DEPARTMENT OF ENERGY & CLIMATE CHANGE

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

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ON
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OBLIGATIONS

September 2010

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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 are 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 some planning assumptions providing for the first new reactors coming into operation in 2017/18 and 10-12 new reactors on-line by 2025. 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 UK report to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Within the UK nuclear safety system there have been no significant corrective actions necessary to comply with 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. Safety challenges remain especially in dealing with the ageing of facilities and legacy issues. However, it is considered that the UK nuclear safety system, being well-founded on the requirements of the Convention and the IAEA Fundamental Safety Principles, has a strong foundation 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 2008, it was reported that the UK Government had decided that nuclear power would be an integral part of the country's future energy strategy and that work had already started to assess the safety of new reactor designs. Since 2008 there has been significant progress towards implementing the new build programme. In particular, enabling measures are being put in place to ensure that the programme is implemented efficiently, effectively and, above all, safely. The decision to enable a new nuclear programme has directly and indirectly influenced 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. 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 the safety authorities. 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 year 2010 marks the fiftieth anniversary of the UK's Nuclear Installations Inspectorate (NII). Since its formation, the NII (now a part of the Health and Safety Executive's (HSE) Nuclear Directorate (ND)) has proved to be an effective nuclear safety regulator that has continuously sought to improve its regulation of the nuclear industry and the safety standards of the industry. However, the new build programme, ageing nuclear plant, decommissioning and the management of radioactive waste have all raised major new regulatory challenges. Consequently, in 2009 the UK Government proposed changes to the nuclear regulators' structure and methods of working to enable it to meet these new challenges and continue to be a world-class regulator[1].

1.4. 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

1.5. 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 fifth, 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.

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

Basis of the report

1.7. In addition to the Convention itself and the Guidelines regarding the production of National Reports (INFCIRC/572/Rev3), 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 fourth review meeting (CNS/RM/2008/6 final), regarding the key safety issues discussed at the fourth review meeting;
- Rapporteur's report for the United Kingdom from the fourth review meeting;
- report of the IAEA secretariat to the fifth review meeting of the Convention on Nuclear Safety - dated 15 September 2009 regarding major issues and trends in nuclear safety; and the
- written and verbal questions raised (and the answers given) on the UK's 2008 report to the Convention and on the presentation made at the review meeting in April 2008.

1.8. In general, the UK report follows the guidelines in INFCIRC/572/Rev3 in terms of scope. However, to ease the understanding of the reader, the changes consequential to the announcement of the Government's policy on new nuclear power plants (NPPs) are addressed fully in Section 2 of the report. Section 3 provides follow-up information on those issues at UK's nuclear power stations that were identified in the fourth report. Sections 4 and 5 identify those issues raised at the fourth review meeting in the President's summary report and in the Rapporteur's report for UK respectively. Both sections 4 and 5 direct the reader to the main body of the report where the specific issue is addressed. In effect, therefore, sections 2-5 together form that part of the report that is referred to as a "Summary" in INFCIRC/572/Rev3.

1.9. 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.

1.10. 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 2010. Changes occurring after this date will be reported in the UK presentation to the review meeting in April 2011.

Section 2 - Significant developments since the report to the 2008 Convention

European Union Nuclear Safety Directive

2.1. The European Council Directive 2009/71/Euratom of 25 June 2009 (the 'Nuclear Safety Directive')[2] 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.

2.2. The Directive requires Member States to:

- establish a national legislative, regulatory and organisational framework for the safety of nuclear installations that includes national safety requirements, a system of licensing and supervision, and enforcement mechanisms. This reflects the position under the Convention and the existing UK regime;
- maintain and, where appropriate, improve this national framework (taking into account matters such as operating experience, research and developments in technology), which goes somewhat beyond what is laid down in the Convention but which is part of the basic approach of the UK;
- establish and maintain a competent regulatory authority. The regulator must be functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy so as to ensure its regulatory decisions are effectively independent. EU Member States must also ensure the regulator is given the legal powers and human and financial resources to carry out its duties under the national framework. These requirements broadly mirror those in the Convention with which the UK already seeks to comply;
- ensure that the prime responsibility for the safety of nuclear installations rests with the licence holder. This is already set out in the Convention and in UK law. The national framework must also require operators to have adequate human and financial resources to meet the obligations that the Directive requires of them. (The UK compliance is demonstrated in Article 11);
- ensure that the national framework requires arrangements for education and training to be made by all parties (including Government, regulators and operators) for their staff who have responsibilities for the safety of nuclear installations. (The UK compliance is demonstrated in Articles 8 and 10);
- ensure that information in relation to the regulation of nuclear safety is made available to workers and the general public, subject to not jeopardising other interests (such as security) that are recognised in national or international law. This requirement is not present in the Convention, but the UK already recognises the importance of transparency in the regulation of nuclear safety. (This is addressed in Section 2 of this report and also Articles 7 and 8);
- at least every ten years, arrange for self assessments of their national framework and regulator and at least to invite an international peer review of segments of both. The UK has and will continue to comply by inviting International Atomic Energy Agency (IAEA) Integrated Regulatory Review Service (IRRS) missions (see Section 2 of this report).

Changes to licensee organisations

2.3. EDF Energy purchased British Energy Group plc in January 2009. Consequently, British Energy was delisted from the London Stock Exchange on 3 February 2009 and became a subsidiary company of EDF Energy UK Ltd., which is a wholly owned subsidiary of Electricite de France SA. Within British Energy Group there is one nuclear operating company, British Energy Generation Ltd. (BEGL). BEGL is the nuclear licensee for Sizewell B, Dungeness B, Hinkley Point B, Heysham 1, Heysham 2, Hartlepool, Hunterston B and Torness. EDF Energy is establishing a new company to become a nuclear licensee for the planned new NPP at Hinkley Point C.

2.4. Magnox North Ltd. and Magnox South Ltd. were established as Site Licence Companies (SLCs) following the reorganisation and separation of Magnox Electric Ltd. in 2008. Magnox South Ltd. became the nuclear site licensee for: Berkeley, Bradwell, Dungeness A, Hinkley Point A and Sizewell A all of which are now permanently closed. Magnox North Ltd. became the nuclear site licensee for operating Magnox stations at Oldbury and Wylfa and for the permanently closed stations at Chapelcross, Hunterston A, and Trawsfynydd. Ownership of all the Magnox North Ltd. and Magnox South Ltd. sites is held by the Nuclear Decommissioning Authority (NDA), but the shares are held for the duration of the contract with NDA by Reactor Sites Management Company Ltd., which is a subsidiary of Energy Solutions EU Ltd., for the management of the two companies. Further information on the NDA can be found in Article 9.

Creation of Department of Energy and Climate Change

2.5. The Department of Energy and Climate Change (DECC) was established in October 2008, bringing together responsibility in Government for energy and climate change for the first time. The creation of DECC reflected the growing importance of these issues and the close links between them.

2.6. DECC's priorities are to tackle climate change, ensure energy security, and maximise the benefits of the transition to a low carbon economy. Achieving these goals in the short, medium and long-term, and doing so in a way that is acceptable to the public, is a major challenge. DECC is a small Department dealing with issues of global importance, and meeting the challenges that lie ahead will require clarity of thought, ingenuity, leadership and effective engagement both within the UK and worldwide.

Office for Nuclear Development

2.7. The Office for Nuclear Development is a department within DECC. Its mission is to facilitate new nuclear investment in the UK and specifically to:

- enable operators to build and operate new nuclear power stations in the UK from the earliest possible date and to enable the new nuclear power stations to make a full and safe contribution to the county's energy needs;
- ensure that the UK is an appropriate place for companies to invest in new nuclear power with unnecessary obstacles removed; and
- maximise the ability of UK firms to take advantage of the UK and worldwide nuclear programme.

New nuclear power plant in the UK

UK Government policy on new nuclear power plant

2.8. The Energy White Paper: *Meeting the Energy Challenge*[3] was published in May 2007. It contained a 'preliminary view that it is in the public interest to give the private sector the option of investing in new nuclear power stations'. Following consultation,

a new white paper entitled "Meeting the Energy Challenge – A White Paper on Nuclear Power"[4] was published in January 2008 that provided a firm basis for the private sector to invest in and seek authorisation for a new generation of nuclear power stations. The Government supports the analysis and conclusions of the White Paper and believes that it is in the public interest to allow energy companies to invest in new nuclear power stations should they choose to do so, without public subsidy.

2.9. This policy applies to England and Wales only: the devolved Scottish Government does not support any new nuclear power stations in Scotland. However, Scottish Ministers are supportive of the possible life extension of existing nuclear power stations in the short term to help security of supply.

Justification of new build

2.10. The January 2008 White Paper stated that the Government would undertake a number of actions which were necessary before new nuclear power stations could be built in the UK. One of these is Regulatory Justification of new Nuclear power stations required in order to comply with the EU Basic Safety Standards (BSS) Directive 1996[5], which requires EU Member States to ensure that a new practice resulting in exposure to ionising radiation is justified in advance of being first adopted.

2.11. The Government consulted between November 2009 and February 2010 on proposed decisions that two nuclear power station designs, Westinghouse's AP 1000 and Areva's EPR, should be justified. Details of the consultation process can be seen on the DECC website[6]. The Government is currently considering responses to that consultation.

Planning reform

2.12. In the UK, obtaining planning permission for major infrastructure projects has often been a somewhat bureaucratic and slow process. This was the case in the early 1980s when the planning process for UK's last NPP, Sizewell B, took over three years.

2.13. To streamline the planning process in England and Wales, fundamental reform of the planning system was required. This process was commenced with the introduction of the Planning Act 2008[7], which provides for a more efficient, transparent and accessible planning system. The new Government supports this reform, although it intends to make some changes to introduce democratic accountability. Whereas the Planning Act 2008 provided for development consent for nationally significant infrastructure to be administered by a new independent body, the Infrastructure Planning Commission (IPC), the intention is now for this unelected body to be abolished. A new body will be established to hear examinations, but decisions will be taken by Ministers. These changes require legislation and therefore in the interim the IPC will continue to operate as the Planning Act 2008 provides. It should be noted that this new planning process applies to major infrastructure projects, not just NPPs, and is separate from the licensing process (see paragraph 2.19).

2.14. Energy National Policy Statements (NPSs)[8] are currently being finalised prior to ratification by Parliament. They will 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.

2.15. The draft Nuclear NPS listed sites that the Government judged to be potentially suitable for the deployment of new nuclear power stations. This was an output of the

Government's Strategic Siting Assessment (SSA) process[9]. The details of the SSA criteria and process are addressed in Article 17.

Radioactive waste

2.16. The draft Nuclear NPS also sets out the Government's preliminary conclusion that it is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced by new nuclear power stations in the UK.

Role of the regulators in planning regime

2.17. The regulator plays an important role in ensuring the safety, security and protection of people and the environment in relation to the design, construction, operation and decommissioning of nuclear power stations and the transport of nuclear material. This is reflected in the draft Nuclear NPS in that the IPC:

- recognises that the relevant licensing and permitting regimes will be properly applied and enforced;
- does not need to consider matters that are within the remit of the nuclear regulators; and
- should not delay a decision on whether to grant consent until completion of the licensing or permitting process.

Potential licensee organisations for new nuclear power plants

2.18. Energy companies have stated their plans for the development of new NPPs in the UK. EDF Energy has publicly made clear its intention to build 6.4 GW of new nuclear generating capacity in the UK. The NDA has sold sites at Wylfa, Bradwell, Oldbury and Sellafield which has enabled new operators to participate in the new build programme. Another company, RWE/E.ON, intends to build at least 6 GW of new nuclear capacity in the UK and has purchased sites at Wylfa and Oldbury. A consortium of GDF SUEZ SA, Iberdrola SA and Scottish and Southern Energy plc has set out plans to build up to 3.6 GW of new nuclear capacity at a site they have purchased at Sellafield as part of the NDA's programme of asset disposals.

Regulating new build

Licensing strategy for new NPPs

2.19. Licensing of nuclear installations for new nuclear power reactors in the UK will follow the standard legal and regulatory processes described under Article 7 and detailed in HSE document 'The licensing of nuclear installations' published in March 2007[10]. The document addresses:

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

It provides basic regulatory information and links to other reference documents that potential licensees need to be aware of. This document, along with other guidance, is being updated.

2.20. The first stage in the licensing process, for a site for a new NPP, is for a prospective operator to apply for a nuclear site licence. The application will need to include a 'safety management prospectus' to demonstrate that the applicant is a corporate body with sufficient resources to discharge the obligations and liabilities connected with holding a nuclear site licence including having a suitable management structure and intelligent operator capability.

2.21. The organisation and management structure set out in the prospectus is not expected to be static; for example it must develop in a timely fashion to identify sufficient suitably qualified, trained and experienced resources within the prospective licensee's organisation that covers all safety-related aspects of the nuclear

installation's activities during construction, commissioning and subsequent operation. HSE therefore expects the original prospectus to be accompanied by plans detailing how the organisation will evolve, including arrangements for review and revision of the prospectus.

2.22. The applicant must be able to demonstrate adequate knowledge of the engineering and safety case for all plant and operations on the licensed site. HSE requires that the licensee is fully in control of nuclear activities on its site, understands the hazards of its activities and how to control them, and is an intelligent customer for any work it commissions externally.

2.23. The application will need to cover the arrangements necessary to comply with the licence conditions including those necessary for responding to an emergency. The licence conditions require the licensee to have suitably qualified and experienced staff undertaking all activities that could affect safety on the site. For most potential reactor designs the expert knowledge will initially rest with the vendor and HSE will therefore expect to see appropriate strategies to transfer this knowledge and information to potential operators/site licensees.

2.24. Before granting a licence, HSE must be satisfied that the applicant will be using the site for licensable activities and that these will be undertaken safely. Sufficient safety case information should be submitted as part of the application. This submission will allow HSE to make judgements about the activities on the site, taking account of other material provided such as the management prospectus and arrangements, as well as the overall safety of the activities in relation to siting etc., to a level sufficient to allow the granting of a site licence.

2.25. Subsequently, it is anticipated that the licensee will apply for consent under the licence condition for construction. This application will be supported by a Pre-construction Safety Report (PCSR) which is site specific but makes full use of any assessments done on a generic basis under the Generic Design Assessment (GDA) process.

Supply chain for new nuclear power plants

2.26. The adequacy of the supply chain for components that meet the stringent safety requirements for nuclear plant was discussed at the 2008 Convention review meeting. The supply chain has commercial as well as safety implications and the Government is taking steps to address both these issues by:

- providing capital investment to establish a Nuclear Advanced Manufacturing Research Centre that combines the knowledge, practices and expertise of manufacturing companies with the capability of universities;
- strengthening the Manufacturing Advisory Service to support British based suppliers for the civil nuclear industry;
- continuing to provide support to the industry-led supply chain in conjunction with the Nuclear Industries Association; and
- providing capital investment in a new advanced manufacturing facility for civil nuclear plant as part of the Advanced Manufacturing package to stimulate the wider UK supply chain.

2.27. The overall objective of these initiatives is to ensure that supply chain shortages of plant and equipment that meet nuclear safety standards do not become a barrier to the early construction and operation of new nuclear power stations in the UK.

2.28. Recognising that, with the proposals for a substantial programme of nuclear new build in the UK, any loss of confidence among stakeholders in the nuclear supply chain for the UK industry could have a negative impact on the successful execution of projects. The regulator is developing a guide for inspectors on procurement. It reinforces the principle that licensees should take overall responsibility for ensuring

quality and safety of their material and systems, but draws attention to the need for licensees to ensure a robust quality management system throughout the complete supply chain.

Background to Generic Design Assessment

2.29. The UK report to the Convention in 2008 reported on the early GDA work regarding a potential new build programme. This section summarises the key features of this work and reports on the progress with the GDA including some of the emerging issues.

2.30. The HSE website[11] explains the GDA process developed by two UK nuclear regulators (the HSE and the Environment Agency). The GDA process is not regulation in the strict legal sense but was designed specifically to allow the nuclear regulators to assess nuclear power station designs ahead of receiving an application to build a reactor design on a particular site.

2.31. In January 2007, the regulators published a suite of guidance material on the generic design assessment of new nuclear power station designs. The guidance was aimed primarily towards those companies that may wish to offer their designs for potential construction and operation in the UK. This can be found on the regulators' 'Nuclear New Build' website[12].

2.32. Paragraph 2.8 refers to the Government's Energy White Paper 'Meeting the Energy Challenge'[3] and the associated consultation document 'The Future of Nuclear Power'[13] published in May 2007. The consultation referred to the GDA process devised by the nuclear regulators for potential new nuclear power stations. The consultation also invited applications from nuclear reactor designers interested in having their designs assessed, and set down criteria that these needed to meet to be eligible for the first step of the assessment process.

2.33. In July 2007 the Government announced that four applications had been made for GDA which met these criteria, including having the support of a 'credible' nuclear power operator. These designs were the:

- Atomic Energy of Canada Ltd Candu reactor - the ACR1000;
- EDF/Areva Pressurised Water Reactor (PWR) - the EPR;
- GE-Hitachi Boiling Water reactor - the GE ESBWR; and the
- Toshiba/Westinghouse PWR - the AP1000.

2.34. In April 2008, Atomic Energy of Canada Ltd. withdrew its ACR1000 reactor design and in September 2008, GE asked for work on its design to be suspended. In both cases, this was because the companies stated they wished to focus on getting the designs certified in their own countries.

Joint Programme Office

2.35. While the UK nuclear regulators have independent responsibilities (as described in Article 8), they all recognise the benefits of building upon their existing close working arrangements to align their processes and regulatory positions wherever possible. To achieve this, a Joint Programme Coordination Team was set up by the regulators to ensure that they work together closely and effectively. In addition, a Joint Programme Office has been set up to administer the GDA process on behalf of HSE and the Environment Agency.

Generic Design Assessment process

2.36. The GDA process consists of four 'steps', with the assessment becoming increasingly detailed at each stage. Technical reports are produced after each step, which provide an indication of how the assessment is progressing and highlighting potential issues that will need to be resolved during the following step. The four steps are:

Step 1: Design and safety case submission, involving putting the formal agreements in place to carry out the assessment (August - September 2007)

Step 2: Fundamental Safety Overview of the reactor design safety case, consisting of a short review of the acceptability of the safety aspects of the proposed reactor design (September 2007 - March 2008)

Step 3: Overall design safety review, involving a more in-depth HSE safety assessment of the case submitted (June 2008 - November 2009)

Step 4: Detailed assessment leading to potential acceptance of the adequacy of the safety features of the design, examining all relevant aspects of the submission, including relevant inspection of an applicant's procedures and records and some verification analysis (November 2009 - June 2011).

Interface with requesting parties

2.37. As part of the assessment of the nuclear power station designs currently going through the GDA process, the regulators will need to ask for more information from the design companies (the 'Requesting Parties'), or tell them if it is judged that a particular feature of the design might not meet UK regulatory standards. One of the benefits of GDA is that it allows early identification of these issues when they can more easily be resolved rather than during construction when a solution may be more complex.

2.38. HSE has systems in place for asking questions and highlighting concerns, which includes raising regulatory issues. Currently there are two outstanding regulatory issues:

- It is HSE's judgement that the Control and Instrumentation architecture on the AREVA EPR design appears not to comply with the independence principle, as there is a very high degree of complex interconnectivity between the control and safety systems.
- Regarding the Westinghouse AP1000 design, HSE considers that there is insufficient evidence to demonstrate that the proposed new steel-concrete-steel construction design for key structures within the "nuclear island" are sufficiently robust to protect the reactor's safety systems.

International collaboration

2.39. A key element of the nuclear regulators international collaboration is the work with overseas regulators who are also assessing the reactor designs that are undergoing GDA. This is being done both bilaterally and through the Multinational Design Evaluation Programme (MDEP)[14]. It provides a forum for discussing technical issues and sharing information. This close collaborative working resulted in the UK, Finnish and French regulators issuing a Joint Regulatory Position Statement[15] regarding the proposed Control and Instrumentation on EDF/AREVA's EPR design in November 2009. The UK is also working closely with the US Nuclear Regulatory Commission and others on the Westinghouse AP1000 design.

Openness and Transparency

2.40. To allow public participation in the process, GDA was designed specifically to be open and transparent. The approach the regulators have taken to deliver these aims is to:

- enable, via the Requesting Parties, public access to design safety cases and inviting comments;
- publish relevant and timely information including guidance, and the regulators' technical and progress reports; and to
- actively engage with stakeholders.

Changes to the nuclear safety regulatory body

Review of nuclear safety regulation

Purpose of review

2.41. In the Nuclear White Paper (January 2008)[4], 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, in dealing with the challenges of new nuclear power stations. Dr Tim Stone, an advisor to Government Ministers, was appointed to carry out the review of the current 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 efficient and effective regulatory system.

Review process

2.42. In undertaking this review, Dr Stone discussed with a range of people the issues confronting the HSE's Nuclear Directorate (ND). These discussions included representatives of the nuclear industry, Government Departments, and the regulator itself.

2.43. The review focused on ND, and paid particular attention to their ability to undertake work relating to new nuclear build, the most immediate aspect of which was the process of GDA. Dr Stone's final report (the Stone Report) was delivered to the Government in early 2009, following which a summary of the findings was published in January 2009[16]. The complete report was later published in December 2009.[17]

Stone Report - conclusions and recommendations

2.44. The Stone Report endorsed the findings of the 2006 IAEA IRRS[18] that the UK's nuclear regulatory arrangements are mature and transparent, with highly trained and experienced inspectors. However, he considered that ND was significantly under-resourced for its predicted future workload. Both with and without a new build programme, ND's staffing shortage is worsening due to an inability to recruit suitable new staff, and also because the age profile of existing inspectors is heavily weighted towards retirement age. The Stone Report considered that the current ND senior management team had already identified, and were implementing, a number of important cultural and governance changes. However progress on such changes was being hampered by resourcing and other institutional constraints.

2.45. The Stone Report recommendations were primarily intended to reinforce and accelerate the ND's existing plans and reforms, as well as recommending a number of important additional steps. The report considered it essential that ND should be fully supported in implementing change so as not to adversely impact on the Government's new nuclear policy aspirations.

2.46. Specific short-term recommendations were made to achieve the fundamental objective of recruiting new inspectors and retaining existing ones, to alleviate the resource difficulties.

2.47. In the medium term, the Stone Report recommended that:

- ND should be put into a different structure to give it financial and organisational flexibility to meet its business needs on a sustainable basis;
- the cost recovery arrangements should be amended so that, given a fluctuating work load, ND has full flexibility to adjust its budgets and charge the industries it regulates accordingly;
- a new governing body should be created for ND whose functions will include strengthening the overall accountability of the wider societal responsibilities of

the NII, supervision and approval of budgets, and preparation of an annual report to the Secretary of State on the operation of ND.

Implementation of the Stone Report recommendations

2.48. The recommendations in the Stone Report were accepted by Government[19] and, in response, DECC and HSE's sponsoring department, the Department for Work and Pensions (DWP), set in place a programme to implement the recommendations.

2.49. An early success was the opening of an additional ND office in Cheltenham in 2009 to facilitate recruitment. Cheltenham is in the South West of the UK about 250 kilometres from HSE's Head Office in Bootle in the North West of the UK. The Cheltenham office is in an area that has a significant nuclear industry presence from which to attract recruits with nuclear experience. In parallel, the Treasury (the UK Finance Ministry) agreed interim significant salary increases for nuclear inspectors pending them being brought out of UK civil service pay arrangements.

2.50. At the same time steps were taken to address the medium term recommendations as part of a wider package of proposals to reform the nuclear regulatory framework, by proposing the creation of a new, sector specific nuclear regulatory body with the necessary freedoms and governance arrangements identified in the Stone Report.

2.51. The programme to achieve this comprised two components: first the development of necessary legislation, the Legislative Reform Order (LRO), which would create the legislative framework for a new body, the Office for Nuclear Regulation; and secondly, preparation within ND for the creation of the new Office for Nuclear Regulation with all the necessary infrastructure ready for when the new legislation came into force.

Preparations for transition to a Nuclear Statutory Corporation

2.52. In March 2009, HSE's ND undertook a planning and scoping exercise to identify work streams that needed to be in place to support the new Nuclear Statutory Corporation (NSC). These would cover Finance, Procurement, HR, Pensions, Insurance, Business Planning and Communications. The programme also included the identification of improvement to ND's working methods and practice that would enhance effectiveness and efficiency in a changing environment. This part of the programme is referred to as "Transformation" (see paragraphs 2.56 – 2.58).

2.53. From April 2009 the Transition Programme was set up as a formal programme with well-defined governance and reporting arrangements to prepare the necessary infrastructure ready for when the new legislation created by the LRO comes into force. Much of the work of transition was carried out by temporary professional staff, with particular skills and experience in these matters, which enabled the regulatory work of ND to proceed as normal.

2.54. DECC and DWP jointly published a consultative document[1] on proposals to create a new, independent, sector specific nuclear regulator. This included the proposal to transfer into the new body that part of the Department for Transport which regulates the transport of radioactive materials.

2.55. In March 2010 the government published, for information, the draft *Legislative Reform (Office for Nuclear Regulation) Order*.[20] This draft legislation, if progressed by the new Government, will create the new regulator and provide its functions in law. It would give the new body responsibility for the regulation of nuclear safety, civil nuclear security, UK safeguards obligations and radioactive materials transport. It would also enhance regulatory independence by, for the first time, putting the Chief Inspector's post, role and responsibilities (such as granting a licence and attaching conditions), on a statutory basis.

Transformation programme

2.56. The Transformation Programme is targeted towards improving the way ND carries out its duties in the context of future challenges as the UK safety and security regulator, and operating as the UK Safeguards Office. It is a comprehensive review of ND policies, practices and structure with the aim of creating a regulatory body which is capable of adapting to a rapidly changing national and international scene. It is initially planned as a three-year programme but may well be extended.

2.57. There are three identified closely-related workstreams:

- regulatory effectiveness;
- organisational effectiveness; and
- openness and transparency.

2.58. The work undertaken in each of these three areas will be informed by a number of sources including:

- international best practices;
- feedback from external UK stakeholders such as licensees, other Government Departments and non-governmental bodies;
- internal feedback - there is a great deal of experience and expertise within ND and this will be used to inform the Transformation Programme; and
- the outcome of past and future IRRS missions.

Progress with transition/transformation

2.59. Dr Stone reviewed progress with the implementation of his recommendations in November 2009[21]. By April 2010 the LRO and associated documents were completed, as was most of the work under the Transition Programme, but the LRO was not laid before Parliament because of the proximity to the general election. However, the draft LRO together with supporting information was put into the public domain on the DECC website. Given the change of Government in May 2010, the Transition programme was placed 'on hold' pending the new Government's approach to these issues. The Transformation element of the programme continues.

Input from IAEA IRRS missions

2.60. In March 2006, an international team of nuclear regulatory safety experts visited the UK, and HSE's Nuclear Safety Directorate (NSD), since renamed the Nuclear Directorate (ND), to conduct the first of a series of IAEA IRRS modular missions. The purpose of the first IRRS mission was to evaluate the effectiveness of selected aspects of the current NSD regulation of existing NPPs and its preparedness to regulate and licence any new reactor designs. The report was put on the HSE website[18].

2.61. In February 2009 the UK Government requested a second modular IRRS mission to review the regulation of operating power plants and fuel cycle facilities; inspection and enforcement and emergency preparedness and response; and to review progress on the recommendations and suggestions made during the 2006 IRRS mission. The IAEA was also requested to review again aspects of regulatory organization as ND moves towards becoming an NSC. The review was conducted from 4 –13 October 2009. The IRRS activities took place mainly at the ND offices in Bootle but also included other locations including the Sellafield site in Cumbria and the Heysham 1 NPP.

2.62. The team concluded that ND has taken initiatives to address, in a systematic manner, not only the recommendations and suggestions from the 2006 IRRS mission but also those new improvements identified through the self-assessment prior to the 2009 mission. There had been significant progress and many improvements have been carried out in significant areas following the implementation of a comprehensive

action plan. The IRRS team believes that the action plan is thorough and addresses all the necessary improvements, and should continue to be implemented and monitored through to completion.

2.63. The review team made a number of recommendations and suggestions as well as identifying areas of good practice. The status of the IRRS findings is addressed in Annex 7. All IRRS findings are being taken forward as an integral part of ND's Transformation programme. The IAEA review report is on the HSE website[22].

Staffing of ND

2.64. Implementation of the Stone Report recommendations on inspectors' salaries and the establishment of satellite offices have had a major impact on ND's ability to recruit new staff.

2.65. ND is currently undertaking its sixth external recruitment campaign for Nuclear Safety Inspectors since October 2007. The previous five campaigns have resulted in 62 appointments to nuclear safety inspector posts across all the Divisions in ND.

2.66. Although there have been recent successes in recruitment, maintaining staff levels and the assimilation and training of new recruits will remain a challenge for several years. These topics are further addressed in Article 8 of this report.

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 fourth report to the Convention in 2008. New issues are addressed in Article 6.

AGR boiler tubes

3.1. In the UK's fourth report to the Convention in 2008 it was noted that, during the 2006 statutory outages, a higher number of defects than expected were found in the Hunterston B and Hinkley Point B Advanced Gas-cooled Reactor (AGR) NPP boiler tubes. These defects were caused by creep damage induced as a consequence of operation at a high temperature for a long period. Following the submission of a satisfactory safety case by the licensee, BEGL, HSE gave permission to start up in May 2007. All four reactors were returned to service at 70% full power and at a reduced boiler steam outlet temperature to significantly reduce further creep damage to the boilers. Following extensive NPP outages in 2008 and 2009, boiler surface has been recovered and the safety case updated allowing reactors to operate now up to 80% of full power.

AGR boiler closure units

3.2. The UK report to the 2008 Convention also noted that an issue had arisen with the boiler closure units (BCU) at Hartlepool and Heysham 1 NPPs. These reactors are of similar design. They have reinforced concrete pressure vessels and the boilers (steam generators) are contained within the pressure vessel. There are penetrations through the pressure vessel both for feed water and steam. The Hartlepool and Heysham 1 NPP boilers each have a primary restraint comprising 48 studs, each approximately 2 metres long and situated within vertical guide tubes disposed around the perimeter of the BCUs.

3.3. In early 2005 an inspection at Heysham 1 Reactor 1 during its statutory outage revealed that some of the guide tubes contained standing water (thought to result from known leaks from the pressure vessel cooling water system) and there were signs of corrosion. This raised questions regarding the adequacy of the safety case. The inspections were extended to Reactor 2 at Hartlepool which was shutdown for refuelling. BEGL developed a case for resuming operation. This was built on inspecting all studs on these shut down reactors. The inspection involved using ultrasonic non-destructive examination, as part of the case to address the potential for stress corrosion cracking. Restraints were also fitted to prevent stud ejection. The case for the continued operation of all the Hartlepool and Heysham 1 NPPs revolved around available inspection data and structural integrity analysis. Shutdown reactors were returned to service in late 2005.

3.4. Leaking pressure vessel cooling water was also found to have entered a chamber containing BCU pre-stressing wires and as a consequence of this, a programme of radiography to reveal corrosion degradation was initiated. During inspections on Reactor 1 at Hartlepool in late 2007, the tendon wires were found to have unexpectedly high levels of corrosion, which led to one tendon wire having broken near to its anchor. Subsequent inspection of the BCUs on these other reactors found similar evidence of corrosion, indicating that this was a generic issue, not confined to Reactor 1 at Hartlepool.

3.5. Comprehensive inspections were carried out on all four reactors in order to establish the extent of corrosion and to identify the causal factors. This confirmed that nearly all the tendon wires were unaffected by any significant corrosion and were serviceable. In those areas where corrosion was observed, it was associated with a localised absence of grease protection originating from the time of original construction.

3.6. The existing pre-stressing system has been improved by the restoration of the protective grease and the installation of an environmental control system which is designed to maintain a non-corrosive environment. The installation of a series of tensioned steel bands around the wire bundles of each BCU will maintain the design level of pre-stress in the event of further wire breaks, albeit that these are not expected given the extent of protection and monitoring that now exists.

3.7. As an additional level of protection, in the event that the pre-stressing system should fail, a new engineered line of protection in the form of an external steel restraint has been installed on all BCUs. This will maintain the reactor pressure boundary in the unlikely event that the modified pre-stressing system should fail.

3.8. Return to service of all four reactors was achieved in early 2009 and the BCU performance has been shown to be consistent with design intent. There are no outstanding reservations from either commissioning or subsequent operation noting that continued service of the BCUs is subject to defined programmes of routine maintenance and inspection.

AGR top dome temperatures

3.9. The temperatures of the hot box domes at Heysham 1 and Hartlepool NPPs are monitored by thermocouples on the underside of the domes, and these temperatures are progressively increasing on all four reactors. The rate of rise has increased over the last 10 years. Historically, the hot box domes have been maintained within acceptable limits through surveillance requirements based on an average dome temperature limit. However, analysis work in 2006 showed that as a result of the observed temperature increases, the compliance methodology could be non-conservative at limited locations on the dome. In consequence, BEGL took the decision to revise the compliance methodology and to reduce power on the lead reactor at Heysham 1 Reactor 2 to restore the margin against the hot box dome design limit. Heysham 1 Reactor 2 is currently operating at 78% feed flow, and the remaining three reactors are demonstrating an acceptable, if reducing, margin against the operating temperature limit.

3.10. The continued operation of the dome was confirmed to be acceptable in a Category 1 engineering change in 2009, and there is an on-going programme of work to investigate the problem and implement effective countermeasures. If BEGL wished to increase reactor power such that the existing dome temperature limit was exceeded, they would be required to justify this in a further engineering change safety case.

Graphite integrity

3.11. Graphite reactor cores suffer from potential problems of both weight loss and graphite cracking. UK operates two types of reactor with graphite moderated cores. The Magnox reactors are fuelled with natural or slightly enriched uranium metal fuel clad in a Magnox can, whilst the AGRs are fuelled with enriched uranium oxide in stainless steel cans. In both cases, the graphite core provides a lattice which allows the movement of control rods and the passage of carbon dioxide to cool the fuel. The fuel construction and gas flow are different in the two designs. The AGR design is much less sensitive to the effects of graphite brick cracking as the fuel is contained in an integral sleeve which maintains gas flow through the fuel even if the fuel channel graphite itself contains cracks.

3.12. Graphite brick cracking in Magnox reactors could lead to:

- gas coolant bypass, if wide-enough cracks were to develop in the fuel channels;
- loss of graphite mass leading to a loss of strength which, combined with the build up of stresses due to irradiation, increases the likelihood of further brick cracking as the reactor cores get older; or

- concerns regarding the ability to insert control rods.

However, unlike the AGRs, where cracking has been found in the graphite bricks, no significant cracking has been seen in any of the Magnox reactor cores.

3.13. It should be noted that only two Magnox power stations are currently operating. These are the twin reactors sites at Oldbury and Wylfa. All four of these reactors have pre-stressed concrete pressure vessels. The “lead reactors” regarding graphite integrity are those at Oldbury. These reactors have undergone major graphite inspection and analysis. The strategy is that those with the most ‘at risk’ cores have had their outages extended until sufficient information has been collected and analysed to give confidence to allow them to return to service. Probabilistic safety cases have been prepared for the graphite cores at both power stations to further underpin the deterministic analysis.

3.14. The UK licensees have taken a multi-legged approach to managing the potential cracking problem that consists of: 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 of core condition during plant operation; and inspection and sampling during reactor outages to ensure that the core is behaving as predicted. The precise limit criteria that would 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 ND has in further safe operation.

Concealed systems

3.15. The 2008 UK report noted that there had been a failure of a buried cast iron emergency cooling water pipe at Hartlepool Power station. There have been several events in recent years involving concealed pipework. BEGL has therefore established a fleet-wide project covering all concealed systems such as cables and civil structures as well as pipework. This work will involve systematically identifying and inspecting all concealed nuclear safety related plant in order to establish its condition and to take any remedial actions necessary. ND is monitoring progress with this work.

Section 4 - Safety issues identified in the President's Summary report at the 2008 Convention Review Meeting

The President's Summary report of the proceedings at the fourth Convention review meeting held in April 2008 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.

Openness and transparency

4.1. In the UK all public bodies are bound by the Freedom of Information Act 2000 (FOI)[23] (see Article 7). In addition pro-active arrangements are in place to further enhance openness and transparency. This is addressed in Section 2 and Articles 8 in respect of the regulatory body and Article 9 in respect of the licensees. 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.

Regulatory independence

4.2. In the UK this is guaranteed by law although the proposals for creating ND as a statutory corporation intend to extend this by making the Chief Nuclear Inspector a statutory post. It is addressed in Articles 7 and 8.

Assessments of safety culture

4.3. It is the UK position that safety culture cannot be regulated directly. The regulator has a strategy of encouraging and influencing the enhancement of safety culture. The methodology for this, and actions taken by licensees, is addressed in Article 12.

Learning from operational feedback

4.4. The regulator 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.

Maintaining staffing levels and competences

4.5. This is a particularly important area bearing in mind the possible worldwide expansion of the nuclear industry. The UK has taken steps to enhance the staffing of the regulatory authority. This is addressed in Section 2 of this report and also in Article 8. The general issue of competences is addressed in Article 11.

The use of Probabilistic Safety Analysis as a basis for risk-based decision making

4.6. In the UK Probabilistic Safety Analysis (PSA) is used as a guide to the making of regulatory decisions. This is addressed in Article 14 and in Annex 6.

Progress with Periodic Safety Reviews

4.7. Article 6 provides information on the status of Periodic Safety Reviews (PSRs) at UK NPPs.

The transfer of trans-border information on incidents

4.8. This is addressed in Article 16 in relation to Emergency Preparedness and in Article 19 on sharing information on incidents and occurrences at NPPs in the UK.

Section 5 - Safety Issues identified for the UK by the Rapporteur at the 2008 Convention Review Meeting

Topic headings for this section are taken directly from those parts of the Rapporteur's report at the 2008 Convention Review Meeting that address "challenges" and "planned measures to improve safety". The corresponding text shows where information can be found in this report.

Timely implementation of new build strategy

5.1. Whilst the timing of the new build strategy is largely commercial and not therefore within the scope of the Convention, it is important to ensure that measures are in place to regulate the safety of a new build programme. The safety assessment for new reactor designs and the strategy for licensing new reactors are covered in Section 2 and in Article 14 (safety assessment), Article 17 (siting) and Article 18 (design).

Ensuring supply chain for new build

5.2. Ensuring the reliability of the supply chain of plant and components for new build is primarily a commercial concern. However ensuring that plant and components for new, operating and decommissioning reactors meet rigorous nuclear safety standards is a major issue and is addressed in Section 2.

Implementation of decommissioning plans

5.3. This is a matter for the Joint Convention and will be addressed fully in the next UK report to that Convention. A brief update on those UK NPPs that have ceased operation can be found in Article 6. The work of the NDA is described in Article 10.

Threat of loss of industrial infrastructure including human skills

5.4. There are many national initiatives involving Government, industry and the UK universities. These are addressed in Section 2 and Article 11.

Human resources - particularly of the regulatory body

5.5. ND has had significant recent success in recruiting staff. However, the age structure of current regulatory staff is heavily weighted towards retirement age so this success will need to be maintained for several years. This is addressed in Section 2 and Article 8.

Development of safety performance indicators (operators and regulators)

5.6. Work is still in progress in this area for both the regulator and licensees. The current position is addressed in Articles 8 and 12.

Plans to reduce the number of events at nuclear power plants by 7.5% by 2011

5.7. The progress, reasons and basis for this target are explained in Article 19.

Move towards an outcome driven regulatory approach.

5.8. This is addressed in Article 8.

Consider effects of climate change (e.g. sea level changes)

5.9. This is a potential external hazard and therefore a normal part of safety case assessments and PSRs. Information on these can be found in Articles 6 and 14 and Annex 6.

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 fourth 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 addressed. Some ageing issues can be controlled and managed by maintenance and replacement of components. Other issues, such as the degradation of the graphite core (see Section 3), 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 effectiveness of the UK's nuclear safety licensing regime, the high priority given to safety by the UK nuclear utilities and the good safety culture in the industry. Furthermore, the PSR requirements of the UK nuclear site licences have meant that for many years the UK has been monitoring and improving the safety of its nuclear installations as a matter of routine. This activity will continue in the future under the legal requirements of the nuclear site licence.

Nuclear installations in the UK

6.3. The UK's nuclear licensed sites with NPPs are listed below. This includes those sites with reactors that have shut down, are de-fuelling or are decommissioning. With the exception of Sizewell B, which is a PWR, all the UK's nuclear power plants use gas-cooled technology. The first generation ('Magnox' reactors) use natural or slightly enriched uranium with magnesium alloy cladding. The second generation, AGRs, 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 North Ltd., Magnox South Ltd. and Sellafield Ltd.:

Berkeley	2 Reactors (Magnox)	Decommissioning
Hunterston A	2 Reactors (Magnox)	Decommissioning
Trawsfynydd	2 Reactors (Magnox)	Decommissioning
Calder Hall	4 Reactors (Magnox)	Shut Down
Chapelcross	4 Reactors (Magnox)	Shut Down
Bradwell	2 Reactors (Magnox)	Decommissioning
Dungeness A	2 Reactors (Magnox)	Shut Down

Hinkley Point A	2 Reactors (Magnox)	Decommissioning
Oldbury	2 Reactors (Magnox)	Operating
Sizewell A	2 Reactors (Magnox)	Shut Down
Wylfa	2 Reactors (Magnox)	Operating

(ii) British Energy Generation Ltd.:

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

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

6.4. The UK's first nuclear installations, the Magnox reactors, started operation between 1956 and 1971. These are carbon dioxide gas-cooled, graphite moderated reactors that use natural (or in some cases very slightly enriched) uranium 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.

6.5. 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.

6.6. The UK's gas-cooled reactors do not need secondary containment. For design basis loss of coolant accidents, the reactor transient does not precipitate 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.

6.7. 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 Zircalloy and pressurised water as the coolant.

6.8. 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

6.9. The safety of the UK's NPPs is assured by the process of routine regulation and inspection (as addressed under Articles 8 and 14) and by the process of PSRs.

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

6.11. Each nuclear power reactor is required to be shut down for inspection and maintenance every two or three years (depending upon the particular NPP design). After these shutdowns, the licensee must apply for a Consent (see Article 7) to restart the reactor. Consents are granted by HSE's Nuclear Directorate (ND) 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 ND the opportunity to review specific aspects known to have safety significance. In addition, Consent for start up is not granted until ND is sufficiently confident that the reactor is safe to operate for the period up to the next shut down for inspection and maintenance.

6.12. 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 HSE 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 again apply to ND for a Consent to restart. Further information concerning the statutory requirements and the operation of ND are given in Articles 7 and 8.

6.13. In addition to the continual day-to-day regulatory inspection and assessment of licensees' activities and the shutdowns, there are PSRs where reappraisals are undertaken not only to confirm continued safe operation but also to examine plant safety in the foreseeable future. The UK approach to PSRs is covered in the following section.

Periodic safety reviews

6.14. 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.

6.15. The rationale for selecting ten years as the review period was chosen by many EU Member States, 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', NS-G-2.10. The legal basis for PSRs in the UK is embodied in the conditions that are attached to the nuclear site licence. Licence Condition (LC) 15 (Periodic Review) requires licensees to "make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases".

6.16. The programme for the UK's nuclear installations' PSRs is given in Table 6.1 below. The second round of PSRs for the BEGL AGR stations was completed in 2009. The findings for each station have been published on the HSE website[24].

6.17. 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. As indicated in Table 6.1 below, both of these stations have extended their previous date for the end of generation, and the validity of the PSR conclusions has been reconfirmed.

Table 6.1 - Status of Periodic Safety Reviews

	STATION STARTED OPERATION	FIRST REVIEW	SECOND REVIEW	THIRD REVIEW
Magnox Installations				
Calder Hall/ Chapelcross	1956 - 1959	1982	1996	Closed
Bradwell	1962	1987	1992	Closed
Berkeley	1962 - 1963	1988	Closed	
Hunterston A	1963	1988	Closed	
Trawsfynydd	1964	1992	Closed	
Hinkley Point A	1965	1990	1995	Closed
Dungeness A	1966	1994	1996	Closed
Sizewell A	1996	1994	1996	Closed
Oldbury	1968	1995	1998	Current closure plan - 2011
Wylfa	1971	1996	2004	Current closure plan - 2014.
AGR/PWR Installations				
Hinkley Point B	1976	1996	2006	
Hunterston B	1976	1996	2006	
Dungeness B	1982	1997	2007	
Heysham 1	1983	1998	2008	
Hartlepool	1984	1998	2008	
Heysham 2	1989	1999	2009	
Torness	1989	1999	2009	
Sizewell B	1995	2005		

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.

6.18. 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.

6.19. 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.

6.20. 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;
- 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 ND.

6.21. In reviewing the total current 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.

6.22. 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.

6.23. Another essential element of the review is for all structures, systems, or components susceptible to ageing or wear-out 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.

6.24. 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 ND. 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 ND’s satisfaction.

6.25. 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. 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. Level 2 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.

6.26. The results of the PSRs have produced, and continue to produce, worthwhile improvements to safety. So far they have 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 ND's monitoring of an operator's performance, and an essential input to any agreement by the ND to the continued operation of any nuclear installation.

Status of UK nuclear power plants

6.27. The following paragraphs summarise the key issues that have arisen at each of the UK's nuclear power stations since the UK's fourth report to the Convention. Technical details on the reactors at each site are shown in Annex 1. Progress on the significant AGR ageing issues identified in the fourth report to the Convention is discussed in Section 3.

Reactors outside the scope of the Convention

6.28. There are no changes since the UK's fourth report to the Convention. The Bradwell, Berkeley, Trawsfynydd, Hunterston A and Hinkley Point A Magnox reactors are de-fuelled and are being decommissioned. As such, they are no longer nuclear installations for the purposes of the Convention. The safe management of the fuel is addressed separately in the UK's report to the Joint Convention.

Reactors de-fuelling

Calder Hall (four Magnox reactors)

6.29. This station permanently ceased generation in March 2003. Due to issues at the reprocessing plant at Sellafield, the start of de-fuelling has been progressing slowly. There are approximately 10,000 fuel elements in each of the four reactors.

Chapelcross (four Magnox reactors)

6.30. This station permanently ceased generation in June 2004. Due to issues at the reprocessing plant at Sellafield, the start of de-fuelling has been progressing slowly. There are approximately 10,000 fuel elements in each of the four reactors.

Dungeness A (two Magnox reactors)

6.31. Dungeness A operated at power for 40 years and ceased generation in December 2006. A Post-Operation and De-fuelling Safety Case was developed between 2004 and 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 are approximately 28,000 fuel elements in each of the two reactors.

Sizewell A (two Magnox reactors)

6.32. Sizewell A operated at power for 40 years and 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 are approximately 30,000 fuel elements in each of the two reactors.

6.33. In January 2007, failure of a pipe resulted in the leakage of a significant volume of cooling pond water. No discharge limits were exceeded, but the incident recently attracted media attention following an FOI request.

Operating reactors

6.34. Overall, UK NPPs have operated successfully and to programme. However, some events have caused disruptions to normal operation. The more significant ones are summarised below. All aspects of operation are subject to regulatory process and oversight as described in Article 7.

Oldbury (two Magnox reactors)

6.35. Oldbury has been operating for 40 years and is planned to cease generation in 2011. During the past four years, safety-related activities have focussed on the end-of-life management of the graphite reactor cores, with the preparation of significant and complex new safety cases being required. The need to prepare these safety cases has resulted in the ability to generate electricity being constrained. The generic graphite ageing issue is addressed in Section 3.

Wylfa (two Magnox reactors)

6.36. Wylfa has been operating for nearly 40 years and was planned to cease generation in 2010. However, Magnox North Ltd. is preparing a detailed safety analysis to extend the operational life of the station by up to 4 years. Many safety improvements have been implemented following a Long Term Safety Review carried out in the 1990s and a PSR carried out in 2004. A probabilistic fire hazard safety-case has been developed for the site, and major modifications to the seawater cooling system were completed in 2009.

Dungeness B (two AGRs)

6.37. Dungeness B staff are continuing to work on the fuel plug unit welds and this is limiting the rate of refuelling. The station continues to optimise work associated with the fuel route to ensure that the refuelling strategy delivers maximum performance from both of the reactors. Currently Dungeness Reactor 21 is undergoing an outage to inspect welds associated with a reheater outlet penetration. A hydraulic oil leak and subsequent fire in Reactor 22 boiler annex resulted in a manual shutdown of the reactor. The required remedial work was completed and the reactor safely returned to power.

6.38. In June 2009 a fuel plug unit failed to latch to a new fuel stringer due to the presence of foreign material (rubber matting). This resulted in the coupling between the plug unit and the fuel stringer not latching correctly and it could not be guaranteed therefore that the fuel stringer would not fall and possibly injure personnel. A decision was made to lessen the consequences of a dropped load by injecting liquid foam into the fuel carrier below the stringer. The station did not recognise that the foam, as a moderator, would present a potential criticality risk to the fuel and, as such, was a breach of the station's criticality arrangements. This event was classified as International Nuclear and Radiological Event Scale (INES) level 2 by BEGL.

Hartlepool (two AGRs)

6.39. In mid-2008 a shortfall in the turbine disintegration safety case was identified, whereby the postulated fire loading following turbine disintegration was not adequately mitigated by the existing safeguards. A new tripping system was installed on the turbine lubricating oil systems, together with modifications to the turbine oil tanks and improvements to the reactor pressure vessel cladding. The work was completed before the reactors returned to service following the BCU recovery mentioned in Section 3.

6.40. The existing safety justification for Hartlepool (and Heysham 1) boiler spines has a limit on the total hours of operation to ensure adequate structural integrity

against a potential challenge from reheat cracking in structural welds. This limit is expected to be reached for the lead reactor by 2012. BEGL has undertaken an experimental and analytical programme to develop techniques for the assessment of reheat cracking in boiler spine welds and radial arm welds, and is preparing a safety case to extend the current limit of operation beyond planned reactor lifetimes.

Heysham 1 (two AGRs)

6.41. It is thought that an area of thermal insulation within the reactor is very slowly degrading and Reactor 2 is operating at about 76% of full power as a result. The root cause of the degradation is still being investigated (see Section 3). Also, the modifications to the turbine disintegration protection, discussed in paragraph 6.39 above for Hartlepool, were installed at Heysham 1 during the BCU recovery outage.

Heysham 2 (two AGRs)

6.42. Following an unplanned automatic trip of Heysham 2 R7 in August 2007, the main boiler feed pump tripped automatically and the standby boiler feed pumps started and ramped up to full discharge pressure. Due to a loss of supplies in B quadrant the main feed route was not isolated, therefore full flow was delivered to 7B quadrant boiler units. The boilers were quickly flooded through causing rapid chilling of the boiler components.

Hinkley Point B (two AGRs)

6.43. In 2006, both reactors at Hinkley Point B were shutdown for a prolonged period of inspection, testing and repair associated with main boilers (see Section 3). They were both safely returned to service in mid 2007 at reduced power, to satisfy revised safety case limits. Station operating life has been extended from 2011 to 2016 and extension until 2021 is being actively pursued.

Hunterston B (two AGRs)

6.44. Since the two reactors returned to service in May 2007 after the boiler repairs described in Section 3, they have operated without significant incident. The accounting lifetime of the station has been extended to 2016 and work to justify further extension is underway.

Torness (two AGRs)

6.45. In July 2009 the pond water cooling pre-coat filter was undergoing a filter media change when pond wet sump water was found to have filled pre-coat mixing tank 2 and overflowed on to the floor of the -9m level. An incorrectly positioned valve during the media change led to an estimated loss of approximately $8m^3$ of pond wet sump water into the sumps and drains and resulted in some contamination of the -9m and -11m levels. Due to the application of additional controls on Final Delay Tank discharges there has been no significant increase in radiation exposure to station personnel or members of the public. This event has led to improvements to operational procedures for the pond water treatment plant and to maintenance and testing instructions.

Sizewell B (one PWR)

6.46. Sizewell B experienced high moisture levels in the reactor containment building in March 2010. A controlled shutdown and depressurisation of the reactor was completed. Inspection of the pressuriser identified a 30mm long defect on a pressuriser heater well Insert external to the pressuriser and deformation of another heater well Insert. Internal pressuriser inspection revealed two heaters had split and another had a hole that appears to be due to an electrical discharge between element and sheath.

6.47. The pressuriser has 78 heater penetrations. The heater well inserts are the Type 3 design manufactured from a single piece forging (no welded boss). The

heater elements have a stainless steel outer sheath containing magnesium oxide powder as an insulating material surrounding electrical coils.

6.48. Metallurgical examination of the section of the heater sheath that failed showed the 316 stainless steel contains trans-granular cracks with branching, typical of stress corrosion cracking. It has been confirmed that all heaters were swaged down during manufacture with no subsequent heat treatment.

6.49. A repair programme is progressing. The reactor will be returned to service once this is completed.

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 fourth UK report (i.e. in a way that has implications for the Convention obligations), except in paragraph 7.9 below.

7.1. 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

7.2. The DECC website[25], under the heading of safety, 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

7.3. This section describes the main primary legislation that sets up 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

7.4. Under the Health and Safety at Work etc. Act 1974 (HSWA74)[26] a general duty is placed on all employers (not just nuclear site licensees) 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 established two regulatory bodies, the Health and Safety Executive (HSE) and the Health and Safety Commission (HSC). However in 2008 the two bodies were merged to a single body that retained the name Health and Safety Executive (see Article 8). Extracts from HSWA74 relevant to this Convention are in Annex 2.

7.5. An important provision of the HSWA74 is that it is permits the HSE to develop secondary legislation in the form of regulations.

Nuclear Installations Act 1965, as amended

7.6. Under the Nuclear Installations Act, as amended, 1965 (NIA65)[27] 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. The parts of each of these sections relevant to the Convention are contained in Annex 3.

7.7. 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. These conditions are, in effect, secondary legislation.

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

7.8. The Environment Act 1995 (EA95)[28] 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.

7.9. 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)[29]. In England and Wales the permitting requirements of RSA93 have now been incorporated into the Environmental Permitting (England and Wales) Regulations 2010 (EPR10)[30]. 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. 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.

7.10. 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 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.

7.11. 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 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.

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

Electricity Act 1989

7.13. Before building or extending nuclear installations, planning consent under the procedure set out in the Electricity Act 1989[31] is necessary. Under this Act a generating station with a capacity greater than 50 megawatts requires a Consent granted by the Secretary of State for Energy and Climate Change (for England and Wales) or the Scottish Ministers under section 36 of the Electricity Act 1989 before

being constructed, extended or operated. An applicant granted planning consent to use the site will need a licence from HSE to install and operate the nuclear installation. This is addressed further in Article 17.

Utilities Act 2000

7.14. The Utilities Act 2000[32] applies to the gas and electricity sectors in Great Britain. It established a single Gas and Electricity Markets Authority with the aim of achieving a fair balance between the interests of consumers and shareholders by setting duties and powers for the Authority. It also established an independent Gas and Electricity Consumer Council. Provisions in this Act enable the gas and electricity sectors to make an appropriate contribution to the Government's social and environmental objectives. Other provisions make regulation more transparent and predictable. This Act also updates the financial regulatory regime for the gas and electricity sectors to take account of, and to facilitate further, competition, and to reflect increasing convergence between the two sectors. It provided the powers needed to bring in electricity trading arrangements.

Energy Act 2004

7.15. The Energy Act 2004[33] 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. The work of the NDA is described in more detail in Article 10.

Freedom of Information Act 2000

7.16. The Freedom of Information (FOI) Act 2000[23] 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

7.17. In common with all UK industries, nuclear installations must comply with all regulations made under the HSWA74. There are, however, a few regulations that in the main relate to nuclear installations and these are described in the following paragraphs. They are all 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

7.18. The nuclear site licensing regime is complemented by the Ionising Radiations Regulations 1999 (IRR99)[34] 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[5] and include 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[42] 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

7.19. The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR99)[35] implement the requirement for an environmental impact assessment for decommissioning nuclear power stations and nuclear reactors arising from EC Directive 85/337/EEC[36] (as amended by EC Directive 97/11/EC)[37] 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

7.20. The Radiation (Emergency Preparedness and Public Information) Regulations 2001 (REPPIR)[38] implemented in Great Britain the Articles on intervention in cases of radiation emergency in EC Directive 96/29/Euratom[5]. It also partly implements EC Directive 89/618/Euratom[39] 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

7.21. The Management of Health and Safety at Work Regulations 1999 (MHSW99)[40] are relevant as they include 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.

7.22. MHSW99 is very wide-ranging. Where its requirements overlap with other Health and Safety Regulations, compliance with the more specific Regulation is normally sufficient for compliance with MHSW99.

Health and Safety (Fees) (Amendment) Regulations 2010

7.23. The Health and Safety (Fees) (Amendment) Regulations 2010[41] amends the Health and Safety (Fees) Regulations 2009. It provides for the charging of fees for work by HSE 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 HSE prior to any application for a nuclear site licence under NIA65 that may be made based upon the particular design proposal that has been assessed.

Process for developing secondary legislation

7.24. 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).

7.25. 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

7.26. IRR99 made under the HSWA74, implemented most of the revised BSS Directive (96/29/Euratom)[5]. IRR99 also implement European Council Directive 90/641/Euratom[42] on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas.

7.27. REPPIR implements in Great Britain the Articles on intervention in cases of radiation emergency in EC Directive 96/29/Euratom[5]. REPPIR also partly implement EC Directive 89/618/Euratom[39] (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 Wales and SEPA is the regulatory body for Scotland. As part of the implementation of the BSS Directive 96/29/Euratom[5] a number of the Agencies' existing administrative practices under RSA93 have been put into legally binding obligations.

7.28. EIADR99[35] 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[36] (as amended by EC Directive 97/11/EC[37]) on the assessment of the effects of certain public and private projects on the environment.

7.29. The implications of the EC Directive on Nuclear Safety 2009/71/Euratom[2] are still being examined and the need for potential changes to primary and secondary legislation is being considered.

Licensing system

Overview of the licensing system

7.30. The licensing system is itself secondary legislation enabled by the provisions of the NIA65.

Authority to issue licences

7.31. HSE derives its licensing authority from NIA65. This requires that all operators of nuclear installations must obtain a licence from HSE and allows HSE to attach such conditions as it considers necessary in the interests of safety and radioactive waste management. The Nuclear Installations Act 1965 etc. (Repeals and Modifications) Regulations 1974[43] made HSE 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 HM Chief Inspector of Nuclear Installations, who heads HSE's Nuclear Directorate (ND). The conditions can be changed quickly, without consultation, and have the force of law.

Licence conditions

7.32. ND has developed 36 standard conditions (see Annex 4) that together form a sound basis for good nuclear safety and radioactive waste management. They 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 quality assurance (QA). Several relate to the licensee having adequate arrangements to manage changes that may have safety implications.

7.33. 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. Similarly, 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 the 'Executive' (HSE, or in practice ND acting on its behalf), which can for example, "Approve" arrangements or "Consent" to specific actions. Some conditions enable HSE to direct a licensee to carry out a specific action including shutting down a reactor. Other conditions require the licensee to obtain HSE's permission before commencing an activity such as starting up a reactor after periodic maintenance. The licensing powers are supplemented by enforcement and investigation powers derived from HSWA74 (see paragraphs 7.54 – 7.60).

Basis for licensing

7.34. A nuclear site licence is issued on the basis of a satisfactory outcome of regulatory assessment of an applicant's case including the suitability of a proposed licensee. Licences are issued for the lifetime 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 imply that a plant is allowed to be built or operate. 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

7.35. 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 and HSWA74 allow HSE to revoke a licence, or for it to be surrendered by the licensee. However, in either event, the licensee will remain responsible for the safety of activities on the site. This "period of responsibility" can end only when a new licence has been granted for the site or HSE has given written notice that in its opinion there has ceased to be any danger from ionising radiations from anything on the site.

7.36. HSE published a policy statement in August 2005[44] 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 HSE under NIA65. It attempts to achieve broad consistency with current scientific thinking, relevant guidance and other published material including the RSA93 (and the exemption orders made under it), and Article 5 of the BSS Directive[5].

Appeals process

7.37. Nuclear site licensees, like all duty holders under HSWA74, have the right of appeal to an industrial tribunal in respect of Improvement and Prohibition Notices (see paragraphs 7.53 to 7.55). 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 ND. Although HM Chief Inspector of Nuclear Installations 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.

7.38. 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.

7.39. In relation to the construction of new installations, applicants who are refused planning permission by a local planning authority, or who are granted permission subject to conditions that they find unacceptable, or who do not have their applications determined within the appropriate period, may appeal to the Secretary of State.

7.40. Additionally, NIA65 Section 4(4) provides for HSE to "…consider any representations by any organisation representing persons having duties upon the site … with a view to the exercise by HSE in relation to the site of any of its powers under the foregoing provisions of this section." There has been very limited experience of this provision being exercised and, in the end, it only allows appeal back to HSE on decisions or activities by one of its own Directorates. There is no other provision in NIA65 for the granting of a legal instrument, or for regulatory decisions by ND to be challenged. This reflects the robust independent nature of the regime.

Involvement of public in licensing system

7.41. ND does not have a formal programme for informing the public about its functions and responsibilities, its policies and the uses of radiation sources. However, there are arrangements to inform the public about its routine inspection activities, usually by making periodic reports. ND provides quarterly reports to local community groups on inspection and regulatory activities relating to licensed sites that it regulates.

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

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

- The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR99)[35] - Statutory Instrument 1999 No. 2892; and
- The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) (Amendment) Regulations 2006[45] - Statutory Instrument 2006 No. 657.

7.44. ND has a procedure for dealing with applications submitted to it for Consent under EIADR99[35]. In addition to information provided to consultees, information is also sent to the HSE Head Office library in Bootle, the HSE office nearest the site and public library/libraries near the site so that they are available for public inspection during the consultation period.

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

7.46. The GDA process has 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 are given access to reports prepared for the design by the Requesting Party, without compromising commercial and security considerations.

Regulatory inspection and assessment

Legal establishment of regulatory bodies

7.47. HSWA74 enables HSE to appoint inspectors and give them regulatory powers (see Article 8) of assessment and inspection. 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.

7.48. ND is one of HSE's operational Directorates and the NII is that part of ND to which the day-to-day exercise of HSE's nuclear licensing function is delegated. In particular, HSE has delegated to HM Chief Inspector of Nuclear Installations the authority to carry out on its behalf certain functions under the HSWA74 and NIA65. Thus the Chief Inspector has the powers to grant or vary Nuclear Site Licences, and to attach, vary or revoke Conditions of the Licence. The Chief 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

7.49. The licensing process largely determines the scope of the regulatory process. The overriding principle is to focus regulatory effort where it is most needed. This is covered in Article 8. Regulatory activities fall broadly into three areas:

Permissioning inspection

7.50. 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 SFAIRP. NII 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 NII uses to judge safety cases are set out in HSE's Safety Assessment Principles for Nuclear Facilities (SAPs)[46].

Compliance inspection

7.51. 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 NII's nominated inspectors who spend about 30% of their time on site. Additionally, NII undertakes team inspections on particular topics.

Influencing licensees

7.52. The regulator also seeks to influence licensees to further the improvement of nuclear safety and radioactive waste standards. This is particularly important for those areas that impact on safety such as the safety culture of an organisation and leadership, which are difficult to regulate by legal means.

Enforcement powers

7.53. There are a range of enforcement powers available to the regulatory body. These arise from both the primary laws (HSWA74 and NIA65) and the licence conditions. HSE has developed an Enforcement Policy[47] that states the requirements of safety should be applied in a manner that is commensurate with the magnitude of the hazard. Inspectors are guided by an enforcement management model[48] to assist in determining which enforcement measure is the most appropriate in a given situation.

Enforcement powers under HSWA74

Improvement notice

7.54. HSWA74 section 21 provides for an inspector, if of the opinion that a statutory provision is being or has been contravened (and the contravention will continue), to serve a notice requiring the person to remedy the contravention.

Prohibition notice

7.55. HSWA74 section 22 also provides for an inspector, if of the opinion that activities are being carried out which risk causing serious personal injury, to serve a notice with immediate effect to prohibit the activity.

Prosecution

7.56. HSWA74 section 39 gives an inspector the power, in England and Wales, to bring a prosecution before a Magistrates Court for an offence under any statutory provision.

Enforcement powers under NIA65

7.57. NIA65 allows HSE to attach such conditions as it considers necessary in the interests of safety and radioactive waste management. A new condition could, if necessary, be implemented quickly without consultation.

Enforcement powers under the site licence

Direction

7.58. A Direction is issued by HSE when it requires the licensee to take a particular action. For example, LC31(1) gives HSE 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

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

Notification

7.60. The standard licence gives HSE 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 HSE, submit a safety case and shall not commence operation of the relevant plant or process without the Consent of HSE.

Interventions under the site licence

7.61. In addition to the above enforcement powers, the site licence conditions identify specific interventions where HSE must give permission before a licensee can proceed with its intended course of action. Withholding or withdrawing such a permission can be regarded as an enforcement power. It should be noted that for a nuclear reactor on a licensed site, its default situation is shutdown unless the regulator gives the licensee permission to operate. This should be compared with conventional industrial plant where the default situation allows operation unless the regulator intervenes to prevent this.

Consent

7.62. 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 HSE that the proposed action is safe and that all procedures necessary for control are in place.

Approval

7.63. An Approval is used to freeze a licensee's arrangements. If HSE so specifies, the licensee is required to submit the arrangements and cannot carry them out until HSE has given its approval. Once approved, the procedures cannot be changed without HSE's agreement, and the procedure itself must be carried out as specified; failure to do so would infringe the licence condition and would be an offence. For example, for nuclear power stations, HSE has approved Operating Rules important to safety in order to ensure that licensees cannot change these without seeking HSE's agreement to the change.

Agreement

7.64. An Agreement issued by HSE 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 modifications to safety related plant. Such arrangements will often state that for modifications which, if inadequately conceived or implemented, there could be significant nuclear safety implications, the modification cannot be carried out without the agreement of HSE. Hence, the licensee submits a safety case justifying the modification and does not proceed until HSE 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 fourth 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 As described in Article 7, the Health and Safety at Work Act 1974 (HSWA74)[26] established two bodies: HSC and HSE. In 2008 in order to improve governance arrangements, the HSC and the HSE merged into a new unitary body, bringing together their powers and functions, and retaining the name Health and Safety Executive (HSE). The function of HSE is to enforce the relevant statutory provisions where it is the enforcing authority. Those parts of Nuclear Installations Act 1965 (NIA65)[27] that concern safety became statutory provisions of HSWA74 in 1974.

Function and responsibilities of the regulatory body

8.2 HSE regulates the nuclear industry through its Nuclear Directorate (ND). The Directorate's primary goal is to ensure that those it regulates have no major nuclear accidents. It is responsible for the UK safety regulation of nuclear power stations, nuclear chemical plants, decommissioning, defence nuclear facilities, nuclear safety research and strategy and for civil nuclear operational security and safeguards matters.

8.3 Through its own regulation and in partnership with other regulators and agencies, ND works to deliver a substantial reduction in nuclear industry precursor incidents, which are occurrences having the potential to lead to an accident. By seeking this, it aims to meet one of HSE's strategic goals: 'To reduce the likelihood of low frequency, high impact catastrophic incidents while ensuring that Great Britain maintains its capabilities in those industries strategically important to the country's economy and social infrastructure.'

8.4 Additionally, ND also takes responsibility for approving security arrangements within the industry, and for securing compliance with those arrangements. It also oversees safeguard measures to verify compliance with international obligations not to use nuclear materials for nuclear explosives purposes.

8.5 In anticipation of the challenges that the UK nuclear sector is likely to face in the future, the Government is considering options to restructure HSE's Nuclear Directorate. The details of this have been explained in Section 2 of this report.

Independence of the regulatory body

8.6 HSE's independence as a regulator is ensured under HSWA74, where HSE is given direct responsibility for the enforcement of the nuclear safety regulatory

system. Similarly, the environment agencies are made responsible for providing the environmental protection regulatory system under RSA93[29]. There are also governmental mechanisms in place to maintain the regulatory independence. HSE is sponsored by DWP, which has no role in promoting nuclear technology or responsibilities for facilities or activities. However, the Secretary of State for Energy and Climate Change (DECC) is answerable to Parliament for nuclear safety in Great Britain. In this respect, the Chief Inspector can provide factual information and advice to this Minister on matters of nuclear safety regulation, but this Minister is not responsible for HSE's nuclear regulatory actions. The draft legislation to create ND as a standalone nuclear regulator proposes to provide more independence by putting the Chief Inspector's post, role and responsibilities on a statutory basis.

8.7 The Environment Agency (in England and Wales) is sponsored by the Department for the Environment, Food and Rural Affairs (Defra) and the Welsh Assembly Government. It works closely with HSE and the Department of Health.

8.8 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. It also maintains good lines of communication with DECC.

8.9 DECC has a number of policy roles in respect of the nuclear industry. These include responsibility for energy policy generally (including the role of nuclear power), prescribing the activities that should be subject to the nuclear licensing regime, nuclear emergency planning, nuclear security and safeguards, international treaties and the Convention on Nuclear Safety, and the international nuclear liability regime. It is also responsible for those parts of the UK civil nuclear industry still owned by the Government.

8.10 In carrying out its responsibilities, DECC will, when appropriate, seek technical factual information on safety related matters from HSE and advice on environmental issues from the environment agencies.

8.11 Concordats or Memoranda of Understanding exist between the regulators and the Food Standards Agency. 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 and SEPA and the Food Standards Agency.

Independent advisory bodies

8.12 HSWA74 Section 13(1)(d) enables HSE to create advisory committees to provide independent advice on any of its functions. Although not a legal requirement, HSE custom and practice has been to constitute advisory committees in relation to activities in the nuclear sector. At the 2008 CNS, UK reported that the Nuclear Safety Advisory Committee (NuSAC) was such a committee. In October 2008 NuSAC's mandate expired and its work was terminated. As an integral part of the ND restructuring, HSE is currently considering how a successor body should be re-constituted.

Financial resources of regulators

8.13 Section 24A of NIA65 enables HSE to impose financial charges on the nuclear licensees to recover the expenses incurred through its regulation of nuclear installations. In addition, further expenses are recovered from the largest licensees in respect of a programme of generic safety research agreed between HSE and the industry. HSE uses a work recording system to identify the effort and expenses of its staff attributable to each licensee.

8.14 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.

8.15 Additionally, Fees Regulations are used to recover charges for work on GDA.

Organisational structure of ND

8.16 As of 1 May 2010, ND is organised into seven Divisions. The Heads of each Division together with the Chief Inspector form the Management Board. The seven Divisions cover:

- Regulation of NPPs (operating and decommissioning);
- Regulation of fuel manufacture, fuel reprocessing, research facilities, waste management and the UK Safeguards Office;
- Regulation of Ministry of Defence related sites;
- Strategy development , planning and finance;
- Regulation of Security;
- GDA; and
- Policy and International Liaison.

In addition there is currently a major programme lead at senior level that is managing the transition process to an NSC (see Section 2). This is mainly staffed by temporary consultant staff.

Human resources

8.17 Section 2 explained the measures taken to enable ND to recruit new inspectors and the success this has achieved to date. As of 1 May 2010, ND has 204 nuclear safety inspectors in post (compared with 165 reported in the UK report to the 2008 Convention). It has sufficient inspectors in post to carry out its current regulatory duties but it is recognised that recruitment will need to continue at the same rate (see paragraph 2.64) for several years as new-build NPPs become a reality and older inspectors retire. As in many other countries, ND's age distribution is heavily weighted towards the older end of the spectrum and it currently has 27 inspectors in post who are beyond the former retirement age of 60 years old (at present around 13% are over 60 and 30% over 57). However, HSE has recently removed all age barriers so there is now no upper age limit to employment.

8.18 Staffing profiles have been prepared for a number of years ahead. These are based on current and anticipated workloads and make various assumptions on the retention of staff beyond the former retirement age of 60.

8.19 In addition, each of ND's Divisions has identified current and anticipated staff requirements in terms of technical discipline. As well as identifying current vacancies, this work has identified potential pressure points caused by future retirements, and where there is a vulnerability arising from only having a single expert in a particular discipline.

Developing and maintaining staff competences

8.20 The intensive recruitment campaign over the last two years has necessitated a radical revision of the training and assimilation of new inspectors. Recruitment in excess of 30 new inspectors per year means that ND 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. ND has a training manager in place and has a significant training budget.

Training of new inspectors

8.21 All inspectors joining ND 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 is to expand and build on this base rather than "convert" them to acquire another knowledge base. It can be regarded as a "holistic" approach to training. To achieve this, the initial training is in two main areas:

- Training to be a regulator – few new recruits have prior knowledge of regulation; and
- Training to expand their technical expertise to gain a working knowledge of other essential technical disciplines.

Competence framework

8.22 In 2008 a new competence framework was developed for nuclear safety inspectors. This framework was based on the requirements of "National Occupational Standards for Nuclear Regulators".[49] This is a high level standard and it sets out the basic requirements for all regulators involved in nuclear safety and security including the environment agencies and transport.

8.23 The competence framework was initially trialled and is being refined continuously to reflect feedback. The purpose of the framework is to specify the training need for specific job functions as well as identifying the basic training needs.

Training methods

8.24 A new inspector's training programme is developed on a personal basis and is based on a training needs analysis. The delivery of the programmes relies extensively on an interactive tutorial approach rather than formal lectures. Training documentation focuses on providing signposts to where information can be found rather than providing detailed training material.

8.25 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

8.26 Whilst considerable effort is spent on the training of new recruits, ND also has a refresher training programme to develop professional competencies for all staff. ND's policy is that this is not centrally managed but is a matter for individual inspectors to agree with their line managers with advice from senior experts in their technical field. Such training covers topics such as communication, influencing skills, change management and interpersonal skills, as well as the development of technical competencies.

Regulatory body quality management

Business Management System

8.27 ND has a Business Management System (BMS) to provide an integrated approach to system management. It documents appropriate policies, management controls and process controls in a manner that augments the experience, training and professional judgment of all staff. Experience of BMS use is gathered and fed back to secure improvements.

8.28 Within the BMS, procedures and guides on ND's Key Business Activities are documented in a consistent manner. The activity-based approach ensures that the documentation adapts easily to accommodate re-organisations or changes in organisational focus. The system includes a means for continuous improvement to

ensure that the focus on processes maximises the efficiency and effectiveness of efforts towards meeting ND's aspirations.

8.29 ND's BMS is seen as a key contributor towards achieving its mission of securing the 'protection of people and society from the hazards of the nuclear industry'. In recognition of this, the BMS has undergone intensive internal and external assessment (e.g. the recent IRRS mission) and best practice systems have been reviewed as benchmarks (Canada, Spain, Switzerland) as well as those of other sector regulators (including the UK Civil Aviation Authority). As a result of this analysis, there is now a cross-functional team of QA experts and technical staff in place to modernise and upgrade the current system, utilising state-of-the-art technology and business process engineering principles. The re-engineering of the BMS is closely linked to the Transformation strategy of enhancing Transparency, Openness and Organisational effectiveness. Good progress is already being made, with launch of the new system planned for 2011 and the aim of achieving certification to the ISO9001 2008 standard.

8.30 An important part of the BMS is the series of Technical Assessment Guides (TAGs). These are primarily guidance for inspectors on the interpretation and application of the HSE SAPs (see Article 14). There is also guidance relevant to principles underlining the enforcement of licence condition compliance. These are known as Technical Inspection Guides (TIGs). Copies of TAGs and TIGs are available through the HSE website detailing HSE's Internal Operational Instructions & Guidance[50].

Effectiveness of the regulatory body

Safety performance indicators

8.31 In the UK Report to the 2008 Convention, it was noted that ND had carried out work with licensees to develop a safety performance indicator (SPI) framework. A pilot study had been completed and a full implementation study was started in 2007. The primary objective of this study was to develop a means whereby licensees can monitor their nuclear safety performance and improve it where necessary. It was also anticipated that this study would help develop a shared understanding of nuclear safety performance and also the targeting of regulatory interventions.

8.32 It was also anticipated in 2007 that it might be feasible to utilize the SPI data as regulatory performance measures. However it was found that this was not a meaningful metric for the regulator. The main use of SPIs is as a licensee performance measure. ND will, through its normal regulatory activity, monitor how effectively the licensees use SPIs, and also use the SPI data as one of many sources of intelligence that inform the targeting and prioritisation of regulatory interactions.

8.33 The current aim of the SPI project is to move their use to "normal business" by March 2011. An industry-led working group is being set up to achieve this. An important aspect is the shared use of it by the industry and the regulator.

Planning and prioritisation of work

8.34 In the document "Health and Safety Executive's Nuclear Directorate, Nuclear Strategy and Operating Plan"[51], ND sets out what it aims to achieve in the medium and longer term and the steps that need to be planned to deliver these aims. The document builds on the changes made in 2008 to ND planning practice when the decision was made to combine two documents that were previously separate: the ND Strategic Plan and the ND Plan of Work. It adopts an approach to setting out intentions based on Government guidance. The change in approach reflects decisions taken in October 2007 to build on and strengthen previous ND work to develop greater long-term strategic direction to the delivery of its aims.

8.35 This Nuclear Programme Strategy and Operating Plan:

- describes how ND goes about its business and identifies key issues facing the Directorate as a whole;
- maps out the near and longer term Directorate objectives intended to address those issues; and
- sets out the details of how Divisions will secure ND's objectives.

8.36 The new planning document is also intended to help stakeholders understand more clearly what ND is trying to achieve. For ND's own teams, it identifies factors that need to be taken into account to secure progress and provides clear direction to all staff in the Directorate on what is expected of them.

8.37 The Strategy and Operating Plan described above sets out ND's broad aims and objectives. It is also essential that the day-to-day regulatory work implements these objectives and makes optimum use of resources. To achieve this, ND sets out its guidance for planning of interventions in its Technical Inspection Guide INS 008[52]. This procedure sets out ND's expectations for the development and delivery of off- and on-site planned regulatory interventions. Its aim is to ensure that ND is making the best use of its resources by:

- aligning ND teams to licensees' programmes;
- allocating resources to target activity at areas of greatest concern;
- managing activity to make and control impact and deliver outcomes; and
- using management metrics to inform decisions on delivery.

As part of its Transformation process, ND is reviewing its planning system to develop a more performance, outcome-orientated approach.

External support to the regulatory body

8.38 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 the regulator through its own staff. To maintain this situation, the regulator 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 HSE. To accommodate this, the regulator has an extramural support budget and framework agreements with some outside bodies known to be independent, to enable contracts to be placed quickly.

8.39 Currently, ND obtains technical support through three main sourcing 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, through normal procurement routes, a range of one-off consultancy contracts from a range of suppliers; and
- purchasing consultancy advice through an ND framework agreement with pre-tendered suppliers.

8.40 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 (see Annex 7), which stated that ND should have access to scientific and technical support in the same way it is available to many other nuclear regulators in other countries.

8.41 The support framework which was set up with 31 contractors from the UK and overseas has been operating successfully for 15 months. Approximately half of

contracted technical support is commissioned through the framework with the intention that this will increase in future years as new work starts up. The total spend on technical support in 2009/10 was £9m. This is expected to increase in the future in line with the need to assess new civil reactors intended for operation in the UK.

Interface with other agencies/regulators

Environmental regulatory bodies

8.42 The Environment Agency is the principal environmental regulator in England and Wales. SEPA has the equivalent responsibilities in Scotland. Their regulatory responsibilities include the authorisation or permitting of the disposal of radioactive wastes from nuclear licensed sites. There are no nuclear installations in Northern Ireland to which the Convention applies (Annex 5 provides more information on the environmental regulatory bodies).

8.43 HSE, the Environment Agency and SEPA work closely with one another to ensure the effective co-ordination of their respective regulatory activities at nuclear installations. They have agreed Memoranda of Understanding 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, HSE consults the Environment Agency 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 or SEPA consult HSE under EPR10[30] or RSA93[29] on proposed (new or varied) authorisations for disposals of radioactive waste including discharges to the environment.

8.44 In addition to their own routine inspection activities on nuclear licensed sites, the Environment Agency and SEPA carry out planned joint inspections with HSE and co-operate in the investigation of incidents where appropriate.

Responsibilities of other agencies and bodies

8.45 The UK Health Protection Agency (HPA) was established on 1 April 2005 under the Health Protection Agency Act 2004[53] as a non-departmental public body, replacing the HPA Special Health Authority and the National Radiological Protection Board, and with radiation protection as part of health protection incorporated in its remit.

8.46 The National Radiological Protection Board role continued as the Radiation Protection Division of HPA and, since 1 April 2010, as the Centre for Radiation Chemical and Environmental Hazards (HPA-CRCE). 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.

8.47 HPA-CRCE also provides technical services to persons concerned with radiation hazards; it makes charges for such services and for providing information and advice.

Openness and transparency of the regulatory body

8.48 In common with all other Government Departments, HSE must comply with the FOI Act 2000 (see Article 7). ND has a dedicated team to handle FOI requests.

8.49 The enhancement of openness and transparency in ND is a key feature of the Transformation process described in Section 2 of this report. The openness and transparency work-stream will address the amount of information that is proactively published.

8.50 Currently the structure of the ND section of the HSE website is being redesigned and new copy is being developed. This is being done alongside the Transformation programme and will address new ways of working and new information in a corporate way. The go-live date of the new website content and structure is Autumn 2010. Its content will be directly transferable into a new branded site when the new NSC comes into being.

8.51 Section 2 discusses the openness policy of the GDA process. ND is currently reviewing this to see if it would be desirable to transfer GDA good practice to the rest of ND, acknowledging that licensing and permissioning will have different stakeholder requirements.

8.52 ND inspectors write a report for, and attend, the Licensees' Site Stakeholder Meetings. Their reports are published on the HSE website.

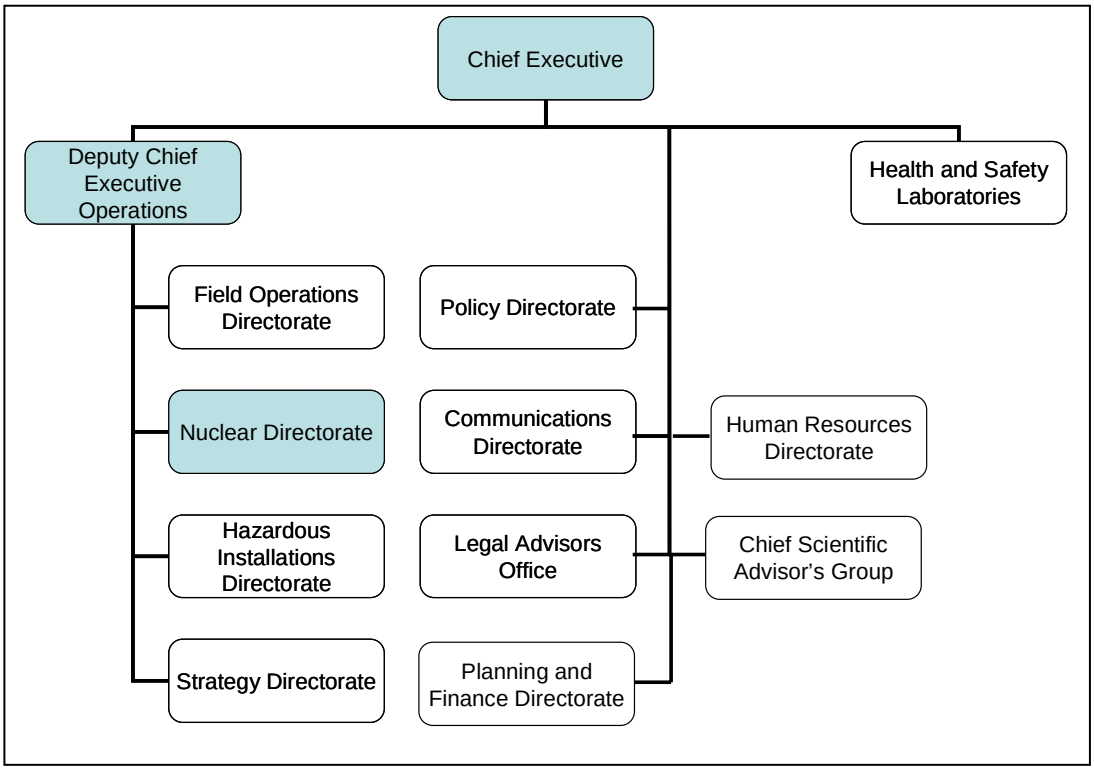
8.53 ND participates in international initiatives initiated by the Organisation for Economic Cooperation and Development (OECD) Nuclear Energy Agency's (NEA) and the Western European Nuclear Regulators' Association (WENRA) to promote openness and transparency.

Status of the regulatory body

8.54 ND is an operating division of HSE. Its place within the organisation is shown in Figure 8.1 below.

8.55 HSE is responsible for enforcing legislation on health and safety at work and in particular, in relation to nuclear installations, for the operation of the nuclear site licensing regime. Within HSE, the responsibility for regulating the nuclear industry through the nuclear licensing regime has been delegated to Her Majesty's Chief Inspector of Nuclear Installations, who is also Head of the Nuclear Directorate (ND). ND includes NII which is responsible for carrying out the licensing and day-to-day regulation of the nuclear industry. Licensing powers are delegated from HSE to the Chief Inspector. This delegated authority gives the Chief Inspector the power to issue, add conditions to, and revoke nuclear site licences.

Figure 8.1 – HSE structure relevant to the Convention

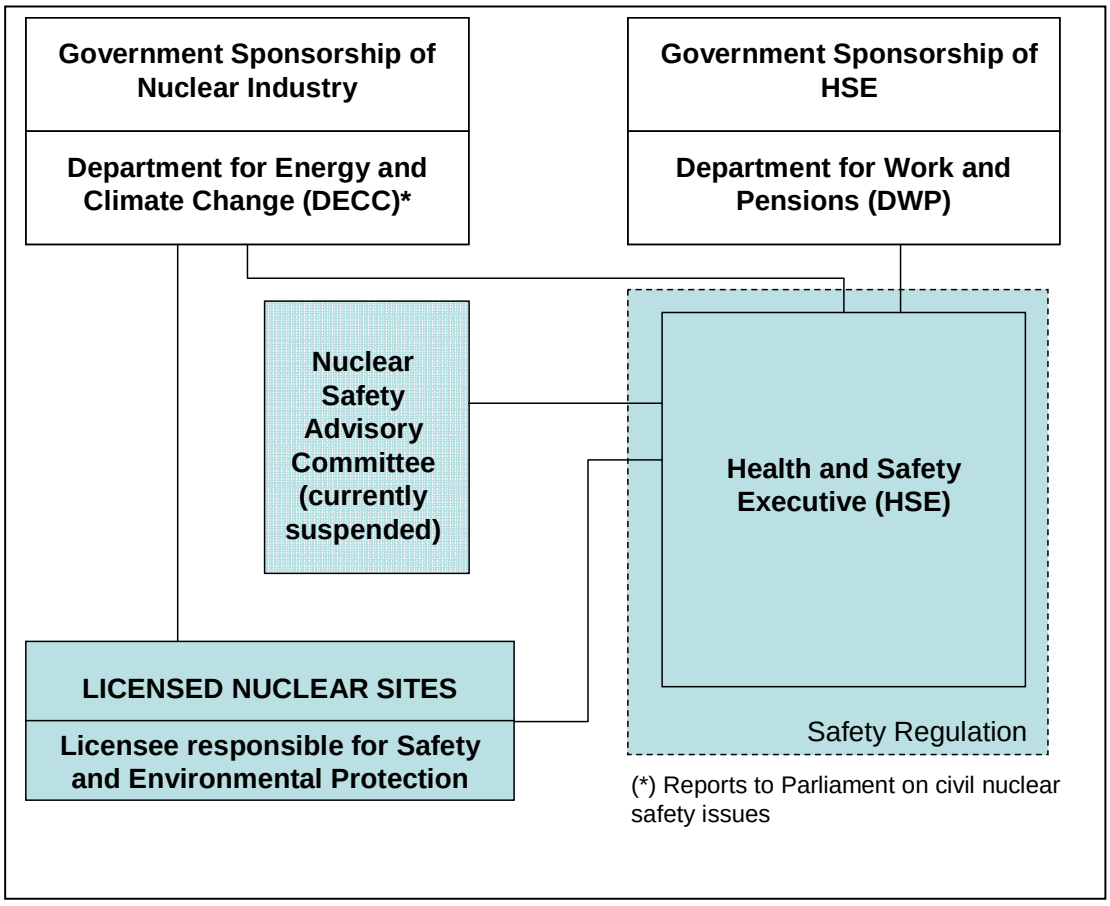


Lines of Reporting

8.56 Her Majesty's Chief Inspector of Nuclear Installations has direct lines of access, on nuclear safety matters, to Ministers for DECC and the Ministry of Defence (MoD), reflecting their respective responsibilities to Parliament on civil and military nuclear safety.

8.57 The interfaces between HSE and other Government Departments are shown in Figure 8.2.

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 fourth 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)[26] 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)[27] 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 in respect of nuclear occurrences.

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 installations' operations. 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. 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 6.

9.4. 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, British Energy 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, 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.

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

Demonstration of safety

9.6. 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.

9.7. On granting a nuclear site licence, NIA65 enables HSE to attach any conditions to the licence in the interests of safety or radioactive waste management. Currently, HSE 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, listed in Annex 4) 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. Nuclear installation inspectors carry out a comprehensive programme to check that the licensee is complying with its arrangements made under each of the licence conditions.

Operator's responsibility for safe operation

9.8. A particularly important aspect of a licensee's safety case is its management and safety organisation. HSE 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 expected to act as an 'intelligent customer' when contracting out work that could have an impact on safety. An intelligent customer understands the safety case for the plant and can manage the work of contractors, ensuring that when goods and services are procured, the safety implications are fully understood.

9.9. 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 specified aspects of the nuclear site licence. The licensees generally 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.

Interfaces between the regulatory body and the operator

9.10. The most frequent interfaces between the licensee and HSE arise through the assessment of safety cases and inspections at nuclear licensed sites by HSE to check the operator's compliance with licence conditions and other legal health and safety requirements. HSE nominates an inspector for each site to lead on this regulatory work. The processes of assessment and inspection provide HSE with assurance that the licensee meets its responsibilities with respect to the licence conditions and safety case. HSWA74 gives inspectors the power to enforce relevant legislation at nuclear installations by imposing legal sanctions against the licensee or its employees if appropriate, as described in Article 7.

9.11. The licensees and HSE also have a formal hierarchy for meetings to address and resolve issues arising from the regulatory processes. The interface includes meetings at different 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 Inspector and at the bottom meetings which, while still formal in conduct, are devoted to discussion and clarification and which may not result in formal commitments.

Regulatory Nuclear Interface Protocol

9.12. The Regulatory Nuclear Interface Protocol (RNIP)[54] is an agreement between nuclear licensees and nuclear safety and security regulators, which sets out a shared vision: **"**To enable the safe, secure, effective use and control of nuclear technology and material for the overall benefit of society."

9.13. The protocol provides:

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

9.14. 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 licensees' nuclear Safety Directors' Forum. It is intended to reinforce methods of working that secure high levels of safety and effective regulation.

Openness and transparency

9.15. All licensees adopt a policy of openness and transparency. Key to this are the Site Stakeholder Groups. Each site has a site stakeholder group where representatives of the local population, local government and regulators attend meetings to discuss site performance (including any incidents) and future plans.

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 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), but has been updated to include information on the NDA and to reflect the division of Magnox Electric Ltd. into Magnox North Ltd. and Magnox South Ltd.

The regulator's (HSE) priority to nuclear safety

10.1. HSE's business is to ensure that risks to people's health and safety from work activity are properly controlled, in ways that are proportionate to risk, allow for technological progress, and pay due regard to cost as well as benefits. They act in close consultation with those whom they regulate or who are affected by work activities, and promote better management of health and safety through systematic approaches to identifying hazards and assessing and controlling risks.

10.2. It should be noted that the UK's non-prescriptive, goal-setting regulatory system is not 'self-regulation'. Rather, in relation to nuclear licensed sites the Conditions attached to the Nuclear Site Licence are designed to encompass the overall management of nuclear safety at the site. Licensees are required to submit a licence compliance statement to show how they comply with the licence requirements. HSE, when satisfied with the compliance statement, requires the licensee to comply with the licence condition arrangements.

The operators' priority to nuclear safety

Nuclear Decommissioning Authority

10.3. 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.

10.4. The NDA is a non-departmental public body set up under the Energy Act 2004[33] to provide a UK-wide strategic focus on cleaning-up 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.

10.5. The nuclear legacy inherited by NDA represents about 85% of the UK's civil nuclear liabilities and is wholly the responsibility of the Government. It includes:

- the nuclear sites and facilities which were developed in the 1940s, 1950s and 1960s to support the Government's research programmes, and the wastes, materials and spent fuels produced by these programmes; and
- the Magnox fleet of nuclear power stations built in the 1960s and 1970s and plant and facilities at Sellafield used for the reprocessing of Magnox and other fuel; and all associated wastes and materials.

10.6. In its first five years the NDA has established itself as a strategic client for nuclear clean up, developing its requirements and specifying them to its contractors and operators of the sites, the Site Licence Companies (SLCs). These SLCs are the

enduring entities which 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 HSE, and the Environment Agency or SEPA. NDA has used 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. Over the next five years competitions will be completed for all the SLCs. NDA regularly reviews 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.

10.7. NDA published its first Strategy in March 2006[55] covering the years 2006 - 2011 which set the scene for the NDA as a new organisation and its plans to restructure the UK nuclear industry. Whilst that first strategy is still a good introduction to the NDA and its mission, NDA is now preparing the second edition of its strategy which will cover the period 2011 - 2016. It is consulting widely on this updated strategy to ensure that stakeholders are able to participate in its development.

10.8. The NDA continues to drive for efficiency and innovation in the pursuit of its decommissioning mission, but in a tight funding environment it needs to prioritise the order in which nuclear clean up proceeds. Its strategy focuses on reducing the highest risks to people and the environment first, whilst progressing the restoration of the sites as soon as is reasonably practicable.

10.9. In respect of the four Magnox reactors that continue to operate, NDA will encourage its SLC contractor to optimise the utilisation of the remaining fuel to generate electricity, always providing that the reactors can be operated safely. NDA's present strategy is to see all spent Magnox fuels reprocessed at Sellafield and it will invest funds to permit the SLC to maintain and operate the relevant plant. NDA will continue to monitor the performance of the reprocessing programme and work with the SLCs to make improvements and implement any contingency plans that might be appropriate.

10.10. In line with its role, the NDA is tackling the significant strategic issues that affect its nuclear liabilities. It has defined these issues in terms of strategic themes that include site restoration, nuclear materials and spent fuel management, and integrated waste management. It will continue to develop and maintain its strategy in these areas, to consult and work with Government to inform policy development. To date, it has agreed End States for its sites which provide the long term objectives; it has published studies on the options for spent fuel management and nuclear materials; and published the UK nuclear industry low-level waste strategy. It will continue to work towards reducing the uncertainty over these strategic issues.

10.11. In its response to the recommendations made by the independent Committee on Radioactive Waste Management (CoRWM) in October 2006[56], the Government decided that NDA should lead the task of developing geological disposal facilities for higher activity radioactive waste. The NDA already has statutory responsibility, under the Energy Act 2004, for the disposal and the safe and secure interim storage of waste on designated civil nuclear sites. Bringing these two roles together has created an organisation with a single point of responsibility for managing higher activity radioactive waste in both the short and long term. The Radioactive Waste Management Directorate of the NDA has assumed responsibility for all aspects of the long-term management of higher activity radioactive waste. It will implement geological disposal for higher activity waste in England, Wales and Northern Ireland, and work with Scottish Government to implement its policy for the long-term management of higher activity waste in near surface, near site facilities where it can be monitored and retrieved and the need for transporting it over long distances is minimal. For more than twenty years, Nirex was the UK nuclear industry's expert

body on the long-term management of some higher activity radioactive waste. The majority of the former Nirex staff has been integrated into the NDA's Radioactive Waste Management Directorate, and the NDA now performs the functions previously undertaken by Nirex.

Magnox North Ltd. and Magnox South Ltd.

10.12. The Parent Body Organisation for Magnox North Ltd. and Magnox South Ltd. is EnergySolutions. The EnergySolutions web site[57] gives details of its commitment to health and safety:

*"Energy*Solutions *is committed to ensuring safety for its employees, the public and the environment. In order to meet the highest standards of safety, Energy*Solutions *employees complete thousands of hours of industrial and radiation safety training overseen by dozens of radiation safety professionals and technicians. Comprehensive environmental monitoring programs at Energy*Solutions *locations and worksites ensure environmental quality of operations and protection of the public through hundreds of samples and analyses of air, water, soil, and vegetation".*

10.13. The Magnox North Ltd. and Magnox South Ltd. Environment Health and Safety (EH&S) policies are:

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

10.14. In support of this policy, Magnox North Ltd. and Magnox South Ltd. have 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 (Magnox North)/(Magnox South), 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 our activities, products and services are in compliance with applicable legislation and meet the requirements of good practice and applicable standards of EH&S performance.*

In doing this we will:

- *consult our employees on EH&S matters of mutual interest;*
- *listen to and respond to our customers, shareholder, suppliers and neighbours;*
- *openly report our EH&S performance every year;*
- *work with our regulators, the rest of our industry and our customers and contractors to raise EH&S standards;*
- *inform, instruct, train and develop the people who work for us and ensure that competent EH&S advice is available;*
- *audit the management system which flows from this policy, and set and review EH&S objectives and targets, working within a quality framework;*
- *maintain high standards in the conduct of our operations, in particular by ensuring that they are adequately resourced and carried out by suitably qualified and experienced people, and with regard to nuclear safety at all times."*

British Energy Group plc

10.15. The British Energy web site[58] states that:

"Safety is the number one priority here at British Energy. Before all else, it is our duty to ensure the safety of the public, our employees, our power stations and the environment."

10.16. The British Energy Health and Safety policy states:

"It is the policy of British Energy Group plc always to place achievement of high standards of health and safety before commercial gain. In respect of its activities British Energy will:

- *promote high standards of health and safety throughout the organisation, placing special emphasis on the primacy of nuclear safety through maintaining the integrity of the core and fuel. In pursuing this aim, any departure from the designed safety margins of the overall plant will be treated with appropriate seriousness and urgency;*
- *strive for continuous improvement in health and safety, using external benchmarking and reviews to test its progress;*
- *work together with staff and their representatives to improve health and safety, including consultation on health and safety matters with appropriate representatives for individual businesses as a whole and at each company site through local health and safety Committees;*
- *promote a culture of co-operation and open communication, in which every opportunity is taken to learn from actual and potential failures of the Health and Safety arrangements and no unfair blame is placed on individuals;*
- *provide effective training and development, to support staff in meeting legal requirements, recognizing that individuals have responsibilities for ensuring the safety of themselves and others. This contributes to the delivery of high standards and continuous improvement in health and safety ;*
- *ensure line responsibility for safety is both clear and unambiguous and that, separate from this line, there is a function whose role is to provide independent assurance on health and safety and which has right of access to the Board through the Chairman of the Safety Health and Environment Committee;*
- *maintain a clearly documented health and safety management system to deliver the Company Policy and carry out regular reviews to test the system's effectiveness and enable performance to be benchmarked and improved from experience;*
- *maintain control of contractors' work by appropriate specification, supervision and monitoring;*
- *ensure its nuclear emergency arrangements are maintained and are regularly exercised to demonstrate their effectiveness;*
- *regularly review and, where necessary, revise this Policy and the resultant arrangements."*

10.17. With respect to organisation, the health and safety policy states further:

"British Energy's health and safety policy is implemented through documented systems and procedures. ... It is a general principle within British Energy that, except where otherwise dictated by legislation, safety responsibilities are vested in individuals rather than committees or other bodies. In implementing this policy British Energy will comply with all relevant national health and safety legislation including the requirement to reduce the risks resulting from the conduct of its business to staff, visitors, contractors and the general public to a level that is as low as is reasonably practicable."

10.18. A UK nuclear installation licensee takes measures that seek to ensure that it has an understanding of the safety significance of any expertise bought in from

outside the organisation and the licensee is in a position to take responsibility for the resultant effects on the site's safety. In addition, the licensee oversees and takes responsibility for its contractors' or consultants' activities to ensure that the use of such resources does not compromise either the licensee's chain of command or the licensee's ability to control activities on the nuclear licensed site. As stated previously, this knowledge base within the licensee's organisation is known in the UK as being an 'intelligent customer'.

Management function's priority to nuclear safety issues

Magnox North Ltd.

Organisation

10.19. Magnox North Ltd. holds the nuclear site licences for five nuclear sites, two of which still have operating reactors. 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 North Ltd. is responsible for nuclear safety standards on these sites. This responsibility is discharged by the Board through the Managing Director. The Chief Nuclear Operating Officer (CNOO) reports to the Managing Director and is responsible for setting standards in Nuclear Safety for site Directors to meet. 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). Guidance on nuclear safety issues is provided to sites primarily through the Engineering Director, who reports to the CNOO.

Nuclear Safety Committees

10.20. On all matters related to nuclear safety, Magnox North 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

10.21. A fundamental part of 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 North's 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 are carried out on each site, some by site-based staff independent of the activities being audited and some by auditors from other sites. 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 monthly basis by a "scrutiny panel" that seeks to identify key trends and areas for improvement that are fed to the Executive team for implementation.

Compliance Arrangements

10.22. The nuclear site licence is just one of a number of legislative and regulatory requirements with which Magnox North 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 North 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 CNOO as appropriate. For new arrangements, 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.

Magnox South Ltd.

Organisation

10.23. Magnox South Ltd. is the licensee organisation responsible for the management and operation of a number of nuclear installations owned by the NDA. Under the Nuclear Installations Act 1965, the responsibility for Health, Safety and Environmental performance lies with the licensee and therefore with the Board of Magnox South Ltd. The Managing Director discharges the accountabilities through the organisation. Delivery of safety is through line management and the Site Directors; setting of environment, health, safety, security, quality and engineering standards is separate from responsibility for delivery of work. The Site Director has responsibility for maintaining high standards of nuclear safety within the company.

Nuclear Safety Committees

10.24. On all matters related to nuclear safety, Magnox South 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

10.25. The Director of EHSS&Q, who reports to the Chief Nuclear Officer (CNO) and Assurance Director, has the responsibility to provide assurance to the Executive that the licensee is meeting its obligations under various EHSS&Q standards, including those relating to nuclear safety. In common with other nuclear plants across the world, Magnox plants are subject to peer evaluations from international organisations such as IAEA; staff from Magnox South also participate as members of peer evaluations of other plants. By these means, performance is measured against international standards and good practices are brought into the organisation from elsewhere. Programmed and reactive audits are carried out at all sites, with the outputs from these and other assurance activities being considered by a central scrutiny process on a regular basis to identify and act on generic issues. The internal assurance team base their reviews on the IAEA Operational Safety Review Team (OSART) process.

Allocation of responsibilities

10.26. In common with other licensee organisations, responsibilities for nuclear safety are vested in a number of positions, both on individual sites and within the central support organisation. Site Directors are responsible for ensuring nuclear safety requirements are implemented at their site. The CNO and Assurance Director is responsible for assuring that nuclear safety requirements are implemented on the sites and for taking an overview of nuclear safety performance. The CNO and Assurance Director ensures that standards for nuclear safety performance, including safety case production and operational standards are set by the Engineering, Strategy and Technical function, whose staff are also responsible for carrying out independent assessment of nuclear safety cases. The Director of EHSS&Q is responsible for providing assurance to the CNO and Assurance Director of nuclear

safety standards, via monitoring of indicators, assessment of audit results and on-site inspection activities.

Compliance with requirements of site licence

10.27. Arrangements have been developed, based on international guidance and in consultation with the regulators, taking into account published regulatory guidance (SAPs etc.), to deliver as a minimum compliance with the conditions of the site licence. These arrangements have developed over time taking into account best practices and improving standards. The arrangements form part of an integrated system for the management of the company.

British Energy Group plc

Organisation

10.28. British Energy Group plc forms the 'Existing Nuclear' business within EDF Energy UK Ltd., a wholly owned subsidiary of Electricite de France SA. Within British Energy Group there is one nuclear operating company, BEGL. BEGL is the nuclear licensee. Responsibility for health, safety and environmental performance within the licensee lies with the Board of that company. Executive responsibility for ensuring that the company operates safely and complies with legislative and regulatory requirements lies with the Managing Director who is also Chairman. Operational management of the business lies with the Existing Nuclear Executive headed by the Management Director and comprising the regional CNOs, the Chief Technical Officer, the Safety and Technical Director, the Continuous Improvement and Operational Support Director, the Finance Director and the Human Resources Director.

10.29. BEGL 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

10.30. On all matters related to nuclear safety, BEGL 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

10.31. BEGL has a Safety and Technical Division charged with independently scrutinising the licensee’s arrangements and performance.

Peer evaluation

10.32. 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.

10.33. 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. In recognition of the benefits of performing these reviews, BEGL has increased their frequency, and there is now a programme to undertake a review at each station every 3 years.

Allocation of responsibilities

10.34. 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 BEGL Policy. The role of the centre is to minimise risk, resolve operational problems 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.

10.35. 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.

10.36. The Chief Technical Officer heads a division supplying a wide range of technical services to the fleet. The main areas included 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 and Fleet Programmes, coordinating longer-term multi-site engineering developments; Fleet Critical Programmes, maintaining specialist expertise in managing the response to significant plant failures; and Projects, providing project management expertise and Asset Management, overseeing the investment and risk management programme.

10.37. The Safety and Technical Director's division provides independent oversight of the company's operations. To reinforce his 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 BEGL'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; Technical Support, who supply specialist expertise and guidance in emergency planning, radiological protection and nuclear materials transport; and Business Interface and Environment, who supply specialist expertise and guidance in sustainability and environmental protection.

10.38. Continuous Improvement and Operational Support manage the company's technical training programme and provide support and guidance across a wide range of operational processes. This is organised via 'Fleet Managers' who monitor performance and coordinate improvement activities for fleet-wide processes including: Operational Experience, Outage Management, Operations, Maintenance, System Health, Work Management, the Corrective Action Programme and Nuclear Professionalism (including human performance and safety culture).

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 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), but has been updated to demonstrate the actions the UK is taking to maintain and enhance the national pool of nuclear skills.

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. The published accounts for the UK's nuclear power station operators are on their web sites.[58] [59] [60]

11.2. The Magnox reactors are all beyond their initially assumed operating lives, and all except Oldbury and Wylfa are now permanently closed. Their assets and liabilities have now been transferred (with effect from 1 April 2005) to the NDA which has strategic oversight of their operations and decommissioning (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 now owned by EDF Energy 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 the nuclear installation's decommissioning costs. In particular, BEGL'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, BEGL is insured against its liabilities and the Government has its financial responsibilities as a contracting party to the Paris and Brussels Conventions. HSE 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, HSE 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.

Financing safety improvements during operational life

11.7. 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).

11.8. 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.

11.9. 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). Lack of affordability is not a valid reason for not implementing a safety improvement.

Financing radioactive waste management at nuclear installations

11.10. 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.

11.11. 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 or SEPA, recover costs in granting, monitoring and enforcing the authorisations or permits from the operator.

Financing decommissioning programmes

11.12. The NDA was set up under the Energy Act 2004 when it took over the liabilities and assets of the Magnox reactors previously owned by British Nuclear Fuels Ltd. It currently manages these through management and operation contracts with the site licensee companies, Magnox North Ltd. and Magnox South Ltd.

11.13. The NDA's Strategy (approved end March 2006) is the first ever UK-wide plan for dealing with the historic civil legacy. The Strategy confirmed the NDA mission as delivering a world-class programme of safe, cost-effective and environmentally responsible decommissioning and clean-up of the nuclear legacy. The NDA does this both by managing contracts placed with the site operators and by implementing

competitions for the ownership of the SLCs, to reduce decommissioning costs through innovative and competitive practices.

11.14. It is the SLC that employs the operations staff, and is the enduring entity which hold the nuclear site licence and discharge authorisation, and which is subject to regulation by both HSE and the Environment Agency in England and Wales or SEPA in Scotland.

11.15. The NDA has responsibility for expenditure of about £2.2 billion per annum. Half of this is from UK Government funding and half from commercial income receipts from the continued operation of its two operating NPPs and other facilities. However, this funding relates only to public sector nuclear sites and their associated plant and facilities. BEGL (now a part of EDF Energy UK Ltd.) is a private sector company with its own duties and responsibilities.

11.16. In January 2005, the NLF was established to take over the assets of the previous Nuclear Generation Decommissioning Fund Ltd. It provides for a larger scope of funding compared with the previous arrangements. It covers, for example, the de-fuelling of BEGL's nuclear power stations which was previously excluded. The UK Government will underwrite the costs of decommissioning BEGL'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.

11.17. The NLF is to be used solely to fund BEGL's liabilities and, as such, is ring-fenced from the funds required to clean up the NDA's sites. It is managed by a board of Trustees appointed by DECC and British Energy Group.

11.18. 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, BEGL is committed to provide 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
- BEGL was also required to pay 65% of its free cash flow into the NLF annually (the "cash sweep").

11.19. Following the sale of British Energy to EDF Energy in January 2009, the proceeds from the sale of the Government's interest in British Energy (£4.42 bn) were received by the NLF, and the cash sweep ceased.

11.20. The arrangements for decommissioning BEGL's nuclear power stations and discharging its uncontracted liabilities are contained within the NLF Agreement. Under this Agreement, BEGL 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. In addition, BEGL 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.

11.21. Although BEGL, as a private company and site licensee, is solely responsible for decommissioning its plants, the restructuring agreements provide for the Secretary of State to acquire BEGL'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.

11.22. Financial details of British Energy Group's liabilities and the NLF are set out in the respective Companies' annual accounts.

Management of human resources for safety related activities

Regulatory background

11.23. HSW74[26] places responsibility for safety on the plant operator. 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[40], in particular Regulation 13 on Capabilities and Training.

11.24. In addition, several licence conditions set goals on training and the management of human resources (see Annex 4). LC10 requires the licensee to make and implement adequate arrangements for suitable training of all those on site who have responsibility for any operations which may affect safety. LC12 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.

11.25. The licensees' arrangements made under other licence conditions such as plant modification procedures (LC22), emergency arrangements (LC11) and the control of management structure (LC36) also require that the licensee should address human resource and training issues.

11.26. HSE's role is to monitor the adequacy of, and compliance with, the arrangements made under the licence conditions. Under normal circumstances, HSE 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 authorized person.

11.27. Training and human resource issues are addressed by nuclear inspectors when they are reviewing safety documentation against HSE's SAPs[46]. The SAPs give inspectors guidance on whether the legal requirement of the licence conditions are 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.

11.28. In order to comply with regulatory requirements, a licensee must demonstrate to HSE'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

11.29. For all tasks undertaken on site, licensees' and contractors' staff receive training to make them aware of the safety hazards on the site, and in the use of preventive and protective measures established to reduce risks to health and safety. For each post or role with a responsibility for safety, licensees ensure that the duties, responsibilities and competencies are identified and that the training needs of an individual are met.

11.30. The assessed competence of an individual to undertake a specific task is 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.

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

11.31. LC12 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. Where such actions need to be controlled or supervised, this must be done by Duly Authorised Persons appointed by the licensee. HSE inspectors will again inspect the adequacy and implementation of this process, and HSE has powers under the Site Licence to require the licensee to ensure that no person continues to act as a Duly Authorised Person if, in the opinion of HSE, they are unfit to do so.

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

Training of external personnel

11.33. 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. A good example of best practice being shared across the UK nuclear industry is the recently developed and introduced Basic Common Induction Standard from Cogent[61]. Cogent is the Sector Skills Council for the nuclear industry and is leading on a number of initiatives to standardise qualifications, training and experience. Part of this approach is the Basic Common Induction Standard which, when fully implemented across the industry, will provide the necessary knowledge to ensure staff can access and move around licensed nuclear sites safely and securely.

11.34. When safety analysis work and/or inspection work (e.g. non-destructive testing and examination) is contracted to organisations external to the licensee, HSE advocates 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.

11.35. In the UK, licensees are responsible for ensuring the safety on the licensed site and are required under LC17 to have QA arrangements for all matters that might affect safety. Licensees are therefore responsible for ensuring, amongst other

things, that its contractors are suitable for the work that they do. HSE 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 carry out inspections of the licensees' QA arrangements. For critical components, such inspections may also involve examination of the QA arrangements of suppliers or contractors. However it is always the licensees' responsibility to ensure that these arrangements are adequate.

Periodic review

11.36. 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, these actions will then be fed into the overall training plan for sites as required by LC10.

Training programme development

11.37. 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, 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 HSE, 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

11.38. LC7 requires the licensee to develop adequate arrangements for the notification, investigation and reporting of incidents on site. The outcomes of these investigations are reported to HSE. These reports ensure that any training deficiencies are identified and that the licensee takes the necessary corrective action.

11.39. 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 NII inspectors.

Competence of instructors

11.40. Training instructors comprise 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

11.41. 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.

11.42. 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 manager, 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.

11.43. 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.

11.44. 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

11.45. The nuclear sector currently employs 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.

11.46. Skill gaps are projected for the nuclear industry. Recent research led by Cogent (see paragraph 11.33) analyses the workforce requirements for new nuclear power station build and operation. This research indicates 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.

11.47. Government is working closely with Cogent, the National Skills Academy for Nuclear (NSA Nuclear)[62], 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 intends to provide 1,200 apprenticeships and 150 foundation degrees into the sector. NSA Nuclear is also developing 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.

11.48. In addition, the NDA, the organisation responsible for ensuring the delivery of an effective decommissioning and waste management programme for the UK, has allocated a budget of £43.5 million to developing the skills needed to deliver its objectives through a Skills and Capability Strategy.

11.49. The National Nuclear Laboratory[63], 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.

11.50. 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 is setting up a Nuclear Centre which will offer a range of courses and research on nuclear (fission and fusion) 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 fourth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect the issues raised at the fourth Review Meeting and in particular to explain the regulatory body's policy on leadership and management and on safety culture.

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 is being 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 HSE SAPs.[46]

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 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.

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

Nuclear Directorate activities

Safety Assessment Principles - leadership and management for safety

12.10. HSE's SAPs[46] now have much greater focus on leadership and management for safety. The principles provide guidance to inspectors on ND'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 HSE'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. ND has developed 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. A series of workshops has been taking place within ND to familiarise inspectors with the lessons from major events and how these relate to ND's strategy and the draft guidance. The draft guidance is being used by groups of inspectors in different parts of ND for a trial period, following which, a review of the strategy and guidance will be undertaken.

12.14. Another important aspect of ND'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 in those areas most likely to be effective.

Safety performance indicators

12.15. HSE, in consultation with industry, has developed a generic framework of SPIs based on IAEA TECDOC 1141, with additional factors to cover leadership and management. It is more difficult to define meaningful indicators for these factors. 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 nuclear licensees are involved in identifying, and agreeing with HSE,

suitable metrics commensurate with the SPI framework, as well as developing their arrangements for managerial oversight of information generated.

Organisational development and change

12.16. ND 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. HSE assessment of the safety management prospectus is guided by a TAG[64]. ND acknowledges that licensees will evolve their organisations over time in response to different drivers, and seeks assurance that organisational change is managed effectively. TAGs on Managing Organisational Change, and Use of Contractors and Intelligent Customer Capability help inspectors to maintain suitable oversight of licensee change activities.

Licensees' activities

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

12.18. Typically, these 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 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.

12.19. Those sites that are no longer operating and are either de-fuelling or decommissioning have adopted measures that include taking into account ergonomic principles (man-machine interfaces) in the design of the equipment for reactor de-fuelling operations. Once the fuel has been dispatched off site, much of the equipment used for de-planting and demolition ceases to be bespoke: for plant decommissioning, much of the equipment used is readily available in the commercial market, and ergonomic aspects will generally have been considered by the manufacturer.

12.20. 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, the ND 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 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

12.21. The HSE's SAPs 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.

12.22. 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 ND, nuclear site inspectors, project managers and human factors specialists agree on the scope of any human factors assessment work that is appropriate to the case in question. ND ensures 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 being developed to support the consistent assessment of licensees' treatment of human factors issues. These address areas such as human reliability analysis; claims for early operator safety action; function allocation; human system interface design; use of administrative controls; and human factors integration.

12.23. Some aspects of human factors are specifically addressed by the nuclear site licence conditions (e.g. LC10 - Training, LC12 - Suitably Qualified and Experienced Persons), and compliance with these LCs is monitored as part of each nuclear site inspector's normal duties. To ensure this is done effectively, ND's nuclear installation 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 ND's specialist human factors inspectors. A TAG[65] is provided to support ND'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.

12.24. ND'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. ND 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. ND also maintains exchange arrangements on human factors, and other technical areas, with regulatory bodies and research establishments in other countries.

12.25. With regard to assessment of safety culture, ND 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 ND 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. ND 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 fourth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect the licensees continued implementation of IAEA Safety Requirements Standard GS-R-3.

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 HSE's SAPs[46] 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

General requirements

13.4. A licensee's management system (sometimes referred to as a QA programme) is developed as part of the arrangements to meet LC17, 'Quality Assurance' (see Annex 4) and is normally derived from the requirements of national and international quality management Codes and Standards such as GS-R-3 and ISO 9001[66]. Furthermore, any significant changes to the licensees' organisational structures or resources are controlled by arrangements made to meet the requirements of LC36, 'Control of Organisational Change'.

13.5. 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

13.6. Licensees use the management system to promote a strong safety culture. They achieve this by encouraging a 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 (see details in Article 13).

Graded application of management system requirements

13.7. 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 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 its assessed safety classification.

Documentation of the management system

13.8. 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.

Management responsibility

Management commitment

13.9. Licensees recognise the important leadership role of senior managers in the implementation and improvement of the management system. This has involved the development of organisational values and expected behavioural standards for individuals. To demonstrate commitment, most 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.

Organizational policies

13.10. 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

13.11. 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

13.12. Licensees' management systems are authorised for use by senior management and are mandatory on all employees. Processes are implemented 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. Responsibilities

and processes are identified for monitoring, audit and review to ensure that management processes and work performance are effective. These activities are integrated such that the specification, execution, supervision and monitoring of the work are properly resourced and carried out.

Resource management

Provision of resources

13.13. 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.

13.14. 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.

13.15. 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

13.16. 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.

13.17. 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 and commissioning.

Process management

13.18. In order to optimise the effectiveness of processes, licensees ensure that processes are planned, documented, assessed, reviewed and improved. Processes are carried out under controlled conditions and identify necessary verification activities and records that demonstrate process results. Licensees retain overall responsibility where processes are contracted to other organisations (see also paragraph 13.15).

Generic management system processes

13.19. 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. 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. Licensees use a variety of approaches and media to communicate to internal and external stakeholders on performance and intentions. LC36 was introduced specifically to guard against any downward drift in the licensees' resources as a result of ill-considered cost cutting and to ensure that licensees have robust arrangements to manage organisational change.

Measurement, assessment and improvement

Monitoring and measurement

13.20. 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, ND, as part of its regulatory activities, also carries out audits and inspections of the licensees' arrangements.

Self audit of procedures

13.21. 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 activities 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

13.22. 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 of 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[67] is used to access current and comprehensive audits to support monitoring and review of safety management arrangements and performance.

Independent assessment

13.23. Licensees typically employ diverse means of independent assessment. These can include: audit, directed at assessing implementation of, and conformance with, the management system; inspection, directed at assessing compliance with the nuclear site licence and other applicable legal requirements; oversight, directed at surveillance to assess the safe and reliable performance of power plant; and 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. 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

13.24. 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

13.25. 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.

13.26. 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

13.27. 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 HSE Safety Assessment Principle MS1 on leadership, in showing commitment to safety and system improvement.

13.28. 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.

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), but has been updated to reflect current procedures and the UK's new build programme for NPPs.

Safety assessment

14.1. The following pages provide an overview of the phases in the lifetime of a nuclear installation that require safety justifications to demonstrate compliance with legal requirements. The key landmarks are:

- Pre-construction safety report;
- Pre-operation safety report;
- Station safety report (operational);
- Pre-decommissioning safety report.

14.2. During the operational and decommissioning phases, the Station safety report is updated frequently to reflect changes to plant or procedures, new safety analysis techniques, research findings and the outcome of PSRs.

14.3. In the UK no new reactors have been constructed since Sizewell B in the early 1990s, so the process for developing pre-construction and pre-operation safety reports is largely historical. However, as described in Section 2, the UK is preparing to embark on a programme of constructing new NPPs. The broad principle of pre-construction and pre-operation reports will still be valid, but the process will need to recognise the international nature of possible vendors and potential licensees, and a generic approach to early assessment of the design.

14.4. Most of the UK's nuclear reactors are in the latter stages of their operating lives, or are undergoing defuelling and decommissioning. In addition to the new build, the current emphasis is on the PSRs and on pre-decommissioning work such as environmental impact studies.

14.5. There are a number of common features for all the safety documentation required during the lifetime of an installation. The initial assessment and verification of the safety of a nuclear installation starts before construction commences, with the submission of safety analysis reports by the licensee. In the case of the new reactors programme, these are expected to make full use of documentation submitted under the GDA process. 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 "owns", understands, endorses and makes use of the safety case at all stages of the installation's life. Licensees' QA arrangements, required under LC17, 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. Comprehensive safety assessments were carried out at the time of construction of the UK's nuclear installations. Under the terms of the licence conditions, these safety assessments are updated, as necessary, during the installation's lifetime.

14.6. The HSE's SAPs[46], section SC3 – SC6, set out what ND expects to see in a Safety Case. It is, in effect, the totality of the documented information and arguments that substantiate the safety of the plant, activities, operations and modifications. 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, as appropriate, supporting research;
- 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 (see Annex 6); and
- have a defined and acceptable operating envelope, with defined limits and conditions, and the means to keep within the envelope (safety management).

Legal requirements for safety documentation

14.7. Some licence conditions (see Annex 4 for the full text) 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 HSE the power to require reviews of safety documentation.
- LC16, 'Site Plans, Designs and Specifications', requires that the licensee provides HSE 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;

- 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.

14.8. The safety case also needs to demonstrate compliance with other appropriate legislation, for example, IRR99.

Safety analysis methodology

14.9. ND does not prescribe the format of safety cases but it does prescribe what a safety case must demonstrate. Consequently HSE’s SAPs were written bearing in mind the content of safety cases that are likely to be submitted to ND. However, licensees may wish to put forward a safety case that differs from this expectation and, as in the past, the regulator will consider such an approach. In these cases the licensee is advised to discuss the method of demonstration with ND beforehand.

14.10. The totality of the documentation that makes up the plant safety case provides a demonstration that the nuclear installation conforms to good nuclear engineering practices and sound safety principles. A nuclear installation is designed against a set of deterministic engineering rules, such as design codes and standards. It uses the concepts of "defence in depth" and "adequate safety margins". To this end, 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. A summary of the scope and content of the HSE SAPs can be seen at Annex 6.

14.11. The safety case provides sufficient information to demonstrate that the engineering rules have been applied in an appropriate manner. In particular, there is a clear demonstration that all equipment important to safety has been designed, constructed, operated, and maintained in such a way as to enable it to fulfil its safety function for its projected life with the reliability claimed in the safety case.

14.12. The licensees’ analyses of normal operating conditions show that resultant radiation doses due to ionising radiations, to both 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 of deterministic and probabilistic assessment, and severe accident analysis (see paragraphs 496 - 503 of the SAPs and SAP FA.1). 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 (see SAP FA.2). The deterministic approach is used in the analysis of design basis accidents 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.

14.14. The PSA provides a comprehensive, systematic and 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. Currently, Sizewell B and the AGRs have established “Living PSA programmes”. UK regulation is not prescriptive; however there is an

expectation that licensees will follow good international practice when developing their safety documentation and their processes. In this regard, the living PSA programmes established by BEGL generally follow the practices proposed in IAEA-TECDOC-1106.

14.15. 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 assumptions made in the safety analysis of the safety case.

14.16. The safety case may include a summary document called a safety report. This report and the safety documentation make reference to supporting arguments and evidence, as well as to existing or proposed instructions, procedures, arrangements and standards. The references may range from national or international codes to corporate standards, criteria and procedures that provide requirements for safety and the means to ensure that the process of producing the safety case is properly controlled.

14.17. All the UK's nuclear power reactor installations are in their operating, defuelling or decommissioning phase. 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. Some UK NPPs have recently undertaken major projects that significantly enhance the visibility, traceability, user-friendliness and manageability of their safety cases.

14.18. 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 QA procedures required by LC17 (discussed in Article 13), and any changes to the safety case are regulated as modifications under LC22.

14.19. 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. QA documentation defines 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.

14.20. 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.

14.21. 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 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 HSE.

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

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

Reviews of the safety case

14.24. PSRs are required by LC15 and are carried out by licensees every 10 years. The current status of PSRs is described in Article 6. HSE TAG 50[68] sets out what ND expects to see in the PSR.

14.25. As well as the PSRs, outage reviews are undertaken every 2 or 3 years. These coincide with the reactor statutory outages that are carried out in accordance with LC30 for the purpose of enabling examination, inspection maintenance and testing. The findings of each reactor statutory maintenance outage are used to update the reference safety case and provide a justification for a further period of operation (usually 2 or 3 years until the next major planned outage). During these reviews 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. Regulatory permission for the reactor start-up, for a period of subsequent operation, is required at the end of each reactor statutory maintenance outage before the return to power may proceed.

14.26. Licensees carry out other reviews of the safety case annually (in support of the regulatory review process of site activities), and when significant changes to plant configuration are planned (e.g. new build) or at a key milestone in the site lifecycle (e.g. the end of power generation).

14.27. In years in which there is no requirement for an outage, a meeting is held by ND at the nuclear licensed site to review the plant and safety case status to maintain a regular overview of the position.

Verification by analysis, surveillance, testing and inspection

Maintenance, testing and inspection

14.28. All UK nuclear installation licensees are required to make and implement adequate arrangements for maintenance, testing, surveillance and inspection of those structures, systems and components that are important to safety. LC28 requires licensees to verify the physical state of all plant that may affect safety by regular and systematic examination, inspection, maintenance and testing. Safety-related plant systems and components are listed in a Maintenance Schedule. This defines 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 still meets the original design assumptions.

14.29. Whilst some maintenance, inspection and testing can be 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. Therefore, LC30 requires licensees periodically to shutdown nuclear installations (referred to as a statutory outage). Statutory outages are for the purpose of examination, inspection, maintenance and testing of plant that may affect safety. Before the re-start of operation after a statutory outage, the safety case is reviewed in the light of any findings arising during the previous operational period and during the statutory outage. The plant must be shown to be safe to operate until the next statutory outage. Periods between statutory outages on NPPs vary from 2 to 3 years, and must be explicitly defined in the Plant Maintenance Schedule.

14.30. LC29 requires licensees, after consultation with HSE, to carry out and report the results of tests, inspections and examinations specified by HSE. This licence condition may therefore be regarded as a verification activity by the nuclear regulator.

14.31. 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 and sample monitoring are used widely to support these analyses.

14.32. The licensees' overall analyses, surveillance, testing and inspection strategies are to ensure that their nuclear installations are kept 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.

14.33. 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).

14.34. Licence conditions require the licensees to maintain records of maintenance, inspection, surveillance and testing. ND nuclear site inspectors routinely review the availability 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.

Surveillance of compliance with operational limits and conditions

14.35. LC23 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. The licensees have systems for implementing and complying with these operating rules. This is achieved by defining a set of safety requirements that are presented to HSE for agreement, and which cannot then be altered without HSE's further agreement. 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, and compliance with them will ensure that the fundamental plant limits and conditions are complied with.

14.36. 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 checks and administrative checks. Each licensee also has an internal safety department which will undertake inspections 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 ND in accordance with the arrangements under LC7.

14.37. 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 predetermined 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

14.38. ND's nuclear installations inspectors check that appropriate standards are developed, achieved and maintained by the licensees. ND 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.

14.39. In the course of its nuclear regulatory work, ND 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 ND. Special emphasis is put on describing how the SAPs are used during the assessment to judge the adequacy of safety case submissions.

Regulatory assessment

14.40. HSE 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 Tolerability of Risk (TOR)[69]. ND publishes guidance to its inspectors on purpose, scope and contents of the safety cases.[70]

14.41. HSE's SAPs form a framework that is used as a reference for technical judgements on the adequacy of licensees' safety cases. They also assist ND in applying a consistent and uniform approach to its assessment process. In carrying out an assessment, the ND assessors 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.

14.42. 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 the ALARP arguments in a safety case. They

represent ND's view of good nuclear engineering practice. They point to the design features that in ND's view would lead to a safe plant.

14.43. The SAPs also contain probabilistic targets, some of which (radiation doses to people) embody specific statutory limits. However, ND assessors will primarily use the engineering principles and use the PSA as a check to inform regulatory decisions. PSA is used to produce numerical estimates of the risk from the plant and thus provides a very important input to 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.

14.44. It is the duty of licensees to meet all statutory limits, and the SAPs should also be met, so far as is reasonably practicable. 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 6 for a further discussion of these concepts.

14.45. The SAPs are aimed at the safety assessment of proposed (new) nuclear facilities, as well as 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 ND's nuclear installations 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.

14.46. Assessment is undertaken by first understanding and then sampling the key aspects of a safety case using HSE's SAPs, and other national and international standards when appropriate. The technical expertise of the staff is used to select the issues to be pursued in depth. ND nuclear project or site inspectors bring together and integrate the findings from assessment of the different technical areas and provide an overall conclusion regarding the adequacy and acceptability of the assessed safety case. This is formally documented in Assessment Reports.

14.47. 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 usually agreed. If agreement cannot be reached with the licensee, and the issue is considered to be of sufficient importance by ND, enforcement action to achieve compliance can be undertaken, using the powers discussed under Article 7.

14.48. The contents of safety cases may vary due to differences in design between different nuclear installations, but ND'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?

14.49. In answering the above questions, ND'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.

14.50. If a safety issue is judged to be of sufficient importance, ND 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, ND may use external recognised independent experts in the appropriate technical field to help to inform its judgement. Such external resources, however, do not make regulatory judgements.

14.51. Not all modifications are reviewed by the regulatory body. However, as described above, the licensee prepares sufficient information on the modifications to allow the regulator to decide whether the decision was justified, should ND decide to undertake a check. Some modifications will be examined as part of the ND's inspection routine.

Regulatory inspection

14.52. ND 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, nuclear installation 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 time on their site. In particular, they check that the licensee is complying with the licence conditions and the arrangements made under the licence conditions.

14.53. Safety audits or 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.

14.54. 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 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 nuclear installation inspectors who carry out specialist assessments or inspections as necessary. The Integrated Intervention Strategy developed by ND 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.

14.55. Following inspections by the nuclear installations 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 inspection report is prepared by the inspector to record appropriate details of the objectives of the visit, matters considered, conclusions drawn and follow-up actions identified. Significant issues are recorded in an issues database so that their resolution can be monitored. Historically, the process for the development of site inspection plans within ND (as described above) has been evolutionary, with the result that there has neither been complete consistency nor transparency, although inspection plans have always been required. Since 1 April 2006, site or plant intervention plans have been produced, monitored and reviewed within the Integrated Intervention Strategy. The purpose of this is to ensure both that ND focuses its resources where they are most needed and that this planning process is transparent to stakeholders.

14.56. The aim of this focused approach is to ensure that ND intervention activities are properly planned, implemented, monitored and reviewed in a way that resources can be efficiently allocated and data can be generated to enable management to form a view on both the efficiency of intervention activities and the effectiveness of those activities.

14.57. To this end, ND now develops targeted intervention strategies for every nuclear licensed site taking 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 inspection interventions will be focused on the ‘cornerstone’ factors of compliance which contribute most to the licensee's safety management performance, and the prevention of significant nuclear events. For high hazard operational plants these will include licence conditions concerning: reporting of incidents, emergency arrangements, qualification and experience of staff, managing change to plant and procedures, operations and maintenance (LCs 7, 11, 12, 19 - 22, 23, 24, 26, 28 and 36). These ‘cornerstone’ licence conditions are inspected at least annually to ensure compliance with the licensees’ arrangements and HSE’s licence condition guidance, working to a common inspection template and protocol. In any year a number of these ‘cornerstone’ licence conditions will be the subject of team inspections to improve consistency and reproducibility of compliance scores/ratings for performance trending. The planned inspection activities also ensure that key components of the safety case are sampled proportionately and scored against these ‘cornerstones’. In addition, inspection visits to site by the 'nominated site inspector' regularly updates awareness of current site performance and operational issues, which is obtained through activities such as examination of event and operational records.

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 fourth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect current procedures. Paragraphs 15.37 – 15.44 reflect the latest information on radiation doses.

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. 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 spending more to reduce them. In general, risk-reducing measures are weighed against the associated costs (in time, trouble and money). The licensee takes the measures, unless the costs 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 6 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 recommended by 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. HPA have work planned to review and revise their advice on this but it is likely to take some time.

15.3. To meet 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;
- protection must be optimised to provide the highest level of safety that is reasonably practicable;
- 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.

15.4. The licensees are obliged in UK law 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.

15.5. 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.

15.6. 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 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. HSE 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 still considered by ND to be reasonably practicable.

Dose limitation

15.7. IRR99 Regulation 11 specifies dose limits for persons engaged in work with ionising radiation that comply with the limits in the Euratom BSS Directive[5] For example, for adult employees the normal dose limit for whole body exposure is 20 mSv/year. In practice, all doses recorded for employees at nuclear installations are well below dose limits for normal operations. 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 HSE's satisfaction that an annual limit of 20 mSv is impracticable for that person.

15.8. 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[71] 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

15.9. For the assessment of compliance with dose limits relating to members of the public (IRR99 Regulation 11, ACoP and guidance[71] refer), the licensee is expected 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.

15.10. 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[5].
- 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.

15.11. The EPR10[30] has introduced the concept of 'Best Available Technology' (BAT). For all practical purposes, the application of BAT is broadly equivalent to the application of BPM 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:

- BPM applied to authorisations granted under RSA1993 in Scotland; and
- BAT applied to authorisations granted under EPR10 in England and Wales.

15.12. 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[72]. 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. 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.

15.13. 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 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 annually publish a joint report[73] 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 for all artificial sources of radiation. 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

15.14. 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[74] 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

15.15. 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[71] (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.

15.16. 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.

15.17. IRR99 Regulation 25 requires that where a licensee suspects or has been informed of an exposure in excess of a dose limit, HSE 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.

15.18. 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 arrangements.

Individual monitoring

15.19. 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[71] 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.

15.20. 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

15.21. 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.

15.22. Reflecting concern expressed at the Public Inquiry[79] into the construction of Sizewell B, an additional licence condition (LC18) 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

15.23. 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.

15.24. 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.

15.25. 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.

15.26. 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

15.27. 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.

15.28. 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

15.29. 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

15.30. 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.

15.31. 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[71] 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.

15.32. 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

15.33. 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 ND 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[75].

Licensing requirements

15.34. In addition to the application of IRR99, the regulation of radiological hazards 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.

15.35. The adequacy of the licensee's safety submissions is assessed by ND against HSE's SAPs (see Annex 6). The principles relating to radiation protection are consistent with the latest recommendations in 'The 2007 Recommendations of the International Commission on Radiological Protection'[76] and ensure that the licensee makes a strenuous pursuit of the objective to keep exposures ALARP. The ND considers that the principles in the SAPs relating to radiation protection are consistent with the new recommendations of the International Commission on Radiological Protection due to be published in 2007.

15.36. 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 ND.

Radiation doses at nuclear installations

15.37. For BEGL sites (which are all operating sites) data for employee and contractor doses for each year under consideration in the present report is given in Table 15.1.

15.38. The total collective dose to all persons working on BEGL sites during calendar year 2009 was 1.74 manSv with 0.35 manSv to employees and 1.39 manSv to contractors.

15.39. No person exceeded the statutory annual dose limit of 20 mSv specified in IRR99, nor the BE dose restriction level of 10 mSv. The maximum individual dose received by a BE employee in 2009 was 8.10 mSv and the maximum individual dose received by a BE contractor was 8.71 mSv. Record information has determined that the average dose received by BE employees in 2009 was 0.064 mSv and by BEGL contractors was 0.142 mSv.

15.40. Electronic Personal Dosimeters are now being used at all BEGL sites as the legal dose meter to make assessments of individual radiation exposure.

TABLE 15.1 - Doses at British Energy sites

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Average dose employee and contractor mSv	0.167	0.155	0.120	0.038	0.095	0.197	0.081	0.163	0.114
Max dose employees and contractors mSv	9.800	11.746	9.140	4.343	7.942	11.657	5.987	9.096	8.709
Collective dose employees and contractors manSv	1.79	1.75	1.39	0.39	1.12	2.65	1.04	2.61	1.74

15.41. At the beginning of the period under consideration, Magnox Electric Ltd was split into two separate licensee companies, Magnox North Ltd. and Magnox South Ltd. As a result, direct comparison of doses per reactor in the same way as in the previous report is not straightforward. For Magnox North Ltd. (which has operating and decommissioning sites) data for employee and contractor doses for each year under consideration in the present report is given in Table 15.2.

TABLE 15.2 - Doses at Magnox North Ltd. sites

	2007	2008	2009
Average Dose Employees and contractors mSv	0.078	0.085	0.094
Maximum Dose Employees and contractors mSv	3.353	3.466	5.139
Collective Dose Employees and contractors manSv	0.40	0.44	0.52

15.42. The consistent increase in doses in the period under consideration is in line with expectations based upon the number of statutory maintenance outages undertaken in the periods and increasing amounts of more invasive decommissioning work.

15.43. The total collective dose to all persons working at the nuclear installations licensed to Magnox North Ltd. during the calendar year 2009 was 0.52 manSv with 0.23 manSv to employees and 0.29 manSv to contractors. The gradual increase in doses over the reporting period reflects the move from operation to defuelling and decommissioning. However all doses are being kept ALARP.

15.44. For Magnox South Ltd. (which has no operating sites), radiation doses to staff from routine operations have reduced since electricity generation ceased: however doses to some individuals or some groups of individuals involved in decommissioning have increased. Doses have been kept ALARP and within statutory limits by appropriate work planning and implementing ALARP measures.

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 fourth UK report (i.e. in a way that has implications for the Convention obligations).

Emergency preparedness for a radiological emergency at a UK nuclear installation

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 an extremely 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 ND.

16.2. 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 Liaison Group (NEPLG), which brings together organisations with interests in off-site civil nuclear emergency planning. Members include representatives of the nuclear operators, the regulatory body, the police, fire service, local authority emergency planning officers and Government Departments and agencies that would be involved in the response to an emergency. NEPLG is a forum for discussing common problems, exchanging information and experience and agreeing improvements in planning, procedures and organisation. It has issued Consolidated Guidance[77] to all organisations that may be involved in planning for a civil nuclear emergency. The guidance describes the underlying arrangements that have been developed for responding to an emergency

in the UK over a number of years, and which have been adapted by NEPLG and its constituent organisations. NEPLG also reviews results of Level 2 and 3 emergency exercises to ensure that important lessons learned from those exercises are put into practice (see paragraphs 16.16-16.18 for exercise classification).

16.4. The Nuclear Emergency Arrangements Forum (NEAF) provides operators of nuclear licensed sites and the ND 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 ND. Since ND attends both NEPLG and NEAF, it is able, as part of its regulatory function for enforcing REPPIR[38] 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. ND attends this forum. As a result of involvement in this and other forums, HSE advises DECC in respect of nuclear emergency preparedness and response.

16.5. 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. So, in practical terms, individuals with a role if there is an emergency at a nuclear installation receive briefing and training, mostly through participation in exercises, to ensure they can cope effectively in the event of any nuclear emergency. The police, working in conjunction with other emergency services, expert bodies, and local and national agencies, would coordinate any response effort locally. DECC would co-ordinate the response at national level; it would brief Ministers and the UK's international partners, and be the main source of information at national level to the public and the media. These arrangements are exercised at regular intervals by all the organisations concerned.

16.6. In the event of a nuclear accident overseas, which may have implications for the UK, DECC would be the lead Government Department and would receive initial notification through arrangements established by a series of multi-lateral or bilateral Conventions, or agreements. In addition, the UK's Radiation Incident Monitoring Network (RIMNET) of continuous radiation monitoring stations would automatically raise an alarm if abnormal increases in the levels of radiation were detected at any of the RIMNET monitoring sites. DECC's Technical Coordination Centre in London would be used to collect, collate and disseminate radiation monitoring data from a wide number of sources and would be used as a basis for any necessary public protection measures.

Governmental emergency preparedness

16.7. REPPIR implement in Great Britain the Articles on intervention in cases of radiation emergency in Council Directive 96/29/Euratom[5]. Council Directive 89/618/Euratom[39] (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 are covered in the UK by REPPIR and the Carriage of Dangerous Goods and the Use of Transportable Pressure Equipment Regulations 2009[78] which includes requirements for emergency preparedness during transport. 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 ND.

16.8. A condition attached to nuclear site licences, LC11 (see Annex 4), on emergency arrangements, ensures that all licensees have adequate arrangements in place to respond effectively to any incident ranging from a minor on-site event to a significant release of radioactive material with off-site consequences. LC11 requires employees to be properly trained and that the arrangements are exercised. There is

also a requirement for licensees to consult with any person not in their employ who may be required to participate in emergency arrangements. The licensees must submit to HSE for approval such parts of the arrangements as HSE may specify. Once approved by HSE, no alteration or amendment can be made to the approved arrangements without HSE's formal Approval.

Main elements of the on-site plan

Arrangements for preparedness and response

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

16.10. HSE's Consent is normally required to bring nuclear fuel onto a site for the first time. As part of the assurances that HSE 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 HSE. 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 HSE may be required at stages specified by HSE 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, ND 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 ND formally observe. Throughout the life of the nuclear installation, the emergency arrangements are subject to review and, with HSE'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.

Preparation and testing of emergency plans

16.11. Whilst REPPIR and licence conditions both apply on site, the principal on site regulatory tool is arrangements made under LC11 which requires rehearsal of the arrangements to ensure their effectiveness. The principal regulatory tool for the off-site component of the Emergency Plan is REPPIR[38]. REPPIR 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. 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 HSE, based on the most significant release of radioactivity from an accident which can be reasonably foreseen. In the event of an accident being larger than the reasonably foreseeable event, the off-site plan outlines arrangements for extending the response.

16.12. The prime function of the off-site facility (Strategic Coordination Centre or SCC) is to decide on the actions 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.

16.13. 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 thus the Operator can focus on dealing with the nuclear emergency. 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), HPA-CRCE and the ND. The lead Government Department would appoint a senior member of ND (normally one of ND's Deputy Chief Inspectors) to act as the Government Technical Advisor (GTA). The role of the GTA is described in NEPLG consolidated guidance, but essentially 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. SEPA, in Scotland, and the Environment Agency, in England and Wales, would also be represented because of their role in radioactive waste disposal and other environment protection roles, as would the 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. The following Figures 16.1 to 16.3 show the arrangements diagrammatically.

Figure 16.1 – Emergency arrangements structure

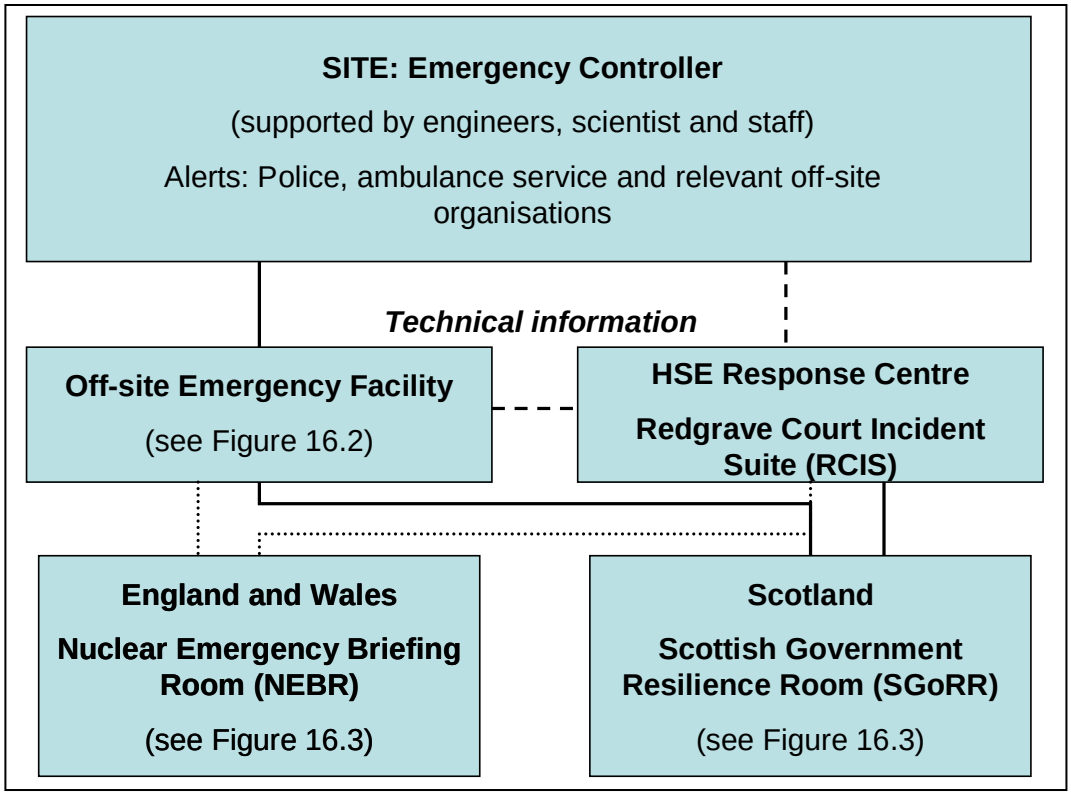


Figure 16.2 – Off-site facility representatives

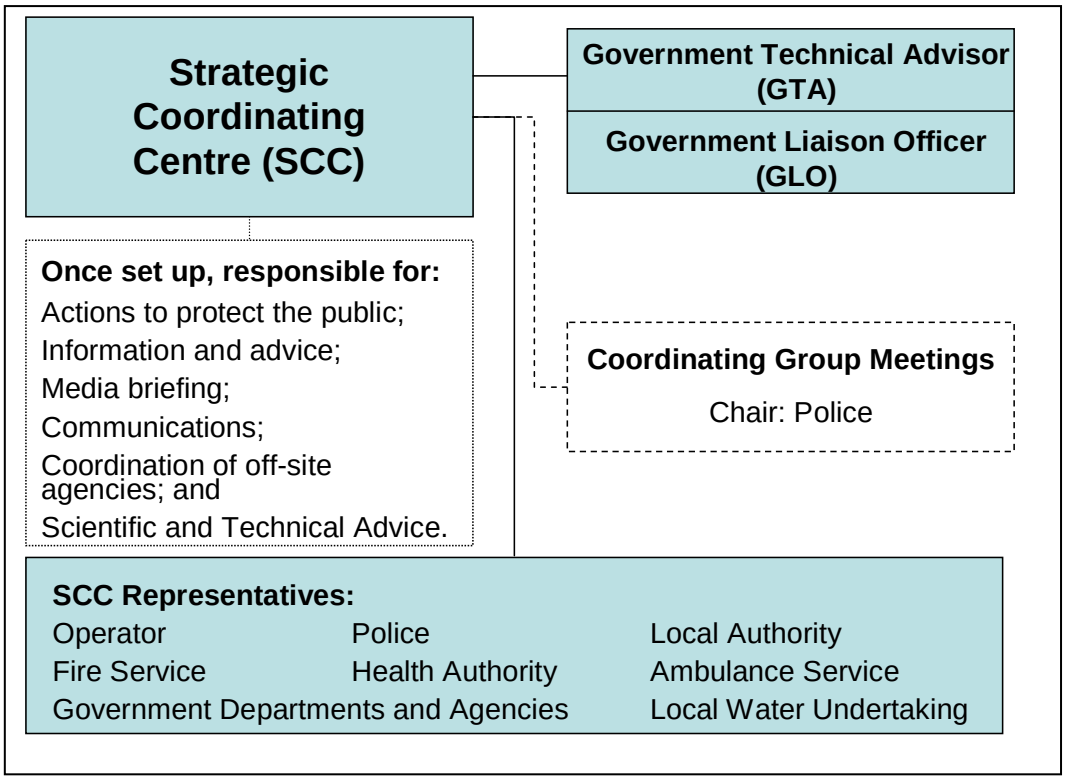
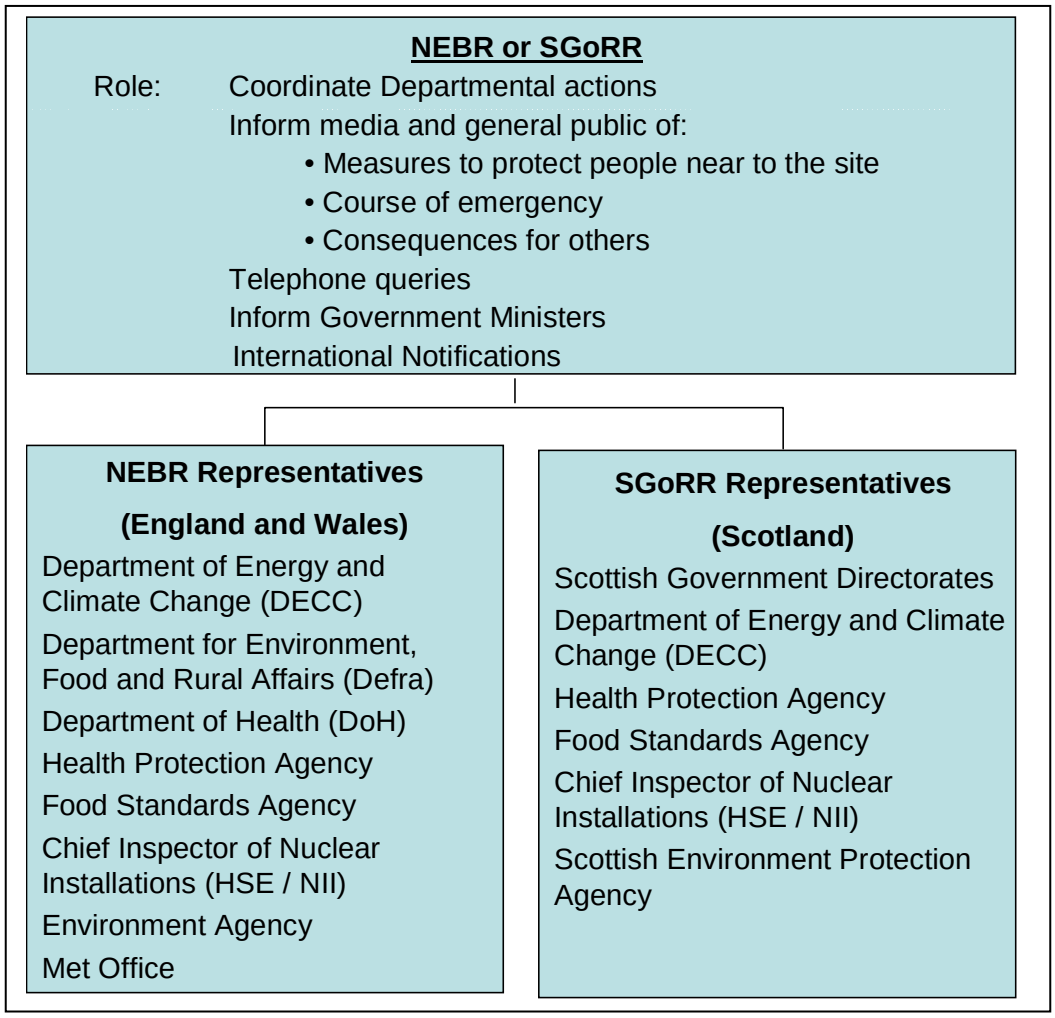


Figure 16.3 – Nuclear Emergency Briefing Room and Scottish Government Resilience Room representation



16.14. In the event that the operator believes that there is the potential for, or there has been, an off-site release they will declare an off-site nuclear emergency. The off-site plan coordinated by the Local Authority identifies the cascade notification and activation process for setting up the multi-agency response organisation.

16.15. 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, to:

(a) monitor the environment on and around the site for radioactivity; and to

(b) 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.

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.

16.16. Emergency arrangements are tested regularly under three categories known as levels 1, 2 and 3. 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. HSE will witness 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.

16.17. 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.

16.18. 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 NEPLG, in consultation with ND.

Public information

16.19. 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.

16.20. REPPIR requires that members of the public within a DEPZ, who could be at risk from a reasonably foreseeable radiation emergency, should receive certain prescribed information. 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

16.21. REPPIR requires local authorities to prepare and keep up-to-date arrangements that ensure that members of the public actually 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.

16.22. 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 checked and the police would advise those who had been evacuated when they could return home. At about this stage, the emergency condition would be officially terminated, but the return to completely normal conditions might take place over a period of time.

16.23. 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.

16.24. The UK regularly takes part in emergency exercises with other countries to test 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

16.25. 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. NEPLG, together with NEAF, reviews the UK Emergency Exercise Programme to ensure that a balanced programme of exercises takes place covering all types of nuclear facilities. Since some nuclear sites have significant chemical hazards, the implications for this on the nuclear emergency response have been put into the exercise programme.

16.26. Lessons learned from nuclear exercises are handled by the HSE-chaired NEPLG Lessons Learned Sub-Group. The sub-group's work is prompted by actions arising from nuclear exercises. These actions are included in the DECC Action Tracking Paper. ND produce a draft 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 by NEPLG. The sub-group submits the draft report to NEPLG for endorsement, comment and further dissemination.

Response to emergencies outside of the UK

16.27. 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. RIMNET is the contact point for inward notifications under these arrangements. 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 17.1-17.6, 17.8-17.9, 17.17 and 17.39 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[79] [80] in the 1980s.

Siting of new nuclear power plants

17.1. The Government's White Paper on Nuclear Power of January 2008[4] announced the UK Government's programme to consider the future development of nuclear power stations in England and Wales. In this paper the Government announced an SSA process that would be subject to a consultation process. The Planning Act 2008[7] is intended to expedite the overall planning process.

17.2. Section 2 of this report explained the new role of National Policy Statements in the planning process for new NPPs and how these will provide the primary input to planning decisions by the IPC for all major infrastructure projects (not just NPPs). The draft Nuclear NPS lists sites that the Government has judged to be potentially suitable for the deployment of new nuclear power stations. The list of sites is the output from the SSA process.

Strategic Siting Assessment

17.3. The aim of the Strategic Siting Assessment (SSA) is to identify and assess which sites in England and Wales will be potentially suitable for the deployment of new nuclear power stations by the end of 2025. This is intended to reduce uncertainty about the siting of new nuclear power stations and to reduce the extent to which alternative sites need to be considered as applications come forward for development consent.

17.4. The Government consulted on the SSA criteria and process in July 2008 and published the response in January 2009[9]. As part of this response, the Government issued a call for nominations of sites into the SSA process. Eleven sites were nominated – Bradwell, Braystones, Dungeness, Hartlepool, Heysham, Hinkley Point, Kirksanton, Oldbury, Sellafield, Sizewell and Wylfa. With the exception of Braystones and Kirksanton, all were existing nuclear sites. In assessing nominated sites against

the SSA criteria, the Government took account of information provided by nominators, comments received from the public, advice from specialists including the nuclear regulators and other Government Departments.

17.5. The Government's preliminary conclusion was that all of the nominated sites, with the exception of Dungeness, were potentially suitable for the deployment of new nuclear power stations by the end of 2025. In the consultation which ran to 22 February 2010, the Government sought views on this preliminary conclusion.

Regulatory input to siting of new build nuclear power plants

17.6. ND provided technical support to aid the Government's decisions on the Nuclear NPS for the strategic selection of nominated sites for new build nuclear power stations. 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. ND also provided advice about the proximity to Hazardous Facilities, mainly focussing on installations subject to the Control of Major Accident Hazard Regulations 1999[81] (which implement the EU Seveso 2 Directive).

The evaluation of site-related factors that affect safety

General

17.7. 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

17.8. 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)[82] for England and Wales, as amended by the Planning Act 2008, and the Town and Country Planning (Scotland) Act 1997 for Scotland[83] and the provisions of the Planning etc (Scotland) Act 2006[84]. 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, 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 or, in the case of a delegated case, a decision letter will be issued by the Directorate.

17.9. 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, from the IPC (see paragraph

17.2 above and Section 2). In Scotland, consent must be obtained from Scottish Ministers.

17.10. 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. Also, under Section 4(1) of NIA65, on granting any nuclear site licence, HSE can attach such conditions as may appear to HSE necessary or desirable in the interests of safety. The licence conditions (see Annex 4) include provisions with respect to siting. In particular, LC2 requires the licensee to mark the boundaries of the nuclear licensed site. Section 6(1) of NIA65 requires the Minister to maintain a list showing every site for which a nuclear site licence has been granted and including a map or maps showing the position and limits of each such site. ND provides UK Planning Authorities with up to date maps showing the land use planning consultation zones for all nuclear installations.

Government siting policy

17.11. Government policy on siting nuclear installations reactors has developed over time. The White Paper 'A programme of nuclear power' (1955) Section 37 stated that '... the first stations, even though they will be of an inherently safe design, will not be built in heavily built-up areas.' A definition of a remote site, based on characteristics of the early sites, was used for all subsequent steel vessel Magnox reactors.

17.12. The Government's siting criteria, developed in 1955, included the following:

- only a few people should be subject to extreme risk: plans should be prepared for effecting the urgent evacuation of persons close to the site in the downwind direction;
- protracted evacuation or severe restriction on normal living should not be imposed on any but small population centres; and
- temporary evacuation or restrictions should not be necessary for more than 10,000 people in any but exceptional weather conditions. If an accident were to coincide with exceptional weather conditions, not more than 100,000 persons should ultimately be affected.

17.13. In February 1968, the Minister of Power stated that, as a result of advances in technology, the safety of a gas-cooled reactor in a concrete pressure vessel was such that it may be constructed and operated much nearer built-up areas than had so far been permitted. The Minister commented that there were advantages in having these stations near centres of population in terms of amenity and of transmission costs.

17.14. In March 1970, the Minister of Technology stated that before a site is accepted for a nuclear power station, account is taken of all known development plans. This ensures that projected developments in the vicinity of the station are not hampered.

17.15. In December 1973, the Secretary of State for Trade and Industry stated that the first of any new type of reactors, if licensable, would be built on remote sites similar to those used for early Magnox reactors. Relaxation of the criteria to build on sites nearer centres of population would depend on relevant experience.

17.16. In March 1988, the Secretary of State for Energy tabled the demographic criteria for assessing potential sites, both for Magnox reactors and AGRs. Magnox reactors in concrete pressure vessels would be allowed some relaxation of the general Magnox criteria, if necessary.

17.17. The 2008 White Paper[4] 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 HSE's Nuclear Installations Inspectorate[85] and presented to NuSAC. 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

17.18. HSE's SAPs for Nuclear Facilities[46] are not mandatory design or operational standards, but they do provide ND inspectors with a framework for making regulatory judgements. SAP ST.1 expects 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 place further specific expectations on licensees (or prospective licensees) to consider population characteristics, local physical data, external hazards, other installations in the vicinity, and potential changes during the life of a plant.

17.19. When siting the UK's existing nuclear installations, account was taken 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.

17.20. HSE's SAPs set out expectations on what should be addressed during 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.

17.21. The Control of Major Accident Hazard (COMAH) Regulations[81] 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 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.

17.22. 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 services and susceptibility to extreme weather.

17.23. HSE SAPs ECE.4 and ECE.5 expect 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.

17.24. Essential services are those resources necessary to maintain the safety systems in an operational state at all times, and they may also provide supplies to safety-related systems. The services may include electricity, gas, water, compressed air, fuel and lubricants, and need to satisfy two requirements. The first requirement is to provide a guaranteed, or non-interruptible short-term supply to ensure continuity until the long-term essential supply is established, and the second is to ensure that there is adequate capacity to supply the service until normal supplies can be restored. SAPs EES.1 – EES.9 address essential services with respect to availability, reliability, back-up systems and the consequences of loss of a service.

Criteria for determining the potential effects of the nuclear facility on individuals, society and environment

17.25. 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. HSE 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 HSE 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.

17.26. SAP ST.2 expects 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 dependant 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 submits to HSE 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. On multi-facility sites, the safety case should consider the site as a whole to establish that hazards from interactions between facilities have been taken into account (SAP ST.6).

17.27. SAPs Targets 4, 6 and 8 set out targets for radiation exposure in design base fault sequences for people on and off the site.

17.28. 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. The total risk should be calculated taking account of the frequency distribution of the source terms together with probabilistic weather conditions. In estimating the risks, fatalities both on-site and off-site should be included.

17.29. SAP ST.3 expects the licensee to 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.

17.30. In March 1988, the Secretary of State for Energy stated that once a site has been accepted for a nuclear station, arrangements are to be 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. HSE 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.

Re-evaluation of relevant safety factors to ensure continued safety acceptability.

17.31. 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 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.

17.32. Local authorities consult the HSE 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 HSE cannot necessarily insist on rigid adherence to demographic constraint limits.

17.33. Circular 04/00: 'Planning controls for hazardous substances'[86] issued by the Department for Communities and Local Government, and a similar circular from the Scottish Development Department (5/1993)[87] give advice on the exercise of planning control over hazardous development and over development in the vicinity of hazardous installations.

17.34. 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)[88]. HSE 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. ND's nuclear installation 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), ND 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.

ND 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.

17.35. 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.

17.36. Both the licensee and ND monitor and assess any phenomena that might affect safety (for example something that may change the assumptions concerning external hazards) around each nuclear site. This is done as part of the normal regulatory process and during the PSRs. In addition, ND 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.

17.37. 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.

17.38. 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.

Consulting Contracting Parties in the vicinity of a proposed nuclear installation

17.39. In the case of an application to the IPC for a Section 36 consent (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 fourth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect current procedures and the government decision to embark on a programme of new NPPs.

General

18.1. The UK licensing system has ensured that all existing nuclear installations were properly designed and constructed to take account of best practices and extant safety standards. This same licensing system will continue to underpin nuclear safety now that the UK is embarking on a new NPP programme.

18.2. The response to this Article will look back briefly at the design and construction of UK's existing nuclear installations and describe the essential features of the licensing process used to ensure safe design and operation. It will then show how this process is being applied and developed to accommodate the changes that inevitably accompany a new build programme.

Design and construction of existing nuclear installations

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. LC14 (see Annex 4) 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 and 20. 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, ND 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 ND 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 ND against the version of the SAPs that were current at the time. This review process will continue on existing plants and, since 2007, ND has carried out its assessments against the 2006 revision of the SAPs[46].

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 NII (as it then was) and licensees needed to deal with international vendors. This is now being continued by ND in the context of the UK's new build programme.

Design and construction of new plant

18.7. The basic licensing system as described above will continue to apply to new plant. However, for the UK's new build programme, the plant designers and potential licensees are multi-national companies or consortia. This represents a major change in the UK and inevitably the processes will need to adapt to this change.

18.8. One of the key changes is the concept of GDAs where ND is dealing directly with plant vendors and designers rather than a prospective licensee until one is identified. This is addressed fully under Section 2. Site specific design issues, and those issues pertinent to the competence of a licensee, will be addressed at a later date when a potential site and licensee have been identified.

18.9. In the past, the UK licensees had their own design guidelines which they used to negotiate with potential vendors to develop reactor designs. This may not necessarily be the case in the future. The design standards used by multinational vendors may not be under the direct control of a UK organisation, particularly if potential licensees are not UK-based. However, during the GDA process, it is still incumbent on ND to ensure that the safety aspects of designs are acceptable in the UK.

18.10. The safety features of the new build designs are being assessed by ND against the SAPs. The SAPs provide ND inspectors with a framework for making consistent regulatory judgements on nuclear safety cases. The SAPs 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 ND's own use in its assessment process. This is also reflected in the following paragraphs under Article 18, where the term "the SAPs expect …." is widely used to emphasise the non-prescriptive nature of the SAPs.

18.11. The Principles of SFAIRP, and ALARP, are key elements of UK health and safety legislation. They are, for the purposes of ND assessment, interchangeable. The SAPs will assist ND inspectors in the judgement of whether, in their opinion, the

licensee's safety case has demonstrated that the requirements of the law have been met.

Defence in depth

18.12. In the UK, defence-in-depth is seen as a fundamental element of reactor safety, and has been a requirement for all nuclear installations since the beginning of the reactor programme. The HSE SAPs (paragraphs 140 – 144) expect that:

- deviations from normal operation and failures of structures, systems and components important to safety are prevented;
- any deviations from normal operation are allowed for by safety margins that enable detection, and action that prevents escalation;
- inherent safety features of the facility, fail-safe design and safety measures are provided to prevent fault conditions that occur from progressing to accidents;
- additional measures are provided to mitigate the consequences of severe accidents.

18.13. An important aspect of the implementation of defence-in-depth is the provision of multiple barriers. The physical barriers preventing uncontrolled release of radioactive materials are dependent on the specific reactor. However they all include:

- Fuel matrix;
- Fuel cladding;
- Pressure circuit;
- Containment;
- Control and protection system; and the
- Use of single failure criteria.

18.14. HSE's SAPs fully reflect the five levels of defence in depth that are described in detail in IAEA Safety Requirement NS-R-1.

18.15. The SAPs expect that safety barriers should, so far as is reasonably practicable, ensure diversity, redundancy and segregation in the structures, systems and components that are important to safety.

Safety classification and standards

18.16. The effective implementation of defence in depth needs support from a number of general principles and related measures. It is important that structures, systems and components, including software for instrumentation and control, are classified on the basis of their safety significance, and are designed, manufactured, installed, and then subsequently commissioned, operated and maintained to a level of quality commensurate with their classification. HSE's SAPs (paragraphs 148 – 161) address the categorisation and classification.

18.17. The SAPs expect that the safety functions to be delivered within the facility, both during normal operation and in the event of a fault or accident, should be categorised, based on their significance with regard to safety. Structures, systems and components (SSCs) that have to deliver safety functions should be identified and categorised on the basis of those functions, and their significance with regard to safety. Nuclear-specific national or international codes and standards should be used in the design of those SSCs in the highest category. The SAPs expect 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.

18.18. 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

18.19. HSE 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.

18.20. 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.

18.21. 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.

18.22. The SAPs expect 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.

18.23. HSE SAPs paragraphs 208 – 233 address specific hazards.

Design for reliability

18.24. 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.

18.25. 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, different working principles or different design teams, different sizes of equipment, different manufacturers, different components, and types of equipment that use different physical methods. The design should also be tolerant of random failure occurring anywhere within the safety systems provided to secure each safety function.

18.26. SAP EDR.4 expects 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 HSE require a special case procedure for design and construction to give confidence that failure is incredible (SAP paragraphs 238 – 279).

18.27. The SAPs expect (EDR.3) 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

18.28. The SAPs expect (FA.1) that a fault analysis should be carried out comprising design basis analysis, suitable and sufficient PSA, and suitable and sufficient severe accident analysis.

18.29. 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:

i) internal plant faults which have an expected frequency lower than about 10^{-5} per year;
ii) 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;
iii) external hazards to the plants where it can be demonstrated that their frequency is less than once in 10,000 years; and
iv) 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).

18.30. 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.

18.31. 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.

Use of established/proven engineering practice

18.32. 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.

18.33. 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.

18.34. 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.

18.35. Before any new design or feature is introduced, the licensee must submit a safety case 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. HSE will only allow construction to commence when it is satisfied that the safety case is adequate.

18.36. SAPs EQU.1 and paragraphs162 – 169 address equipment qualification. The SAPs expect 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.

18.37. SAPs EAD.3 – EAD.5 expect 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.

18.38. 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

18.39. 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 2006 will be used to assess operability of new plant and upgrading the operability of existing plant.

18.40. 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.

18.41. Inherent passive safety is an essential feature of design. 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 become 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.

18.42. The HSE, during its assessment of the licensee's safety case, checks that the above approach has been followed, SFAIRP.

Man/machine interface

18.43. 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.

18.44. 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.

18.45. Specifically, SAP EHF.2 expects that when designing systems, the allocation of safety actions between humans and technology should be substantiated and dependence on human action to maintain a safe state should be minimised.

18.46. SAP EHF.3 expects that analysis should be carried out of tasks important to safety to determine demands on personnel in terms of perception, decision making and action.

18.47. LC23 requires that the plant safety case identifies the safe limits and conditions for operation. These are known as the operating rules (or technical specifications). LC24 requires the production of operating instructions that plant operators use to implement the ORs.

18.48. At the time the current fleet of nuclear installations were built in the UK, the licensee was fully involved in the design of its reactors, and was able to retain comprehensive details of the design, which have been used and updated when subsequent plant modifications have been made. This could change in future if the licensees buy "off-the-shelf" designs. Rigorous enforcement of the licence conditions will ensure that the licensee will be responsible for the production or acquisition of all necessary safety documentation.

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 fourth UK report (i.e. in a way that has implications for the Convention obligations), but has been updated to reflect issues raised at the fourth Review Meeting relating to the reporting of incident and operating experience feedback.

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 the HSE 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 HSE (or more specifically ND as part of HSE) 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.

Safety analysis and commissioning programme

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. 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 allow the commissioning to be divided into stages (or not) and for HSE

to specify that the licensee should not proceed from one stage to the next without HSE Consent (see Article 7). Such Consent is dependent upon the licensee providing adequate documentation to justify the safety of plant when at the next stage. The LC also 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. The intended approach for new reactors in the UK, based on GDA, is that one consent is granted at the start of construction to run right through, subject to continuing regulatory supervision under licence conditions which allows ND to stop construction if needed.

19.3. The Pre-commissioning Safety Report builds on the PCSR to reflect the plant as built (i.e. including modifications to the initial design, or those made during the course of construction). 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. 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 ORs 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.

19.4. There are regulatory controls in place to ensure major activities do not take place without the agreement of HSE. The Commissioning Programme identifies key stages when permission may be required before further progress towards operation can be made. These are such times as: the bringing of nuclear fuel onto site; loading fuel into the reactor; bringing the reactor to its first criticality; and various power levels up to full power. After commissioning, the licensee may need a Consent to move to routine operation. 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 for the continued operation and maintenance of the plant.

19.5. The licensee collects 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 HSE 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

19.6. LC23 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.

19.7. LC24 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). ND has agreed that, at some nuclear installations, ORs can be replaced by Technical Specifications. These serve the same function, but using internationally accepted terminology.

19.8. LC10 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 familiarisation with the background to 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.

19.9. Under LC25 (Operational Records), the licensee ensures that adequate records of operation, inspection and maintenance of plant important to safety are made and kept. Under the QA arrangements required under LC17, the Licensees' safety staff periodically audit these records to ensure compliance with procedures, including Operating Rules and Operating Instructions. ND inspectors will also routinely monitor compliance with Operating Rules and Instructions during inspection visits. Periodic review of procedures and processes is required under LC15 (see Article 6).

Operating, maintenance, inspection and testing procedures

Operations

19.10. Paragraph 19.6 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. The arrangements under LC14 include internal peer review, discussion and endorsement by the Licensee's Nuclear Safety Committee (LC13) and, where appropriate, submission to HSE 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).

19.11. When the need to change an OR is identified, LC23 requires the licensee to submit a safety case to HSE that substantiates the proposed change. Normally, HSE 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 the HSE has approved the alteration or amendment.

19.12. 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 ND receives a safety case that substantiates the continued operation of a reactor, whether or not the OR limits and conditions need to be changed.

19.13. LC12 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.

19.14. 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 ND (on behalf of HSE) before the non-routine operation is carried out.

Maintenance, inspection and testing

19.15. LC28 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.

19.16. In addition to the requirements of LC28, HSE also has powers under LC29 (duty to carry out tests and inspections). After consultation with the licensee, HSE 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.

19.17. All UK nuclear reactors must shut down at regular intervals for inspection and testing. These statutory shutdowns occur every 2 or 3 years, depending on the reactor type. Once shutdown, the reactor cannot 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. This evaluation will identify any need for changes to the type and frequency of maintenance, inspection and testing.

19.18. 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 and HSE Approval obtained. The process for modifications is prescribed in the licensees' arrangements made under LC22.

19.19. 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 ND before implementation, while others can be implemented by the licensee in accordance with approved procedures and notified to ND.

Operational occurrences

19.20. 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. Beyond the design basis, 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 19.12–19.14.

19.21. HSE's SAPs[46] 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. These analyses will inform preparation of accident mitigation strategies and emergency plans.

19.22. 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 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.

19.23. In the event of an incident on site, arrangements made under LC7 require that the licensee notifies HSE, as well as recording, investigating and preparing a report on such incidents. If appropriate, ND will enforce corrective action.

Engineering and technical support

19.24. The nuclear site licence ensures 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. ND's view is that this is acceptable, providing that the licensees retain sufficient expertise to be an 'intelligent customer'.

19.25. ND continues to oversee 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.

19.26. Licensees' arrangements under LC17 (Quality Assurance) ensure appropriate control and supervision of contractors' staff.

19.27. The maintenance of technical expertise in the nuclear industry was an issue that was discussed in detail at previous Convention review meetings. With the revival of the nuclear industry, the availability of adequate engineering and technical resources will remain a major challenge for several years. 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

19.28. 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 HSE the responsibility to co-ordinate a long-term generic (i.e. not site specific) safety research programme 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.

19.29. There are two secondary objectives of this research programme that recognise the need to maintain technical competence at a time when fewer people are choosing nuclear engineering as a career in the UK. 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.

19.30. ND directs the programme, on behalf of HSE, by identifying safety issues that are expressed in the Nuclear Research Index and in technical strategies. It is expected that the nuclear licensees commission research to address issues raised by ND. ND also commissions its own 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. Over the last 12 months, the scope of the programme has expanded to account for the needs of ND's GDA 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. In addition, strategic approaches are in development aimed at identifying research needs related to low level waste, land quality and deep geological disposal.

Reporting of incidents

19.31. In the UK, HSE ensures incidents that may affect nuclear safety are notified by licensees in a timely manner by attaching LC7 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:

(i) is required by any other condition attached to the licence;
(ii) the HSE may specify; and as
(iii) the licensee considers necessary.

19.32. The non-prescriptive nature of the licence conditions means that each UK licensee can adopt their own reporting arrangements to meet ND's expectations. ND has discussed and agreed these arrangements with each site. Consequently local arrangements exist on each licensed site that establish a proportionate approach to reporting, based on the safety significance of the incident in question.

19.33. LC7 compliance arrangements made by each licensee include a wide spectrum of incidents. The proportionate approach to the arrangements means that, significant incidents are reported immediately, while others may be reported at a later date. Records and investigations of the less significant incidents are held on site where they are inspected by ND as part of its inspection programme.

19.34. 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[89] for the purposes of section 22(1) of NIA65[27.] These include:

a. releases of radioactive or toxic substances which have, or may have caused, death or serious injury to persons on or off the licensed site;

b. 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;

c. 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

d. any uncontrolled criticality excursion.

(ii) Incidents that relate to LC23 (Operating Rules), LC28 (Examination, Inspection, Maintenance and Testing), and LC34 (Leakage and Escape of Radioactive Material and Radioactive Waste);

(iii) Incidents that meet the UK Ministerial Reporting Criteria and HSE's own Public Reporting Criteria, which are identical. These include:

a. occurrences on a licensed site, which are to be reported to DECC and HSE under section 4(1)(a) of the Nuclear Installations (Dangerous Occurrences) Regulations 1965;

b. 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)[34];

c. examination, inspection, maintenance, test or operation of any part of the plant revealing that the safe operation may be significantly affected;

d. 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)[29] or the Environmental Permitting Regulations 2007[30] in England and Wales;

e. 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

f. 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.

(iv) 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;

(v) 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.

19.35. As part of its Operational Experience Feedback (OEF) processes, ND has made arrangements with licensees to be informed of incidents covered by international reporting arrangements, for which ND is the UK reporting authority, i.e. the

(i) International Nuclear and Radiological Event Scale;

(ii) IAEA/NEA International Reporting System for Operating Experience (IRS); and the

(iii) Fuel Incident Analysis and Notification System (FINAS).

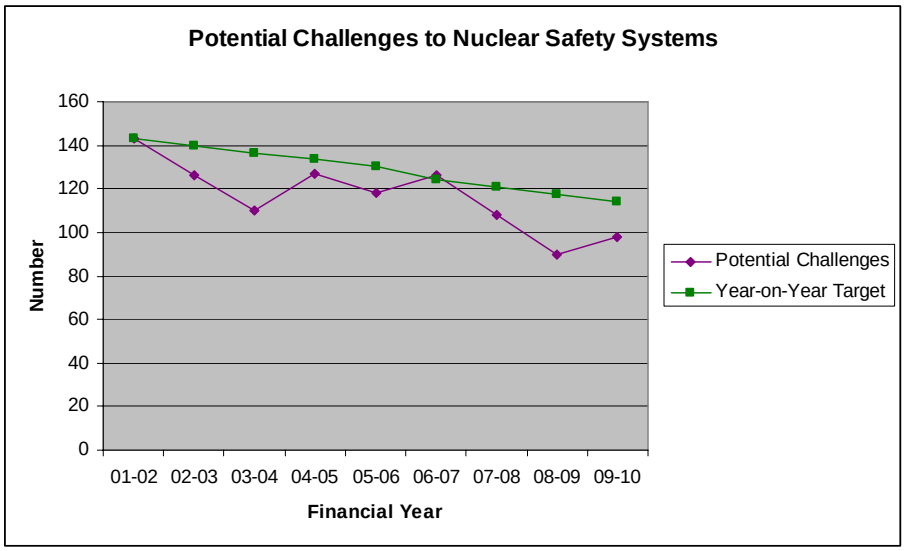
19.36. ND continues to develop its OEF processes. Written procedures document the internal processes for capturing and assessing incident information, for which the

'Fast Stream Report' is the starting point for significant incidents in the UK, as explained below.

19.37. The more important incidents are usually reported by licensees to ND through the site inspector(s) assigned to each licensed site. When such a report is received, subject to its significance and/or its potential for media interest, the site inspector may raise a Fast Stream Report which summarises both the incident and the proposed, sometimes preliminary, course of action for ND. The Fast Stream Report is circulated within ND, HSE and relevant Government Departments, as appropriate. Such reports, together with others received from major licensees, are screened by a team of inspectors on a routine basis for their possible causes and consequences, and also for the type of event they represent. The information from the screening process is available to inform ND's wider consideration of its regulatory intervention programmes of site inspection and plant assessment.

19.38. HSE has recently placed on its web site[90] in response to a public FOI request, the dates, relevant site names, INES ratings and descriptions of all such civil incidents which have attracted an INES rating of 0 or above since 2001. HSE's records from 2001 to October 2009 show that there have been a total of eight civil events that were finally categorised at INES level 2, and one event at INES level 3. This was an incident in 2005 at the Thermal Oxide Reprocessing Plant at Sellafield and not applicable to this Convention.

19.39. HSE's business performance is monitored by DWP in accordance with a Public Service Agreement. The Agreement states that ND will endeavour to secure a sustained improvement in the numbers of incidents reported by licence holders that are judged to have a potential to challenge a nuclear safety system. The sustained improvement is targeted on a 20% reduction over nine years from an agreed baseline figure of 143 in 2001, at a rate of 2.2% year-on-year improvement. The figure below indicates ND's declared progress against the target:



19.40. The above UK information is augmented by regular reviews of IRS, FINAS and non-regulatory compliance reports which are undertaken by HSE's OEF function. Where significant and generally wider implications for both regulators and operators are identified, OEF Advice Notes focussing on the possible lessons for both regulators and operators are authored and distributed to both ND and the nuclear licensees. Summaries of the IRS and FINAS reports with views on causes and consequences are circulated to ND's specialist Nuclear Topic Groups for their further consideration, discussion and action as appropriate.

19.41. ND 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 have attracted an INES rating of 2 or above. Locally, ND includes incident reports in the quarterly reports that it makes to the local Liaison Committees of each Nuclear Licensed Site. The committees comprise members of both central and 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 ND together with any remedial actions being planned or taken by the relevant licensee. The Local Liaison Committee Reports also cover HSE's wider regulation and activities on the particular site for the quarter in question.

19.42. 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 transboundary release that could be of radiological safety significance for another state". DECC is the UK competent authority and contact points for issuing and receiving notification and information on the nuclear accident arising from NPPs.

Analysis of operating experience.

19.43. Operational matters which may affect safety and which are identified during operation or during maintenance, inspection and testing are notified, recorded, investigated and reported as required 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. 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.

19.44. 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 a 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.

19.45. An analysis of operating experience is a key part of the PSRs that are required under LC15. The main review is carried out every 10 years, but other reviews also take place before start-up after statutory outages.

19.46. ND is responsible for national publication of the results of its regulatory activities (such as the assessment of licensees' PSRs) and international reporting of events. ND 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.

19.47. Some licensees have well-developed OEF processes in place based on WANO performance objectives and criteria. These build on the incident reporting system described in paragraphs 19.30-19.41 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

19.48. LC34 requires radioactive material or waste to be controlled and contained so that it does not leak or escape. Licensees have to demonstrate to the satisfaction of the 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.

19.49. CoRWM has considered various management options for the long term management of higher activity radioactive wastes, and has held widespread public consultation. This committee reported in 2006[56]. Its key recommendations were that radioactive waste should be managed by means of geological disposal, and that the choice of any site for geological disposal should be based on the concepts of partnership and voluntarism.

19.50. On 12 June 2008 the UK, Welsh and Northern Ireland Governments published the White Paper "Managing Radioactive Waste Safely: A Framework for Implementing Geological Disposal"[91]. Communities in England were also invited to enter into discussions with Government to find out more about hosting a geological disposal facility. This is a discussion with no commitment to proceed. The Government invitation went to local authorities in England. Welsh Authorities were informed, and may choose to enter into discussions, though their Government is currently neutral on geological disposal. The Scottish Government policy is for the long-term management of higher activity radioactive waste in near surface, near site facilities where it can be monitored and retrieved and the need for transporting it over long distances is minimal. The Scottish Government undertook a public consultation between January and April 2010 on its Detailed Statement of Policy[92] and supporting Environmental Report[93] as part of the Strategic Environmental Assessment of its policy. The Detailed Statement of Policy allows the storage and disposal of waste in facilities constructed on the surface or near the surface down to depth of several tens of metres where the waste can be monitored and is retrievable.

19.51. In the meantime, 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). These arrangements include the preparation and assessment of a safety case, and the identification of limits and conditions necessary in the interests of safety. In addition, ND (as part of HSE), the Environment Agency and SEPA have been working on improved regulatory arrangements to ensure that ILW is managed in a sustainable way, taking account of long-term environmental considerations.

19.52. 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 HSE. HSE's assessment of PSRs currently includes consideration of radioactive waste management and associated safety cases.

19.53. LC33 (Disposal of Radioactive Waste) requires the disposal of radioactive waste to be in accordance with an Authorisation granted under RSA93[29] in Scotland and EPR10[30] 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 granted by the appropriate regulatory body under RSA93 and EPR10. These authorisations also require that operators use BPM to minimise the creation of radioactive waste. However, nuclear licensed sites are

exempt from the requirement to have a RSA93 and EPR10 authorisation to accumulate radioactive waste on the sites. The regulation of such accumulation of radioactive waste is undertaken using licence conditions (see paragraph 19.52 above) at least as stringently as it would if it were subject to RSA93 and EPR10.

19.54. In the UK, regulation under RSA93 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 Wales; SEPA, for disposals made in, or from sites, in Scotland, and the Environment and Heritage Service of the Department of the Environment, for disposals made in, or from sites, in Northern Ireland. In addition, the FSA has responsibility for all aspects of food safety and is consulted on the setting of authorisations to assess the impact and uptake of radioactive discharges to the food chain.

19.55. Authorisations or permits for nuclear licensed sites granted by the environment agencies generally set limits on the discharge of specific radio-nuclides, or groups of radio-nuclides. The Environment Agency incorporates conditions for annual, quarterly and monthly limits according to the circumstances. SEPA places conditions on annual limits when granting authorisations. In addition, the environment agencies can include conditions in authorisations or permits that require the site operator to notify the regulator, explain reasons why and take action if either weekly or monthly discharge levels are higher than normal. In addition to the limit setting conditions other conditions require operators to use BPM to minimise the volume of radioactive waste produced and the activity of waste discharged, and to minimise the radiological impacts of those discharges. Authorisations require operators to monitor compliance with the authorisation and may also impose requirements on the operators to carry out monitoring of levels of discharged radionuclides in the surrounding environment.

19.56. The UK has a general policy progressively to reduce discharges overall. 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’[94] to cover the period to 2030. In parallel, the Government is producing Statutory Guidance to be issued to the Environment Agency, to help it to take account of radiological principles and environmental policy objectives when determining discharge authorisations under EPR10, in England. The Scottish Government issued Statutory Guidance[95] to SEPA in February 2008 on the application of the Strategy for Radioactive Substances under the Oslo and Paris (OSPAR) Convention.

19.57. Information on radioactive discharges, and on the disposal of solid radioactive waste, is provided in the UK’s national report for the Joint Convention.

ANNEXES

Annex 1 - UK Civil Nuclear Power Stations - Key Parameters

Nuclear Installation	Calder Hall	Chapel-cross	Dungeness A	Dungeness B	Hartlepool	Heysham 1	Heysham 2
Licensee	SL	MNL	MSL	BEGL	BEGL	BEGL	BEGL
Reactor type	Magnox	Magnox	Magnox	AGR	AGR	AGR	AGR
No. of reactors	4	4	2	2	2	2	2
1st Power Operation	1956	1959	1965	1983	1983	1983	1988
Reactor Thermal Power (MWth)	268	260	840	1500	1500	1500	1550
Electrical Gen. Power (MWe)	60	60	230	615	655	625	680
Sent off site (MWe)	50	48	225	520	595	585	615
Nuclear fuel	U metal	U metal	U metal	UO2	UO2	UO2	UO2
Fuel cladding	Magnox	Magnox	Magnox	S. Steel	S. Steel	S. Steel	S. Steel
Nuclear moderator	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
Reactor core							
Fuel channels	1696	1696	3932	408	324	324	332
Assemblies per channel	6	6	7	7	8	8	8
Fuel pins /assembly	-	-	-	36	36	36	36
Coolant	CO2	CO2	CO2	CO2	CO2	CO2	CO2
Coolant containment	Steel PV	Steel PV	Steel PV	PCPV	PCPV	PCPV	PCPV
Coolant pressure (Bar)	7	7	20	34	42	42	43
Coolant max. temp (°C)	345	345	370	673	675	651	635
Steam turbine inlet pressure (Bar)	15.5	15.5	19.9	163	163	163	159
Steam turbine inlet temp. (°C)	329	321	371	555	538	538	538
Gross electrical power (MWe)	240	240	469	1230	1310	1250	1360

Key:

SL	Sellafield Ltd	MNL	Magnox North Ltd
BEGL	British Energy Generation Ltd	MSL	Magnox South 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	Wylfa
Licensee	BEGL	BEGL	MNL	MSL	BEGL	BEGL	MNL
Reactor type	AGR	AGR	Magnox	Magnox	PWR	AGR	Magnox
No. of reactors	2	2	2	2	1	2	2
1st Power Operation	1976	1976	1967	1966	1995	1988	1971
Reactor Thermal Power (MWth)	1494	1496	730	1010	3425	1623	1920
Electrical Gen. Power (MWe)	655	644	230	245	1250	682	540
Sent off site (MWe)	430	430	217	210	1188	600	475
Nuclear fuel	UO2	UO2	U metal	U metal	UO2	UO2	U metal
Fuel cladding	S. Steel	S. Steel	Magnox	Magnox	Zr-4	S. Steel	Magnox
Nuclear moderator	Graphite	Graphite	Graphite	Graphite	Water	Graphite	Graphite
Reactor core							
Fuel channels	308	308	3308	3784	-	332	6156
Assemblies per channel	8	8	8	7	193	8	8
Fuel pins /assembly	36	36	-	-	264	36	-
Coolant	CO2	CO2	CO2	CO2	Water	CO2	CO2
Coolant containment	PCPV	PCPV	PCPV	Steel PV	Steel PV	PCPV	PCPV
Coolant pressure (Bar)	42	40	27	19.6	158	42.3	27.6
Coolant max. temp (^{o}C)	655	639	365	360	323	635	370
Steam turbine inlet pressure (Bar)	163	163	27	46.4	67	163	35
Steam turbine inlet temp. (^{o}C)	495	538	350	354	283	538	320
Gross electrical power (MWe)	1310	1288	460	490	1250	1364	1080

Key:

SL	Sellafield Ltd	MNL	Magnox North Ltd
BEGL	British Energy Generation Ltd	MSL	Magnox South 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 therefrom 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[29], 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 - Nuclear Site Licence: Standard Licence Conditions

In this Annex, compliance with the Convention is demonstrated in a way that has not substantially changed since the third UK report (i.e. in a way that has implications for the Convention obligations), except the minor change in LC3 below.

1: Interpretation

The purpose of LC1 is to ensure that there is no ambiguity in the use of certain specified terms which are found in the text of the Conditions. It also contains important powers for the Executive to modify, revise or withdraw approvals, etc. and to approve modifications to any matter currently approved. Where appropriate reference is made back to the relevant statutory Acts of Parliament.

2: Marking of the Site Boundary

(1) The licensee shall make and implement adequate arrangements to prevent unauthorised persons from entering the site or, if so directed by the Executive, from entering such part or parts thereof as the Executive may specify.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall mark the boundaries of the site by fences or other appropriate means, and any such fences or other means used for this purpose shall be properly maintained.
(5) The licensee shall, if so directed by the Executive, erect appropriate fences on the site in such positions as the Executive may specify and shall ensure that all such fences are properly maintained.
The purpose of LC2 is to delineate the extent of the site in order to prevent unauthorised access in order to limit the risk of injury to intruders and to other persons or damage to their property.

3: Restriction on Dealing with the Site

The licensee shall not convey, assign, transfer, let or part with possession of the site or any part thereof or grant any licence in relation thereto without the consent of the Executive.
The purpose of LC3 is to ensure that nothing confuses the absolute responsibility of the licensee under NIA65 in respect of safety on the whole licensed site. The licensee should be able to demonstrate that there are organisational procedures to prevent individuals within the company from conveying, assigning, transferring, letting, feuing or granting any licences in relation to the site or parts of the site without first obtaining the Consent of the Executive.
For sites operated under contract to the NDA, LC3 has been modified to reflect the site's ownership by the NDA and not the licensee and to take account of the formation of the Civil Nuclear Police Authority under the Energy Act 2004. For the Magnox sites LC3 reads:

(1) No person shall convey, assign, transfer, let or part with possession of the site or any part thereof or grant any licence in relation thereto, except to the Civil Nuclear Police Authority, without the consent of the Executive.

(2) The licensee shall notify the Executive forthwith if occupancy of any part of the site is taken by the Civil Nuclear Police Authority.

(3) The licensee shall make and implement adequate arrangements to control all property transactions affecting the site or parts thereof.

(4) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.

(5) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

4: Restrictions on Nuclear Matter on the Site

(1) The licensee shall ensure that no nuclear matter is brought onto the site except in accordance with adequate arrangements made by the licensee for this purpose.
(2) The licensee shall ensure that no nuclear matter is stored on the site except in accordance with adequate arrangements made by the licensee for this purpose.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(5) For new installations, if the Executive so specifies, the licensee shall ensure that no nuclear matter intended for use in connection with the new installation is brought onto the site for the first time without the consent of the Executive.
The purpose of LC4 is to ensure that the licensee carries out its responsibilities to control the introduction and storage of nuclear matter on the licensed site (nuclear matter being fuel, sources, radioactive waste, etc., as defined by NIA65).

5: Consignment of Nuclear Matter

(1) The licensee shall not consign nuclear matter (other than excepted matter and radioactive waste) to any place in the United Kingdom other than a relevant site except with consent of the Executive.
(2) The licensee shall keep a record of all nuclear matter (including excepted matter and radioactive waste) consigned from the site and such record shall contain particulars of the amount, type and form of such matter, the manner in which it was packed, the name and address of the person to whom it was consigned and the date when it left the site.
(3) The licensee shall ensure that the aforesaid record is preserved for 30 years from the date of dispatch or such other period as the Executive may approve except in the case of any consignment or part thereof subsequently stolen, lost, jettisoned or abandoned, in which case the record shall be preserved for a period of 50 years from the date of such theft, loss, jettisoning or abandoning.
The purpose of LC5 is to ensure that the transfer of nuclear matter, other than excepted matter and radioactive waste, to sites in the UK other than relevant sites:
(a) is carried out only with the consent of the Executive; and that
(b) the licensee has adequate records of where such nuclear matter has been sent.
The licensee should also be able to demonstrate that there are organisational procedures to prevent individuals from inadvertently consigning such matter to non-relevant sites without first obtaining a Consent from the Executive.
[Relevant sites are other licensed or Crown sites as defined in NIA65 and excepted matter is defined in NIA65 and Statutory Instrument (S.I.) 1965/1826 and S.I. 1978/1779].

6: Documents, Records, Authorities and Certificates

(1) The licensee shall make adequate records to demonstrate compliance with any of the conditions attached to this licence.
(2) Without prejudice to any other requirements of the conditions attached to this licence, the licensee shall make and implement adequate arrangements to ensure that every document required, every record made, every authority consent or

approval granted and every direction or certificate issued in pursuance of the conditions attached to this licence is preserved for 30 years or such other periods as the Executive may approve.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall furnish to the Executive copies of any such document, record, authority or certificate as the Executive may specify.
The purpose of LC6 is to ensure that adequate records are held by the licensee for a suitable period to demonstrate compliance with licence conditions.

7: Incidents on the Site

(1) The licensee shall make and implement adequate arrangements for the notification, recording, investigation and reporting of such incidents occurring on the site:
(a) as is required by any other condition attached to this licence;
(b) as the Executive may specify; and
(c) as the licensee considers necessary.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
The purpose of LC7 is to ensure that incidents are notified, recorded, investigated and reported as required by other licence conditions, as may be specified by the Executive and as the licensee considers necessary.

8: Warning Notices

The licensee shall ensure that suitable and sufficient notices are kept on the site for the purposes of informing persons thereon of each of the following matters, that is to say :
(a) the meaning of any warning signal used on the site;
(b) the location of any exit from any place on the site, being an exit provided for use in the event of an emergency;
(c) the measures to be taken by such persons in the event of fire breaking out on the site or in the event of any other emergency;
and that such notices are kept posted in such positions and in such characters as to be conveniently read by those persons.
The purpose of LC8 is to ensure the safety of all people on site in respect of their ability to be able to respond appropriately and without delay to an emergency situation. The licensee therefore needs to ensure that all warning notices are in appropriate places to advise people on what to do in that area in the event of fire or any other emergency.

9: Instructions to Persons on the Site

The licensee shall ensure that every person authorised to be on the site receives adequate instructions (to the extent that is necessary having regard to the circumstances of that person being on the site) as regards the risks and hazards associated with the plant and its connection therewith and the action to be taken in the event of an accident or emergency on the site.
The purpose of LC9 is to ensure that the licensee provides all persons allowed on the site with adequate instruction where necessary so that they are aware of the risks and hazards associated with the plant and its operations, the precautions that must

be taken to minimise the risk to themselves and others and the actions to be taken in the event of an accident or emergency.

10: Training

(1) The licensee shall make and implement adequate arrangements for suitable training of all those on site who have responsibility for any operations which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.
The purpose of LC10 is to ensure that all those people on the site who have responsibility for an action which may affect safety are adequately trained for that purpose. This Condition is in addition to the general duty under HSWA74 s. 2(2)(c) and IRR99 Regulation 12(a).

11: Emergency Arrangements

(1) Without prejudice to any other requirements of the conditions attached to this licence the licensee shall make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) Where any such arrangements require the assistance or co-operation of, or render it necessary or expedient to make use of the services of any person, local authority or other body the licensee shall ensure that each person, local authority or other body is consulted in the making of such arrangements.
(5) The licensee shall ensure that such arrangements are rehearsed at such intervals and at such times and to such extent as the Executive may specify or, where the Executive has not so specified, as the licensee considers necessary.
(6) The licensee shall ensure that such arrangements include procedures to ensure that all persons in his employ who have duties in connection with such arrangements are properly instructed in the performance of the same, in the use of the equipment required and the precautions to be observed in connection therewith.
The purpose of LC11 is to ensure that the licensee has adequate arrangements in place to respond effectively to any incident ranging from a minor on-site event to a significant release of radioactive material.

12: Duly Authorised and Other Suitably Qualified and Experienced Persons

(1) The licensee shall make and implement adequate arrangements to ensure that only suitably qualified and experienced persons perform any duties which may affect the safety of operations on the site or any duties assigned by or under these conditions or any arrangements required under these conditions.
(2) The aforesaid arrangements shall also provide for the appointment, in appropriate cases, of duly authorised persons to control and supervise operations which may affect plant safety.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.

(5) The licensee shall ensure that no person continues to act as a duly authorised person if, in the opinion of the Executive, he is unfit to act in that capacity and the Executive has notified the licensee to that effect.

The purpose of LC12 is to ensure that only suitably qualified and experienced persons perform duties which may affect the safety of any operations on the site or any duties required by other licence conditions or the arrangements made thereunder.

13: Nuclear Safety Committee

(1) The licensee shall establish a nuclear safety committee or committees to which it shall refer for consideration and advice the following:

(a) all matters required by or under these conditions to be referred to a nuclear safety committee;

(b) such arrangements or documents required by these conditions as the Executive may specify and any subsequent alteration or amendment to such specified arrangements or documents;

(c) any matter on the site affecting safety on or off the site which the Executive may specify; and

(d) any other matter which the licensee considers should be referred to a nuclear safety committee.

(2) The licensee shall submit to the Executive for approval the terms of reference of any such nuclear safety committee and shall not form a nuclear safety committee without the aforesaid approval.

(3) The licensee shall ensure that once approved no alteration or amendment is made to the terms of reference of such a nuclear safety committee unless the Executive has approved such alteration or amendment.

(4) The licensee shall appoint at least seven persons as members of a nuclear safety committee including one or more members who are independent of the licensee's operations and shall ensure that at least five members are present at each meeting including at least one independent member.

(5) The licensee shall furnish to the Executive the name, qualifications, particulars of current posts held and the previous relevant experience of every person whom he appoints as a member of any nuclear safety committee forthwith after making such appointment. Notwithstanding such appointment the licensee shall ensure that a person so appointed does not remain a member of any nuclear safety committee if the Executive notifies the licensee that it does not agree to the appointment.

(6) The licensee shall ensure that the qualifications, current posts held and previous relevant experience of the members of any such committee, taken as a whole, are such as to enable that committee to consider any matter likely to be referred to it and to advise the licensee authoritatively and, so far as practicable, independently.

(7) The licensee shall ensure that a nuclear safety committee shall consider or advise only during the course of a properly constituted meeting of that committee.

(8) The licensee shall send to the Executive within 14 days of any meeting of any such committee a full and accurate record of all matters discussed at that meeting including in particular any advice given to the licensee.

(9) The licensee shall furnish to the Executive copies of any document or any category of documents considered at any such meetings that the Executive may specify.

(10) The licensee shall notify the Executive as soon as practicable if it is intended to reject, in whole or in part, any advice given by any such committee together with the reasons for such rejection.

(11) Notwithstanding paragraph (7) of this condition, where it becomes necessary to obtain consideration of or advice on urgent safety proposals (which would normally

be considered by a nuclear safety committee) the licensee may do so in accordance with appropriate arrangements made for the purpose by the licensee, considered by the relevant nuclear safety committee and approved by the Executive.
(12) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements described in paragraph (11) of this condition unless the relevant nuclear safety committee has considered and the Executive has approved such alteration or amendment.
The purpose of LC13 is to ensure that the licensee sets up a senior level committee which should consider and advise on matters which affect the safe design, construction, commissioning, operation and decommissioning of the installations on the licensed site and any other matter relevant to safety. The committee must have members who are adequately qualified to perform this task and to provide a source of authoritative advice to the licensee. The committee, however, is purely advisory and must not be considered to have an executive function, but the Executive must be informed if the advice of the committee is not to be followed by the licensee.

14: Safety Documentation

(1) Without prejudice to any other requirements of the condition attached to this licence the licensee shall make and implement adequate arrangements for the production and assessment of safety cases consisting of documentation to justify safety during the design, construction, manufacture, commissioning, operation and decommissioning phases of the installation.
(2) The licensee shall submit to the Executive for approval such parts or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall furnish to the Executive copies of any such documentation or any such category of documentation as the Executive may specify.
The purpose of LC14 is to ensure that the licensee sets up arrangements for the preparation and assessment of the safety related documentation comprising "safety cases" to ensure that the licensee justifies safety during design, construction, manufacture, commissioning, operation, and decommissioning.

15: Periodic Review

(1) The licensee shall make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall, if so directed by the Executive, carry out a review and reassessment of safety and submit a report of such review to the Executive at such intervals, within such a period and for such of the matters or operations as may be specified in the direction.
The purpose of LC15 is to ensure that the plant remains adequately safe and that the safety cases are kept up to date throughout its lifetime. The safety cases should be periodically reviewed in a systematic manner against the original design intent and current safety objectives and practices.

16: Site Plan, Designs and Specifications

(1) The licensee shall submit to the Executive an adequate plan of the site (hereinafter referred to as the site plan) showing the location of the boundary of the licensed site and every building or plant on the site which might affect safety.

(2) The licensee shall submit to the Executive with the site plan a schedule giving particulars of each building and plant thereon and the operations associated therewith.
(3) If any changes are made on the site which may affect the said buildings, plant or operations, the licensee shall forthwith send an amended site plan and schedule to the Executive incorporating these changes.
(4) The licensee shall furnish to the Executive such plans, designs, specifications or any other information relating to such buildings, plant and operations as the Executive may specify.
The purpose of LC16 is to ensure that the licensee indicates, using a site plan, all buildings and plant or areas which might affect safety and provides a schedule updated as necessary, giving details of each building and its associated operations.

17: Quality Assurance

(1) Without prejudice to any other requirements to the conditions attached to this licence the licensee shall make and implement adequate quality assurance arrangements in respect of all matters which affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The licensee shall furnish to the Executive such copies of records or documents made in connection with the aforesaid arrangements as the Executive may specify.
The purpose of LC17 is to ensure that the licensee sets out the managerial and procedural arrangements that will be used to control and monitor those actions necessary in the interests of safety, and to demonstrate compliance with the site licence conditions (and in particular the arrangements made under them) and any other relevant legislation.

18: Radiological Protection

(1) The licensee shall make and implement adequate arrangements for the assessment of the average effective dose equivalent (including any committed effective dose equivalent) to such class or classes of persons as may be specified in the aforesaid arrangements and the licensee shall forthwith notify the Executive if the average effective dose equivalent to such class or classes of persons exceeds such level as the Executive may specify.
(2) The licensee shall submit to the Executive for approval such part or parts of the arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
The purpose of LC18 is to ensure that the licensee makes and implements adequate arrangements to assess the average effective dose equivalent to specified classes of persons. Also the licensee shall notify the Executive if such dose exceeds the specified level. This is complementary to IRR99 Regulation 13.

19: Construction or Installation of New Plant

(1) Where the licensee proposes to construct or install any new plant which may affect safety the licensee shall make and implement adequate arrangements to control the construction or installation.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.

(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall where appropriate divide the construction or installation into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the construction or installation without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed construction or installation and shall where appropriate provide for the submission of this documentation to the Executive.
(5) The licensee shall, if so directed by the Executive, halt the construction or installation of a plant and the licensee shall not recommence such construction or installation without the consent of the Executive.
The purpose of LC19 is to ensure that the licensee provides and implements adequate control over the construction and installation of new plant which may affect safety.

20: Modification to Design of Plant under Construction

(1) The licensee shall ensure that no modification to the design which may affect safety is made to any plant during the period of construction except in accordance with adequate arrangements made and implemented by the licensee for that purpose.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of modifications according to their safety significance. The arrangements shall where appropriate divide modifications into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the modification without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed modification and shall where appropriate provide for the submission of this documentation to the Executive.
The purpose of LC20 is to ensure that where necessary adequate arrangements exist to control safety-related modifications during design and construction of plant or process.

21: Commissioning

(1) The licensee shall make and implement adequate arrangements for the commissioning of any plant or process which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration and amendment.
(4) The aforesaid arrangement shall where appropriate divide the commissioning into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the commissioning without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed commissioning and shall where appropriate provide for the submission of this documentation to the Executive.

(5) The licensee shall appoint a suitably qualified person or persons for the purpose of controlling, witnessing, recording and assessing the results of any tests carried out in accordance with the requirements of the aforesaid commissioning arrangements.
(6) The licensee shall ensure that full and accurate records are kept of the results of every test and operation carried out in pursuance of this condition.
(7) The licensee shall ensure that no plant or process which may affect safety is operated (except for the purpose of commissioning) until:
(a) the appropriate state of commissioning has been completed and a report of such commissioning, including any results and assessments of any tests as may have been required under the commissioning arrangements referred to in paragraph (1) of this condition, has been considered in accordance with those arrangements; and
(b) a safety case or cases as appropriate, which shall include the safety implications of modifications made since the commencement of construction of the plant and those arising from the commissioning of the plant, and any matters whereby the operation of the plant may be effected by such modifications or commissioning, has been considered in accordance with the arrangements referred to in paragraph (1) of this condition.
(8) The licensee shall, if so notified by the Executive, submit to the Executive the safety case for the aforesaid plant or processes prepared in pursuance of paragraph (7) of this condition and shall not commence operation of the relevant plant or process without the consent of the Executive.
The purpose of LC21 is to ensure that adequate arrangements exist for the commissioning of a new or modified plant or process which may affect safety and to ensure qualified supervision of this work.

22: Modification or Experiment on Existing Plant

(1) The licensee shall make and implement adequate arrangements to control any modification or experiment carried out on any part of the existing plant or process which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of modifications or experiments according to their safety significance. The arrangements shall where appropriate divide the modification or experiment into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the modification or experiment without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed modification or experiment and shall where appropriate provide for the submission of the documentation to the Executive.
(5) The licensee shall if so directed by the Executive, halt the modification or experiment and the licensee shall not recommence such modification or experiment without the consent of the Executive.
The purpose of LC22 is to ensure that adequate arrangements exist to ensure that all modifications and experiments that may affect safety are adequately controlled.

23: Operating Rules

(1) The licensee shall, in respect of any operation that may affect safety, produce an adequate safety case to demonstrate the safety of that operation and to identify

the conditions and limits necessary in the interests of safety. Such conditions and limits shall hereinafter be referred to as operating rules.
(2) The licensee, where the Executive so specifies, shall refer the operating rules arising from paragraph (1) of this condition to the relevant nuclear safety committee for consideration.
(3) The licensee shall ensure that operations are at all times controlled and carried out in compliance with such operating rules. Where the person appointed by the licensee for the purposes of condition 26 identifies any matter indicating that the safety of any operation or the safe condition of any plant may be affected that person shall bring that matter to the attention of the licensee forthwith who shall take appropriate action and ensure the matter is then notified, recorded, investigated and reported in accordance with arrangements made under condition 7.
(4) The licensee shall submit to the Executive for approval such of the aforesaid operating rules as the Executive may specify.
(5) The licensee shall ensure that once approved no alteration or amendment is made to any approved operating rule unless the Executive has approved such alteration or amendment.
(6) Notwithstanding the preceding provisions of this condition the Executive may, if in its opinion circumstances render it necessary at any time, agree to the temporary suspension of any approved operating rule.
The purpose of LC23 is to ensure that all operations that may affect safety are supported by a safety case, and that the safety case identifies the conditions and limits that ensure that the plant is kept in a safe condition.

24: Operating Instructions

(1) The licensee shall ensure that all operations which may affect safety are carried out in accordance with written instructions hereinafter referred to as operating instructions.
(2) The licensee shall ensure that such operating instructions include any instructions necessary in the interests of safety and any instructions necessary to ensure that any operating rules are implemented.
(3) The licensee shall, if so specified by the Executive, furnish to the Executive copies of such operating instructions and when any alteration is made to the operating instructions furnished to the Executive, the licensee shall ensure that such alteration is furnished to the Executive within such time as may be specified.
(4) The licensee shall make and implement adequate arrangements for the preparation, review and amendment of such operating instructions.
(5) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(6) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
The purpose of LC24 is to ensure that all operations as defined in Condition 1 which may affect safety, including any instructions to implement Operating Rules, are undertaken in accordance with written operating instructions.

25: Operational Records

(1) The licensee shall ensure that adequate records are made of the operation, inspection and maintenance of any plant which may affect safety.
(2) The aforesaid records shall include records of the amount and location of all radioactive material, including nuclear fuel and radioactive waste, used and processed, stored or accumulated upon the site at any time.
(3) The licensee shall record such additional particulars as the Executive may specify.

(4) The licensee shall furnish to the Executive such copies of extracts from such records as the Executive may specify.

The purpose of LC25 is to ensure that adequate records are kept regarding operation, inspection and maintenance of any safety-related plant.

26: Control and Supervision of Operations

The licensee shall ensure that no operations are carried out which may affect safety except under the control and supervision of suitably qualified and experienced persons appointed for that purpose by the licensee.

The purpose of LC26 is to ensure that safety-related operations are carried out only under the control and supervision of suitably qualified and experienced personnel.

27: Safety Mechanisms, Devices and Circuits

The licensee shall 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.

The purpose of LC27 is to ensure that plant is not used unless safety mechanisms, devices and circuits are installed and maintained to an adequate standard.

28: Examination, Inspection, Maintenance and Testing

(1) The licensee shall make and implement adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant which may affect safety.

(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.

(3) The licensee shall ensure that once approved no alteration is made to the approved arrangements unless the Executive has approved such alteration or amendment.

(4) The aforesaid arrangements shall provide for the preparation of a plant maintenance schedule for each plant. The licensee shall submit to the Executive for its approval such part or parts of any plant maintenance schedule as the Executive may specify.

(5) The licensee shall ensure that once approved no alteration or amendment is made to any approved part of any plant maintenance schedule unless the Executive has approved such alteration or amendment.

(6) The licensee shall ensure in the interests of safety that every examination, inspection, maintenance and test of a plant or any part thereof is carried out:

(a) by suitably qualified and experienced persons;

(b) in accordance with schemes laid down in writing;

(c) within the intervals specified in the plant maintenance schedule; and

(d) under the control and supervision of a suitably qualified and experienced person appointed by the licensee for that purpose.

(7) Notwithstanding the above paragraph of this condition the Executive may agree to an extension of any interval specified in the plant maintenance schedule.

(8) When any examination, inspection, maintenance or test of any part of a plant reveals any matter indicating that the safe operation or safe condition of that plant may be affected, the suitably qualified and experienced person appointed to control and supervise any such examination, inspection, maintenance or test shall bring it to the attention of the licensee forthwith who shall take appropriate action and ensure that the matter is then notified, recorded, investigated and reported in accordance with the arrangements made under condition 7.

(9) The licensee shall ensure that a full and accurate report of every examination, inspection, maintenance or test of any part of a plant indicating the date thereof and signed by the suitably qualified and experienced person appointed by the licensee to control and supervise such examination, inspection, maintenance or test is made to

the licensee forthwith upon completion of the said examination, inspection, maintenance or test.
The purpose of LC28 is to ensure that all plant that may affect safety is scheduled to receive regular and systematic examination, inspection, maintenance and testing, by and under the control of suitable personnel.

29: Duty to carry out Tests and Inspections

(1) The licensee shall carry out such tests, inspections and examinations in connection with any plant (in addition to any carried out under condition 28 above) as the Executive may, after consultation with the licensee, specify.
(2) The licensee shall furnish the results of any such tests, inspections and examinations carried out in accordance with paragraph (1) of this condition to the Executive as soon as practicable.
The purpose of LC29 is to enable the Executive, following consultation, to require the licensee to perform any tests, inspections and examinations which it may specify, and to be provided with the results.

30: Periodic Shutdown

(1) When necessary for the purpose of enabling any examination, inspection, maintenance or testing of any plant or process to take place, the licensee shall ensure that any such plant or process shall be shut down in accordance with the requirements of its plant maintenance schedule referred to in condition 28.
(2) Notwithstanding paragraph (1) of this condition the Executive may agree to an extension of a plant's operating period.
(3) The licensee shall, if so specified by the Executive, ensure that when a plant or process is shut down in pursuance of paragraph (1) of this condition it shall not be started up again thereafter without the consent of the Executive.
The purpose of LC30 is to ensure that any part of the plant or process shall, where necessary to allow examination, inspection, maintenance and testing to take place, be shut down in accordance with the plant maintenance schedule. The Executive has discretion to require its consent to start-up of any process shut down under this condition.

31: Shutdown of Specific Operations

(1) The licensee shall if so directed by the Executive shut down any plant, operation or process on the site within such period as the Executive may specify.
(2) The licensee shall ensure that when the plant, operation or process is shut down in pursuance of paragraph 1 of this condition it shall not be started up without the consent of the Executive.
The purpose of LC31 is to give discretionary powers to the Executive to shut down any plant, operation or process within a given period and to require its consent to start-up of any plant, operation or process shut down under this condition.

32: Accumulation of Radioactive Waste

(1) The licensee shall make and implement adequate arrangements for minimising so far as is reasonably practicable the rate of production and total quantity of radioactive waste accumulated on the site at any time and for recording waste so accumulated.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.

(4) Without prejudice to paragraph (1) of this condition the licensee shall ensure that radioactive waste accumulated or stored on the site complies with such limitations as to quantity, type and form as may be specified by the Executive.
(5) The licensee shall, if so specified by the Executive, not accumulate radioactive waste except in a place and in a manner approved by the Executive.
The purpose of LC32 is to ensure that the production rate and accumulation of radioactive waste on the site is minimised, held under suitable storage arrangements, and that adequate records are made.

33: Disposal of Radioactive Waste

The licensee shall, if so directed by the Executive, ensure that radioactive waste accumulated or stored on the site is disposed of as the Executive may specify and in accordance with an Authorisation granted under the Radioactive Substances Act 1960 or, as the case may be, the Radioactive Substances Act 1993.
The purpose of LC33 is to give discretionary powers to the Executive to direct that radioactive waste be disposed of in a specified manner. This is related to the powers available to the Environment Agency in England and Wales and SEPA in Scotland under RSA93, s. 13.

34: Leakage and Escape of Radioactive Material and Radioactive Waste

(1) The licensee shall ensure, as far as is reasonably practicable, that radioactive material and radioactive waste on the site is at all times adequately controlled or contained so that it cannot leak or otherwise escape from such control or containment.
(2) Notwithstanding paragraph (1) of this condition the licensee shall ensure, so far as is reasonably practicable, that no such leak or escape of radioactive material or radioactive waste can occur without being detected, and that any such leak or escape is then notified, recorded, investigated and reported in accordance with arrangements made under condition 7.
(3) Nothing in this condition shall apply to discharges or releases of radioactive waste in accordance with an approved operating rule or with disposal authorisation granted under the Radioactive Substances Act 1960 or, as the case may be, the Radioactive Substances Act 1993.
The purpose of LC34 is to ensure so far as reasonably practicable that radioactive material and radioactive waste is adequately controlled or contained so as to prevent leaks or escapes, and that any unauthorised leak or escape can be detected and reported.

35: Decommissioning

(1) The licensee shall make and implement adequate arrangements for the decommissioning of any plant or process which may affect safety.
(2) The licensee shall make arrangements for the production and implementation of decommissioning programmes for each plant.
(3) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements or programmes as the Executive may specify.
(4) The licensee shall ensure that once approved no alteration or amendment is made to the arrangements or programmes unless the Executive has approved such alteration or amendment.
(5) The aforesaid arrangements shall where appropriate divide the decommissioning into stages. Where the Executive so specifies the licensee shall not commence nor thereafter proceed from one stage to the next of the decommissioning without the consent of the Executive. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of the proposed decommissioning and shall where appropriate provide for the submission of this documentation to the Executive.

(6) The licensee shall, if so directed by the Executive where it appears to them to be in the interests of safety, commence decommissioning in accordance with the aforesaid arrangements and decommissioning programmes.
(7) The licensee shall, if so directed by the Executive, halt the decommissioning of a plant and the licensee shall not recommence such decommissioning without the consent of the Executive.
The purpose of LC35 is to require the licensee to make adequate provisions for decommissioning. It also gives discretionary powers to the Executive to direct that decommissioning of any plant or process be commenced or halted.

36: Control of Organisational Change

(1) The licensee shall make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety.
(2) The licensee shall submit to the Executive for approval such part or parts of the aforesaid arrangements as the Executive may specify.
(3) The licensee shall ensure that once approved no alteration or amendment is made to the approved arrangements unless the Executive has approved such alteration or amendment.
(4) The aforesaid arrangements shall provide for the classification of changes to the organisational structure or resources according to their safety significance. The arrangements shall include a requirement for the provision of adequate documentation to justify the safety of any proposed change and shall where appropriate provide for the submission of such documentation to the Executive.
(5) The licensee shall if so directed by the Executive halt all change to its organisational structure or resources and the licensee shall not recommence such change without the consent of the Executive.

Annex 5 - The Environmental Regulatory Bodies

A5.1 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

A5.2 The Environment Agency was created by the Environment Act 1995 (EA95)[28] with the aim of providing a more integrated approach to protecting and improving the environment of England and Wales as a whole – land, air and water. It is a 'non-departmental public body', sponsored largely by Defra and the Welsh Assembly Government. 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".

A5.3 As a modern regulator, the Environment Agency use 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.

A5.4 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.

A5.5 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

A5.6 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, except for one Board Member for Wales, who is appointed by the Welsh Assembly Government. The Board delegates the Environment Agency's day-to-day management to its Chief Executive and staff.

A5.7 For most of its activities, the Environment Agency has broken down its work between eight 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). There is also an advisory committee for Wales.

A5.8 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.

A5.9 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 FSA 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)[73].

(iii) Financial resources

A5.10 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

A5.11 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

A5.12 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

A5.13 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

A5.14 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.

A5.15 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.

A5.16 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

A5.17 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)[29] 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.

A5.18 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.

A5.19 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.

A5.20 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.

A5.21 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.

A5.22 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)[73].

(ii) Structure

A5.23 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.

A5.24 As detailed in SEPA's Annual Operating Plan 2009-2010, SEPA's Regional Boards (North, South West and East) have been phased out and a new approach to local engagement has been developed. From January 2010, non-executive engagement with customers, partners and stakeholders have been carried out by Agency Board members and are reported to a meeting of the Board.

A5.25 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

A5.26 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)

A5.27 In the financial year 2005/06, SEPA's grant-in-aid from the Scottish Executive amounted to £38.1 million and the total budget is £72.9 million. 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

A5.28 SEPA has approximately 1250 staff, around 17 of whom are involved in nuclear site regulation.

(v) Inspectors' qualifications

A5.29 Nuclear regulatory staff recruited by the Agency are required to have a degree in a relevant discipline.

(vi) Inspectors' training

A5.30 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.

A5.31 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.

A5.32 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.

Annex 6 - HSE's Safety Assessment Principles

Background

A6.1 HSE inspectors use the Safety Assessment Principles[46] (SAPs), together with the supporting Technical Assessment Guides[50], 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.

A6.2 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[79]. He also recommended that HSE should publish for discussion its thinking on risk assessment. The HSE paper 'The tolerability of risk from nuclear power stations' (1988, revised in 1992)[69] emerged in response. It provides background on levels of risks that may be tolerable by comparing them with other risks that society chooses to bear in return for certain benefits.

A6.3 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; and

e) combining nuclear power reactor and nuclear chemical plant principles.

A6.4 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.

A6.5 On the international front, the IAEA has restructured and has revised, or is revising, all of its safety standards. This has been occurring in parallel with greater European recognition that IAEA standards are an appropriate high standard to benchmark against. 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. HSE agrees with this need for periodic review. This new 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. 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.

A6.6 HSE 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; and the 2006 SAPs, TAGs and other forms of guidance used when granting nuclear site licences and in regulating licensees' activities.

A6.7 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 new revision 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.

A6.8 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)[96]. 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 R2P2 did not tackle and HSE has further developed its thinking in this area.

A6.9 Since the previous edition of the SAPs in 1992, HSE has been developing assessment guidance for its inspectors in the TAGs, which give further interpretation of the principles and guidance in their application. These have been written to help interpret the 1992 SAPs and in some cases have addressed gaps in them. The current 2006 edition of the SAPs covers these gaps, and the TAGs are being reviewed in the light of the revised principles. The SAPs and the TAGs will become a more integrated suite of guidance.

A6.10 In summary, therefore, this edition of the SAPs has been:

a) benchmarked against the IAEA Safety Standards, as they existed in 2004, that represent good practice;
b) expanded to address emergency arrangements, remediation and decommissioning;
c) reviewed for application to defence nuclear activities covered by DNSR;
d) clarified for the assessment of safety cases, and now includes safety management systems; and
e) updated to be consistent with HSE's thinking on societal risk.

A6.11 In reviewing and revising these principles, HSE has taken into account the technical interests and views of others through inviting comment on specific technical topic areas, and wider issues. However, the final decision on the content has been HSE's.

Introduction

The purpose of the Safety Assessment Principles (SAPs)

A6.12 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 HSE.

A6.13 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.

A6.14 The SAPs provide HSE 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[50]. The SAPs also provide nuclear site duty holders with

information on the regulatory principles against which their safety provisions will be judged. However, they are not intended or sufficient to be used as design or operational standards, reflecting the non-prescriptive nature of the UK's nuclear regulatory system. In most cases the SAPs are guidance to inspectors, but some reflect legal requirements and hence may incorporate mandatory elements.

SFAIRP, ALARP and ALARA

A6.15 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 in 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 may choose to concentrate solely on the consequences to which the hazard could lead.

A6.16 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 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.

A6.17 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.

A6.18 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.

A6.19 The basis for demonstrably adequate safety is that the normal requirements of good 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 proposed 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.

A6.20 The principles are used in judging whether ALARP is achieved, 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. HSE inspectors need to apply judgement on the adequacy of a safety case in accordance with HSE guidance on ALARP[97].

A6.21 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.

A6.22 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 HSE inspectors that the costs of any further measures would be grossly disproportionate to the risks their adoption would reduce.

A6.23 The application of 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

A6.24 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.

A6.25 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

A6.26 The Management of Safety at Work Regulations[40] and its Approved Code of Practice (ACoP)[98] 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[47] 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 assessments undertaken by duty holders as part of a safety case, including their independent assessment and verification, need 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.

A6.27 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[40].

A6.28 They must, among other things, be suitable and sufficient for the purpose of identifying all measures to control the risk.

A6.29 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 need a much more limited analysis to ensure adequacy. This might be expected to result in fewer or less extensive safety provisions.

A6.30 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

A6.31 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 provides more detailed guidance for the assessment aspects to be considered at the main life-cycle stages.

New facilities

A6.32 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

A6.33 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.

A6.34 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 NS-G-2.10).

A6.35 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

A6.36 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

A6.37 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.

A6.38 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.

A6.39 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

A6.40 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

A6.41 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.

Annex 7 - IAEA IRRS UK missions, 2006 and 2009

This Annex has been updated since the fourth report to take account of the IRRS mission to UK in 2009.

IRRS mission to HSE in 2006

A7.1 In January 2006, following the announcement of a review of energy policy, the then Department of Trade and Industry asked the Health and Safety Executive (HSE) to contribute an expert report on some specific health and safety risks arising from recent and potential energy developments and on the HSE's approach to ensure that risks arising from these are sensibly managed by industry. The report was to include a review of HSE's approach to regulating potential new nuclear build, especially the potential role of pre-licensing assessments of candidate designs.

A7.2 In this context, an IAEA IRRS was invited to conduct a review to assess how HSE intends to go about the appraisal of reactor designs. The review took place between 26 March - 03 April 2006, and focused on the following IRRS topics: Organisation; Authorisation; and Review and Assessment. Three further IRRS topics were reviewed to ensure that the team had an appreciation of the UK's legal system and its approach to nuclear safety regulation. These topics were: Legislative and Governmental Responsibilities; Authority, Responsibilities and Functions of the Regulatory Body; and Regulations and Guides.

A7.3 The final report of the IAEA mission[18] is based on the combined expertise of the team, with reference to the relevant IAEA standards.

A7.4 The review team identified 13 good practices, which will be promulgated world-wide by IAEA for the benefit of their Member States. The team also made 13 recommendations and 14 suggestions.

A7.5 The current status of the recommendations as reviewed during the 2009 IRRS mission are shown in Table A7.1.

IRRS mission to HSE in 2009

A7.6 In February 2009 the Government requested a second IRRS mission, to review the recommendations and suggestions of the 2006 IRRS mission. In addition, this second modular mission was to consider: the regulation of operating power plants and fuel cycle facilities; and, as new areas for review, inspection and enforcement and emergency preparedness and response. The IAEA was also requested to review again aspects of regulatory organization as HSE/ND moves towards becoming an NSC. The review was conducted from 4 – 13 October 2009.

A7.7 The team concluded[22] that ND has taken initiatives to address, in a systematic manner, not only the recommendations and suggestions from the 2006 IRRS mission but also those new improvements identified through the self-assessment prior to the 2009 mission. The IRRS team considered that HSE's action plan was thorough and addressed all the necessary improvements,

A7.8 The review team made a number of recommendations and suggestions as well as identifying areas of good practice. These are shown in Table A7.2.

Table A7.1 – Status of Recommendations and Suggestions from the 2006 IRRS mission

IAEA Comment No *R: Recommendations,* *S: Suggestions,*	Status of Recommendations and Suggestions from 2006 IRRS Mission
Legislative and governmental responsibilities	
S1 *HSE should make arrangements to charge fees for pre-licence application work.*	**Closed**
R1 *HSE should review and document the legislative authority that allows the appeal and review of technical basis for regulatory decisions in addition to the procedural review that is currently allowed, and take appropriate actions.*	**Open**
S2 *HSE should initiate actions to establish and document the role of the public in the regulatory process.*	**Closed**
S3 *NSD should take an initiative to clarify:* ▪ *What is the NDA's responsibility for safety in view of its authority to decide on activities and their financing at the nuclear sites; and* ▪ *Whether the NSD should, regulate the NDA activities and what means it would have available for such regulation.*	**Closed**
Authority, responsibilities and functions of the regulatory body	
R2 *processes should be developed and documented that describe the steps to be followed for the issuance or amendment of a licence, including the activities, responsibilities, inputs and outputs*	**Closed**
S4 *NSD should review, document and publicize its internal practices and procedures for the appeal of technical decisions.*	**Open**
Organization of the Regulatory Body	
R3 *It is recommended that NSD clearly define and document the minimum elements of its annual responsibilities (in relation to its strategic goals and key business activities (KBA)) and estimate the resources required to accomplish those elements. Future budget requests would then be based on these minimum resource needs plus an allocation for additional work as appropriate.*	**Open**
S5 *NSD resources necessary to accomplish new build activities need to be established and included into budget planning.*	**Closed**
R4 *It is recommended that NSD consider developing and implementing an integrated recruitment, retention and training programme that hires staff, with appropriate technical qualifications into all levels of an appropriately sized organization.*	**Closed**
R5 *NSD should review current and anticipated expert staffing needs for all relevant safety assessment positions. This review should consider which areas of expertise require a staffing defence-in-depth approach by having more than a single expert in the organization.*	**Closed**

Authorization process	
R6 *Processes should be developed and documented for potential new build nuclear power plants that describe the steps to be followed by an applicant for the issuance of a site licence, including pre-licensing phase. Respectively, formal guidance should be developed on the content and format of required safety submissions, to improve efficiency and effectiveness of the entire licensing process.*	**Closed**
R7 *Enhance the process to ensure a more systematic NSD review of the safety classification of planned modifications, and a consideration of the need for NSD review.*	**Closed**
R8 *Consider developing an approach that includes appropriate levels of direct evidence on adequate qualification of licensee's control room operators and other personnel in positions with direct influence on safety, and also ensures verification of consistent qualification requirements throughout the UK nuclear industry.*	**Closed**
Review and assessment	
S6 *When a project is completed, a formal audit of the review and assessment process should be performed to identify lessons learned.*	**Open**
S7 *NSD should develop a process for recording and analysing its observation of Human Factors and organizational aspects of the licensees activities in a systematic and auditable way.*	**Closed**
R9 *NSD should identify expertise and technical support available inside UK or abroad to support it in its review and assessment work. This should include the possibilities to perform independent analysis and validation of codes in areas such as PSA, Thermal Hydraulics, Severe Accident Analyses. Appropriate arrangements should be made to assure that for all safety relevant topics high qualified expertise can be identified by NSD.*	**Closed**
R10 *NSD should review its processes and resources to ensure that assessment of events from UK plants as well as from foreign plants is carried out. A formal process for reviewing events should put in place to ensure that lessons learned are available in due*	**Open**
R11 *NII should further develop a means by which it can ensure that the operators share operating experience among themselves, analyse the international operating experiences and take appropriate corrective action.*	**Open**
S8 *NSD should carry out audits and inspections themselves or/and through a contractor on the QA process of manufacturer and vendors on important safety components (e.g. the fabrication of a new vessel head).*	**Closed**
S9 *When NSD issue a formal regulatory decision the basis of its decision should be sent to the licensee.*	**Open**
S10 *NSD should review the completeness of the PSA model of each plant to ensure it reflects the actual state of the modelled plant. This should be carried out periodically to assure that the insights gained from the analyses are sound and robust.*	**Closed**

Development of regulations and guides	
S11 *That the NII issue by formal means the various internal guides that indicate ways of meeting general regulatory requirements, such as the current 36 licence conditions.*	**Closed**
The Review of the Management System	
R12 *the development of the BMS be continued in order that the BMM can contain the policies, processes and procedures necessary to describe the functioning of the organization. As an initial step, the BMM should be made consistent with Annex 4 of the Strategic Plan 2004-2010, or contain the information directly.*	**Open**
S12 *The Business Management Manual should include all the processes that describe how work is to be prepared, reviewed, carried out, recorded, assessed and improved.*	**Open**
R13 *A senior manager should be given responsibility for the management system. The person responsible for developing the management system should report directly to the senior manager.*	**Closed**
S13 *A process should be developed to describe the means by which the Business Management Manual is maintained up-to-date. This for example may permit immediate updating for minor alternations to the document, whereas changes to the BMS itself would be identified on some regular basis and approval given by the Management Board before the Manual is revised.*	**Open**
S14 *A process for conducting independent assessments (audits) should be developed and a means by which they be performed proposed. This could require the establishment of an internal unit or use of external resources*	**Open**

Table A7.2 Recommendations, Suggestions and Good practices arising from 2009 IRRS Mission

Area	***RF: Recommendations*** ***SF: Suggestions,*** **GF: Good Practices**	**Recommendation, Suggestion or Good Practice**
LEGISLATIVE AND GOVERNMENTAL RESPONSIBILITIES	SF1	*ND should continue, in the new build sector as well as in its other activity areas, to develop and implement its stakeholder engagement work, and document and publish the processes.*
	SF2	*ND should institute a programme for the reconstitution on an advisory committee on nuclear safety.*
AUTHORITY, RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY	*No recommendations or suggestions were made in respect of this Module.*	
ORGANIZATION OF THE REGULATORY BODY	RF1	*ND should strengthen the integration of nuclear safety, security and safeguards at the inspector level to improve delivery of strategic regulatory priorities.*
	GF1	*ND has established a thorough transition programme and organization, dedicated to the handling of its transition to the new Statutory Corporation, especially the implementation of a detailed and thorough staffing programme.*
AUTHORISATION PROCESS	SF3	*ND should develop a methodology and guidance on balancing risk to take into consideration long-term hazard and risk reduction when approving modifications for facilities undergoing decommissioning or remediation.*
REVIEW AND ASSESSMENT	GF2	*The establishment of Nuclear Topic Groups to provide consistency across ND in technical assessment areas and to provide guidance for reviews is considered a good practice.*
	SF4	*ND should further document the processes associated with Intervention Progress Groups, including management of technical issues, with the goal of increasing the level of consistency throughout the directorate.*
	GF3	*Establishment of the Technical Support Framework based on systematic and transparent selection of independent contractors that are pre-qualified for specific areas of expertise, and overall arrangements for contracting necessary technical support without undue delay is a good practice.*

INSPECTION AND ENFORCEMENT	RF2	*ND should ensure that its inspectors have followed a specific training programme before being issued with a warrant.*
	RF3	*ND should consider enhancing its arrangements to ensure that results of all inspections are communicated in written form to the licensee.*
	SF5	*ND should provide guidance on the creation, recording, use and management of regulatory issues to ensure that licensees are informed of issues recorded by NII and are treated in a consistent and proportionate manner in resolving them.*
	GF4	*ND has developed and implemented a public and formal enforcement policy statement and enforcement management model.*
	RF4	*ND should review and assess whether sufficient inspector effort is being applied to nuclear power plants to achieve adequate assurance of safety taking into consideration facility ageing.*
DEVELOPMENT OF REGULATIONS AND GUIDES	GF5	*Development and implementation of a comprehensive programme for review, update and completion of the suit of guidance documents with clear responsibilities for each individual document and for overall coordination, including detailed time schedule for the whole process, taking into account the importance of the TAGs and resource availability is a good practice.*
THE REVIEW OF THE MANAGEMENT SYSTEM	RF5	*ND's management should be actively involved in the development of the integrated management system and ensure that enough resources are allocated to this activity.*
	SF6	*Senior managers should be involved in the development of the management processes needed to reflect the goals and strategies outlined in ND's strategic plan.*
	SF7	*Senior managers should be closely involved in project realisation and its progress and should ensure that deviations from the plans are addressed in a timely manner.*
	SF8	*The project plan to update BMS to a fully integrated management system should include a detailed procedure on how to develop processes. To each process a process owner should to be assigned and his/her duties and responsibilities should be clearly outlined, approved by the senior management and included in the revised BMS.*
	RF6	*Senior management should perform a management review at regular frequency (typically once or twice a year) to identify strengths and weaknesses of the system and to propose improvements and changes.*

EMERGENCY PREPAREDNESS	RF7	*Considering the role of ND in responding to a nuclear or radiation emergency ND should, as a priority, further develop suitable training for all the ERG roles.*
	SF9	*The process for setting up the ERG, and the availability of ERG staff, could be enhanced by a more formal process.*
	RF8	*ND should, within its regulatory responsibilities, consider extending guidance on radiological emergencies introducing IAEA threat assessment categories into its guidance for the development of on-site and off-site plans.*
	SF10	*ND should provide guidance to ensure that a range of reference accidents is developed to cover the threat categories appropriate to the sites in regulates.*
	SF11	*ND should consider developing guidance extending and introducing the use of the full IAEA scale of emergency declarations contributing to a common definition of emergencies to ensure clarity of its communication about an event as part of international notification.*

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.
BAT	Best Available Technology
BCU	Boiler Closure Unit
BEGL	British Energy Generation Ltd.
BMS	Business Management System
BPM	Best Practicable Means
BSS	Basic Safety Standards (EC Directive 96/29/Euratom)
CCF	Common Cause Failure
CNO	Chief Nuclear Officer (BEGL)
CNOO	Chief Nuclear Operations Officer
COMAH	Control of Major Hazards Regulations 1999
Convention	Convention on Nuclear Safety
CoRWM	Committee on Radioactive Waste Management
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
EH&S	Environment, Health and Safety
EIADR99	Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulation 1999
EPR	European Pressurised Water Reactor
EPR10	Environmental Permitting (England and Wales) Regulations 2010
EU	European Union
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
HPA	Health Protection Agency
HPA-CRCE	HPA Centre for Radiation Chemical and Environmental Hazards
HSC	Health and Safety Commission - created by HSWA74 and responsible to the Secretary of State for Work and Pensions (and other Secretaries of State) for the administration of the Act. The HSC was merged with HSE in 2008.
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
IPC	Infrastructure Planning Commission
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
LRO	Legislative Reform Order
MEL	Magnox Electric Ltd.
MHSW99	Management of Health and Safety at Work Regulations 1999
MoD	Ministry of Defence
mSv	milliSieverts
ND	HSE's Nuclear Directorate, senior officers of which have delegated regulatory and enforcement powers relating to nuclear site licensing under the NIA65 (see HSE above)
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)
NII	Nuclear Installations Inspectorate - a part of the HSE's Nuclear Directorate
NLF	Nuclear Liabilities Fund
NPP	Nuclear Power Plant
NPS	National Policy Statement
NSA	National Skills Academy
NSC	Nuclear Statutory Corporation
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
OR	Operating Rule
OSART	Operational Safety Review Team
PCSR	Pre-construction Safety Report
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
PWR	Pressurised Water Reactor
QA	Quality Assurance
R2P2	Reducing Risk, Protecting People
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
User Interface	The medium through which personnel obtain information about the plant and perform actions which impact upon plant behaviour
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association

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