carrying into effect any of the relevant statutory provisions within the field of responsibility of the enforcing authority which appoints him, exercise the powers set out in subsection (2) below.

(2) ….., namely -

(a) at any reasonable time (or, in a situation which in his opinion is or may be dangerous, at any time) to enter any premises which he has reason to believe it is necessary for him to enter for the purpose mentioned in subsection (1) above;

(b) to take with him a constable if he has reasonable cause to apprehend any serious obstruction in the execution of his duty;

(c) without prejudice to the preceding paragraph, on entering any premises by virtue of (a) above to take with him -

(i) any other person duly authorised by his (the inspector's) enforcing authority; and

(ii) any equipment or materials required for any purpose for which the power of entry is being exercised;

(d) to make such examination and investigation as may in any circumstances be necessary for the purpose mentioned in subsection (1) above;

(e) as regards any premises which he has power to enter, to direct that those premises or any part of them, or anything therein, shall be left undisturbed (whether generally or in particular respects) for so long as is reasonably necessary for the purpose of any examination or investigation under paragraph (d) above;

(f) to take such measurements and photographs and make such recordings as he considers necessary for the purpose of any examination or investigation under paragraph (d) above;

(g) to take samples of any articles or substances found in any premises which he has power to enter, and of the atmosphere in or in the vicinity of any such premises;

(h) in the case of any article or substance found in any premises which he has power to enter, being an article or substance which appears to him to have caused or to be likely to cause danger to health or safety, to cause it to be dismantled or subjected to any process or test (but not so as to damage or destroy it unless this is in the circumstances necessary for the purpose mentioned in subsection (1) above);

(i) in the case of any such article or substance as is mentioned in the preceding paragraph, to take possession of it and detain it for so long as is necessary for all or any of the following purposes, namely -

(i) to examine it and do to it anything which he has power to do under that paragraph;

(ii) to ensure that it is not tampered with before his examination of it is completed;

(iii) to ensure that it is available for use as evidence in any proceedings for an offence under any of the relevant statutory provisions or any proceedings relating to a notice under section 21 or 22;

(j) to require any person whom he has reasonable cause to believe to be able to give any information relevant to any examination or investigation under paragraph (d) above to answer (in the absence of persons other than a person nominated by him to be present and any persons whom the inspector may allow to be present) such questions as the inspector thinks fit to ask and to sign a declaration of the truth of his answers;

(k) to require the production of, inspect, and take copies of or any entry in -

(i) any books or documents which by virtue of any of the relevant statutory provisions are required to be kept; and

(ii) any other books or documents which it is necessary for him to see for the purposes of any examination or investigation under paragraph (d) above;

(l) to require any person to afford him such facilities and assistance with respect to any matter or things within that person's control or in relation to which that person has responsibilities as are necessary to enable the inspector to exercise any of the powers conferred on him by this section;

(m) any other power which is necessary for the purpose mentioned in subsection (1) above."

Section 21 gives an inspector the power to serve improvement notices.

Section 22 gives an inspector the power to serve prohibition notices.

Section 25 gives an inspector the power to deal with cause of an imminent danger

Section 28 places restrictions on the disclosure of information.

Section 39 gives an inspector the power in England and Wales to prosecute before a magistrates' court proceedings for an offence under any of the relevant statutory provisions.

Annex 3 - Extracts from NIA65 relevant to the Convention

Sections 1, 3 to 6, 22 and 24A of NIA65 are relevant statutory provisions of HSWA74. The parts of each of these sections relevant to this Convention are:

Section 1 restricts certain nuclear installations to licensed sites:

(1) Without prejudice to the requirements of any other Act, no person shall use any site for the purpose of installing or operating

(a) any nuclear reactor (other than such a reactor comprised in a means of transport, whether by land, water or air)

unless a licence so to do (a 'nuclear site licence') has been granted in respect of that site by the HSE and is for the time being in force.

Section 3 concerns the granting and variation of nuclear site licences:

(1) A nuclear site licence shall not be granted to any person other than a body corporate and shall not be transferable.

(1A) The HSE shall consult the appropriate Agency [the Environment Agency in England and Wales and the Scottish Environment Protection Agency (SEPA) in Scotland] before granting a nuclear site licence in respect of a site in Great Britain.

(2) Two or more installations in the vicinity of one another may, if the HSE thinks fit, be treated for the purposes of the grant of a nuclear site licence as being on the same site.

(6) The HSE may from time to time vary any nuclear site licence by excluding there from any part of the licensed site -

(a) which the licensee no longer needs for any use requiring such a licence; and

(b) with respect to which the HSE is satisfied that there is no danger from ionising radiations from anything on that part of the site.

(6A) The HSE shall consult the appropriate Agency [Environment Agency or SEPA] before varying a nuclear site licence in respect of a site in Great Britain if the variation relates to or affects the creation, accumulation or disposal of radioactive waste, within the meaning of the Radioactive Substances Act 1993."

Section 4 allows HSE to attach conditions to licences:

(1) The HSE by instrument in writing shall on granting any nuclear site licence, and may from time to time thereafter, attach to the licence such conditions as may appear to the HSE to be necessary or desirable in the interests of safety, whether in normal circumstances or in the event of any accident or other emergency on the site, which conditions may in particular include provision -

(a) for securing the maintenance of an efficient system for detecting and recording the presence and intensity of any ionising radiations from time to time emitted from anything on the site or from anything discharged on or from the site;

(b) with respect to the design, siting, construction, installation, operation, modification and maintenance of any plant or other installation on, or to be installed on, the site;

(c) with respect to preparations for dealing with, and measures to be taken on the happening of, any accident or other emergency on the site;

(d) without prejudice to Sections 13 and 16 of the Radioactive Substances Act (Ref. 41), with respect to the discharge of any substance on or from the site.

(2) The HSE may at any time by instrument in writing attach to a nuclear site licence such conditions as the HSE may think fit with respect to the handling, treatment and disposal of nuclear matter.

(3) The HSE may at any time by a further instrument in writing vary or revoke any condition for the time being attached to a nuclear site licence by virtue of this section.

(3A) HSE shall consult the appropriate Agency [Environment Agency or SEPA]

(a) before attaching any condition to a nuclear site licence in respect of a site in Great Britain or

(b) before varying or revoking any condition attached to such a nuclear site licence,

if the condition relates to or affects the creation, accumulation or disposal of radioactive waste, within the meaning of the Radioactive Substances Act 1993.

(5) At all times while a nuclear site licence remains in force, the licensee shall cause copies of any conditions for the time being in force under this section to be kept posted upon the site, and in particular on any part thereof which an inspector may direct, in such characters and in such positions as to be conveniently read by persons having duties upon the site which are or may be affected by those conditions.

Section 5 deals with the revocation and surrender of licences:

(1) A nuclear site licence may at any time be revoked by the HSE or surrendered by the licensee.

(1A) HSE shall consult the appropriate Agency before revoking a nuclear site licence in respect of a site in Great Britain.

(2) Where a nuclear site licence has been revoked or surrendered, the licensee shall, if so required by the HSE, deliver up or account for the licence to such person as the HSE may direct, and shall during the remainder of the period of his responsibility cause to be kept posted upon the site such notices indicating the limits thereof in such positions as may be directed by an inspector; and the HSE may on revocation or surrender and from time to time thereafter until the expiration of the said period give to the licensee such other directions as the HSE may think fit for preventing or giving warning of any risk of injury to any person or damage to any property by ionising radiations from anything remaining on the site.

(3) In this Act, the expression 'period of responsibility' in relation to the licensee under a nuclear site licence means, as respects the site in question or any part thereof, the period beginning with the grant of the licence and ending with which ever of the following dates is the earlier, that is to say -

(a) the date when the HSE gives notice in writing to the licensee that in the opinion of the HSE there has ceased to be any danger from ionising radiations from anything on the site or, as the case may be, on that part thereof;

(b) the date when a new nuclear site licence in respect of a site comprising the site in question or, as the case may be, that part thereof is granted either to the same licensee or to some other person.

Section 6 refers to the maintenance of a list of licensed sites by the Secretary of State for Business, Enterprise and Regulatory Reform.

Section 22 refers to reporting of and inquires into dangerous occurrences:

(1) The provisions of this section shall have effect on the happening of any occurrence of any description as may be prescribed, being an occurrence -

(a) on a licensed site

(2) The licensee shall cause the occurrence to be reported forthwith in the prescribed manner to the HSE and to such other persons, if any, as may be prescribed in relation to occurrences of that class or description, and if the occurrence is not so reported the licensee shall be guilty of an offence.

Section 24A covers the recovery of expenses by the HSE.

Annex 4 - The Environmental Regulatory Bodies

A4.1 This Annex provides further information to that supplied in Article 8 on the regulators that enforce environmental regulation in the UK.

Environment Agency

(i) Mandate and duties

A4.2 The Environment Agency was created by the Environment Act 1995 (EA95) (Ref. 25) with the aim of providing a more integrated approach to protecting and improving the environment of England as a whole – land, air and water. It is a 'non-departmental public body', sponsored largely by DEFRA. Its powers and duties relate to environmental protection, flood defence, water resources, fisheries, recreation, conservation and navigation. The Environment Act sets out the principal aim of the Environment Agency "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"..

A4.3 As a modern regulator, the Environment Agency uses approaches based on assessing environmental risks to ensure society and the environment reap the maximum possible benefits. In targeting its resources at the highest environmental risks and the poorest performing operators, it has developed outcome-focused and risk-based approaches to regulation that are communicated clearly and delivered in a consistent manner.

A4.4 The Environment Agency works in partnership with the nuclear industry to develop and implement new approaches to regulation and recognise and reward good environmental performance. A good example of this is its Nuclear Sector Plan that outlines eight environmental objectives for the nuclear sector; voluntary activities which will be carried out by the industry, over and above their statutory responsibilities; and areas where it has agreed to improve its work as an environmental regulator.

A4.5 The Environment Agency follows the principles for a modern regulator as set out by the Better Regulation Taskforce:

- Transparent - with clear rules and processes
- Accountable - the Environment Agency will explain its performance
- Consistent - the same approach will be applied within and across sectors
- Proportionate - resources will be allocated according to environmental risk
- Targeted - the desired environmental outcome will be central to our planning
- Regulations must be practicable

(ii) Structure

A4.6 The Environment Agency has a board of up to 15 members, including the Chairman and Chief Executive, who are accountable to Government Ministers for the Environment Agency's organisation and performance. All are appointed by the Secretary of State for Environment, Food and Rural Affairs. The Board delegates the Environment Agency's day-to-day management to its Chief Executive and staff.

A4.7 For most of its activities, the Environment Agency has broken down its work between seven geographical regions. In each region, three statutory committees advise the Environment Agency about the operational performance of its functions, regional issues of concern and regional implications of national policy proposals. These committees are the Regional Fisheries, Ecology and Recreation Advisory Committee (RFERAC), Regional Flood Defence Committee (RFDC) and the Regional Environment Protection Advisory Committee (REPAC).

A4.8 Committee members are appointed under statutory membership schemes designed to achieve representation from a wide range of the Environment Agency's stakeholders. All REPAC meetings are advertised locally and the public is welcome to attend.

A4.9 Following a reorganisation in mid-2002, the Environment Agency has established two specialist groups (North and South) to carry out the regulation of radioactive waste disposals, including discharges of liquid and gaseous wastes on and off nuclear licensed sites, and radioactive waste management on other sites. Associated with the northern group are two assessment teams providing national support on solid waste disposal and on generic designs of potential new nuclear reactors. Similarly, associated with the southern group, there is a small team providing national support on radiation incident management. The national groups, working within the Environment Agency's head office, include the Radioactive Substances Regulation Policy and Process Group, and the group responsible for checking, monitoring and assessment of discharges to the environment. The Environment Agency and the Food Standards Agency liaise closely to ensure that their environmental monitoring programmes in England and Wales are appropriate. Annual results from the environmental monitoring programme in the UK are published jointly by the environment agencies, the FSA and the Environment and Heritage Service for Northern Ireland in a report entitled 'Radioactivity in Food and the Environment' (RIFE) (Ref. 93) .

(iii) Financial resources

A4.10 The Environment Agency has a total budget of approximately £1200 million, over half of which is spent on flood defence and £367 million on Environment Protection. Income is derived chiefly from three sources:

(a) Income raised from charging for regulation
(b) Flood defence levies
(c) Government grants, which help to finance amongst other things, pollution prevention and control activities

A4.11 The Environment Agency charges operators for its nuclear regulatory activities on the basis of a daily rate for inspectors. This rate is reviewed annually. The Environment Agency also recharges operators for monitoring it carries out. Annual charges for nuclear regulatory work and monitoring activities are approximately £7 million.

(iv) Human resources

A4.12 The Environment Agency has a total of over 13,000 staff, although only a small proportion of these are involved in nuclear regulation. The North and South nuclear regulatory groups have a total of around 45 technical staff, with additional administrative support. The other groups identified above involved with nuclear regulatory activities comprise approximately a further 20 technical staff.

(v) Inspectors' qualifications

A4.13 Nuclear regulatory staff recruited by the Environment Agency are required to have a good honours degree in science or engineering, and several years experience in a technical or management role in the nuclear industry.

(vi) Inspectors' training

A4.14 The Environment Agency has established standards of competency for its staff involved with the regulation of radioactive substances. Competence standards for nuclear regulation are separately identified within the overall framework.

A4.15 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.

A4.16 Developing the competences of staff is achieved by combination of structured training (for example on legal requirements) and developmental experience (for example on site inspection or issuing Enforcement Notices). The system adopted by the Environment Agency 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

(i) Mandate and duties

A4.17 The Scottish Environment Protection Agency was set up by EA95 to provide environmental protection and improvement in Scotland. Powers under the Radioactive Substances Act 1993 (RSA93) (Ref. 41) are a matter for the devolved administrations in the UK, including the Scottish Government. SEPA is a 'non-departmental public body' whose main source of funding is from Grant in Aid provided by the Scottish Government.

A4.18 Using its statutory powers, SEPA issues various permits, licences, consents and registrations, ranging from major industrial authorisations, such as a licence to abstract water from rivers, down to recreational ones such as fishing licences.

A4.19 SEPA's main aim is to provide an efficient and integrated environmental protection system for Scotland which will both improve the environment and contribute to the Scottish Ministers' goal of sustainable development.

A4.20 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.

A4.21 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.

A4.22 In Scotland, the FSA and SEPA liaise closely together to ensure that the environmental monitoring programme for radioactivity is appropriate. Annual results from the environmental monitoring programme in the UK are published jointly by the environment agencies, the FSA and the Environment and Heritage Service for Northern Ireland in a report entitled 'Radioactivity in Food and the Environment' (RIFE) (Ref. 93).

(ii) Structure

A4.23 Legally, the Agency 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 the Scottish Ministers and membership of the Board includes a Chief Executive to whom is delegated the day-to-day management of SEPA. The Board has ultimate responsibility for the organisation. It meets regularly and is specifically concerned to:

a. establish the overall strategic direction of the organisation within the policy and resources framework agreed with the responsible Minister;
b. oversee the delivery of planned results by monitoring performance of the organisation against agreed objectives and targets;

c. ensure that SEPA operates sound environmental policies in relation to its own operations;
d. demonstrate high standards of corporate governance at all times; and
e. ensure that statutory requirements for the use of public funds are complied with.

A4.24 SEPA has two specialist teams dealing with the radioactive waste disposals from nuclear sites in Scotland. The Environmental Protection and Improvement Unit covers the day-to-day regulatory activities such as issuing authorisations, inspection, enforcement etc. The Policy Unit covers more strategic matters such as liaison with Government or other bodies, influencing the development of forthcoming policy or legislation. This Unit is also responsible for managing part of the UK's RIMNET in Scotland and leads on environmental monitoring such as the collection and assessment of samples. In all there are 20.5 technical staff dealing with radioactive substances, the majority of whom have some involvement in matters relating to nuclear sites.

(iii) Financial resources

A4.25 SEPA's income is derived chiefly from three sources:

(a) Income raised from charging for regulation
(b) Government grant-in-aid, which helps to finance amongst other things, pollution prevention and control activities
(c) Other sources (like financial agreements with NDA for work for its Radioactive Waste Management Directorate (RWMD)

A4.26 SEPA charges operators for its nuclear regulatory activities on the basis of a daily rate for an inspector, which includes an appropriate overhead allowance. The prices for all SEPA charging schemes is updated annually by the Retail Price Index. In the event that SEPA prices have to increase by more than the Retail Price Index, or a scheme requires other changes, a public consultation is held. All changes which have been the subject of consultation have to be approved by the Scottish Minister before SEPA can implement them.

(iv) Human resources

A4.27 SEPA has approximately 1250 staff, around 17 of whom are involved in nuclear site regulation.

(v) Inspectors' qualifications

A4.28 Nuclear regulatory staff recruited by the Agency are required to have a degree in a relevant discipline.

(vi) Inspectors' training

A4.29 SEPA has established standards of competency for its staff involved with the regulation of radioactive substances. Competence standards for nuclear regulation are separately identified within the overall framework.

A4.30 SEPA's grading structure for regulatory staff starts at trainee Environmental Protection Officer (EPO). Trainee EPOs are required to complete a training programme in order to progress onto Environmental Protection Officer grade. This will include training in general inspection techniques, evidence gathering and enforcement etc. Thereafter EPOs can progress to a more general promoted post as Senior EPOs or move into a specialist area.

A4.31 Specialist staff regulating nuclear facilities, who are normally recruited from outside SEPA, are required to have minimum of 3 years (Specialist 2 grade) technical or scientific professional experience upon appointment but the majority have at least 5 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

A4.32 From 1 April 2013, Natural resources Wales (NRW) became responsible for the enforcement of environmental protection in Wales and is sponsored by the Welsh Government. Although NRW took over the EA's responsibilities in Wales for regulating radioactive substances, including the disposal of solid radioactive waste from nuclear licensed sites and non-nuclear premises that use radioactive substances. The regulatory function in these areas will continue to be delivered in Wales for the time being by the EA on behalf of and under agreement with NRW thus ensuring continuity of effective regulation in these areas while NRW develops its own expertise. The non-nuclear regulatory function will in due course be delivered by NRW. Nuclear regulation is expected to continue to be delivered in Wales by the EA on behalf of NRW for the foreseeable future.

Annex 5 – ONR's Safety Assessment Principles

Background

A5.1 HSE inspectors use the Safety Assessment Principles (SAPs) (Ref. 43), together with the supporting Technical Assessment Guides, to guide regulatory decision making in the nuclear permissioning process. Underpinning such decisions is the legal requirement on nuclear site licensees to reduce risks so far as is reasonably practicable, and the use of these SAPs should be seen in that context.

A5.2 The principles were first published in 1979 for nuclear power reactors. Corresponding principles for nuclear chemical plants followed in 1983. The principles were amended in 1988, following a recommendation by Sir Frank Layfield arising from the Sizewell B inquiry (Ref. 69). He also recommended that HSE should publish for discussion its thinking on risk assessment.

A5.3 In 1992, the SAPs underwent a thorough revision with the objectives of:

a) consolidating the revisions made as a result of the recommendations of the Sizewell B inquiry;

b) implementing lessons learned since first publication;

c) ensuring greater consistency with international criteria (IAEA Safety Standards, Codes and Guides);

d) implementing suggestions made in HSE's 'The tolerability of risk from nuclear power stations' paper (1988) and also in its 1992 revision (Ref. 94); and

e) combining nuclear power reactor and nuclear chemical plant principles.

A5.4 Since that review, experience in their use and developments in the field of nuclear safety, both internationally and in the UK, have led to the need to undertake a further thorough revision of the principles.

A5.5 The revision of SAPS took into account revisions made to the IAEA safety standards. IAEA Requirements are explicit in requiring a regulatory body to keep its principles, regulations and guidance under review from time to time, taking account of internationally endorsed standards and recommendations. ONR agrees with this need for periodic review. The edition of the SAPs, published in 2006, is the result of such a review and has included benchmarking against the IAEA standards, as they existed in 2004. It should eb noted that the UK's goal-setting legal framework for health and safety does not apply IAEA requirements in a prescriptive manner, but they are reflected within the newly revised SAPs.

A5.6 Following the Fukushima Dai-ichi accident ONR recognised the need for revision of its SAPs. A project is currently underway to carry out this review. The process has not revealed any significant gaps but has identified areas where further clarification and/or amplification of principles would be beneficial.

A5.7 ONR is a member of WENRA, which is dedicated to ensuring that all EU Member States and candidate countries with civil nuclear power stations, as well as Switzerland have harmonised high levels of nuclear safety. To this end, WENRA has developed reference levels that represent good practices for civil NPPs and for radioactive waste management and decommissioning. Harmonisation requires there to be no substantial differences from the safety point of view in generic, formally issued, national safety goals, and in their resulting implementation on nuclear power station licensed sites. In the UK, the reference levels are secured using a combination of: national laws; health and safety regulations; conditions attached to nuclear site licences; the SAPs and the associated TAGs and other forms of guidance used when granting nuclear site licences and in regulating licensees' activities.

A5.8 In addition, a significant proportion of assessment work is directed towards the PSR of older facilities, decommissioning and radioactive waste management. The 1992

SAPs, with their focus on design, were not readily suited to these applications and complementary guidance had to be created. This current version of the SAPs, while remaining applicable to new nuclear facilities, makes greater provision for decommissioning and radioactive waste management, and is also clearer in its application to safety cases related to existing facilities.

In 2001 HSE built upon its work on 'The tolerability of risks from nuclear power stations' with its publication 'Reducing risk, protecting people: HSE's decision making process' (known as R2P2) (Ref. 62). This further explains HSE's decision making process, and has been supported by guidance on the principle that risks should be ALARP. There were, however, aspects of societal concerns specific to the nuclear context that were not addressed in R2P2 specifically. ONR therefore provided additional guidance in these areas in its TAG on the principle of ALARP. This and other TAGs provide further interpretation of the principles and guidance in their application.

Introduction

The purpose of the Safety Assessment Principles (SAPs)

A5.9 The SAPs apply to the assessment of safety cases for nuclear facilities that may be operated by potential licensees, existing licensees, or other duty holders. The term 'safety case' is used throughout the document to encompass the totality of a licensee's (or duty holder's) documentation to demonstrate high standards of nuclear safety and radioactive waste management, and any sub-set of this documentation that is submitted to ONR.

A5.10 The principles presented in the SAPs relate only to nuclear safety and radioactive waste management. Other conventional hazards are excluded, except where they have a direct effect on nuclear safety or radioactive waste management. The use of the word 'safety' within the document should therefore be interpreted accordingly.

A5.11 The SAPs provide ONR inspectors with a framework for making consistent regulatory judgements on nuclear safety cases. The principles are supported by TAGs, and other guidance, to further assist decision making by the nuclear safety regulatory process. In most cases the SAPs are guidance to inspectors, but some reflect legal requirements and hence may incorporate mandatory elements. The SAPs also provide nuclear site duty holders with information on the regulatory principles against which their safety provisions will be judged. Given the non-prescriptive nature of the UK's nuclear regulatory system, the SAPs are not intended to be used as design standards. The nuclear duty holders need to demonstrate that they satisfy the intent of the SAPs directly or by equivalent means.

SFAIRP, ALARP and ALARA

A5.12 The SAPs are consistent with R2P2, which provides an overall framework for decision making to aid consistency and coherence across the full range of risks falling within the scope of the HSWA74. This extended the framework detailed in the Tolerability of Risk (TOR). R2P2 discusses the meaning of risk and hazard and explains the distinction HSE makes between the terms. Hazard is the potential for harm from an intrinsic property or disposition of something that can cause detriment, and risk is the chance that someone or something is adversely affected in a particular manner by the hazard. The SAPs use these definitions. HSE regards anything that presents the possibility of danger as a 'hazard'. The relative importance of likelihood and consequence in determining control measures may vary. In some circumstances, particularly where the consequences are very serious or knowledge of the likelihood is very uncertain, HSE and ONR may choose to concentrate solely on the consequences to which the hazard could lead.

A5.13 R2P2 describes risks that are unacceptably high and the associated activities would be ruled out unless there are exceptional reasons, and also the risks that are so low that they may be considered broadly acceptable and so no further regulatory pressure to reduce risks further need be applied. However, the legal duty to reduce risk so far as is reasonably practicable (SFAIRP) applies at all levels of risk and also extends below the broadly acceptable level. Both R2P2 and TOR set out indicative numerical risk levels, but the requirement to meet relevant good practice in engineering and operational safety management is of prime importance.

A5.14 In applying the TOR framework, the term 'as low as reasonably practicable' (ALARP) has been introduced: for assessment purposes, the terms ALARP and SFAIRP are interchangeable and require the same tests to be applied. ALARP is also equivalent to the phrase 'as low as reasonably achievable' (ALARA) used by other bodies nationally and internationally.

A5.15 The SAPs assist inspectors in the judgement of whether, in their opinion, the duty holder's safety case has satisfactorily demonstrated that the requirements of the law have been met. The guidance associated with each principle gives further interpretation on their application.

A5.16 The basis for demonstrably adequate safety is that the normal requirements of good relevant practice in engineering, operation and safety management are met. This is a fundamental requirement for safety cases. In addition, this is expected to be supported by a demonstration of how risk assessments have been used to identify any weaknesses in the facility design and operation, showing where improvements were considered and to demonstrate that safety is not unduly reliant on a small set of particular safety features. A number of numerical targets are included in the SAPs, and some of these embody specific statutory limits that must be met.

A5.17 The principles are used in judging whether risks are reduced ALARP and that is why they are written using 'should' or similar language. Priority should be given to achieving an overall balance of safety, rather than satisfying each principle or making an ALARP judgement against each principle. The principles themselves should be applied in a reasonably practicable manner. The judgement using the principles in the SAPs is always subject to consideration of ALARP. This has not been stated in each case to avoid repetition. ONR inspectors need to apply judgement on the adequacy of a safety case in accordance with ONR guidance on ALARP (Ref. 86).

A5.18 In many instances, it will be possible to demonstrate that the magnitude of the radiological hazard will result in doses that will be low, in relation to the legal limits, so that considerations of off-site effects or detailed worker risks will be unnecessary.

A5.19 The development of standards defining relevant good practice often includes ALARP considerations, so in many cases meeting these standards is sufficient to demonstrate that the legal requirement has been satisfied. In other cases, for example where standards and relevant good practice are less evident or not fully applicable or the demonstration of safety is complex, the onus is on the duty holder to implement measures to the point where it can demonstrate to ONR inspectors that the costs of any further measures would be grossly disproportionate to the risks their adoption would reduce.

A5.20 Consideration of whether risks are ALARP should be carried out comprehensively and balance the risks. This requires all applicable principles to be considered as a combined set. When judging whether risks have been reduced ALARP, it may be necessary to take account of conventional risks in addition to nuclear risks.

Application of the SAPs

General

A5.21 The SAPs contain principles and guidance. The principles form the underlying basis for regulatory judgements made by HSE inspectors, and the guidance associated

with the principles provides either further explanation of a principle, or their interpretation in actual applications and the measures against which judgements can be made.

A5.22 Not all of the principles in the SAPs apply to all assessments or every facility; clearly, principles specific to reactors do not apply to fuel-cycle facilities. Less obviously, not all of the reactor principles apply to all reactors: research reactors have significant differences from power reactors. Additionally, the assessment of a modification to a facility will only require the relevant principles to be applied. In short, the principles are a reference set from which the inspector needs to choose those to be used for the particular nuclear safety situation.

Proportionality

A5.23 The Management of Safety at Work Regulations (Ref. 37) and its Approved Code of Practice (ACoP) (Ref. 95) define three levels of risk assessment: low, intermediate and high. Nuclear installations are in the high category, which should use 'the most developed and sophisticated techniques'. However, there are a wide range of hazards associated with different facilities and activities on nuclear licensed sites. So, within the high category of assessment, the depth and rigour of the analysis required for nuclear facilities will vary considerably. This is consistent with HSE's Enforcement Policy Statement (Ref. 44) that the requirements of safety should be applied in a manner that is commensurate with the magnitude of the hazard. Therefore, the extent and detail of analyses undertaken by duty holders as part of a safety case, including their independent assessment and verification, need also to be commensurate with the magnitude of the hazards. Similarly, subject to other legal duties or public policy requirements, regulatory attention should also be commensurate with the magnitude of the hazard, although issues such as novelty and uncertainty will also be factors.

A5.24 Safety cases, and the analyses and assessments contained within them, must be fit for purpose and in accordance with the nuclear site licence condition requirements, and with Regulation 3 of the Management Regulations (Ref. 37).

a. They must, among other things, be suitable and sufficient for the purpose of identifying all measures to control the risk.

A5.25 Inspectors must be proportionate in what they require from duty holders. The higher the hazard, the more rigorous and comprehensive the analysis which would be expected to lead to greater defence–in-depth to protect people. Therefore a low hazard facility may only require a much more limited analysis to ensure adequacy. This may well be expected to result in fewer or less extensive safety provisions.

A5.26 In some cases, the magnitude of the potential radiological hazard may be uncertain. In these cases, a precautionary approach should be applied, erring on the side of safety. Where the absence of a radiological hazard cannot be shown, an assumption must be made of an appropriate radiological hazard and its magnitude.

Life-cycle

A5.27 The SAPs are for regulatory assessment throughout the life-cycle of an activity on a nuclear licensed site. Specific sections of the SAPs are devoted to siting and decommissioning. However, not every principle in the other sections will apply to all the other life-cycle stages, and as always, the principles are a reference set from which the inspector chooses those to be used for the particular stage in the life-cycle. The sections of the SAPs on Leadership and management for safety and the Regulatory assessment of safety cases include life-cycle issues. The Engineering principles are relevant to design, construction, manufacture and installation, but will also apply to later operational stages. Commissioning is a key stage in providing the necessary assurance of safety, and a number of the principles include aspects of commissioning. Decommissioning also needs to be considered at all life-cycle stages. IAEA Safety Standard NS-G-1.2 (Ref. 96) provides more detailed guidance for the assessment aspects to be considered at the main life-cycle stages.

New facilities

A5.28 One of the aims of the SAPs is the safety assessment of new (proposed) nuclear facilities. They represent HSE's view of good practice and we would expect modern facilities to have no difficulty in satisfying their overall intent.

Facilities built to earlier standards

A5.29 Inspectors will assess safety cases against the relevant SAPs when judging if a duty holder has demonstrated whether risks have been controlled to be ALARP. The extent to which the principles have been satisfied must also take into account the age of the facility or plant. For facilities that were designed and constructed to standards that are different from current standards, the issue of whether sufficient measures are available to satisfy ALARP considerations will be judged case by case.

A5.30 A common situation when the SAPs are applied to facilities built to earlier standards is in the assessment of a PSR as required by LC15. PSRs are a thorough and comprehensive review of the safety case at regular intervals throughout a nuclear facility's life. The reviews are more wide ranging than a restatement of the safety case (see IAEA Safety Standard NS-G-1.2 and SSG-25).

A5.31 For certain activities, such as decommissioning, it is recognised that some principles may not be met transiently, and this is allowable provided the result is to achieve a safer end-state. However, during this period, the requirement to reduce risks ALARP remains.

Ageing

A5.32 As a facility ages, plant safety margins may be eroded and a duty holder may argue that it is not worthwhile to make improvements. Remaining lifetime may be invoked in making the ALARP demonstration, but this factor should not be used to make a case for a facility to operate outside legal requirements. A minimum period of ten years, or the minimum future life of the facility if longer, should be used in ALARP demonstrations.

Remaining lifetimes of less than ten years will be subject to regulatory action to ensure that the declared lifetime is not extended beyond that assumed without further justification.

Multi-facility sites

A5.33 When considering the radiological hazards and risks posed by a nuclear site, all the facilities, services and activities on it need to be considered. In most cases, the SAPs are considered in relation to single facilities, and so the control of risks is also generally considered on a facility basis. However, there is a need to consider the totality of control of risks from a site. Two different situations arise: where all the facilities and services are under the control of a single licensee, covered by a single nuclear site licence, and where some of the facilities and services are on neighbouring sites, under the control of different duty holders. Many of the issues are similar.

A5.34 Sites that have multiple facilities often produce a set of individual safety cases for each facility. Shared services are also generally dealt with by separate cases. The division of the site in this way requires the definition of boundaries and interfaces between facilities, facilities and services, and services. It also requires an appropriate combination of the individual analyses to develop the site safety case. This is necessary to account for the interactions and interdependencies between facilities and services.

A5.35 Determining whether risks have been controlled and reduced ALARP therefore requires an overall consideration of the site and, in determining if good practices have been met, all risks need to be assessed. On a complex site there will be many different radiological hazards and risks that, in determining the necessary safety measures for the site, may need to be balanced in demonstrating that the overall risks are ALARP.

Alternative approaches

A5.36 The principles are written bearing in mind the content of safety cases likely to be submitted to HSE. However, duty holders may wish to put forward a safety case that differs from this expectation and, as in the past, the inspector will consider such an approach. In these cases the duty holder is advised to discuss the method of demonstration with HSE beforehand. Such cases will need to demonstrate equivalence to the outcomes associated with the use of the principles in the SAPs, and such a demonstration may need to be examined in greater depth to gain such an assurance. An example of such a situation is the greater use of passive safe concepts.

Structure of the principles

A5.37 The SAPs are structured in separate sections, as follows:

- Fundamental principles. These principles are founded in UK health and safety law and international good practice, and underpin all those activities that contribute to sustained high standards of nuclear safety.
- Leadership and management for safety. This section sets out principles that form the foundation for the leadership and management for safety in the nuclear environment.
- The regulatory assessment of safety cases. This section sets out the principles applicable to the assessment of the production and nature of safety cases.
- The regulatory assessment of siting. This section provides principles applied in the assessment of a site, since the nature of a site can have a bearing on accident consequences.
- Engineering principles. This section comprises the major part of this document and covers many aspects of the design and operation of nuclear facilities.
- Radiation protection. This section provides a link with IRR99.
- Fault analysis.
- Numerical targets and legal limits. This section sets out the targets to assist in making ALARP judgements.

- Accident management and emergency preparedness. This section provides the links to assessing compliance with licence conditions and REPPIR.
- Radioactive waste management.
- Decommissioning.
- Control and remediation of radioactively contaminated land.

Glossary and Abbreviations

ACoP	Approved Code of Practice
ADS	Approved Dosimetry Service
AGR	Advanced Gas-cooled Reactor
ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable - the ALARP principle is fundamental to the regulation of health and safety in the UK. It requires that risks should be weighed against the costs of reducing them. Measures must then be taken to reduce or eliminate the risks unless the cost of doing so is obviously unreasonable compared with the risk.
AP1000	Pressurised Water Reactor designed by Westinghouse
BAT	Best Available Technology
BCU	Boiler Closure Unit
BPM	Best Practicable Means
BSS	Basic Safety Standards (EC Directive 96/29/Euratom)
CCF	Common Cause Failure
CNO	Chief Nuclear Officer (BEGL)
COMAH	Control of Major Hazards Regulations 1999
Convention	Convention on Nuclear Safety
COO	Chief Operating Officer
DBA	Design Basis Accident
DEFRA	Department for Environment, Food and Rural Affairs
DECC	Department for Energy and Climate Change
DEPZ	Detailed emergency planning zone
DNSR	Defence Nuclear Safety Regulator - Under NIA65, nuclear activities under the control of the Crown are exempted from civil nuclear licensing requirements, although they are subject to regulation by HSE under HSWA74. DNSR is a department within the Ministry of Defence which exercises an internal regime for assessing the safety of defence-related nuclear activities, wherever possible using equivalent standards to those used by HSE for the regulation of licensed civil nuclear activities.
DWP	Department for Work and Pensions
EA95	The Environment Act 1995
EC	European Council
EDF	Electricite de France
EDF NGL	Electricite de France Nuclear Generation Limited
EH&S	Environment, Health and Safety
EHS&Q	Environment, Health , Safety and Quality
EHSS&Q	Environment, Health , Safety, Security and Quality
EIADR99	Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulation 1999
ENSREG	European Nuclear Safety Regulators
EPR	European Pressurised Water Reactor
EPR10	Environmental Permitting (England and Wales) Regulations 2010
EU	European Union
FAC	Flow Assisted Corrosion
FINAS	Fuel Incident Analysis and Notification System
FOI	Freedom of Information
FSA	Food Standards Agency
GDA	Generic Design Assessment
Government	The UK Government unless otherwise stated
GTA	Government Technical Advisor
GW	GigaWatts
HLW	High Level radioactive Waste
PHE	Public Health England

HPA-CRCE	HPA Centre for Radiation Chemical and Environmental Hazards
HSE	Health and Safety Executive - a distinct statutory body with day-to-day responsibility for making arrangements for the enforcement of safety legislation. HSE is the statutory licensing authority for nuclear installations. This function is delegated to senior officials within the HSE's Nuclear Directorate.
HSWA74	Health and Safety at Work etc. Act 1974
IAEA	International Atomic Energy Agency
ILW	Intermediate Level radioactive Waste
INES	International Nuclear and Radiological Event Scale
INPO	Institute of Nuclear Power Operators
IRR99	Ionising Radiations Regulations 1999
IRRS	IAEA Integrated Regulatory Review Service
IRS	Incident Reporting System
Joint Convention	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
LC	Licence Condition
MHSW99	Management of Health and Safety at Work Regulations 1999
MoD	Ministry of Defence
mSv	milliSieverts
NDA	Nuclear Decommissioning Authority
NEA	Nuclear Energy Agency (a part of OECD)
NEAF	Nuclear Emergency Arrangements Forum
NEBR	Nuclear Emergency Briefing Room
NEPLG	Nuclear Emergency Planning Liaison Group
NIA65	Nuclear Installations Act 1965 (as amended)
NLF	Nuclear Liabilities Fund
NNB Genco	NNB Generation Company Limited – the licensee for Hinkley Point C
NPP	Nuclear Power Plant
NPS	National Policy Statement
NSA	National Skills Academy
NuSAC	Nuclear Safety Advisory Committee - independent advisors on nuclear safety matters to HSC (not reconstituted post 2008). Prior to mid 1997 NuSAC was known as the Advisory Committee on the Safety of Nuclear Installations
OECD	Organisation for Economic Cooperation and Development
OEF	Operational Experience Feedback
ONR	Office for Nuclear Regulation
OR	Operating Rule
OSART	Operational Safety Review Team
PBO	Parent Body Organisation
PCSR	Pre-construction Safety Report
PMO	Programme Management Office – part of ONR
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
PWR	Pressurised Water Reactor
QA	Quality Assurance
R2P2	Reducing Risk, Protecting People
RANET	Response and Assistance Network
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations 2001
RIFE	Radioactivity in Food and the Environment
RIMNET	Radiation Incident Monitoring Network
RPA	Radiation Protection Adviser
RSA93	Radioactive Substances Act 1993
RWMD	Radioactive Waste Management Directorate of the NDA
SAPs	HSE's Safety Assessment Principles
SCC	Strategic Coordination Centre
SEPA	Scottish Environment Protection Agency

SFAIRP	So far as is reasonably practicable
SGoRR	Scottish Government Resilience Room
SLC	Site Licensee Company
SPI	Safety Performance Indicator
SSA	Strategic Siting Assessment
SSC	Structures, systems and components
TAG	Technical Assessment Guide
TIG	Technical Inspection Guide
TOR	Tolerability of Risk
UK	United Kingdom of Great Britain and Northern Ireland
UK ABWR	An Advanced Boiling Water Reactor design by Hitachi-GE Nuclear Energy Ltd
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association

References

1. ONR website: http://www.hse.gov.uk/nuclear/
2. Guidance Regarding National Reports under the Convention on Nuclear Safety, INFCIRC/572/Rev3; http://www.iaea.org/Publications/Documents/Infcircs/2011/infcirc572r3.pdf
3. United Kingdom fifth national report on compliance with the Convention on Nuclear Safety,(CNS/RM/2011/8); https://www.gov.uk/government/publications/compliance-with-the-convention-on-nuclear-safety-obligations-5th-national-report
4. The United Kingdom's National Report to the Second Extraordinary Meeting of the Convention on Nuclear Safety (CNS/ExM/2012/04/)
5. 'Meeting the Energy Challenge – A White Paper on Nuclear Power', Cm 7296, January 2008, http://www.berr.gov.uk/files/file43006.pdf
6. House of Lord's Science and Technology Select Committee report (published November 2011, http://www.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-committee/inquiries/parliament-2010/nuclear/
7. Nuclear National Policy Statement National Policy Statements for Energy Infrastructure, Nuclear National Policy Statement, https://www.gov.uk/government/publications/national-policy-statements-for-energy-infrastructure
8. Localism Act 2011 http://www.legislation.gov.uk/ukpga/2011/20/contents/enacted
9. Department of Energy and Climate change consultation on National Policy Statements, https://www.energynpsconsultation.decc.gov.uk/home/intro/
10. Government response to consultations on the Strategic Siting Assessment process and siting criteria for new nuclear power stations in the UK; and to the study on the potential environmental and sustainability effects of applying the criteria, URN 09/581, January 2009, http://www.berr.gov.uk/files/file49865.pdf
11. Licensing nuclear installations', ONR, http://www.hse.gov.uk/nuclear/licensing.htm
12. Japanese earthquake and tsunami: Implications for the Nuclear Industry, Interim Report, http://www.hse.gov.uk/nuclear/fukushima/interim-report.pdf
13. Japanese earthquake and tsunami: Implications for the Nuclear Industry, Final Report, http://www.hse.gov.uk/Nuclear/fukushima/final-report.pdf
14. Japanese earthquake and tsunami: Implementing the lessons for the UK's nuclear industry, www.hse.gov.uk/nuclear/fukushima/implementation-report-oct-2012.pdf
15. IAEA International Fact Finding Expert Mission of the Nuclear Accident Following the Great East Japan Earthquake and Tsunami; http://www.iaea.org/newscenter/focus/fukushima/missionsummary010611.pdf
16. IAEA Action Plan on Nuclear Safety; http://www.iaea.org/newscenter/focus/actionplan/reports/actionplanns130911.pdf
17. ENSREG Action Plan- Follow-up on the Peer Review on Stress Tests; http://www.ensreg.eu/sites/default/files/ENSREG%20Action%20plan.pdf
18. UK ONR ENSREG Related 'National Action Plan', ONR, 31 December 2012, http://www.hse.gov.uk/nuclear/fukushima/ensreg-report.pdf
19. The United Kingdom's National Report to the second extraordinary meeting of the Convention o nuclear Safety, May 2012.
20. European Council Directive 2009/71/EURATOM of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0071:EN:HTML:NOT

21. The Freedom of Information (FOI) Act 2000, http://www.legislation.gov.uk/ukpga/2000/36/contents
22. Responsibilities for Nuclear safety in UK, https://www.gov.uk/government/policies/providing-regulation-and-licensing-of-energy-industries-and-infrastructure/supporting-pages/safety-at-uk-civil-nuclear-sites
23. Health and Safety at Work etc. Act 1974 (1974 c.37), ISBN 0-10-543774-3, http://www.hse.gov.uk/legislation/hswa.pdf
24. Nuclear Installations Act 1965 (as amended) (1965 c.57), ISBN 0-10-850216-3, http://www.statutelaw.gov.uk/Home.aspx
25. Environment Act 1995, ISBN 0-10-542595-8, http://www.opsi.gov.uk/acts/acts1995/Ukpga_19950025_en_1.htm
26. Radioactive Substances Act 1993, ISBN 0-10-541293-7, http://www.opsi.gov.uk/ACTS/acts1993/Ukpga_19930012_en_1.htm
27. Environmental Permitting (England and Wales) Regulations 2010, http://www.opsi.gov.uk/si/si2010/draft/ukdsi_9780111491423_en_1
28. Energy Act 2004, http://www.opsi.gov.uk/acts/acts2004/20040020.htm
29. The Ionising Radiations Regulations 1999, http://www.opsi.gov.uk/si/si1999/19993232.htm
30. European Council Directive 85/337/EEC, http://ec.europa.eu/environment/eia/full-legal-text/85337.htm
31. European Council Directive 90/641/Euratom – Outside Workers Directive, http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/90641_en.pdf
32. Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999, SI 1999 no. 2892, ISBN 0-11-085395-4, http://www.opsi.gov.uk/si/si1999/19992892.htm
33. European Directive 97/11/EC, http://ec.europa.eu/environment/eia/full-legal-text/9711.htm
34. Radiation (Emergency Preparedness and Public Information) Regulations 2001, SI 2001 no. 2975, http://www.opsi.gov.uk/sr/sr2001/20010436.htm
35. European Council Directive 96/29/Euratom Basic Safety Standards http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/9629_en.pdf
36. European Council Directive 89/618/Euratom, Official Journal of the European Communities (1989) 32, No L357; http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31989L0618:EN:HTML
37. The Management of Health and Safety at Work Regulations 1999, SI 1999 no. 3242, ISBN 0-11-085625-2, http://www.opsi.gov.uk/SI/si1999/19993242.htm
38. The Health and Safety (Fees) (Amendment) Regulations 2010, http://www.opsi.gov.uk/si/si2010/uksi_20100579_en_1
39. Nuclear Installations Act 1965 etc. (Repeals and Modifications) Regulations 1974, http://www.opsi.gov.uk/SI/si1990/Uksi_19901918_en_1.htm
40. 'HSE criterion for delicensing nuclear sites', August 2005, http://www.hse.gov.uk/nuclear/delicensing.pdf
41. Radioactive Substances Act 1993, ISBN 0-10-541293-7, http://www.opsi.gov.uk/ACTS/acts1993/Ukpga_19930012_en_1.htm
42. The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) (Amendment) Regulations 2006[1] - Statutory Instrument 2006 No. 657, http://www.opsi.gov.uk/si/si2006/20060657.htm
43. Safety Assessment Principles for Nuclear Facilities 2006 Edition', HSE, 2006, http://www.hse.gov.uk/nuclear/saps/saps2006.pdf

44. HSE Enforcement Policy Statement, http://www.hse.gov.uk/pubns/hse41.pdf
45. HSE Enforcement Management Model, http://www.hse.gov.uk/enforce/emm.pdf
46. Nuclear Industries security (Fees) Regulations 2005; http://www.uklaws.org/statutory/instruments_33/doc33721.htm
47. Regulatory Nuclear Interface Protocol http://www.hse.gov.uk/nuclear/rnip/index.htm
48. Department for Energy and Climate Change website on 'Providing regulation and licensing of energy industries and infrastructure'; https://www.gov.uk/government/policies/providing-regulation-and-licensing-of-energy-industries-and-infrastructure
49. Department for Energy and Climate Change website on 'Safety at UK Civil Nuclear Sites; https://www.gov.uk/government/policies/providing-regulation-and-licensing-of-energy-industries-and-infrastructure/supporting-pages/safety-at-uk-civil-nuclear-sites
50. ONR document, "Our Strategy"; 2013; http://www.hse.gov.uk/nuclear/onr-strategy.pdf
51. ONR document, "Annual Plan", 2013, http://www.hse.gov.uk/nuclear/documents/annual-plan-2013-2014.pdf
52. NDA Strategy Effective from April 2011 http://www.nda.gov.uk/documents/upload/NDA-Strategy-Effective-from-April-2011-full-colour-version.pdf
53. EDF Nuclear Generation Limited website http://www.edfenergy.com/about-us/energy-generation/nuclear-generation/
54. EnergySolutions website http://www.energysolutions.com/
55. ONR Technical Assessment Guide 48, Organisational Capability NS-TAST-GD-048 Revision 4, http://www.hse.gov.uk/nuclear/operational/tech_asst_guides/ns-tast-gd-048.pdf
56. National Skills academy for Nuclear website, http://www.nuclear.nsacademy.co.uk/
57. ONR Technical Assessment Guide 27, Training and Assuring Personnel competence, http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/tast027.htm
58. ONR Technical Assessment Guide 77, Procurement of Nuclear Safety Related Items or Services, http://www.hse.gov.uk/nuclear/operational/tech_asst_guides/ns-tast-gd-077.pdf
59. International Organisation for standardisation, http://www.iso.org/iso/home.html
60. Achilles website, https://www.achilles.com/en/uk/
61. ONR Technical Assessment Guide 50, Periodic Safety Reviews, http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/tast050.pdf
62. 'Reducing risks, protecting people' – HSE's decision making process, http://www.hse.gov.uk/rsik/theory/r2p2.pdf
63. ONR Technical Assessment Guide 51, Scope and Content of Safety Cases, http://www.hse.gov.uk/foi/internalops/nsd/tech_asst_guides/tast051.pdf
64. ONR website Project Assessment Reports (PARs) http://www.hse.gov.uk/nuclear/pars/index.htm
65. Approved Code of Practice for IRR99, ISBN 0 7176 1746 7, HSE Books. http://www.hse.gov.uk/pubns/priced/l126.pdf
66. Guidance for the Environment Agencies' Assessment of Best Practicable Environmental Option Studies at Nuclear Sites, http://www.sepa.org.uk/pdf/radioactivity/bpeo_guidance.pdf

67. Radiation and Food in the Environment CEFAS report 2007, http://www.cefas.co.uk/publications/scientific-series/radioactivity-in-food-and-the-environment(rife).aspx
68. HSE Statement on Radiation Protection Advisors, http://www.hse.gov.uk/radiation/rpnews/statementrpa.htm
69. The Sizewell B Public Inquiry - The Layfield Report HMSO ISBN 0 11 411575 3
70. HSE, Respiratory Protective Equipment at Work – A Practical Guide http://www.hse.gov.uk/pubns/priced/HSG53.pdf
71. The 2007 Recommendations of the International Commission on Radiological Protection", Volume 37, Issues 2-4, Publication 103, Elsevier
72. Emergency Arrangement Consolidated Guidance, https://www.gov.uk/government/publications/nuclear-emergency-planning-consolidated-guidance
73. Emergency Preparedness, Chapter 19, The Fit with Other Legislation, https://www.gov.uk/government/publications/emergency-preparedness
74. Hinkley Point C Inquiry Records http://discovery.nationalarchives.gov.uk/SearchUI/Details?uri=C7083
75. Control of Major Accident Hazards Regulations 1999 (COMAH), http://www.hse.gov.uk/comah/index.htm
76. Town and Country Planning Act 1990, http://www.opsi.gov.uk/ACTS/acts1990/Ukpga_19900008_en_1.htm
77. Town and Country Planning Act (Scotland) Act 1997, ISBN 0-10-5900389, http://www.opsi.gov.uk/acts/acts1997/1997008.htm
78. The Planning etc (Scotland) Act 2006, http://www.opsi.gov.uk/legislation/scotland/acts2006/pdf/asp_20060017_en.pdf
79. The Town and Country Planning (Appeals) (Scotland) Regulations 2008, http://www.legislation.gov.uk/ssi/2008/434/introduction/made
80. Towards a Nuclear National Policy Statement: Consultation on the Strategic Siting Assessment Process and Siting Criteria for New Nuclear Ppower Stations in the UK, http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/files/file47136.pdf
81. The Planning Act 2008, http://www.opsi.gov.uk/acts/acts2008/ukpga/2008/29/contents
82. "The siting of Nuclear Power Stations in UK", http://www.hse.gov.uk/aboutus/meetings/iacs/nusac/030708/p12-sittingpaper.pdf
83. Circular 16/1993 Hazardous Substances Consent – A Guide for Industry Supplement 5/1993.
84. The Planning (Hazardous Substances) Regulations 1992, http://www.opsi.gov.uk/SI/si1992/Uksi_19920656_en_1.htm
85. IAEA Safety Standards No.SSG-25., Periodic Safety Review for Nuclear Power Plants, http://www-pub.iaea.org/MTCD/publications/PDF/Pub1588_web.pdf
86. ONR Technical Assessment Guide T/AST005, ONR Guidance on the demonstration of ALARP (as low as reasonably practicable), , May 2013, http://www.hse.gov.uk/nuclear/operational/tech_asst_guides/ns-tast-gd-005.pdf
87. ONR webpage New Reactors http://www.hse.gov.uk/newreactors/index.htm
88. ONR Technical Assessment Guide T/AST/049 – Licensee Core and Intelligent Customer Capabilities, April 2013, http://www.hse.gov.uk/nuclear/operational/tech_asst_guides/ns-tast-gd-049.pdf

89. Licensing of safety critical software for nuclear reactors, common position of seven European nuclear reactors and authorised technical support organisations, 2013 http:// www.hse.gov.uk/nuclear/software.pdf.
90. ONR Technical Assessment Guide G/INS 007, Guidance for Notifying and Reporting Incidents and Events to ONR, April 2013, http://www.hse.gov.uk/nuclear/operational/inspection/gins007.pdf
91. Nuclear Installations (Dangerous Occurrences) Regulations 1965, http://www.legislation.gov.uk/uksi/1965/1824/contents/made
92. Joint Regulatory Guidance on Radioactive Waste Management, http://www.hse.gov.uk/nuclear/wastemanage.htm
93. Radioactivity in Food and the Environment' (RIFE), http://www.cefas.defra.gov.uk/publications/rife/rife17
94. Tolerability of risk from nuclear power station, http://www.hse.gov.uk/nuclear/tolerability
95. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance L21 (Second edition), HSE Books 2000, ISBN 0 7176 2488
96. IAEA Safety Standard Series No. NS-G-1.2, Safety Assessment and verification for Nuclear Power Plants,
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1112_scr.pdf

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