Department for
Business, Energy
& Industrial Strategy

UNITED KINGDOM's NATIONAL REPORT ON COMPLIANCE WITH EUROPEAN COUNCIL DIRECTIVE ARTICLE 9

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Executive Summary

This report has been prepared by the United Kingdom (UK) to meet the requirement of Article 9.1 of the European Council Directive 2009/71/Euratom (Nuclear Safety Directive). The European Nuclear Safety Regulators Group (ENSREG) has produced guidance on the format of reports to demonstrate compliance, which is used as the basis for this report. As identified in the ENSREG guidance, the report explains how the UK complies with Articles 4 to 8 of the directive.

The UK already had measures in place to give effect to the provisions introduced by the 2009 Nuclear Safety Directive through national laws, regulations or conditions attached to the site licences. As set out in the UK's 2014 National Report, where the UK regulatory system did not explicitly include measures that showed compliance with the 2009 directive, new measures were put in place. In particular, the UK's nuclear safety regulator – the Office for Nuclear Regulation (ONR) – modified the standard licence conditions that are placed on all licensees to ensure compliance with these Articles. This report includes details of all measures taken by the UK since the last report to comply with the Directive and includes details of how the UK has implemented the 2014 amendments.

This report demonstrates that the UK is compliant with all of the relevant articles in the Nuclear Safety Directive (NSD) and, as importantly, highlights the UK's commitment to ensuring the directive is delivered through an approach that seeks to ensure continuous improvement to nuclear safety in the UK.

This report will be the final submission by the UK government as part of its obligations under the European Council Directive 2009/71/Euratom. The UK has fully implemented the NSD into its regulatory framework. The UK's adherence to the international safety framework will not be affected by leaving the EU and Euratom and will remain in place after the Transition Period. The UK will continue to be an active member of the International Atomic Energy Agency (IAEA), implementing the international nuclear safety standards that it sets and submitting the UK's regime to independent scrutiny.

The UK has consistently championed the highest standards of nuclear safety at home and internationally and remains committed to continuing this in the future.

Introduction

1.1. Article 9.1 of Council Directive 2009/71/Euratom (Ref 1) of 25 June 2009 established a Community framework for the nuclear safety of nuclear installations (the 'Nuclear Safety Directive').This was subsequently amended by Council Directive 2014/87/Euratom, which requires that: "Member States shall submit a report to the Commission on the implementation of this Directive for the first time by 22 July 2014, and then by 22 July 2020". This is the second UK report to demonstrate that it meets that requirement and has been based on the guidelines for production of Member States' reports produced by the ENSREG (Ref 2).

Nuclear power programmes in the UK

1.2. In the UK, nuclear power has been part of the energy mix since 1956, providing around 20% of the country's electrical energy needs in recent years. Currently, the UK has a fleet of operating gas-cooled reactors (AGR) and one operating pressurised water reactor (PWR). Many of these were designed and built over 30 years ago. Nuclear sites are regulated by the UK's independent nuclear regulator, the ONR as well as the Environment Agency (EA), Natural Resources Wales (NRW) and the Scottish Environment Protection Agency (SEPA).

1.3. Nuclear power has an important role to play in the UK's energy future as we transition to net zero greenhouse gas emissions in 2050. The nuclear industry in the UK continues to evolve, with plans to develop a new generation of nuclear power stations as part of the government's energy policy in England and Wales. The UK is building its first nuclear power station in a generation at Hinkley Point C, which will consist of two European Pressurised Water Reactors (EPR) capable of generating 3.2GW. The UK also has other nuclear facilities that require continuing commitment to safety and regulation. These include the Magnox fleet, nuclear fuel manufacture, spent fuel reprocessing facilities, research reactor facilities (Dounreay, Harwell and Winfrith) and radioactive waste storage facilities.

1.4. The UK maintains high standards of operational nuclear safety and environmental protection within a robust regulatory framework. The UK approach has a culture of learning and a drive for continuous improvement. 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, including participation in international peer reviews such as the IAEA's Integrated Regulatory Review Service (IRRS).

Civil nuclear installations in the UK

1.5. Article 3.1 (a) of the NSD identifies the types of licensed nuclear installation that come under the Directive as follows:

- enrichment plant;
- nuclear fuel fabrication plant;
- nuclear power plant;
- reprocessing plant;
- research reactor facility;
- spent fuel storage facilities; and
- storage facilities for radioactive waste that are on the same site and are directly related to the nuclear installations above

1.6. The UK has at least one installation of each type and details of the installations are provided in Annex 2 and summarised below.

1.7. There is a single fuel enrichment facility at Capenhurst. This produces enriched fuel for the civil nuclear industry using gas centrifuges. The site also stores UK stocks of depleted uranium.

1.8. Nuclear fuel fabrication is undertaken at Springfields. This facility produced the fuel for the Magnox and AGR programmes in the UK, and also PWR fuel. The site last produced fuel for the Magnox programme some years ago and is planned to go into a decommissioned state. Oxide fuel is still produced at the site. In addition to fuel production, the site also converts uranium to uranium hexafluoride for enrichment and back to oxide after enrichment.

1.9. The UK opened its first operational civil nuclear reactor in 1956 at Calder Hall, which was a Magnox reactor. It developed a programme of these reactors, followed by a programme of AGRs and a single PWR. The UK is currently constructing an EPR at Hinkley Point C. The principal features of these reactor types are as follows:

- The first generation of nuclear power plants (NPPs) in the UK consisted of 26 Magnox reactors on 11 sites throughout the UK. Magnox reactors use bars of natural uranium metal fuel clad in an alloy of magnesium and aluminium, known as Magnox. The reactor is built from graphite blocks with channels containing the fuel. The graphite acts as a moderator with the primary coolant being pressurised carbon dioxide. The earlier reactors had steel reactor pressure vessels (RPV) with heat exchangers external to the RPVs to generate steam to drive the turbines. The final two reactors (Oldbury and Wylfa) had pre-stressed concrete pressure vessels (PCPV), with heat exchangers within the PCPV. Each site had two reactors, with the exception of the Calder Hall and Chapelcross sites, which had four reactors each. The Magnox reactors have reached the end of their lives and ceased operation through the period 1989-2015. All reactors have been defueled (Berkeley, Bradwell, Calder Hall, Chapelcross, Dungeness A, Hinkley Point A, Hunterston A, Oldbury, Sizewell A, Trawsfynydd and Wylfa with Calder Hall and Wylfa formally declared fuel free in October 2019). The Magnox fuel is currently being reprocessed through the Magnox reprocessing plant at Sellafield.

- There are seven sites with AGRs, with two reactors on each site, at Dungeness B, Hartlepool, Heysham 1, Heysham 2, Hinkley Point B, Hunterston B and Torness. These started operation between 1976 and 1988. Like the later Magnox sites, these have PCPVs, a graphite core, which acts as the moderator, pressurised carbon dioxide gas as a primary coolant and heat exchangers internal to the PCPV to raise steam to power the turbines. However, they use enriched uranium dioxide fuel in pellets within a stainless-steel container to allow them to run at higher temperatures than the Magnox reactors. All 14 reactors are still operational. The licensee has planned closure for the reactors between 2023 and 2030, subject to being able to continue to demonstrate safe operation**.** Following the cessation of reprocessing through thermal offsite reprocessing (THORP) in November 2018, the spent fuel from the AGRs is despatched to Sellafield for interim storage pending a decision on its disposition once one become available. Until that time, nuclear operators will continue to provide interim storage of waste on their sites across the UK and will continue to do so for as long as it takes to site and construct a Geological Disposal Facility (GDF). The UK government remains committed to geological disposal as the best means to manage higher-activity radioactive waste for the long-term. It does this through its GDF programme.

- The PWR is located at Sizewell B. In common with all PWRs, this has enriched uranium dioxide fuel in a zircalloy can with pressurised water as a moderator and coolant contained within a steel RPV and a concrete containment. Sizewell B started operation in 1995 and is currently scheduled to close in 2035 - again, subject to being able to demonstrate safe operation. The spent fuel is stored onsite in a dry fuel store pending disposal to a GDF if it is declared as waste.

- For the new nuclear power station under construction at Hinkley Point C, laying of the Unit 1 nuclear island concrete completed on 28 June 2019, meaning construction above ground has now commenced. The same milestone for Unit 2 was reached on 1 June 2020. The generic

design assessment (GDA) conducted by ONR and the EA is ongoing for the Chinese HPR1000. The UK continues to explore the potential benefits of advanced nuclear technologies (ANTs).

1.10. The UK plant for reprocessing spent fuel is at Sellafield. It is an extensive site with a wide range of facilities and buildings of varying ages. There are over 80 facilities that hold a significant amount of nuclear material. The site was originally established to support the UK nuclear deterrent and civil nuclear reactor programmes and subsequently developed to reprocess spent reactor fuel and store radioactive waste. The facilities range from very old (late 1940s) and degrading facilities, built to the standards of that time, to more recent facilities. This is a major industrial complex which houses two principal reprocessing lines – one for oxide fuel (THORP) and one for Magnox and similar fuels. These lines require a significant number of other plants to prepare the fuel for reprocessing and to process and store the product from reprocessing and the waste streams. Sellafield is anticipating completion of its final reprocessing operations in 2020/21. The end of reprocessing at the Magnox Reprocessing Plant follows the cessation of operations at THORP in 2018. Sellafield has significant legacy plants and waste streams, which are outside the scope of the NSD. There are also four Magnox reactors on the Sellafield site at Calder Hall, which are permanently closed and have been defueled.

1.11. Dounreay was the UK's site for demonstrating liquid sodium cooled fast reactors. Two fast reactors were built on the site – the Prototype Fast Reactor (PFR) and the Demonstration Fast Reactor (DFR), which are now both permanently shut down. The PFR has been defueled, although there is still fuel in its pond. The remaining PFR fuel is currently dry stored in the Irradiated Fuel Cave. The intention is for this material to be packaged for transport and storage at Sellafield. The remainder of the irradiated fuel is stored in a shielded cave that was previously used for the examination of irradiated fuel. Options are being explored to relocate this fuel to Sellafield. The DFR defueling is more than 50% complete and significant progress has been made in remote cutting of the reactor top plate to release some stuck breeder fuel elements. DFR fuel reprocessing will continue until the closure of Magnox reprocessing at Sellafield, following which the remainder of the breeder elements will be packaged for storage on the Sellafield site. The Fuel Cycle Area (FCA) was used to reprocess fuel from the fast reactors on the site and was permanently shut down in 2001 and is now being decommissioned.

1.12. The UK had two research reactor sites at Harwell and Winfrith, with research reactors at both sites. These have been closed for many years and some have been fully decommissioned. There are three reactors at Harwell and two at Winfrith that are currently being decommissioned. At Harwell there are three reactors, with intermediate level waste (ILW) retrieval and packaging operations underway and nuclear materials being transferred off-site. At Winfrith, the experimental high-temperature helium-cooled power reactor (DRAGON) and Steam-Generating Heavy Water Reactor (SGHWR) have been emptied of all fuel and are being decommissioned. ILW retrieval and packaging operations are being prepared for and will be transferred to Harwell interim stores. The Nuclear Decommissioning Authority (NDA owned) sites at Winfrith, Harwell and Dounreay are being restored to brownfield status where they can be reused.

1.13. The UK's last research reactor to operate, the CONSORT II reactor, operated by Imperial College, was a low power (100 kW thermal) research reactor. It first achieved criticality in 1965 and permanently shut down in 2007. The site is currently being decommissioned with eventual delicensing of the site in 2023.

1.14. Spent fuel from the Magnox reactors has either been reprocessed or is stored at Sellafield pending reprocessing through the Magnox reprocessing plant. Spent AGR fuel is stored for an initial period of cooling to reduce decay heat in dry buffer stores before being transferred to the power station's cooling pond for a period of at least 100 days. The spent fuel is then transported to the THORP Receipt and Storage Pond at Sellafield. The smaller quantities of non-standard

and diverse fuel types including from the reactors at Dounreay, Winfrith and Imperial College, will be consolidated and managed at Sellafield using existing facilities, capability, and technical expertise for managing these nuclear materials at that site. The approach at Sizewell B is to store the spent fuel in a purpose-built Dry Fuel Store pending disposal to a GDF if it is declared as waste. This approach will also be taken with the Hinkley Point C nuclear power station which is currently being constructed.

1.15. All nuclear installations that store radioactive waste must do so in accordance with conditions under the site licence. Waste at all sites other than Sellafield is either low level waste (LLW) or ILW and is stored in appropriate facilities, depending on its characteristics. There is also a near-surface low level waste disposal facility at Dounreay, operated by Dounreay Site Restoration Ltd (DSRL). It is used to dispose of LLW that arises from the Dounreay site and the adjacent Vulcan defence site which was previously used to test PWR reactors used to power naval submarines. ILW is stored on site for future treatment and immobilisation during decommissioning, which is underway on the decommissioning Magnox sites. Sellafield has a significant programme of ILW immobilisation, and Dounreay also has a Cementations Plant for Immobilisation of ILW Liquors. High level waste (HLW), produced as part of the reprocessing activities, requires continuous cooling and Sellafield is currently the only site which generates and stores this type of waste, which is in liquid form. Sellafield has a programme for immobilisation of this waste stream, in which the HLW is vitrified.

1.16.The UK government is committed to implementing geological disposal for the long term, safe and secure management of higher activity radioactive waste. In December 2018, the UK government and in January 2019, the Welsh Government launched a new process to identify a suitable location for a GDF. This is focussed on a consent-based approach which requires a willing community to be a partner in the project's development. The Scottish Government is not a sponsor of the geological disposal programme. Its policy is that the long-term management of higher activity radioactive waste should be in near-surface facilities.

Article 4 – Legislative, regulatory, and organisational framework

> *Article 4*
> *1. Member States shall establish and maintain a national legislative, regulatory and organisational framework ("national framework") for the nuclear safety of nuclear installations*

Overall framework

Role of Parliament

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

1.2. Parliament has an upper house, the House of Lords, and a lower house, the House of Commons. The Queen is the third component of the legislature.

1.3. The House of Commons is a democratically elected chamber with elections to it held at least every five years. The two houses meet in separate chambers in the Houses of Parliament. By constitutional convention, all government ministers, including the Prime Minister, are members of the House of Commons or, less often, the House of Lords, and are thereby accountable to the respective branches of the legislature.

1.4. Laws are made by Acts of Parliament. Acts can apply to the whole of the UK, including Scotland. Due to Scotland's having a separate legal system, many acts do not apply to Scotland and are either matched by equivalent Acts that apply to Scotland alone or, since 1999, by legislation made by the Scottish Parliament relating to devolved matters. Nuclear safety is not a devolved matter, and hence any legislation applies to the whole of the UK. Protection of the environment is a devolved matter and hence the Scottish Government and the Welsh Assembly have responsibility for this area. There are no nuclear installations in Northern Ireland, nor are any planned.

1.5. Laws in draft form, known as Bills, may be introduced by any member of either House, but usually a Bill is introduced by a minister of the Crown. The Bill passes through many stages in both Houses and may be amended many times during this process. When passed in identical form by both Houses, it will be presented for the Sovereign's Assent. Theoretically, the Sovereign may either grant the Royal Assent (that is, make the Bill a law) or withhold it (that is, veto the Bill). Under modern conventions the Sovereign always gives Royal Assent.

Principal legislation for nuclear installations

1.6. The principal legislation for ensuring the safety of nuclear installations consists of the following acts of Parliament, known as primary legislation:

- Health and Safety at Work etc. Act 1974 (Ref. 3)
- Energy Act 2013 (Ref. 4)
- Nuclear Installations Act 1965 (Ref 5.)

1.7. Under the UK system of legislation, all these Acts of Parliament have equal status, and all must be complied with. The key features of each of them is summarised in the following three sections.

Health and Safety at Work etc. Act 1974

1.8. Under the Health and Safety at Work etc. Act 1974 (HSWA74), a general duty is placed on all employers and the self-employed to conduct their undertaking in such a way as to ensure, so

far as is reasonably practicable (SFAIRP), the health and safety at work of their employees and also those affected by their work activities. This covers both nuclear and conventional health and safety. For further information on secondary legislation which provides for further legal requirements made under HSWA74, please refer to the section on regulation below.

Energy Act 2013

1.9. The Energy Act 2013 (TEA13) is the legislation that sets the framework for nuclear regulation in the UK. It establishes ONR as a public corporation managed by its own management Board and defines its purposes and functions. It also allows ONR to appoint inspectors and defines their powers.

Nuclear Installations Act 1965

1.10. Under the Nuclear Installations Act 1965 (NIA65), no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force. Only a corporate body, such as a registered company or a public body can hold a licence and the licence is not transferable. Sections 1, 3-6, 22 and 24A of NIA65 are enforceable by the ONR. The parts of NIA65 relevant to safety became relevant statutory provisions of TEA13.

Secondary Legislation

1.11. Secondary legislation, commonly in the form of regulations which, within the UK legislation system, are one type of 'relevant statutory provision', can be made by a Secretary of State (SoS) if there is provision for them doing so in primary legislation. Within the three principal Acts of Parliament that impact on nuclear safety (HSWA74, TEA13 and NIA65), described in paras 2.8–2.10, the relevant SoS has the power to make regulations. The scope of these regulations is specified in the primary legislation, and often contains the detailed provisions regarding how the broader requirements of primary legislation are to be carried out. This legislation also includes who must be consulted during their drafting, which includes the relevant regulators.

1.12. Under the simplest parliamentary procedure, regulations come into force at least 21 days after they are laid before Parliament. This is a complex process but, in simple terms, allows for scrutiny by Parliamentary Committees as to the merits and drafting accuracy of the regulations.

Ionising Radiations Regulations 2017 (Ref. 6)

1.13. The Ionising Radiations Regulations 2017 (IRR17) provide for the protection of all workers and members of the public, whether on licensed sites or elsewhere, from ionising radiations. IRR17 came into force on 1 January 2018 and replaced the Ionising Radiations Regulations 1999 (IRR99), Ref.7). IRR17 implements the occupational exposure aspects of the European Council (EC) Directive, establishing Basic Safety Standards (2013/59/Euratom) (BSSD) (Ref.8) and includes the setting of radiation dose limits for employees and members of the public for all activities involving ionising radiations.

1.14. Under IRR17, employers must comply with:

- Regulation 5 – Notification of certain work;
- Regulation 6 – Registration of certain practices; and/or
- Regulation 7 – Consent to carry out specified practices.

The above three regulations together represent the UK's transposition of the 'Graded Approach' introduced in EU Directive 2013/59/EURATOM.

1.15. From January 2018, all employers who undertake work with ionising radiations on nuclear premises are required to either notify, register, or obtain consent via the ONR process in compliance with IRR17. Another significant change relevant to existing nuclear facilities from IRR99 relevant to existing nuclear facilities is that the dose limit for exposure to the lens of the

eye has been reduced from 150 millisieverts (mSv) to 20mSv in a year. Under IRR17, employers are required to consult Radiation Protection Advisers (RPA) regarding compliance with the regulations.

Radiation (Emergency Preparedness and Public Information) Regulations 2019 (Ref 9)

1.16. Site operators must comply with The Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR19), which came into force on 22 May 2019 in Great Britain (GB) and which implements the radiation emergency preparedness and response requirements set out in Council Directive 2013/59/Euratom (Ref.8). Implementation of REPPIR19 will ensure that arrangements are sufficiently flexible to respond to very low probability events and are commensurate with the range of hazards for each facility in addition to a number of other enhancements.

Management of Health and Safety at Work Regulations 1999 (Ref 10)

1.17. The Management of Health and Safety at Work Regulations 1999 (MHSWR99) are relevant as they place requirements on employers including nuclear site licensees. MHSWR99 are very wide ranging. Where requirements overlap with other health and safety regulations, compliance with the more specific regulations is normally sufficient for compliance with MHSWR99.

1.18. As part of the suite of supporting regulations to HSWA74, MHSWR99 sets the expectations on dutyholders in regulation 5 to make appropriate arrangements for health and safety management. It also states that these should be prioritised and set in the appropriate context, for the size and complexity of the organisation and the hazards and risks present. This works in line with regulation 4, which requires the principle of prevention to be applied and is supported by Schedule 1 which defines the principles of control.

Role of Department for Business, Energy and Industrial Strategy

1.19. The Department for Business, Energy and Industrial Strategy (BEIS) and its SoS and ministers are responsible to Parliament for nuclear safety matters. Under TEA13, the SoS for BEIS has the power to make regulations for nuclear safety purposes. In addition, BEIS 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), international treaties and conventions, as well as the international nuclear liability regime. It also has governmental responsibility for those parts of the UK civil nuclear industry still owned by the government.

1.20. The UK is a contracting party to many nuclear safety conventions, including:

- The Convention on Nuclear Safety;
- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
- The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

BEIS is responsible for ensuring that the UK complies with these conventions and the NSD.

1.21. In carrying out its responsibilities, BEIS will, where appropriate, seek information on nuclear safety-related matters from ONR. BEIS has regular engagement with ONR on safety related matters, including quarterly working-level meetings to discuss incident reporting. Safety is very closely monitored with ONR and any issues are escalated quickly and effectively.

Role of the Department for Work and Pensions

1.22. The Department for Work and Pensions' (DWP) SoS has principal responsibility for ONR governance, finance and performance in relation to conventional health and safety and a framework agreement signed by both organisations sets out the broad framework within which ONR will operate. BEIS and DWP liaise regularly, hold Quarterly Accountability Reviews with the ONR and have a memorandum of understanding (MoU) to provide clarity about their working relationships with each other and the ONR.

Role of the Office for Nuclear Regulation

1.23. The ONR was established as the independent regulator under TEA13. ONR has five designated purposes:

- nuclear safety;
- nuclear site health and safety;
- nuclear security;
- nuclear safeguards;
- transport

1.24. In this report, the focus is on the first purpose – nuclear safety. This purpose is the protection of persons against the risk of harm from ionising radiation from UK nuclear sites. The second purpose – nuclear site health and safety – relates to all other potential risks to health and safety.

1.25. The ONR must do whatever it considers appropriate to ensure nuclear safety in the UK and, through provisions in the UK regulatory regime, are able to do so without any undue influence in its regulatory decision making. In particular, the roles of Chief Nuclear Inspector (CNI) and Chief Executive Officer (CEO) are enshrined in legislation. See Article 4 1.e for details of ONR's enforcement powers. The ONR carries out its regulatory functions through the imposition of the 36 standard licence conditions, the Technical Inspection Guides (TIGS) and the Technical Assessment Guides (TAGS).

Article 4
The national framework shall provide in particular for:
1. (a) the allocation of responsibilities and coordination between relevant state bodies;

1.26. The main bodies with responsibilities under the national framework are described above. To ensure coordination between relevant bodies with responsibility for nuclear safety, UK legislation and MoUs between regulatory bodies allocates responsibilities between responsible parties.

1.27. These are set out below:

- Under section 3 of the NIA65, ONR must consult the appropriate environment agency (i.e. the EA, NRW or SEPA) before:
    - granting a nuclear site licence; or
    - varying a nuclear site licence if the variation relates to or affects the creation, accumulation or disposal of radioactive waste.
- Section 96 of TEA13 requires ONR and the Health and Safety Executive (HSE) to cooperate in relation to their respective functions.
- Under HSWA74 and TEA13 there is a requirement that where the regulator who has primacy in those Acts e.g. HSE or the ONR, proposes new regulations, they are required to consult with other enforcing agencies that might be affected by the new regulations. HSWA74 Section 50 requires that when HSE proposes regulations on certain matters to the SoS it will first

consult appropriate bodies such as the ONR. Section 81 of TEA13 allows ONR to make proposals for regulations to HSE and requires HSE to consult with persons/bodies it has been directed to consult and anyone it considers appropriate to consult.

- Section 18(2)(b) HSWA74 / Regulation 6A of the Health and Safety (Enforcing Authority) Regulations 1998 enables assignment of enforcement responsibility between HSE and ONR.
- ONR has a number of other agency agreements and memoranda of understanding which either transfer or clarify enforcement functions as among ONR, HSE and the Office of Road and Rail. These are listed at http://www.onr.org.uk/agency-agreements-mou.htm.
- The EA, NRW or SEPA consult ONR or the HSE under the Environmental Permitting (England and Wales) Regulations 2016 (EPR16) or the Environmental Authorisations (Scotland) Regulations 2018 (EASR18) on proposed (new or varied) authorisations for disposal of radioactive waste including discharges to the environment.

1.28. To provide further coordination between government departments and regulatory bodies with responsibility for nuclear and radiological safety, the UK has established the Radiological Safety Group (RSG), a cross-departmental and regulatory group which aims to provide strategic oversight of the UK's nuclear and radiological safety regulatory framework. The government's Regulators Code (Ref 43) also provides a framework for how all UK regulators should engage with those they regulate ensuring that their approach to regulatory activity is transparent.

Safety requirements

Article 4
1. (b) national nuclear safety requirements, covering all stages of the lifecycle of nuclear installations;

Licence conditions

1.29. An important provision of NIA65, is that it requires ONR to attach such conditions to the licence as it considers necessary in the interests of safety and radioactive waste management. Contravention of the conditions attached to a licence is a criminal offence. The licence conditions (LCs) apply throughout the lifetime of a nuclear site, including installation, commissioning and operation and eventual decommissioning. NIA65 allows ONR to revoke a licence, or for it to be surrendered by the licensee. However, in either event, the licensee would remain responsible for the safety of activities on the site until another licence had been granted. This 'period of responsibility' can end only when a new licence has been granted for the site or ONR has given written notice that in its opinion there has ceased to be any danger from ionising radiations on the site.

1.30. ONR has developed 36 standard LCs (Ref. 11), attached to each site licence that together form a sound basis for good nuclear safety and radioactive waste management for the whole lifecycle of a nuclear facility. These address, for example, issues such as operating rules (OR) and instructions, maintenance, safety justifications, periodic safety reviews (PSR), reporting and following-up on events, training and qualification of staff, modification to plant and procedures, independent nuclear safety committees, emergency arrangements, organisational structures and management systems. Several relate to the licensee having adequate arrangements to manage changes that may have safety implications. ONR inspectors use Safety Assessment Principles (SAPs), together with the supporting TAGs and TIGs to guide regulatory decision making in the nuclear permissioning process. ONR acknowledges the importance of regular reviews and carries out reviews of the SAPs at least every five years, with TAGs being updated at least every three years.

1.31. The LCs mainly set goals but do not prescribe how these are to be met. Therefore, each licensee can develop licence condition compliance arrangements that best suit its activities, whilst demonstrating that safety is being managed properly. Under the licence, the licensees have a legal duty to demonstrate adequacy of these arrangements. The arrangements may change as the facility progresses through its life from initial design to final decommissioning. Licensees' compliance with the conditions and with their own compliance arrangements is mandatory. Whilst the system gives flexibility to licensees, it secures high standards in a wide spectrum of nuclear facilities without being prescriptive or requiring detailed rule making by the regulatory body. The conditions allow for interventions by ONR, which can, for example, 'approve' arrangements or 'consent' to specific actions. Some conditions enable ONR to 'direct' a licensee to carry out a specific action, including shutting down a plant. Other conditions require the licensee to obtain ONR's permission before commencing an activity such as starting up a reactor after a periodic shut down for maintenance.

1.32. The LCs specify the majority of the safety requirements on the licensees. However, there are a number of sets of regulations that are relevant to nuclear installations, which relate to general safety management or other topics such as radiation safety, details of these are provided under Article 4.1 above.

Legal Directions

1.33. Section 92 of TEA13 enables the SoS to give directions to the ONR to support national safety and security requirements. The ONR is legally required to comply with a direction given to it by the SoS. Non-compliance can be challenged by way of judicial review proceedings being brought in court.

1.34. There are three separate powers of directions under Section 92 of the Act. The SoS is able to issue directions to the ONR as to the exercise by it of its functions generally, or any of its functions specifically. A direction given under this power may modify, but not confer, a new function on the ONR.

1.35. The SoS is also able to give directions to the ONR as may appear to the SoS to be necessary or desirable in the interests of national security. A direction given under this power may modify or confer a new function on the ONR. In such circumstances, the SoS may give the ONR a direction as to the exercise by the ONR of a regulatory function in a particular case. There are strict controls regarding the use of this power, which include a requirement that the direction be laid before Parliament (unless publication would be contrary to the interests of national security, in which case a memorandum stating that a direction has been given must be laid before Parliament). This exceptional power reflects the particular expertise that government may have in the sphere of security, but the power is only exercisable in very limited circumstances.

1.36. In exercising these powers, the SoS is prohibited from issuing a direction in relation to the exercise of a regulatory function in a particular case.

Licensing

Article 4

1. (c) a system of licensing and prohibition of operation of nuclear installations without a licence;

1.37. As set out in the UK's transposition table, the ONR is the 'appropriate national authority' for nuclear licensing in England, Wales, and Scotland, with the SoS assuming the role in Northern Ireland (which has no nuclear licensed sites). NIA65 requires that a nuclear installation is not

installed or operated unless ONR has granted a site licence. Under the NIA65 it is a crime to operate without the necessary licence. The power to grant a licence or not is delegated to ONR's CNI.

1.38. A nuclear site licence is issued on the basis of a satisfactory outcome of regulatory assessment of an applicant's case, including the financial and organisational capability of a proposed licensee. A licence is issued for all phases of the life of the site. The issue of a site licence brings an operating organisation, or potential operating organisation, into a more rigorous regulatory regime than would be achieved using conventional health and safety legislation. The granting of a site licence does not automatically give permission for a proposed plant to be built and operated. Regulatory control of activities on a licensed site is exercised using the site LCs. Routine regulatory inspection and assessment, and the PSR process, ensure that the licensing basis is maintained.

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

1.40. A licence is not transferable, but a replacement licence may be granted to another corporate body if that body demonstrates it is fit to hold a licence. Other circumstances which may lead to the need to relicense a site include changes to the site boundary and changes to the types of prescribed activity for which the site is licensed. In considering an application for a replacement licence ONR would take a proportionate approach and focus particularly on those aspects of the licensing basis which are the subject of the change.

1.41. ONR's guide "The Delicensing Process for Existing Licensed Nuclear Sites" (Ref 12) provides a basis for the considerations that need to be made in order to de-license the whole or part of a nuclear licensed site, licensed by ONR under NIA65. Its purpose is to achieve broad consistency with current scientific thinking, relevant guidance, legislation and other published material.

System of regulator control for Nuclear Safety

Article 4

1. (d) a system of regulatory control of nuclear safety performed by the competent regulatory authority

1.42. The ONR has responsibility for the day-to-day exercise of the nuclear licensing function. The regulatory functions are vested in the CNI, as the authoritative regulatory head, who delegates these functions as appropriate to nominated inspectors.

1.43. ONR carries out its regulatory activities (assessment, inspection and control processes) through consistent and proportionate regulation of nuclear safety by focusing on four core activities. These core activities reflect ONR's regulatory philosophy and are:

- securing sustained compliance;
- influencing improvements in safety;
- making balanced judgements in its regulatory decisions;

- engaging with its stakeholders.

In order to achieve these core activities, ONR carries out interventions such as inspection, assessment and investigation to secure compliance or to permission certain activities. Further details of these are presented in this report when addressing Article 5 of this Directive.

Enforcement Powers

Article 4 *1. (e) effective and proportionate enforcement actions, including, where appropriate, corrective action or suspension of operation and modification or revocation of a licence.*

Enforcement powers under TEA13 and HSWA74

1.44. There are a range of enforcement powers available to the regulatory body. These arise from the primary laws, TEA13 and HSWA74, and the site LCs.

1.45. ONR has an Enforcement Policy Statement (EPS) (Ref 22) that sets out the purpose of enforcement, and the principles that should be applied. Inspectors are guided by an Enforcement Management Model (EMM) (Ref 23) to assist in determining which enforcement measure is the most appropriate in a given situation. Individual inspectors are appointed through a legal instrument called a warrant and this document confers a wide range of powers on the inspector such as the power of entry to premises at any time, power to take evidence into possession; power to have an incident scene left undisturbed etc.

1.46. The key elements of ONR's enforcement model are set out in paragraphs 2.46 to 2.50 below:

Improvement notice

1.47. If an inspector is of the opinion that a relevant statutory provision or a licence condition has been contravened, and that contravention will continue or be repeated, the inspector can serve a notice that requires the contravention to be remedied. ONR has chosen to put in place administrative arrangements which require a corporate decision before any such notice can be issued. The notice requires that the stated improvements be made within a specified timescale.

1.48. ONR's internal processes require Superintending Inspector-level approval before an Improvement Notice is issued.

Prohibition notice

1.49. If an inspector is of the opinion that an activity is being or is likely to be carried out which risks causing serious personal injury, the inspector can serve a notice to prohibit the activity. In practice, this power is rarely used by ONR as there are more appropriate powers available under the LCs.

Prosecution

1.50. In England and Wales, ONR and an inspector have the power to institute proceedings for an offence under TEA13, HSWA744 or any of the relevant statutory provisions, including appropriate parts of NIA65. In Scotland, an inspector can recommend to the Crown Office Procurator Fiscal's Service that a prosecution is initiated. Again, ONR's own administrative arrangements require a corporate decision to be made for the exercise of this power.

Powers under the site licence conditions

1.51.As well as placing requirements on the licensee, the standard 36 LCs (Ref. 11) also include requirements for regulatory interactions between ONR and the licensees. These are used within specific LCs and provide ONR with the powers described below.

Direction

1.52.A direction is issued by ONR when it requires the licensee to take a particular action. For example, LC31(1) gives ONR the power to direct a licensee to shut down any plant, operation or process. Such a direction would relate to a matter of major or immediate safety importance. ONR have similar powers for security under the Nuclear Industries Security Regulations 2003 (NISRs).

Specification

1.53.The standard LCs give ONR discretionary controls with regards to a licensee's arrangements and these are implemented through specifications. For example, in LC23(2), if ONR specifies, the licensee is required to refer ORs to its nuclear safety committee for consideration.

Notification

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

Consent

1.55.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 restarted following its periodic shutdown. Before being granted a consent, the licensee must satisfy ONR that the proposed action is safe and that all procedures necessary for control are in place.

Approval

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

Agreement

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

1.58.The powers through the licence and the primary legislation above are deemed sufficient to regulate nuclear safety. However, to ensure efficient regulation, the licensee's arrangements incorporate further provisions referred to as derived powers. By virtue of the licensee's arrangements, the highest category modification proposals are usually submitted to the ONR for its agreement before they can be implemented. The same control could be achieved through primary powers by the ONR specifying that consent is required. The use of derived powers does

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

Environmental Regulation

1.59. Although related to environmental and public protection rather than nuclear safety specifically, it should be noted that there are also range of enforcement powers available to the environmental regulators, arising from both EPR16 (in England and Wales) and RSA93 (in Scotland and Northern Ireland) which can be applied to a nuclear site. These are broadly the same across both pieces of legislation.

1.60. Individual inspectors are appointed through warrants under Section 108 of the Environment Act 1995 (EA95) (Ref. 17), This gives inspectors a range of powers such as the power of entry to premises at any time, power to take evidence into possession; and power to have an incident scene left undisturbed etc.

1.61. The EA has published the Enforcement and Sanctions Policy (Ref.13) which explains how it makes enforcement decisions, the types of tools available and associated processes. These range, for example, from providing advice and guidance through to prosecution. Similarly, NRW has published regulatory guidance on its enforcement powers (Ref.14), and SEPA has published enforcement policy and enforcement guidance (Ref. 15).

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

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

Maintenance of the National Framework

Article 4

2. Member States shall ensure that the national framework is maintained and improved when appropriate, taking into account operating experience, insights gained from safety analyses for operating nuclear installations, development of technology and results of safety research, when available and relevant.

1.63. As noted under Article 4.1(a), the requirements placed on the licensee through the site licence and through health and safety legislation are high level and goal setting. A benefit of this is that it minimises the need to make legislative changes to the UK regime, as usually any changes can be accommodated through the licensee's arrangements for compliance with the safety requirements. This in turn allows for the UK regime to be responsive to changes in technology, international best practice/standards and lessons learned from international incidents.

1.64. An example of this is the issue of new standards by the IAEA or changes to Western European Nuclear Regulators' Association (WENRA) reference levels. These do not usually require a change to safety requirements, but the licensee is required to review its arrangements and make any necessary changes. New or revised nuclear safety standards can therefore be introduced quickly and without the need for legislative change.

1.65. Furthermore, dutyholders are required to keep risk 'as low as reasonably practicable' (ALARP) under HSWA74. In most cases this is not done through an explicit comparison of costs and benefits, but rather by applying established relevant good practice and standards. As a result, the whole of the UK safety regime is set up and is conducive to international best practice, and continuous improvement. The IAEA Safety Standards and the Safety Reference Levels developed by WENRA for reactors, decommissioning, and the storage of radioactive waste and spent fuel are considered to be UK relevant good practice.

1.66. The UK remains committed to learning from its experiences and the experience of others as part of our approach of seeking continuous improvements to nuclear safety. In particular, as a contracting party to the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the UK periodically subjects its nuclear safety framework to international peer review to identify any improvements that could be made. The UK continues to play an active role in the review meetings of these conventions so that any examples of best practice can be identified and, where appropriate, adopted in the UK. Additionally, the UK took a leading role at the 6th Review Meeting of the Convention on Nuclear Safety in seeking changes to the Convention's peer review processes so that they were strengthened to help ensure the continued robustness of international peer review.

1.67. As an IAEA member state, the UK is subject to IRRS missions. Three partial scope IRRS missions to the UK have taken place and a follow-up mission took place in 2014. These focused on specific areas of nuclear safety - for example, the 2006 mission reviewed ONR's preparations for regulating new reactor build.

1.68. In keeping with the requirement to host a full scope IRRS mission every 10 years, the UK completed its first full scope mission in October 2019. The UK has published the mission team's final report at https://www.gov.uk/government/publications/nuclear-and-radiological-safety-review-of-the-uk-framework-2019. The mission team's report included 24 recommendations to

further strengthen the UK's radiological regulatory framework. As part of the IRRS process, the UK carried out a self-assessment prior to the mission. The UK identified many of the mission team's findings in its self-assessment - such as the need to produce a statement which sets out the UK's policy and framework for radiological safety - so work is already in progress or planned in those areas.

Article 5 – Competent regulatory authority

Article 5

1. Member States shall establish and maintain a competent regulatory authority in the field of nuclear safety of nuclear installations.

Regulatory authority competence

2.1. As set out under Article 4.1, TEA13 established ONR as an independent regulator public corporation with the duty to enforce the law on nuclear safety, as well as a number of other purposes as listed in para 2.13. The ONR's role, responsibilities and powers are also set out in TEA13, as well as the make-up of ONR's Board.

ONR independence

Article 5

2. Member States shall ensure the effective independence from undue influence of the competent regulatory authority in its regulatory decision-making. For this purpose, Member States shall ensure that the national framework requires that the competent regulatory authority:

(a) is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy, and does not seek or take instructions from any such body or organisation when carrying out its regulatory tasks;

2.2. As previously set out under Article 4, ONR's independence as a regulator is currently ensured under TEA13, where ONR is given direct responsibility for the enforcement of the nuclear safety regulatory system. Schedule 7 1(1) of TEA13 makes clear that "The ONR is not to be regarded as a servant or agent of the Crown ….".

2.3. To further confirm and maintain functional separation, ONR is sponsored by DWP, which has no role in promoting nuclear technology or responsibilities for nuclear facilities or activities. DWP sponsors the ONR in relation to governance, finance and conventional health and safety issues. The relationship between ONR and DWP is codified in the ONR/DWP framework document (Ref 13).

2.4. The SoS for BEIS is accountable to Parliament for nuclear safety in GB. ONR therefore provides assurance through factual information and advice to this minister on nuclear safety matters but operates its regulatory functions separately from government and ministers. Government cannot direct ONR with respect to regulatory functions in a particular case – i.e. government is unable to influence the individual regulatory decisions taken by inspectors – thereby ensuring that regulatory decisions are independent.

2.5. A key component of the ONR/DWP framework document is that the DWP Permanent Secretary, as Principal Accounting Officer, has designated the CEO of ONR as ONR's Accounting Officer. The ONR CEO, as Principal Accounting Officer, is therefore directly accountable to Parliament for an appropriate budget for ONR, and giving evidence, if summoned before the Public Accounts Committee, on ONR's stewardship of public funds.

2.6. The ONR Board is responsible for ensuring that any statutory or administrative requirements for the use of public funds are complied with, and that the ONR Board operates within the limits of its statutory authority and any delegated authority agreed with DWP. ONR must publish an annual report of its activities together with its audited accounts after the end of each financial year. The annual report and accounts must be laid in Parliament and made available on ONR's website.

2.7. In respect of ONR Board members, under TEA13 any non-executive member of the Board may be removed from office where there is a conflict of interest that is likely to affect the carrying out of the member's functions as a member of the Board. Further information on conflict of interest is set out under Article 5.2 (e).

2.8. The ONR Board Standing Orders set out a procedure to be followed for the declaration of interests and a process for ensuring that such interests are managed appropriately.

Article 5

2. (b) takes regulatory decisions founded on robust and transparent nuclear safety-related requirements;

2.9. The ONR uses a range of mechanism to ensure it takes regulatory decisions founded on robust and transparent nuclear safety-related requirements. These are set out below.

2.10. **Rigorous inspection regime:** Nuclear licensed sites are subject to a rigorous inspection regime with one or more ONR site inspectors being allocated to major sites. Typically, around 30% of a site inspector's available time is spent at site, the balance of time being committed to reviewing the licensee's justifications of safety with other site inspectors and with technical assessors and administering the nuclear site licence for the site. Inspectors also seek to advise and encourage licensees to enhance nuclear safety where this is consistent with the ALARP principle.

2.11. **Regulatory oversight:** As part of ONR's Integrated Audit and Assurance Framework, there is a three Tier regulatory oversight structure to provide assurance to the Chief Nuclear Inspector (CNI) on all aspects of its regulatory activities.

2.12. Tier 1 provides additional within-directorate assurance to the CNI and Regulatory Directorate divisional directors that regulatory activities are being undertaken in accordance with ONR's management system; are bounded by the legislative framework within which it operates; and meets the expectations of ONR's EPS.

2.13. Tiers 2 and 3 perform their task independently of the Regulatory Directorate.

2.14. Tier 2 is provided by the Regulatory Assurance function which provides assurance independent of the Regulatory Directorate divisions. The integrity of the model is maintained by ensuring that the Regulatory Assurance function remains independent of (i.e. outside) the Regulatory Directorate. Locating the function within the Finance Directorate provides this independence and also places the function within the management of the overall ONR Audit and Assurance Framework for ONR. This Second Line independent assurance information is provided to the CNI to augment his First Line assurance, enabling assurance to be provided to the highest levels of the organisation and to Government.

2.15. Tier 3 assurance is provided by the Government Internal Audit Agency (contracted from the Government Internal Audit Agency – GIAA) across all ONR directorates, including the Regulatory Directorate, on a risk-informed basis. The overarching audit and assurance information is provided to the ONR CEO and the CNI to discharge their responsibility to the ONR Board. GIAA works closely with ONR Regulatory Assurance to ensure an integrated approach to meeting ONR's overall assurance requirements

2.16. ONR is also reviewed by other external bodies such as the National Audit Office (annually) and the IAEA peer reviews (the International Regulatory Review Service – (autumn 2019), and the International Physical Protection Advisory Service (2016). ONR is also reviewed by other external bodies such as the National Audit Office (annually) and the IAEA peer reviews (the IRRS – (autumn 2019), and the International Physical Protection Advisory Service (IPPAS - 2016). These reviews can be regarded as a 'fourth line of defence assurance' and the findings from these reviews provide a valuable independent insight for ONR.

2.17. **SAPs and TIGs:** ONR inspectors use SAPs, together with the supporting TAGs and TIGs to guide regulatory decision making in the nuclear permissioning process. ONR acknowledges the importance of regular reviews and carries out reviews of the SAPs at least every five years, with TAGs being updated at least every three years.

2.18. **Transparency:** All inspectors are trained to make regulatory decisions in line with established regulatory processes and guidance which are published on ONR's website, including ONR's EMM (which provides a clear, logical process to help inspectors make enforcement decisions and underpins ONR's EPS) and make consistent, balanced and proportionate regulatory decisions. ONR publishes details of enforcement notices, the full text of project assessment reports (PARs) and summaries of intervention records on the ONR website. It also publishes all SAPs, TAGs and TIGs on its website.

ONR financial resources

Article 5

2. (c) is given dedicated and appropriate budget allocations to allow for the delivery of its regulatory tasks as defined in the national framework and is responsible for the implementation of the allocated budget;

2.19. Section 24A of NIA65 enables ONR to recover costs from licensees and licence applicants, for expenses associated with its nuclear site licensing and inspection work. Licensees and licence applicants are charged according to the amount of ONR staff time applied to their sites or applications. Charges may also cover the costs of research and of nuclear safety studies commissioned to assist ONR and ensure that it has access to independent technical advice and information. Such costs are allocated to licensees according to the nature of the work commissioned.

2.20. ONR uses a work recording system to identify the effort and expenses of its staff attributable to each licensee. Where ONR cannot reclaim costs from the industry, it receives funding from the government (currently approximately 5% of ONR's costs.

2.21. On an annual basis, ONR must publish an Annual Report of its annual report including activities together with its audited accounts which provide information on its after the end of each financial

year (Ref.16). The Annual Report must meet the requirements set out in paragraph 24 of Schedule 7 of TEA13. ONR's income could be significantly reduced should a major dutyholder experience financial difficulties. In this situation, the government will ensure that ONR has sufficient access to funds, in case of an actual or anticipated short-term cash-flow deficit, to discharge its functions, thereby also ensuring that the government complies with its international duties to ensure that the regulator is adequately resourced. In such circumstances, ONR will provide government with details of the funding requirement, including the impacted dutyholder, the action taken and the outcome of that action.

2.22. Section 41 of EA95 (Ref.17) provides EA, NRW 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 the environment agencies. All the environmental agencies use a work recording system to identify the effort and expenses of its staff attributable to each licensee.

Human resources

> *Article 5*
>
> *2. (d) employs an appropriate number of staff with qualifications, experience and expertise necessary to fulfil its obligations. It may use external scientific and technical resources and expertise in support of its regulatory functions;*

2.23. ONR's power to appoint/second and pay staff/secondees is set out in Schedule 7 of TEA13, paragraphs 12-13. ONR must fulfil this duty under its principal function i.e. to do what it considers appropriate to fulfil its purposes, including nuclear safety.

2.24. The ONR/DWP Framework sets out that ONR will have responsibility for the recruitment, retention and management of its staff.

2.25. The ONR has a number of mechanisms in place to ensure that it meets its staffing needs. ONR ensures it has an appropriate number of qualified and competent staff in accordance with its Human Resource Directorate plans. These plans ensure that all disciplines have the required number of staff, with the relevant knowledge, skills and abilities to perform their regulatory functions. ONR's HR Department works closely with Regulatory divisions to review all workforce planning requirements and to initiate recruitment where required. Within ONR's matrix structure, the Technical Division has oversight of the capacity and capability of specialist regulatory resources that are effectively managed in technical specialisms by the Professional Leads.

2.26. ONR's Regulatory Deployment and Resilience (RDR) Group has a key role in maintaining technical expertise across ONR, with one of its key purposes to maintain suitable and sufficient regulatory capability and capacity across the professional disciplines. RDR maintains close links with the Strategic Workforce Planning Group (SWPG) to ensure that strategic planning implications are understood by appropriate specialism leads to enable them to take direct action to meet ONR demands.

2.27. ONR has also established a new Technical Support Framework to provide a renewed and modernised approach for procuring technical support. The Framework focuses on securing the continued supply of expert supply chain resources at competitive rates, with greater flexibility and efficiency in the call-off of supplier work.

2.28. In recent years, a number of experienced staff have retired, replaced mainly by younger and less experienced staff - 80% of regulatory staff have joined ONR in the last ten years. ONR has

a net recruitment requirement for nuclear specialists to replace retiring staff and match predicted workforce planning figures, particularly to address capacity challenges in niche areas.

2.29. ONR has introduced innovative recruitment pipelines to ensure that it can be adequately resourced in the future. This includes:

a. sponsoring talented students during study and subsequently employing them;
b. the new Associate grade which allows those with less nuclear/high hazard experience to develop and grow in ONR in a number of fields;
c. the recruitment and training of those with niche skills from other industry sectors to undertake an additional training needed to become nuclear inspectors; and
d. an apprentice scheme introduced in 2019 which entails a five-year programme resulting in a degree in nuclear engineering and science. Apprentices progress their degree whilst working with ONR and completing secondments in other parts of the nuclear industry.

2.30. These are all supported by ONR's Academy, which was launched in March 2018. This comprises a dedicated team of experienced inspectors led by a training manager to develop specialist and core regulatory training courses and expanded its capacity to meet the increasing training needs of the organisation.

2.31. The Regulatory Directorate and HR directorates have accountability to the Board for ensuring the right cadre of technical and specialist resource is available. Strategic workforce planning is initiated and sponsored by the senior leadership team to oversee and model the resource demands of the organisation. Associated risks of failing to secure the requisite capability are overseen within ONR's strategic risk register.

Warrants for new inspectors

2.32. As set out under Article 4, all inspectors are formally appointed by ONR through issue of a warrant, which entitles them to exercise specified legal powers. Newly recruited inspectors are issued with a 'limited warrant', which does not confer the full scope of powers available through TEA13 and HSWA74 etc. This is in recognition that it takes time to train new recruits and for them to develop sufficient experience and competency to use all of the available powers. The powers excluded from the limited warrant are those broadly associated with investigation and enforcement action, for which ONR mandates specific legal training. Following a period of training and sufficient and suitable on-the-job experience, which typically lasts 12 months, inspectors undergo an interview to demonstrate their competence and present further evidence of experience before being issued with a 'full warrant'.

2.33. ONR has also put in place a dedicated team of experienced inspectors led by a training manager to develop specialist and core regulatory training courses and expanded its capacity to meet the increasing training needs of the organisation. This is known as the ONR Academy.

2.34. ONR is further developing its training and knowledge management system to ensure an effective succession plan for its core resource capability. Each of these aspects are covered separately in the following paragraphs.

Training of new inspectors

2.35. All inspectors joining ONR are required to have good academic qualifications and several years of experience in a relevant industry such that they can be regarded as being technical experts in their own discipline. This includes having the ability to be a chartered member of a relevant professional institution, thus being recognised as technical experts in their own discipline. The main purpose of the training given to inspectors is to equip them with detailed legal knowledge

and skills required for core regulatory work rather than 'convert' them to acquire another knowledge base. To achieve this, inspectors receive training in two main areas:

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

Training methods

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

2.37. 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.

2.38. The ONR Academy project concluded in February 2019 and is now established as a centre of excellence for training and development. ONR have developed bespoke training more suited to regulatory needs with an ethos of "little, local and often". This enables ONR to deliver consistency in how they develop staff, through effective knowledge management and clear development pathways, and offers a modern learning environment.

2.39. ONR has also launched the 'ONR Academy Online' which provides e-learning and the 'go-to' place for coaching guides and any learning and development guidance. Designed to complement existing learning and development opportunities, it works alongside face-to-face and classroom learning and provides an efficient and effective system to support staff to develop their capability.

Continued professional development

2.40. While considerable effort is spent on the training of new recruits, ONR also has a refresher training programme to ensure all staff maintain professional competencies. This applies to all inspectors within ONR, up to and including the CNI. ONR's current policy is that further training needs are a matter for discussion between individual inspectors and their managers, in consultation with the professional leads responsible for overseeing the application of regulatory standards in their particular specialism (e.g. structural integrity). That training would cover topics such as communication, influencing skills, change management and interpersonal skills, as well as the development of technical competencies.

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

Re-warranting of inspectors

2.42. All inspectors' warrants are issued for a fixed period of five years. As the expiry date approaches, inspectors are expected to complete a formal legal refresher training course and competence assessment process, which demonstrates continued knowledge and understanding of their powers and ONR's legal authorities.

External technical support to the regulatory body

2.43. As stated above, the nuclear safety regulator in the UK does not use technical support organisations in the way many other regulators do. Most of the expertise to regulate nuclear safety is available to ONR through its own staff. To maintain this situation, ONR periodically reviews its expertise and its likely needs for the near and intermediate term and adjusts its recruitment and training activities accordingly. There are occasions, however, when specialist advice and/or additional resources are needed to respond to a high workload, or the specialism is not available in ONR. To accommodate this, ONR has an extramural support budget and framework agreements with some outside bodies known to be independent, to enable contracts to be placed quickly. The work done under these contracts is to produce technical assessments to a specification prepared by ONR. ONR uses the outcome of the technical assessments to inform its regulatory assessment and its staff make any necessary regulatory decisions.

2.44. Currently, ONR obtains technical support through three main routes:

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

2.45. The framework agreement 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 IRRS mission in 2006, which stated that ONR should have access to scientific and technical support in the same way it is available to many other nuclear regulators in other countries. The support framework, which was set up with 31 contractors from the UK and overseas, operated successfully for 15 months. Approximately half of contracted technical support was commissioned through the framework. It is envisaged that this will increase in future years as work on assessment of new reactor designs begins.

Conflict of interest

Article 5

2. (e) establishes procedures for the prevention and resolution of any conflicts of interest;

2.46. ONR has established procedures for the prevention and resolution of any conflicts of interest, which are set out in the ONR Staff Handbook. The handbook applies to all staff members and contains information on avoiding and dealing with conflicts of interest. The ONR handbook is part of an individual's terms and conditions of appointment and is references in their employment contract.

2.47.The handbook states that:

- "As a public servant, ONR requires that its staff must be, and must be seen to be, honest and impartial in the discharge of your duties. ONR's responsibilities as a regulator must also be taken into account.
- "To support this, staff must manage and register your "interests". Interests are those external factors that may influence your dealings with others, impair your ability to carry out your job fairly, or, just as importantly, could be viewed by others as having an effect on your professional judgement. By registering your interests and being aware of such potential concern, ONR staff can ensure that ONR's reputation and credibility as a public body are maintained."

2.48.In respect of ONR Board members, under Schedule 7 of TEA13 the SoS is able to remove any non-executive member of the Board from office where they are satisfied that any of the following conditions apply:

a) the member has a financial or other interest that is likely to affect prejudicially the carrying out of his or her functions as a member of the ONR;
b) has been guilty of misbehaviour; or
c) is otherwise incapable of carrying out, or unfit to carry out, the functions of his or her office.

2.49.The ONR Board Standing Orders set out a procedure to be followed for the declaration of interests and a process for ensuring that such interests are managed appropriately.

Article 5

2. (f) provides nuclear safety-related information without clearance from any other body or organisation, provided that this does not jeopardise other overriding interests, such as security, recognised in relevant legislation or international instruments.

2.50.Section 87 of TEA13 requires the ONR to make such arrangements as it considers appropriate for providing information that it holds that is relevant to the ONR's purposes, this includes its nuclear safety purposes. Section 87 sets out that arrangements include:

a) for providing information to any person or category of persons (whether or not concerned with matters relevant to the ONR's purposes);
b) for providing information on request or on the ONR's initiative; and
c) for providing only such information as the ONR considers appropriate.

2.51.Section 94 requires that the ONR not issue any communication without the consent of the SoS where the communication includes any security guidance, statement of the ONR's nuclear security policy, or where the SoS has issued a direction requiring that the ONR seek consent from the SoS before the release of communications of a particular description. Such a direction may only be issued if it appears to the SoS that the communication might contain security guidance or information about the ONR's nuclear security policy, or that ONR's nuclear security policy might otherwise be relevant to such a communication, or that the communication might concern any matter to which government policy or national security relates.

2.52.ONR is subject to the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 and is required by that legislation to provide information upon request. Further information on this is set out in paragraphs 5.2. – 5.3.

Regulatory powers to ensure compliance with safety requirements

> *Article 5*
> 3. Member States shall ensure that the competent regulatory authority is given the legal powers necessary to fulfil its obligations in connection with the national framework described in Article 4(1). For this purpose, Member States shall ensure that the national framework entrusts the competent regulatory authorities with the following main regulatory tasks, to:
> *(a) propose, define or participate in the definition of national nuclear safety requirements;*

2.53. The top- level safety requirements for a nuclear site can be summarised as follows:

- The dutyholder must ensure SFAIRP the health and safety at work of their employees and others affected by their work activities.
- No site can be used for a nuclear installation unless a nuclear site licence is in force, granted by ONR.
- Licensees must comply with the conditions attached to the site licence.
- Other requirements may be specified in regulations.

Failure to comply with these requirements is specified as an offence in the appropriate legislation.

2.54. TEA13 and HSWA74 give ONR general powers of enforcement to issue improvement and prohibition notices as set out in Article 1(e).

2.55. The LCs themselves also assign specific ONR powers to ensure compliance in relation to each of the separate conditions. These powers are direction, specification, notification, consent, approval and agreement.

2.56. ONR also has the power to prosecute the licensee in the event of a significant breach of legislation.

Regulator powers to require demonstration of compliance with safety requirements

> *Article 5*
> 3. *(b) require that the licence holder complies and demonstrates compliance with national nuclear safety requirements;*

2.57. The powers to require the licensee to demonstrate compliance with the nuclear safety requirements come from the site LCs which are provided for under NIA65. The licence conditions provide the main basis for regulation by ONR. Contravention of the conditions attached to a licence is a criminal offence.

2.58. LC14 requires the licensee to produce safety cases consisting of documentation to justify safety during the design, construction, operation and decommissioning phases of the installation. A safety case provides a written demonstration that relevant standards have been met and that risks have been reduced SFAIRP.

2.59. LC23 requires the licensee to produce an adequate safety case for any operation and to identify the conditions and limits that are necessary in the interests of safety, i.e. the ORs. To ensure that the plant remains within the boundaries of the safety case the licensee must remain within the conditions and limits defined by the ORs. Compliance with the ORs is a key element of ensuring safety on the plant.

2.60.To ensure continuing safety in the light of changes to the plant there are two key LCs:

- LC22 requires the licensee to make and implement adequate arrangements to control any modifications to the plant. Modifications mean alterations to buildings, plants, operations, processes or safety cases. As well as intentional modifications, these include changes in the licensee's knowledge of the plant which may result from events on the site or elsewhere. The licence condition requires the licensee to revise the safety case and implement any revised conditions and limits resulting from modifications.
- LC15 requires the licensee to carry out PSRs to demonstrate that the safety case continues to be adequate and is being complied with and to update the safety case and any conditions and limits if necessary.

2.61.Under LC6, the licensee is required to make adequate records to demonstrate compliance with all LCs. The licensee must make adequate arrangements for keeping records or documents which relate to the licence requirements. This includes the LCs mentioned above and hence is part of the arrangements for the licensee to demonstrate compliance with the safety requirements.

Regulator powers to verify compliance

> *Article 5*
>
> 3. *This includes the powers and resources to:*
>
> *(c) verify this compliance through regulatory assessments and inspections;*

2.62.As set out above, LC14 requires the licensee to produce safety cases consisting of documentation to justify safety during the design, construction, operation and decommissioning phases of the installation. ONR has the legal authority to perform assessment and inspection work to verify that the licensees are complying with this condition; these assessments and inspections are performed regularly. In addition, LC15 (Periodic Review) states that the licensee shall make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases. These are performed regularly, and examples of ONR's assessments are available on its website.

Powers to allow inspection and assessment

2.63.ONR takes its powers to inspect and assess from TEA13 and HSWA74.

2.64.The powers in TEA13 and HSWA74 are essentially the same. When undertaking an inspection or assessment using the powers, the inspector must consider under which legislation it is being performed. Typically for a licence condition inspection it will be under TEA13, but if an inspection is against a relevant statutory provision of HSWA74, which includes, for example, IRR17, it will be under that legislation. If the inspector has to formally use the powers, they must be from the correct law. The powers include all those necessary for inspection and assessment, and also for investigations. There are a broad range of powers, but those that are key for inspection and assessment are the powers to:

- enter a premises;
- carry out any examination or investigation; and
- inspect and take copies of any document.

2.65.ONR takes its powers to inspect and assess from TEA13 and HSWA74.

2.66.LCs require the licensee to provide ONR with documents for inspection and assessment. A number of the LCs require the licensee to furnish copies of documents to ONR if it specifies that it should do so. Documentation that the licensee must furnish to ONR when specified, includes:

- any document, record, authority or certificate – LC6(5);
- any safety case documentation – LC14(4);
- any copies of records or documents made in connection with quality management systems – LC17(5); and
- extracts of operational records – LC25(4).

Assessment and verification by the nuclear regulator

2.67.Through a programme of planned and reactive inspections and technical assessments, ONR inspectors check that appropriate standards are developed, achieved and maintained by the licensees, in line with the carrying out of ONR's safety purpose under the TEA13. ONR also:

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

2.68.In the course of its nuclear regulatory work, ONR scrutinises the activities of licensees both at their licensed nuclear sites and through assessment of the licensees' written safety submissions. This section describes the assessment and verification activities carried out by ONR. Special emphasis is put on describing how ONR uses its SAPs (Ref. 18) during assessment to judge the adequacy of safety case submissions.

2.69.It is the duty of licensees to meet all statutory limits, and to reduce the risk to ALARP. This latter phrase is a fundamental principle of UK health and safety law embodied in HSWA74, which conveys many of the same ideas such as 'as low as reasonably achievable' (ALARA) concepts, more familiar to international safety experts. Assessment of the safety of nuclear plants is therefore based on assessing the licensee's safety case and dutyholders' demonstration of ALARP.

Granting permission for activities following regulatory assessment of safety submissions

2.70.Licensees submit requests for permission to carry out activities supported by safety submissions. ONR sets safety standards in broad terms for the reviews and assessments using the legal requirements of the LCs, and guidance set out in SAPs, which are based on the philosophy described in HSE's Reducing risks, protecting people (R2P2) (Ref. 19). ONR publishes guidance to its inspectors on purpose, scope and contents of the safety cases (Ref. 20).

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

2.72.The majority of the SAPs are engineering (or deterministic) principles. These principles provide inspectors with guidance on what to look for when judging whether the licensee has made a case to demonstrate that risks are reduced to ALARP. They represent ONR's view of good

nuclear engineering practice. They also point to the design features that in ONR's view would lead to a safe plant.

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

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

2.75. The UK's goal-setting legal framework for health and safety does not apply IAEA requirements in a prescriptive manner, but they are reflected in the revised SAPs so that the SAPs benchmark status is retained. For example, the text of the revised SAPs was reviewed for consistency against the individual requirements of IAEA SSR-2/1 'Safety of Nuclear Power Plants: Design' and SSR-2/2 'Safety of Nuclear Power Plants: Commissioning and Operation'. See further details under article 4 and the maintenance of the national framework.

2.76. Assessment of licensees' safety cases is undertaken by first understanding and then sampling the key aspects of a safety case using ONR's SAPs, and other national and international standards when appropriate. Guidance is provided to inspectors in the form of TAGs for a range of technical topics, e.g. a number of TAGs are relevant to the assessment of digital instrumentation and control.

2.77. The output of the assessment by an inspector from a particular technical discipline is an assessment report (AR). ONR project or site inspectors bring together and integrate the findings from ARs covering each of the relevant technical areas and provide an overall conclusion regarding the adequacy and acceptability of the assessed safety case, leading to a recommendation as to whether permission should be granted for the requested activity. This is formally documented in PARs. To ensure openness and transparency of regulatory decisions, PARs are now published on the ONR's website (Ref 21).

2.78. Extensive discussion between the different specialist inspectors 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 inspectors make recommendations, if appropriate, on where safety can be improved. These recommendations are discussed with the licensee and a programme to implement improvements is agreed. ONR monitors progress with implementation of these recommendations and other issues that may be raised requiring regulatory follow-up. ONR utilises a system for recording and monitoring progress made by the licensee in addressing regulatory issues and recommendations. Appropriate enforcement action is taken if the issues remain unresolved or inadequate progress is made.

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

- Are the objectives of the safety case right?
- Are the details of the safety case right?
- Has enough been done to demonstrate ALARP?

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

- **Completeness:** All reasonably foreseeable threats to safety must be identified, and it should be shown that the plant incorporates adequate protection against these threats, or that their contribution to the risk is negligible.
- **Clarity:** There must be a logical presentation of the plant, system and processes and the safety justification that applies, with clear referencing of supporting information and clear identification of conclusions and recommendations.
- **Rationality:** The safety case should provide cohesive and logical arguments to support the conclusions.
- **Accuracy:** The safety case should reflect the physical 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.

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

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

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

Inspection of nuclear sites

2.84. ONR carries out planned inspections of nuclear licensed sites to monitor licensees' compliance with the LCs and the requirements of HSWA74 and other regulations. An inspector (or team of inspectors) is allocated to the nuclear installation site from the start of construction. This means that frequent inspections and discussions take place, key tests can be witnessed, and the test reports checked. In addition, ONR inspectors often visit the site and key manufacturers' works to monitor the construction of components important to safety and witness quality assurance procedures.

2.85. The allocation of inspectors to site takes into account the risk associated with the site and the number of plants. For operational reactor sites, there is a single site inspector and for decommissioning reactors a site inspector may cover two sites. Sellafield has a large number of plants on the site and therefore has significantly more site inspectors. The actual number depends on the regulatory strategy for the site and may vary from year to year.

2.86. Individual site intervention plans are produced according to generic templates based on a matrix that includes both the LCs and relevant legislation, the important critical systems (derived from the safety case) and recent operational experience feedback (OEF). Before the start of each year, the plan is modified, as necessary, to take into account OEF, regulatory issues and developments affecting the plant. Unplanned and reactive inspection work is also integrated, as necessary, into the site inspection activities throughout the year. Site inspectors are supported by other ONR inspectors who carry out specialist assessments or inspections as necessary. The Integrated Intervention Strategy (IIS) developed by ONR embraces the site and corporate inspection processes, together with the assessment processes, to help provide a consistent and integrated framework for all regulatory activities. ONR's organisational change and the implementation of programme working has brought about further consistency in regulating similar sites and enables ONR to have better oversight of regulatory issues within the operating fleet, defueling and decommissioning plants, and hence more effective targeting of its regulatory efforts.

2.87. Site intervention plans are produced, monitored and reviewed within an IIS whose purpose is to ensure both that ONR focuses its resources where they are most needed and that the planning process is transparent to stakeholders. The IIS takes into account issues of local environment, priorities and changes in the industry. Within the intervention strategies for each site it is expected that a significant proportion of the planned inspections will be focused on systems or structures and processes required for nuclear safety as identified in the safety case. These are factors that contribute most to the licensee's safety management performance, and the prevention of significant nuclear events. In order to bring further consistency to disciplined delivery of these inspections, ONR inspects these factors against LC12 (Suitably qualified and experienced staff), LC23 (ORs), LC24 (Operating instructions), LC27 (Safety mechanisms), LC28 (Examination, maintenance and testing) and LC34 (Leakage and escape of radioactive material and radioactive waste).

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

- any site-related work arising from progressing outstanding PSR requirements or other reviews of the safety case;
- emergency arrangements;
- strategic themes important for safety such as organisational resilience and supply chain;
- operational experience and organisational learning; and
- leadership and management for safety.

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

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

2.91.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 organisation's 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.

2.92.Following inspections by the ONR inspector, the findings are discussed with the licensee and, where appropriate, the corrective actions required from the licensee are agreed. Subsequently, the inspector prepares an intervention report that records appropriate details of the objectives of the visit, matters considered, conclusions drawn, and any follow-up actions identified. Significant issues are recorded in a database so that their resolution can be monitored. Executive summaries of all intervention reports for operating reactors are published on the ONR website.

Regulatory enforcement actions

Article 5 3. (d) propose or carry out effective and proportionate enforcement actions.

2.93.There are a range of enforcement powers available to the regulatory body. These arise from both the statutes (TEA13 and HSWA74), which apply to health and safety inspectors of all industries and the LCs, which only apply to the nuclear industry. They are described in paras 2.42-2.57.

2.94.Enforcement powers in TEA13 and HSWA74 are essentially the same, and both consist of improvement notices, prohibition notices and prosecution. When undertaking an enforcement action, the inspector must consider which legislation is applicable. Typically, for a licence condition inspection it will be under TEA13, but if an inspection is against a relevant statutory provision of HSWA74, which includes, for example, IRR17 it will be under that legislation. If the inspector has to use enforcement action, the correct piece of legislation must be cited.

2.95.Regulatory actions to suspend operation of a nuclear installation are rarely used, but would be implemented using the LCs.

2.96. As described in para 2.51, LC31(1) allows ONR to direct a licensee to shut down any plant, operation or process on the site within such period as ONR may specify. Furthermore, it cannot be restarted without ONR's consent (LC31(2)). In addition, other LCs also allow ONR to direct the licensee to halt other activities on the site, such as:

- LC19 – construction or installation of a new plant;
- LC22 – modification or experiment on an existing plant;
- LC25 – decommissioning of a plant.

2.97.Again, once a direction has been issued the licensee cannot restart the activity without ONR's consent.

2.98.A prohibition notice could be used to suspend operation. However, this requires an inspector to make the judgement that an activity risks causing serious personal injury, which is unlikely to be the case for situations that require suspension of operation. Also, for a prohibition notice, the licensee can make its own judgement when the situation has been remedied and operation can be restarted without ONR involvement. Hence, a direction can be used in a wider range of circumstances and gives ONR, as the regulator, greater control than a notice. I

2.99.In taking regulatory action, ONR follows its Enforcement Policy (Ref 22), which sets out the purpose of enforcement and the principles that should be applied. Inspectors are guided by the

EMM (Ref 23) to help determine which enforcement measure is the most appropriate in a given situation.

2.100. The discussion on enforcement actions above and in paras 3.42–57 deals only with the most significant issues. Inspectors can use less formal enforcement actions such as verbal warnings or letters to secure compliance. These are the most frequent actions used in response to a licensee's shortfalls against safety requirements and also to secure continuous improvement on plants. They are particularly useful to deal with shortfalls in a licensee's arrangements that have not resulted in direct challenges to safety, but do need to be remedied to ensure that safety is maintained.

Article 6 – Licence holders

Article 6

1. (a) the prime responsibility for the nuclear safety of a nuclear installation rests with the licence holder. That responsibility cannot be delegated and includes responsibility for the activities of contractors and sub-contractors whose activities might affect the nuclear safety of a nuclear installation;

Licensee's responsibility for safety

4.1.The responsibility for safety is embodied in HSWA74, which applies to all industries not just nuclear. Section 2.1 of the Act states: "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.

4.2.With respect to persons not employed on site, section 3(1) 1 states: "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 thereby exposed to risks to their health or safety."

4.3.For nuclear installations, the responsibility is further refined by NIA65 as follows:

- Section 1(1) prohibits operation of a nuclear installation without a licence and section 1(7) makes breach of this prohibition a criminal offence.
- Under section 4(10) contravention of any conditions attached to the licence is also a criminal offence, and the licensee is liable for such contravention regardless of whether it was committed by the licensee or by another person.
- Section 3(1) states that a nuclear site licence shall not be granted to any person other than a body corporate and shall not be transferrable. This ensures that the licensee cannot delegate any of its obligations set out in the licence.

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

4.5.As required by Article 9 of the Convention on Nuclear Safety, NIA65 provides that the prime responsibility for the safety of nuclear installations rests with the licence holder. Under NIA65, a nuclear site licence is required for any organisation wanting to install or operate a nuclear reactor or a prescribed nuclear installation in the UK. A nuclear site licence is granted for an indefinite period and is intended to cover the entire lifecycle of a nuclear site from installation and commissioning through operation and decommissioning to site clearance and remediation.

4.6.The non-prescriptive licensing regime in the UK ensures that the licensees recognise and accept their responsibilities, while allowing them to determine their own methods for complying with the law, subject to the regulator being satisfied that they meet requirements. The way in which this responsibility is carried out is monitored and, if necessary, safety improvements are enforced by ONR.

Licensee's responsibility to regularly assess, verify and improve nuclear safety

Article 6

1. (b) when applying for a licence, the applicant is required to submit a demonstration of nuclear safety. Its scope and level of detail shall be commensurate with the potential magnitude and nature of the hazard relevant for the nuclear installation and its site;

Legal requirements for safety documentation

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

- LC14 (Safety documentation) requires the licensee to make arrangements for the production and assessment of safety cases consisting of documentation to justify safety during the life of the nuclear installation.
- LC15 (Periodic review) gives ONR the power to require reviews of safety documentation. PSRs are the output from this process.
- LC16 (Site plans, designs and specifications) requires that the licensee provides ONR with a site plan, a schedule of buildings on the site and the description of the function of plant contained therein.
- LC19 (Construction or installation of new plant) requires the provision of adequate documentation to control safety during the construction and installation of new plant.
- LC20 (Modification to design of plant under construction) requires the provision of adequate documentation to control safety-related modifications that are found necessary or desirable during construction.
- LC21 (Commissioning) requires the provision of adequate documentation to control all commissioning activities that confirm the design intent of the plant, that activities are carried out by suitably qualified people, that records are kept and that modifications are implemented according to a change procedure.
- LC22 (Modification or experiment on existing plant) requires the provision of adequate documentation to justify the safety of a modification or experiment on the plant and that this justification is subject to appropriate review.
- LC23 (ORs) requires the licensee to produce an adequate safety case for any operation that may affect safety and that this safety case identifies safe limits and conditions for operation, known as operating rules.
- LC24 (Operating instructions) requires the licensee to carry out all operations that may affect safety in accordance with written instructions.
- LC27 (Safety mechanisms, devices and circuits) requires the licensee to ensure that a plant is not operated, inspected, maintained or tested unless suitable and sufficient safety mechanisms, devices and circuits are properly connected and in good working order.
- LC28 (Examination, inspection, maintenance and testing) requires the licensee to verify that the limits and conditions identified in the safety case continue to be valid by instigating a regime for the maintenance, inspection and testing of safety-related plant.
- LC36 (Organisational capability) requires the licensee to make and implement adequate arrangements to control any change to its organisational structure or resources which may affect safety.

4.8. The licensee must also have adequate arrangements for compliance with relevant statutory provisions of HSWA74, for example IRR17, as well as other appropriate legislation.

4.9. Regulation 3 of MHSWR99 contains a general requirement for licensees to carry out a health and safety risk assessment (including for the purpose of complying with licensing requirements) and to review and amend such assessment as necessary.

4.10.All licensees have arrangements to ensure that requirements are complied with in a manner that is most appropriate to the specific installation, the licensee's activities on the site and its management systems. Where the licence condition requires compliance arrangements, they are expected to be proportionate and appropriate to the activities that are being performed. They are expected to evolve as plant construction and commissioning proceeds. Initially, ONR expects the applicant to focus on putting in place fully developed arrangements covering activities scheduled to commence as soon as the nuclear site licence comes into force. The agreed programme will need to satisfy ONR that more developed arrangements for the balance of the licence conditions will be put in place in a timely manner.

Safety assessment by the licensee

Article 6

1. (c) licence holders are to regularly assess, verify, and continuously improve, as far as reasonably practicable, the nuclear safety of their nuclear installations in a systematic and verifiable manner. That shall include verification that measures are in place for the prevention of accidents and mitigation of the consequences of accidents, including the verification of the application of defence-in-depth provisions;

The Safety Case

4.11.To comply with LC23, each licence holder must have a valid safety case, which is essentially a written demonstration that relevant standards and legal requirements have been met and that risks have been reduced so far as is reasonably practicable.

4.12.LC14 requires that arrangements be made 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. Therefore, the safety case is not a one-off series of documents but a living framework which underpins all safety-related decisions made by the dutyholder.

4.13.ONR does not prescribe the format of safety cases but ONR's SAPs (Ref. 24) and TAG 'The Purpose, Scope, and Content of Safety Cases' (Ref. 25) set out what ONR expects a safety case to demonstrate. The safety case should demonstrate in writing that the plant, its processes, activities and any modifications:

- identify all credible faults / hazards;
- meet any relevant design safety requirements and criteria;
- conform to good nuclear engineering practice and to appropriate standards and codes of practice or other relevant good practice;
- are adequately safe during all modes of operation and fault conditions;
- are, and will remain, fit for purpose;
- give rise to a level of nuclear risk to both public and workers which is ALARP; and
- have a defined and acceptable operating envelope, with defined limits and conditions, and the means to keep within the envelope (safety management).

4.14.During the operational and decommissioning phases, the NPP's safety case is updated as necessary to reflect changes to plant or procedures and respond to challenges arising from operational experience, new safety analysis, techniques, research findings, plant modifications, plant ageing and the outcome of PSRs.

4.15. Defence-in-depth is seen as a fundamental element of reactor safety. It is one of ONR's key engineering principles (SAP EKP.3) (Ref. 26) that nuclear facilities should be designed and operated so that defence-in-depth against potentially significant faults or failures is achieved by the provision of multiple independent barriers to fault progression. It has been a requirement for all nuclear installations since the beginning of the reactor programme and continues to be a requirement for new build. Safety cases for UK NPPs need to demonstrate how the defence-in-depth principle has been applied. See Article 8b for further details.

4.16. Even if a safety measure is not formally claimed in the design basis assessment (DBA) the law requires operators and designers to do everything that is reasonably practicable to ensure that risks are reduced to ALARP to maximise the effectiveness and reliability of level 1 and level 2 measures. Further details on level 1 and level 2 measures are set out in Table 4 on defence-in-depth levels. PSA is one tool used in safety case to show the contribution of these measures to safety and to inform design, modification, and maintenance decisions on the measures.

Safety analysis

4.17. The ONR's SAPs expect that analyses of normal operating conditions should show that resultant radiation doses due to ionising radiations, both to members of the workforce and the public, are, and will continue to be, below regulatory limits and, furthermore, are ALARP.

4.18. The accident analyses should use the complementary approaches of DBA, PSA and severe accident analysis (SAA), as appropriate. The dutyholders prepare an analysis of faults that could initiate accident sequences (initiating faults) and the defences available at the plant to mitigate the predicted consequences. 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.

4.19. The deterministic approach is used in the analysis of design basis accidents to demonstrate the capability of the safety systems. As part of this approach, the dutyholders are expected to ensure that a small change in design basis parameters does not lead to a disproportionate increase in radiological consequences. Analyses are also undertaken for more severe faults outside the design basis, and of severe accidents which could lead to large releases of radioactivity. These SAAs include study of the potential failures of the physical barriers to the release of radioactivity, analysis of the magnitude and characteristics of the releases, identification of the accident management strategies to reduce the risk, together with the necessary equipment, instrumentation and accident management procedures.

4.20. It is a dutyholder requirement that internal hazards on nuclear facilities be identified and their effects considered in safety assessments. Internal hazards are those hazards to plant, structures and personnel which originate within the site boundary but are external to the primary circuit in a reactor (i.e. the dutyholder has control over the initiating event in some form). Internal hazards include internal flooding, fire, toxic gas release, collapses, dropped loads, impacts from vehicular transport and explosion/missiles.

4.21. The safety assessment should demonstrate that threats from internal hazards are either removed or tolerated and minimised. This may be done by showing that structures, systems and components important to safety are designed to meet appropriate performance criteria, and by the provision of safety systems which mitigate the radiological consequences of fault sequences.

4.22. In addition, the safety assessments must demonstrate that threats from external hazards are removed, minimised or mitigated. For each type of external hazard identified as applicable to a

particular site, a design basis event is defined. Regarding the severity of the design basis event for natural hazards, a frequency of 1x10-4 per year (conservatively defined) is considered reasonable in the UK (SAP EHA.4). However, due attention should be paid to providing adequate capacity for events beyond the design basis, and cliff edge effects should be avoided as far as practicable.

4.23. For all external hazards, the safety case demonstrates that the design has sufficient robustness to allow shutdown and cooling of the reactor from any operating state, and integrity (and cooling as required) of any other facility at the NPP where significant amounts of radioactive material are expected to be present (for example, facilities for handling spent nuclear fuel).

4.24. The PSA provides a comprehensive, systematic analysis of the plant response to a fault condition and the numerical analysis of the risk from the plant, in order to demonstrate its acceptability. ONR's SAPs expect PSA to be performed as part of the fault analysis and design development and analysis, and to be used to inform the design process and help ensure the safe operation of the site and its facilities. The PSAs for all operating reactors within the UK are 'living PSAs' and are updated approximately every three years, or sooner if there are significant changes to plant or operations that require a more frequent update. The updates include revisions to initiating event frequencies, plant reliability data, hazards analysis and other modelling aspects

Periodic reviews of the safety case

4.25. Major safety reviews are carried out by licensees, every ten years (or more frequently, if necessary, for example following a major event). The legal basis for PSRs in the UK is embodied in the licence conditions. LC15 requires licensees to "make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases." PSR is therefore a well-established practice in the UK. ONR's PSR TAG (Ref. 25) sets out what ONR expects to see in the PSR.

4.26. The purpose of the review is to revalidate the extant safety case, to ensure the plant and operations remain adequately safe and fully reflect the site licence requirements. This is achieved by reviewing the previous 10 years of operation together with considering changes in activities that impact on nuclear safety over the following 10 years. The review takes into consideration compliance with modern standards and potential impact of ageing and obsolescence. There has been a requirement for licensees to undertake PSRs since the introduction of the standard nuclear site licence in 1990. The programme for the UK's nuclear installations' PSRs is given in Table 1 below.

Table 1 - Status of Periodic Safety Reviews (EDF Energy NGL Stations)

AGR/PWR Sites	Operational Since	1st Review	2nd Review	3rd Review
Hinkley Point B	1976	1996	2006	2016
Hunterston B	1976	1996	2006	2016
Dungeness B	1983	1997	2007	2017
Heysham 1	1983	1998	2008	2018
Hartlepool	1983	1998	2008	2018
Heysham 2	1988	1999	2009	2019
Torness	1988	1999	2009	2019
Sizewell B	1995	2005	2014	Planned for 2024

4.27. The PSRs aim to confirm that the arrangements are adequate to maintain safety until the time of the next review. PSRs complement the normal operational monitoring of safety, which is also regulated by ONR. Therefore, although the PSRs may conclude that the arrangements are adequate for another 10 years, operation will be dependent upon a robust safety case underpinned by continuing satisfactory results from routine inspections. Should any inspection or safety-related factor emerge in the interim period that may throw doubt upon the continuing validity of the safety case, this would require the licensee to resolve the matter to ONR's satisfaction.

Improvements as a result of safety assessments and reviews

4.28. The results of the PSRs have produced, and continue to produce, worthwhile improvements to safety. A number of projects arising from previous periodic reviews, or from event-driven reviews have delivered improvements in nuclear safety at NPPs owned by EDF Energy NGL. Examples include:

- Extensive inspections of the reactor peripheral shield walls at Heysham 2 and Torness following discovery of unexpected cracking. The inspection programme has provided significant confidence that the shield walls are in generally good condition with very low occurrence of cracking that is likely to have been present since very early on in life.
- Ongoing projects to enhance the secondary shutdown systems at Heysham 2 / Torness and Hartlepool / Heysham 1, to mitigate the potential for primary shutdown reliability to be affected by late life effects of graphite core brick cracking.
- Enhancements to the detection of, and protection against, transmission system single phase faults at all the AGRs. This followed identification of design weaknesses against this fault mechanism which were not previously recognised within the safety cases.

Regulatory review of dutyholders' safety submissions

4.29. ONR assesses the safety of proposed and existing sites and nuclear installation designs through review of the licensees' safety submissions.

4.30. In the UK, there are different regulatory requirements for nuclear safety, security, safeguards and the environment. To ensure that there are no inconsistencies in what the regulators do, they work

as an integrated team whenever possible. They attend programme meetings together, often conduct interventions together and share reports when there are mutual interests. They also meet with the dutyholders together. The GDA process is a successful example of joint working between the nuclear regulators.

4.31. When licensees submit requests for permission to carry out activities supported by safety submissions, or a GDA requesting party submits a generic design and safety case for regulatory assessment, ONR sets standards for the reviews and assessments using the guidance in the SAPs (Ref. 24) and TAGs (Ref. 25).

4.32. In its assessment of safety cases, ONR seeks assurance that the ALARP principle has been met, as this is required by law. To aid in this judgement, ONR inspectors make use of the SAPs numerical targets which set the deterministic and probabilistic criteria to be used when considering whether radiological hazards are being adequately controlled and risks reduced to ALARP.

4.33. It should be noted that ONR does not approve the codes and standards chosen by the dutyholders. The choice of codes or standards to underpin the design and safety case is a matter for the dutyholder. ONR will assess the safety case and among other things will take a view on the standards that have been used. Where a standard is well known to ONR or an internationally recognised standard has been used, for example, ASME III, there is unlikely to be any examination of the standard itself; however, the standard's application may be reviewed. Where the standard being used is new or unfamiliar to ONR then the dutyholder will be asked to justify its use. An example of such a review can be found in Section 4.2.3.5 of the GDA Step 4 report on the Structural Integrity of the UK EPR (Ref. 27).

4.34. In its appraisal of an NPP safety case should be intelligible, valid, complete, evidential, robust, integrated, balanced, and forward looking.

4.35. ONR specialist inspectors have the capability to commission analysis work from a number of Technical Support Contractors (TSC). This work is used to support their technical assessment of safety case submissions. TSCs do not make regulatory judgements but provide expert authoritative advice to ONR inspectors. Funding for the work is charged directly to the relevant dutyholder.

4.36. The output of the assessment by an inspector from a particular technical discipline is captured in an assessment report. ONR project or site inspectors bring together and integrate the findings from assessment reports covering each of the relevant technical areas and provide an overall conclusion regarding the adequacy and acceptability of the assessed safety case, leading to a recommendation as to whether permission should be granted for the requested activity. This is formally documented in a PAR. To ensure openness and transparency of regulatory decisions, PARs are published on the ONR's website (Ref. 28).

4.37. In its assessment of NPP fault analyses, ONR uses relevant SAPs and TAGs, other guidance such as WENRA and industry relevant good practice. The Basic Safety Objectives (BSOs) of the SAPs numerical targets are used as benchmarks that reflect modern standards and expectations. Thus, ONR refers to the BSOs when judging whether analyses are demonstrating adequate results for new reactors.

4.38. In line with wider international guidance, ONR expects the severe accident analysis to form part of a demonstration that potential severe accident states have been 'practically eliminated'. For this the safety case should show either that it is physically impossible for the accident state to occur or that design provisions mean that the state can be considered to be extremely unlikely with a high degree of confidence.

4.39. Ultimately, ONR seeks confirmation that the level of risk is reduced in so far as is reasonably practicable and that it would be disproportionate to reduce risk further by implementing further improvements

Verification of safety: regulatory review and control activities

4.40. An inspector (or team of inspectors) is allocated to the nuclear installation site before the start of construction. During the construction and commissioning phases the site inspector(s) will conduct frequent inspections and discussions with the licensee, witness key tests and check test reports.

4.41. Once the reactor is operational, the nuclear site inspector(s) allocated to the site spend about 30% of their working time on their site. They ensure that the licensee is complying with the licence conditions and the arrangements made under them. ONR's approach is to ensure that inspectors do not remain at only one site for an indefinite period. Instead, there is a periodic change, normally after a few years. This helps to preserve the continued independence of the inspectors as well as supporting their career development.

4.42. Individual site intervention plans are produced according to generic templates that include the licence conditions and relevant legislation, the key safety systems and structures (derived from the safety case) and themes based on recent operational experience feedback. Unplanned and reactive inspection work is also integrated, as necessary, into the site inspection activities throughout the year. The site intervention plan is enhanced to include other factors that ONR considers to be important to the overall safety of the site. These include:

- any site related work arising from progressing outstanding PSR requirements or other reviews of the safety case;
- emergency arrangements;
- strategic themes important for safety such as organisational resilience and supply chain;
- operational experience and organisational learning; and
- leadership and management for safety.

4.43. Team inspections that address specific or more generic aspects of the safety of the nuclear installations are carried out at the plants and at the licensee's corporate centres. For such inspections, 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. Reactive inspections are undertaken in response to specific events where operational matters may affect safety. Further investigation may be undertaken by ONR inspectors and appropriate regulatory action taken, in line with its Enforcement Policy Statement and the regulatory strategy for the site. Occasionally, ONR inspectors also undertake unannounced inspections and out of hours inspections.

4.44. LC29 requires licensees to carry out and report the results of tests, inspections and examinations specified by ONR. This condition may therefore be regarded as a verification activity by the nuclear regulator or as a means to intervene to improve knowledge or secure a safety improvement.

4.45. ONR also carries out programme of system-based inspections (SBIs). These are intended to establish that the basic elements and requirements of a site/facility safety case are met in practice, that the systems are fit for purpose and that they will fulfil their safety functional requirements. SBIs are structured around compliance with six licence conditions; these cover training, ORs, operating instructions, safety mechanisms, maintenance and leakage of radioactive materials.

4.46. Broadly, the outcomes of ONR's SBI interventions have allowed ONR to gain high confidence that the safety systems of the operating reactor fleet continue to deliver the function required by the reactor safety cases.

Licensee's management systems

> *Article 6*
>
> *1. (d) licence holders establish and implement management systems which give due priority to nuclear safety;*

4.47. In July 2011, ONR varied its standard LC17 (Management systems) in order to transpose the obligation in this article into UK law. The principal change is that a duty is now placed on licensees to establish and implement management systems which give due priority to safety. In recognition of this change, LC17 is now titled 'Management systems' rather than 'Quality assurance'. In addition, LC17(2) 'Quality assurance arrangements' now refers to 'Quality management arrangements' to reflect modern terminology. In response to the change in emphasis in LC17, ONR revised its internal guidance to inspectors.

4.48. ONR requires that a licensee's quality management arrangements be based on current national or international quality management system standards and that the arrangements adequately address all matters which may affect safety. The licensee may choose to use an integrated management system. This approach is a requirement of the IAEA's GS-R-3 (Ref. 44) and is encouraged by the ONR as it ensures safety is considered in all the licensee's activities and is not confined to the quality / safety management systems.

4.49. ONR requires quality assurance arrangements for procurement to be included in LC17 and therefore inspectors are advised as part of the internal guidance to consider what arrangements the licensee has to guard against poor quality goods / services or counterfeit material relating to safety-significant items. ONR has developed guidance on procurement, TAG077 (Ref. 29), to provide further guidance to inspectors addressing this area.

4.50. In addition, Regulation 5 of the MHSWR requires every employer to make arrangements for the effective planning, organisation, control, monitoring and review of preventive and protective health and safety measures. Regulation 3 of the MHSWR contains a general requirement on licensees to carry out a health and safety risk assessment (including for the purpose of complying with licensing requirements) and to review and amend such assessment as necessary.

General requirements

4.51. A licensee's management system is developed as part of the arrangements to meet LC17 and is normally derived from the requirements of national and international quality management Codes and Standards such as GS-R-3 and ISO9001 (Ref. 30). Furthermore, any significant changes to the licensee's organisational structures or resources are controlled by arrangements made to meet the requirements of LC36 'Organisational capability'.

4.52. 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 competence, 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

4.53. Licensees use the management system to promote a strong safety culture. They achieve this by encouraging:

- clear safety leadership from management;
- the ability to question the effective delivery of relevant safety principles and practices, and to report in a timely manner on safety issues;
- training in error prevention methods;
- the development of methods to enhance learning;
- the improvement of safety culture through learning from experience and benchmarking; and
- monitoring safety performance.

For further detail on how a safety case is enforced and demonstrated, please refer to article 8b.

Graded application of management system requirements

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

Documentation of the management system

4.55. Licensees typically describe the documentation of the management system in a hierarchical structure. The top tier includes policies, organisational structure, and the mission or principal objectives. The second tier contains processes and procedures and job or post profiles. The third tier normally contains working level instructions and training material.

Requirement for the licence holder to provide on-site emergency procedures and arrangements

> *Article 6*
> *1. (e) licence holders provide for appropriate on-site emergency procedures and arrangements, including severe accident management guidelines or equivalent arrangements, for responding effectively to accidents in order to prevent or mitigate their consequences. Those shall in particular:*
> *(i) be consistent with other operational procedures and periodically exercised to verify their practicability;*
> *(ii) address accidents and severe accidents that could occur in all operational modes and those that simultaneously involve or affect several units;*
> *(iii) provide arrangements to receive external assistance;*
> *(iv) be periodically reviewed and regularly updated, taking account of experience from exercises and lessons learned from accidents*

Onsite preparedness (LC 11)

4.56. LC11 requires the licensee to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their effects. Onsite plans include:

- a description of the organisation that is set up on the site to manage the emergency;
- responsibilities of personnel in the emergency organisation;
- training requirements for personnel;
- equipment for use in an emergency;

- arrangements for liaison with emergency services on the site;
- radiological monitoring of the environment on and around the site; and
- communications with organisations off the site.

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

4.58. ONR's consent is normally required to bring nuclear fuel onto a site for the first time. As part of the assurances that ONR require prior to granting this consent, appropriate emergency and evacuation arrangements must be demonstrated, and an on-site Emergency Plan that is in the public domain must be approved. This plan cannot then then be changed without the further approval of ONR. Relevant considerations for providing the consent include sufficient trained personnel and suitable available equipment to deal with the risks from hazards on the site. Similarly, ONR's consent may be required at stages specified by ONR relating to key increases in hazard on the site during the active commissioning process, for example in which reactor plant is brought from initial criticality up to its full reactor power rating. At any of these stages, ONR may require a demonstration of enhanced emergency arrangements prior to the granting of consent to proceed to the next stage. This may be through an examination of the training records for all staff affected, or by means of a demonstration exercise that staff from ONR formally observe. Throughout the life of the nuclear installation, the emergency arrangements are subject to review and, with ONR's approval as described above, revised as appropriate.

REPPIR 19

4.59. REPPIR19 ensures that the emergency preparedness and response arrangements remain in step with the latest international best practice. REPPIR19 covers the civil nuclear sector, defence licensed and authorised nuclear sites, and the radiological sector.

4.60. A summary of REPPIR19 is set out in the Explanatory Memorandum (Ref. 45). It is supported by an Approved Code of Practice and guidance (Ref. 46). In short, the approach requires:

- all hazards capable of resulting in a radiation emergency to be identified and their consequences consistently assessed;
- planning effort to be commensurate to that assessment, having considered local needs and where protective actions may be justified, i.e. through:
    - on-site emergency plans;
    - off-site Detailed Emergency Planning Zones (DEPZs) where appropriate; and
    - off-site Outline Planning Zones (OPZs) where appropriate;
- on-site and (where appropriate) off-site emergency plans prepared must include:
    - conditions or events which could be significant in bringing about a radiation emergency, a description of the action which should be taken to control the conditions or events and to limit their consequences, including a description of the safety equipment and resources available;
    - the arrangements to set emergency procedures in motion;
    - provision for off-site notification;
    - decision making arrangements to inform response action;
    - clearly specified roles and responsibilities in responding to a radiation emergency, and co-ordinating that response;

    - the minimum number of staff deemed necessary to implement the emergency plan at all times, including periods outside working hours;
    - protection arrangements and protective actions for people on or off-site, including emergency workers;
    - arrangements for information exchange and co-operation / assistance;
    - public communication arrangements;
    - arrangements for taking account of lessons learned;
    - arrangements to prioritise keeping exposure under reference levels and to justify and optimise protective action; and
    - arrangements for the transition to an existing exposure situation.
- on-site emergency plans (and off-site emergency plans where appropriate) to be implemented without delay in the event of a radiation emergency or where one is likely. Once implemented a provisional assessment must be undertaken of the consequences of the emergency and to optimise protection strategies;
- on-site and off-site plans to be reviewed and tested at least every three years, with an explicit requirement to them take account of lessons learned;
- documents and processes to be in place for analysis of the emergency response;
- consultation and co-operation between organisations so that on-site and off-site plans can operate effectively both independently and together;
- provision of suitable and sufficient information, equipment, instruction and training for any employee who may be involved with or may be affected by arrangements in an operator's emergency plan;
- protection of emergency workers responding on the site; and
- provision of information to the public prior to and in the event of a radiation emergency.

4.61. Public Health England (PHE) have also produced a range of guidance materials (Ref. 47) to support the technical aspects of the approach, such as a recommended methodology for assessing the radiological consequences of a radiation emergency, and radiation protection advice.

The Ionising Radiations Regulations 2017

4.62. The IRR17 lay down the statutory requirements for the protection of persons against ionising radiation. These include (at Regulation 8) that the Radiation Employer should carry out a risk assessment, sufficient to show that all hazards with the potential to cause a radiation accident have been identified and the nature and magnitude of the associated risks have been evaluated.

Legal requirement for Financial Resources

Article 6

1. f) licence holders provide for and maintain financial and human resources with appropriate qualifications and competences, necessary to fulfil their obligations with respect to the nuclear safety of a nuclear installation. Licence holders shall also ensure that contractors and subcontractors under their responsibility and whose activities might affect the nuclear safety of a nuclear installation have the necessary human resources with appropriate qualifications and competences to fulfil their obligations.

4.63. The principal legal requirement for nuclear site licensees to have adequate resources is contained in LC36 on organisational capability. This states that "The licensee shall provide and maintain adequate financial and human resources to ensure the safe operation of the licensed site."

The provision of adequate financial resources for nuclear safety and security

4.64. 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.

4.65. ONR has issued guidance on how the licensee can comply with the requirement for adequate financial resources. The essence of this guidance is that ONR gains confidence that licensees provide and maintain adequate financial resources to fulfil their obligations in respect of safety, by demonstrably understanding and managing the hazards and risks associated with their undertakings. This means that they are reducing risk so far as is reasonably practicable and implementing improvements in a timely manner, maintaining an adequate organisational capability, assessing what financial resources are necessary to continue to meet those needs and assigning those resources accordingly. Although it has not yet happened, if a safety issue could not be resolved to the satisfaction of the inspector, and financial resource issues were identified as a possible factor, ONR would seek appropriate external advice on the issue before taking a decision on appropriate enforcement action.

4.66. Regarding the financial responsibilities of the operator for potential damages to the public or the environment, under section 19 of NIA65 the government approves a nuclear operator's third-party liability insurance (or other financial arrangements). ONR seeks assurance from BEIS on the issue of liability before issuing a nuclear site licence. Should an operator's arrangements change, approval of new arrangements must be sought from the government.

4.67. When issuing a licence to an organisation for the first time, ONR seeks advice from BEIS 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 company.

Financing safety improvements during operational life

4.68. 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).

4.69. As with any other expenditure, the licensee's internal financial control processes determine the authority required before commitments are made to make safety or any other improvements. These processes examine the impact on the licensee's 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 commercial activities.

Provision of resources

4.70. LC36 was introduced specifically to guard against any downward drift in a licensee's resources as a consequence of cost-cutting. The licensee determines the resources necessary to carry out its activities during the planning of its 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.

4.71. 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.

Contractors and subcontractors

4.72. MHSWR99 requires employers to ensure that employees and temporary workers are provided with adequate health and safety training and that they are not required to carry out work which exceeds their ability to carry out work without risk to themselves or others.

4.73. In addition, under Section 2(2)(c) of HSWA74, as part of the employer's broader duty to ensure the health, safety and welfare at work of every employee (so far as reasonably practicable), employers must provide adequate information, instruction, training and supervision to employees. This is supplemented by Regulation 13 of MHSWR99 which contains detailed requirements as to training of employees in the area of health and safety. Such training must be provided to employees when they are first recruited and at any time when the employee may be exposed to new risks as part of their employment (for example due to a change of responsibility, introduction of a new technology or new equipment). The training must also be repeated on a regular basis, must be adapted to take new risks into account and must take place during working hours. The MHSWR99 also require employers to seek competent advice.

4.74. IRR17 Regulation 15 sets out a specific requirement for training of employees who are engaged in work with ionising radiation:

> Every employer must ensure that –
>
> a) those of its employees who are engaged in work with ionising radiation are given appropriate training in the field of radiation protection and receive such information and instruction as is suitable and sufficient for them to know –
> i. the risks to health created by exposure to ionising radiation as a result of their work;
> ii. the general and specific radiation protection procedures and precautions which should be taken in connection with the work with ionising radiation to which they may be assigned; and
> iii. the importance of complying with the medical, technical and administrative requirements of these Regulations.
>
> b) adequate information is given to other persons who are directly concerned with the work with ionising radiation carried on by the employer to ensure their health and safety so far as is reasonably practicable.

4.75. Additionally, LC10 requires the licensee to make and implement adequate arrangements for suitable training of all those on the site who have responsibility for any operations which may affect safety.

4.76.LC12 requires the licensee to ensure that persons who perform duties which may affect safety are suitably qualified.

4.77.Under LC11(6) (relating to emergency preparedness) the licensee is required to ensure that all employees who have a role in the emergency arrangements are properly instructed in the performance of the arrangements, including equipment required and precautions to be observed.

Article 7 – Expertise and skills in nuclear safety

Article 7
Member States shall ensure that the national framework requires all parties to make arrangements for the education and training for their staff having responsibilities related to the nuclear safety of nuclear installations so as to obtain, maintain and to further develop expertise and skills in nuclear safety and on-site emergency preparedness.

Regulatory background

5.1. The obligation to provide suitable training applies to all employers that are engaged in work with ionising radiation exists in the MHSWR99, HSWA74 and IRR17. Further details of these requirements have been provided above under Article 6.1(f) regarding contractors and subcontractors.

5.2. In addition, the following LCs set goals on management of human resources and training:

- LC10 requires the licensee to make and implement adequate arrangements for suitable training of all persons on site who have responsibility for any operations which may affect safety.
- LC11(6) (relating to emergency preparedness) requires the licensee to ensure that all employees who have a role in the emergency arrangements are properly instructed in the performance of the arrangements, including equipment required and precautions to be observed.
- 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.
- LC36 includes a specific requirement for the licensee to provide and maintain adequate human resources to ensure safe operation.

5.3. ONR's nuclear safety inspectors review safety documentation against these licence conditions supported by ONR's guidance in the relevant TIGs and TAGs, considering particularly whether the organisation has the capacity and capability to secure and maintain the safety of its operations.

5.4. ONR expects the licensee to show that provision of adequate resources, delivery of training and assuring competence are set out in policies and plans which are supported by commitment from senior managers.

Regulatory expectations for training and qualification

5.5. ONR's approach is to seek confidence that the licensee has implemented effective arrangements for training, and competence assurance for all personnel whose activities may impact upon plant safety. This should cover both licensee employees and others, such as contractors whose actions could impact upon nuclear safety. It does this by assessing the adequacy of and compliance with licence condition arrangements, notably LC10. ONR's expectations are set out in ONR's TAG 'Training and Assuring Personnel competence' (Ref. 25).

5.6. ONR looks for clear links between an individual's post and roles and the training required. For example, within EDF Energy NGL, training profiles have been developed for both posts and roles which set out 'essential' and 'performance' training requirements. ONR also regards the design, control and maintenance of training records as an essential requirement in support of LC10 and LC12. ONR inspectors routinely assess training outcomes during SBIs which assess whether systems will perform the safety functions claimed in the safety case.

5.7.LC7 requires the licensee to develop adequate arrangements for the notification, investigation and reporting of incidents on site. Licensees' arrangements for investigations include determination of whether deficiencies in resources, training or competence are part of the cause. The licensee must then identify any necessary corrective actions. ONR expects the licensee to have robust management arrangements for conducting reviews of all available sources of internal and external operating experience and to adjust training provision accordingly.

Licensees' Qualifications, experience, and training

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

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

- the 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.

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

5.11.LC12 (Duly authorised and other suitably qualified and experienced persons) requires that any posts on site that may affect operational safety, or that implement any actions connected with the site licence conditions, must be performed only by suitably qualified and experienced persons (SQEP).

5.12.LC12 further provides for the appointment of duly authorised persons (DAP). DAPs are identified as individuals who are in direct control or supervision of operations or activities that impact on the safety envelope of the facility. Their appointments are therefore subject to additional management controls covering areas such as appointment and assessment. However, the general principle that persons whose activities may impact upon nuclear safety should be appropriately trained, and their competence adequately assured, is similar for SQEPs and DAPs.

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

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

Training of external personnel

5.15.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.

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

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

Periodic review

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

Training programme development

5.19. 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 arrangements for compliance with LC22 (Modification or experiment on existing plant), identify where instructions and procedures need to be changed and the associated training needs. For large modifications that need stage consents to be granted by ONR, evidence of satisfactory retraining may be a requirement prior to a consent being granted to bring the modified plant into routine service.

Operational experience feedback to improve training

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

5.21. 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 licensees' staff and also routine and team inspections by ONR inspectors.

Competence of instructors

5.22. Training instructors are staff of proven competence and experience who are employed in the work area in which they provide training, as well as full-time instructors normally based at a training centre. Instructors are given training on how to present training materials to best effect. Arrangements are

in place for line managers to assess the performance of instructors, and feedback is also provided by the staff receiving instruction.

Technical support resources

5.23. 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. Similarly, the technical services of the licensee may be contracted to external organisations where this does not compromise the support needs of each licensee's operating locations. In these areas, there may be technical support from, and collaboration with, other licensees.

5.24. Each licensed nuclear site has engineering and technical support staff that 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 site director, for ensuring that nuclear safety cases are prepared at the location, in the central organisation, or externally. They are also responsible for the preparation, review and development of the written instructions for operational staff.

5.25. For the major licensees, and most of the others, a 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 a licensee's plants. These staff understand the design of the plants 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 have access to specialist facilities and support staff to enable it to maintain and develop the necessary knowledge base.

5.26. Each licensee's health and safety function will have 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

5.27. Existing operations, decommissioning and clean-up, together with a planned programme of new nuclear build, means the nuclear industry has a sustained recruitment demand and associated requirement for skills training and reskilling of the workforce. The Nuclear Workforce Assessment 2019 report (Ref. 48) produced by the Nuclear Skills Strategy Group (NSSG) summarises the latest labour market intelligence currently available for the nuclear industry in the UK which is kept under review.

5.28. Occupations with potential demand / supply pinch points include safety case preparation, control and instrumentation, reactor operation, site inspectors, project planning and control, commissioning engineers, electrical engineers, emergency planners, quality assurance staff, chemists, and physicists. Other potential resource vulnerabilities include steel fixers, concreters, civil engineering operatives and scaffolders.

5.29. The government, industry and training providers recognise that there are substantial challenges to be overcome. The existing nuclear workforce is ageing, and attrition rates are high. The government continues to address the threat of skill shortages through a collaborative and strategic approach with industry, i.e. the NSSG (formed in late 2015), which is UK-wide, and covers all parts of the sector and represents views on the skills needs and solutions.

5.30. In June 2018, the Government published the Nuclear Sector Deal (Ref. 49), as part of its modern Industrial Strategy, which includes a package of measures to support the sector as the UK develops low carbon power and continues to clean up its nuclear legacy. The NSSG is recognised within the UK's Nuclear Sector Deal as the lead on skills for the sector, and resulting from its launch, published its updated Nuclear Skills Strategic Plan on 6 December 2018 (Ref.n 50), a key milestone set out in the deal. Its purpose remains to secure the required supply of suitably qualified and competent personnel for the current and future needs of the UK's nuclear sector by providing the strategic direction on skills infrastructure, processes and training provision. More specifically, its remit includes:

- "To bring together major employers, government, regulators, and trades unions to address the sector's skills challenge
- To ensure we can meet the demand for 100,000 skilled jobs needed in the UK by 2021 – both skills for nuclear and nuclear skills
- To build a more diverse workforce – including 40% female representation by 2030 (up from 22%)
- To grow our Subject Matter Experts, to replace those retiring and to ensure we lead innovation in new technology
- To improve the mobility of skilled people, both within our sector and from other sectors
- To attract young people into the nuclear sector, increasing visibility in schools of careers in nuclear"

5.31. In support of its activities, the NSSG has now convened two Skills Summits to influence its direction and delivery. At the most recent summit (March 2020), there was focus on delivery in relation to the key themes identified within the Nuclear Sector Deal. Following the Summit, the NSSG have been working with committed Theme leads (as well as shadow theme leads) to take the output and refine it into the delivery plan for the next phase of delivery. Each NSSG theme has a delivery plan with interventions identified, a schedule for delivery, and supporting organisations identified.

5.32. The UK's Nuclear Sector Deal, agreed between government and industry, also commits to a target of 40% women in nuclear by 2030. The UK government, regulators and industry are also collectively acting to increase the numbers of young people with science, technology, engineering, and mathematics (STEM) skills by working with schools and is committed to creating 3 million apprenticeships by 2020. Increased diversity enhances the quality of the skills available to the nuclear sector, boosting innovation and productivity through greater diversity of thought. All of these actions taken together will help to ensure the UK has the skilled personnel required to support the nuclear sector.

5.33. There are numerous training providers and academic establishments across the UK who support the delivery of a skilled workforce, an example of which is the National College for Nuclear, which officially opened in February 2018 with two hubs: one in the North West and the other in the South West of England. The college, set up with government and industry funding, operates through a 'virtual college model' aiming to deliver industry specific courses. These training providers and establishments are continuing to adapt to new ways of working through the COVID-19 crisis in order to ensure skills training continues.

5.34. The national skills base is also being enhanced through international collaboration. The UK and France held two Nuclear Skills Seminars in 2018 identifying future opportunities for collaborative working in mutual areas of interest on the capacity and capability of skills for nuclear.

5.35. The NDA has a statutory duty as set out in The Energy Act 2004 (Ref. 31) to take appropriate action to ensure that adequate skills are available for it to carry out its duties. It has a budget allocated annually to develop the skills needed to deliver its objectives through a skills and capability strategy.

5.36. Looking forward, the Government is committed to protect and grow the UK's national nuclear technology capability and skills base, e.g. through the National Nuclear Laboratory (NNL), based in Cumbria. The NNL holds a significant breadth of technology expertise. At the £250 million purpose-built facility, around 600 staff manage a wide range of radioactive and non-radioactive experimental programmes, as well as offering a wide range of analytical services.

Training of regulatory authority - ONR

5.37. Paragraphs 2.20-2.27 provide details of ONR's human resource arrangements. Nuclear Safety Inspectors new to ONR receive a Limited Warrant on entry to ONR and will follow a defined training programme during their first year to achieve Full Warrant status.

5.38. 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 is 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.

5.39. ONR opened the ONR Academy in 2018. Since the launch of the academy, there has been more than a 60% increase in the number of regulatory staff attending core skills training. ONR has also developed and introduced a host of e-learning modules. This replaces some classroom-based courses and making it easier to learn in a convenient location.

5.40. Topics cover both regulatory and non-regulatory subjects, and all modules are available to all staff. Based on IAEA good practice, the Academy project has developed a regulatory competence framework (RCF) identifying what competences an inspector needs, along with an accompanying syllabus to show what training opportunities are linked to the competence.

5.41. ONR also has a refresher training programme to ensure all staff maintain professional competencies. ONR's current policy is that any further training requirements should be discussed between individual inspectors and their managers in consultation with the professional leads. The professional leads have the responsibility for oversight of application of regulatory standards in their particular specialism, for example structural integrity. Such training covers topics such as communication, influencing skills, change management and interpersonal skills, as well as the development of technical competencies. Please also note the ONR's approach to re-warranting inspectors as set out under Article 5.2(d).

5.42. In addition to regulatory and technical training, ONR has agreements in place for staff exchange schemes with other regulatory bodies. These schemes facilitate sharing and capture of best regulatory practices.

Article 8 – Information to the public

Article 8
1. Member States shall ensure that necessary information in relation to the nuclear safety of nuclear installations and its regulation is made available to workers and the general public, with specific consideration to local authorities, population and stakeholders in the vicinity of a nuclear installation. That obligation includes ensuring that the competent regulatory authority and the licence holders, within their fields of responsibility, provide in the framework of their communication policy:

(a) information on normal operating conditions of nuclear installations to workers and the general public; and

6.1. To comply with the Nuclear Safety Directive, the SoS gave a Direction to the ONR in accordance with section 92 of TEA13 on 12 July 2017. That Direction requires the ONR to ensure that licence holders make the information required by Article 8(1) available to the public. Compliance with the Direction is legally enforceable.

Freedom of Information Act 2000 and Environmental Information Regulations 2004

6.2. Responses to requests under the Freedom of Information Act 2000 (FOI) 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 information held by ONR, as 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.

6.3. Information on radiation and emissions fall under the Environmental Information Regulations 2004 (EIRs), which implement the UK's obligations under EU law and under the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. As a public body, ONR must comply with both the FOI and the EIRs. ONR has a dedicated team to handle requests relating to these two pieces of legislation. As a public body, the ONR is also required to issue its own publication scheme, setting out the categories of information it publishes and how the public can access that information.

Openness and transparency of the regulatory body

6.4. For ONR, openness and transparency mean proactively adopting a presumption of disclosure of information on its own activities. ONR established a dedicated project to develop ideas and implement these in order to enhance openness and transparency in all its activities. One of the key outputs of this project was the introduction of a process to publish all ONR's major regulatory decisions. These are now published on ONR's website, with details underpinning each decision.

6.5. ONR has also demonstrated its commitment to openness and transparency during the GDA of the new reactor design, both throughout the process and by publication of the final assessment reports of its findings and regulatory decisions on the UK EPR™. The good practices on openness and transparency identified during the GDA process have been captured and transferred to the rest of ONR's programmes, where appropriate.

6.6. Every three months, ONR produces a report for each licensed site which summarises its regulatory activities associated with the site. As well as being published on ONR's website, the report for a site is forwarded to the members of the local community group for that site and is usually presented at the three-monthly meeting of the group.

6.7. TEA13 requires ONR to produce and publish three key documents:

- a strategy for carrying out its functions;
- an annual plan for carrying out its functions; and
- a report to the SoS on the performance of the ONR's functions.

The latest versions of these documents are available on ONR's website (Ref. 32–34).

6.8. As set out above, ONR must comply with the FOI (Ref. 35) and EIRs (Ref. 36) and is required to issue its own publication scheme, setting out the categories of information it publishes and how the public can access that information.

6.9. ONR also participates in international initiatives from the Organisation for Economic Cooperation and Development Nuclear Energy Agency (OECD-NEA) and WENRA to promote openness and transparency.

Openness and transparency of the licensees

6.10. Licensees adopt a policy of openness and transparency and place importance on assuring the public that they can be trusted to act to the highest professional standards. Under REPPIR19 there are also requirements on the operator to work and co-operate with local authorities to provide information to the public. EDF NGL openness and transparency policy requires site or station directors to write to local stakeholder groups providing updates on safety and operational performance as well as details of specific events reported through the recording processes. EDF NGL also holds local community meetings at all nuclear licensed sites to give updates on developments, with regulators in attendance to present their reports. In addition, monthly newsletters are circulated to the community and local media and also published on the company website for all to see.

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

Article 8
1. (b) prompt information in case of incidents and accidents to workers and the general public and to the competent regulatory authorities of other Member States in the vicinity of a nuclear installation.

Legal Requirements under REPPIR

6.12. REPPIR19 and the supporting Approved Code of Practice (ACOP) are both publicly available, and both were subject to public consultation to shape and finalise the approach taken for emergency preparedness and public information in the civil nuclear sector. REPPIR19 includes provisions which require the notification of a radiation emergency and activation of emergency arrangements without delay, including notifying the public and informing them of any protective actions to take. It also requires local authorities and operators to provide prior information to the public, and to pre-prepare and then provide information to those actually affected in the event of a radiation emergency.

6.13. Regulations 10, 11 and 18 of REPPIR19 provide that employees and emergency workers should be provided with suitable and sufficient information, instruction and training, and the equipment necessary to be able to perform that role and restrict their exposure to radiation. No person can be

required to work with ionising radiation and where an emergency plan is put into effect, no employee can be subject to an emergency exposure unless the employee has agreed to it. REPPIR 19 also places obligations of consultation of employees by the operator when preparing or reviewing its emergency plan.

ONR's communication policy framework

6.14. Public confidence in ONR's regulation of nuclear safety and security is essential and ONR is committed to inspiring a climate of stakeholder respect, trust and confidence. As set out in ONR's 2025 Strategy it is key to public confidence that ONR engage with diverse stakeholders with a wide range of views, learn from others, work openly and transparently, and communicate in accessible ways.

6.15. ONR strives to maintain high standards of openness and transparency through its established and effective mechanisms of communication:

- ONR staff are highly visible at various stakeholder forums across the country and internationally and they routinely engage with local stakeholder groups and local liaison committees at all sites attending local stakeholder groups convened by the licensees - these groups meet routinely and include local authorities, trade unions, interested local groups and members of the public and the media.
- ONR engages routinely with non-governmental organisations (NGOs) and in 2019/20, their NGO engagement programme includes two forum meetings, a webinar programme and regular correspondence to keep NGO groups informed and involved. To enhance engagement and collaboration, the NGO meetings are co-chaired jointly by ONR's CEO and a nominated member of the NGO community. ONR have a policy of disclosing information about its activities and publishes regulatory decisions and judgements, the outcome of site inspections and publishes details of enforcement notices, project assessment reports and intervention records to make our advice decisions open and transparent. These are available through the enforcement pages on ONR's website and other channels, ensuring the information ONR publishes is accessible to the public and its stakeholders. As noted under Article 8.1, ONR must comply with both the FOI and the EIRs.
- ONR consults publicly on the significant elements of its regulatory system. For examples include, ONR consulted on the development of its SAPs and Security Assessment Principles (SyAPs) and formal consultation on the REPPIR ACOP.

6.16. ONR communicates effectively with government at working and leadership levels, through nominated contacts in DWP, BEIS and Ministry of Defence (MoD). For BEIS, this is supported by a 'priorities letter' defining agreed priority projects/activities between ONR and lead policy department for civil nuclear safety and radioactive waste management. A Framework Document is in place to define arrangements between ONR and DWP, as sponsor department, and is supported by Quarterly Accountability Review meetings, attended by ONR's CEO and Finance Director. As necessary, ONR also engage with the Scottish Parliament, and other devolved administrations, and Ireland's Environmental Protection Agency over matters of mutual interest in nuclear safety.

6.17. ONR reports information on incidents to ministers according to ONR-OPEX-GD-001 Revision 6 – ONR Guidance: Notifying and Reposting Incidents and Events to ONR – 2019 - Ministerial Reporting Criteria (Ref. 51). This information is published in quarterly statements of nuclear incidents at nuclear installations. Non-routine matters on site are reported to the public in Quarterly Local Liaison Committee/Site Stakeholder Group Reports and published on the ONR website.

6.18. Openness and transparency on its regulatory independence and objectivity underpin its approach on communications, to help build and maintain public confidence and as detailed in ONR's Corporate Plan 2019/20, (Ref. 52) it will:

- continue to embed and enhance use of digital communication, including videos, webinars and social media, to optimise engagement, sharing and exchange of information;
- proactively embrace opportunities to improve its media profile in a way that builds confidence and trust in its role as a regulator;
- establish an Insight Hub to gather frontline intelligence to support its staff in their stakeholder engagements;
- welcome and respond positively to international peer review findings;
- publish the CNI's Annual Report: 'Safety, security and safeguards performance of Great Britain's Nuclear Industry 2019' – October 2019 (Ref. 53);
- continue to publish its rationale for regulatory decisions; and
- continue to take regulatory decisions independent of government.

> *Article 8*
> *2. Information shall be made available to the public in accordance with relevant legislation and international instruments, provided that this does not jeopardise other overriding interests, such as security, which are recognised in relevant legislation or international instruments.*

6.19. As noted above, ONR is subject to both the FOI Act and EIRs and is required to provide information in accordance with that legislation.

6.20. When making information available to the public, ONR ensures it takes into account security interests. ONR Information Security Policy outlines how it keeps information secure. This is a strategic document with further sub-policies, standards, processes, procedures, instructions, guidelines and references which enforce and support the umbrella Information Security Policy. This applies to all information, including Sensitive Nuclear Information (SNI), and to all ONR staff and third parties employed, directly or indirectly, by ONR. ONR is committed to ensuring that all information is managed and protected throughout its lifecycle in accordance with its classification and the core information security principles.

6.21. ONR understands the information it holds and how it needs to be protected (which security controls should be used). This is recorded in Information Asset Registers, which are owned by Directors and senior leaders (Information Asset Owners).

6.22. Information Security is everyone's responsibility in ONR, established in the Information Governance Framework. (Ref. 54)

6.23. ONR has established a protective security environment that sets appropriate controls and standards to enable all staff to understand, manage and protect information.

6.24. The protective security environment consists of a number of specialist functions from within ONR: People Security; Cyber Security; Procurement; Risk Management; Physical security; Information Management; and Incident Management.

Engagement with Member States

Article 8
3. Member States shall, without prejudice to Article 5(2), ensure that the competent regulatory authority engages, as appropriate, in cooperation activities on the nuclear safety of nuclear installations with competent regulatory authorities of other Member States in the vicinity of a nuclear installation, inter alia, via the exchange and/or sharing of information..

ONR's Engagement with competent regulatory authorities of other Member states

6.25. As set out in ONR's Strategic Framework for International Engagement to 2025 (Ref. 55), as part of its work to enhance nuclear safety, security, safeguards and radioactive transport in the UK and internationally, ONR participates in a number of European and international forums and works closely with overseas regulators. Where this involves sharing technology and information, the UK puts in place bilateral and formal information exchange agreements. The work in this area takes many forms and is aimed at supporting the UK's objective of continuous improvement of its national framework for the regulation of the nuclear industry, and ONR's mission to hold the industry to account on behalf of the public.

6.26. ONR represents the UK at the expert safety standards committees of the IAEA where it uses its regulatory expertise to both develop those standards and benchmark its own arrangements. ONR also supports the UK's invitations to the IRRS missions which examine the UK's adoption and deployment of IAEA standards. ONR is also working with government to ensure that peer review requirements related to European Directives are addressed. ONR strategic objectives are deployed in these forums, and others that ONR identifies as strategically important. These include ENSREG, Heads of the European Radiological protection Competent Authorities (HERCA), the International Nuclear Regulators' Association (INRA) and WENRA.

6.27. Ensuring compliance with international obligations, ONR supports the UK government in meeting the obligations stemming from its signature of various international obligations. These include:

- The Convention on Nuclear Safety;
- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management; and
- The Convention on the Physical Protection of Nuclear Material.

6.28. In addition, ONR has contributed to the negotiation and implementation of European Council Directives which in recent years have included:

- the BSSD;
- the Nuclear Safety Directive;
- the Dangerous Goods Directive; and
- the Directive on the Management of Spent Fuel and Radioactive Waste.

6.29. ONR coordinates and maintains a number of information exchange arrangements (also known as International Bilateral Agreements) which have been developed with other regulators to promote and improve safety standards. Many are mature and significant exchange activities have taken place such as with France (ASN) and USA (USNRC). This has provided significant benefit to ONR. The international scene is changing rapidly with the potential for nuclear power development worldwide and recently exchange arrangements have been agreed with Poland and South Africa.

Table 2: ONR International Bilateral Arrangements

Country	Organisation
Canada	Canadian Nuclear Safety Commission (CNSC)
China	National Nuclear Safety Administration (NNSA)
Finland	Radiation and Nuclear Safety Authority (STUK)
France	Autorité de Sûretée Nucleaire (ASN)
Ireland	Radiation Protection Institute of Ireland (RPII)
Japan	Nuclear Regulation Authority (NRA)
Poland	Panstwowa Agencja Atomistyki (PAA)
South Africa	National Nuclear Regulator (NNR)
Sweden	Swedish Radiation Safety Authority (SSM)
UAE	Federal Authority for Nuclear Regulation (FANR)
USA	United States Nuclear Regulatory Commission (USNRC)

UK Information exchange/sharing mechanisms

6.30. ONR operational guidance[1] states that the UK is a member of three international reporting systems for exchanging information on safety related operating experience from nuclear installations. The objective of these systems is to contribute to improving the safety of civil nuclear installations worldwide by providing timely and detailed information on lessons learnt from events and other experience. The principal systems are:

Table 3: international reporting systems

Name	Description	Scope
IRS	International Reporting System for Operating Experience	Nuclear Power Plants
FINAS	Fuel Information Notification and Analysis System	Fuel Cycle Facilities
IRSRR	Incident Reporting System for Research Reactors	Research Reactors

[1] http://www.onr.org.uk/operational/inspection/onr-opex-gd-003.pdf

Public participation in Decision-making process

Article 8
4. Member States shall ensure that the general public is given the appropriate opportunities to participate effectively in the decision-making process relating to the licensing of nuclear installations, in accordance with relevant legislation and international instruments.

Justification process

6.31. Before a nuclear power station can be built, its design must be assessed to find out if the social, economic, or other benefits outweigh the health detriment of ionising radiation. This assessment process is known as Regulatory Justification and includes public consultation.

6.32. The justification process under the Justification of Practices Involving Ionising Radiations Regulations 2004 (Ref. 56) requires that before any new class or type of practice involving ionising radiation can be introduced in the UK, the government must first assess it to determine whether the individual or societal benefit outweighs the health detriment it may cause. The justification process may include a public consultation and an inquiry or hearing.

6.33. In accordance with EPR16, the public are consulted as part of the environmental permitting process (permits for air and water discharges at a minimum) that relates to the process of licensing a nuclear installation.

6.34. Section 3(2) of NIA65 requires that ONR consults the appropriate environmental authority before granting a nuclear site licence. In addition, ONR must consult the appropriate environmental authority before varying a nuclear site licence if the variation relates to or affects the creation, accumulation or disposal of radioactive waste.

6.35. The UK has implemented Directive 2003/35/EC on public participation in the drawing up of plans and programmes (which implements the Aarhus Convention for the European Union, and Articles 6 and 7 of which relate to environmental matters,) and Directive 2011/92/EU, which codifies environmental impact assessment requirements, via a number of statutory amendments and instruments. For further details on the UK's sitting process see Article 8c.

ONR: Public engagement

6.36. ONR fosters openness and transparency in its regulatory process through:

- Regular attendance at site stakeholder group meetings and local liaison committees which are attended by members of the public.
- Publishing guidance, inspection reports and project assessment reports etc on the ONR website.
- Webinars to inform the public on important topics.

6.37. The public also have the opportunity to participate in decision-making on nuclear licensing more broadly; for example, consultations were held in 2015 on ONR strategies and ONR's responsiveness to innovation.

6.38. ONR is currently developing a programme of work to review its current arrangements for public engagement going forward.

Article 8a: Nuclear safety objective for nuclear installations

> *Article 8a*
> *1. Member States shall ensure that the national nuclear safety framework requires that nuclear installations are designed, sited, constructed, commissioned, operated and decommissioned with the objective of preventing accidents and, should an accident occur, mitigating its consequences and avoiding:*
> *(a) early radioactive releases that would require off-site emergency measures but with insufficient time to implement them;*
> *(b) large radioactive releases that would require protective measures that could not be limited in area or time.*

6.39. Section 67 of the TEA13 sets out ONR's five purposes which guides everything it does. One of these being nuclear safety, which is further defined in Section 68:

"nuclear safety purposes" means the purposes of protecting persons against risks of harm from ionising radiations from GB nuclear sites, including through—

a) the design and construction of relevant nuclear installations and their associated sites,

b) arrangements for the operation and decommissioning of, and other processes connected with, relevant nuclear installations,

c) arrangements for the storage and use of nuclear matter on GB nuclear sites, and

d) arrangements to minimise those risks in the event of an escape or release of such ionising radiations.

6.40. As a result, the requirement to minimise risks from the harm of ionising radiations is central to ONR's purposes and is embedded in the UK's regulatory framework.

Legal requirement to keep risks of radioactive release as low as possible

6.41. The UK's framework is also based on the principle of keeping risks ALARP. This includes preventing accidents and radiation releases. ALARP is a fundamental requirement established under HSWA74. In simple terms it is a requirement for a dutyholder to take all measures to reduce risk where doing so is reasonable (and demonstrate this in its safety documentation). The ALARP principle applies to construction, operation and decommissioning.

6.42. To achieve this underlying regulatory requirement ONR's TAGs set out specific guidance for ONR inspectors on what they should expect of a nuclear licensee in meeting its legal requirement to reduce risks to ALARP.

6.43. Further to this, the UK applies the internationally endorsed principle of defence-in-depth to the design and operation of its nuclear installations and to reducing risks where reasonably practicable; these principles are firmly embedded in ONR's SAPs which have been benchmarked against IAEA Safety Standards.

- ONR expects licensees' safety cases to consider the full scope of operational occurrences, design basis events, low frequency fault sequences beyond the design basis and severe accidents predicted for the UK that could lead to a radiological release.
- In all cases, the requirement is to demonstrate that the plant has been designed to prevent accidents, mitigate any possible release and ensure risks are reduced to ALARP.

6.44. The final layer of defence-in-depth is emergency preparedness and response and the UK continues to develop and test local, regional, and national plans to ensure emergency preparedness is maintained and improved.

- The requirement for emergency planning is covered in the UK as part of ONR's regulatory function for enforcing the Radiation Emergency Preparedness and Public Information Regulations 2001 (REPPIR) (Ref.36).
- BEIS co-ordinates emergency preparedness policy at national level, as the lead government department for the UK.
- The UK has signed a number of international agreements covering exchange of information in the event of a nuclear emergency.
- EDF NGL has enhanced its arrangements to respond to severe accidents through the development and implementation of improved training in respect of the symptom-based emergency response guidelines and severe accident guideline.

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

6.46. Corrective measures to bring back under control any unplanned releases or uncontrolled releases of radioactivity with the potential to travel outside the boundary of the licensed facility, and to mitigate their effect, are dealt with under Article 25 Emergency Preparedness for Radiological Emergencies at UK Nuclear Installations (Ref. 57).

Nuclear safety objective: Construction licence

Article 8a
2. Member States shall ensure that the national framework requires that the objective set out in paragraph 1:

(a) applies to nuclear installations for which a construction licence is granted for the first time after 14 August 2014;

6.47. Since August 2014, ONR have permissioned the following key activities on the Hinkley Point C (HPC) site (unit 1):

- First Nuclear Safety Related Concrete – 6th March 2017;
- Start construction of the pumping station (raft) – 26th July 2018 (derived power); and
- Nuclear Island Concrete – 8th November 2018.

6.48. See Annex 3 for a list of the full range of Licence Instruments (LIs) for HPC.

Article 8a

2. (b) is used as a reference for the timely implementation of reasonably practicable safety improvements to existing nuclear installations, including in the framework of the periodic safety reviews as defined in Article 8c(b).

Implementation of Safety Improvements

6.49. Regulatory expectations regarding fault identification and safety analysis for nuclear safety installations is discussed under Article 6.1 (c), see safety case and safety case analysis.

6.50. UK licensees monitor and assess any natural phenomena that might affect safety (for example something that may change the assumptions concerning external hazards) around each nuclear site. The PSRs required under LC15 and 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.

6.51. In the event of a major accident or occurrence of other extreme events, ONR would carry out a systematic review of the safety implications for UK nuclear sites, such as that carried out following the nuclear accident at Fukushima in 2011. ONR would request that relevant nuclear site licensees review the response of their facilities to a set of extreme situations defined within a scope determined by the nature of the event (and, where applicable, informed by international standards, agreements and specifications). This is in order to evaluate the robustness of the defence-in-depth approach, the adequacy of current accident management measures (including severe accident management strategies) and to identify the potential for safety improvements, both technical and organisational. ONR would assess the adequacy of the nuclear site licensee reviews and may make additional recommendations regarding potential safety improvements. Monitoring of the implementation of safety improvements and the completion of actions related to potential safety improvements would be included within ONR's regulatory intervention strategies.

6.52. ONR would monitor and assess the adequacy of progress made by the UK nuclear industry until satisfied that the significant lessons learned from the event have been adequately discharged. It will, if necessary, use its regulatory powers to ensure that all reasonably practicable improvements are implemented.

6.53. Below are examples of reasonably practicable safety improvements at existing nuclear installations:

- Post Fukushima, 25 Passive Autocatalytic Recombiners (PARs) have been installed in the containment at Sizewell B to mitigate hydrogen generation under accident conditions.
- A number of existing control rods were replaced with super articulated control rods at Hinkley Point B and Hunterston B to ensure that they could be can be inserted if a channel becomes significantly distorted
- Seismically qualified nitrogen injection systems were installed at Hinkley Point B and Hunterston B to enhance secondary holddown capability.
- Post-Fukushima a new flood wall was constructed at Dungeness B to preserve a dry site.
- Boiler modifications are being carried out at Dungeness B to enhance protection in water ingress faults.
- At Sizewell B a major mid-life control and instrumentation system upgrade was carried out using modern technology to ensure the systems can be managed to maintain security and reliability for the next period of station operation
- Sizewell B's battery charging diesel generators have been replaced to improve the seismic and flooding resilience of the site.
- Improvements were made to the Torness cooling systems to improve the resistance of the station to the combined effects of severe marine conditions and debris

- The supply chain for neutron flux detectors was re-established to combat obsolescence issues at all AGR stations.

6.54. Following Fukushima, additional measures have been taken to ensure severe core damage is prevented at EDF NGL's reactor sites. Depots have been established to enhance resilience containing the following Deployable Back Up Equipment (DBUE):

- Off-road vehicles
- Debris moving vehicles (route clearance, for example)
- Personal protective equipment
- Diesel driven electricity generators
- Diesel driven water pumps – for reactor and fuel cooling
- Reverse osmosis equipment to supply clean water
- Damage repair equipment
- Diesel driven dewatering pumps
- Wastewater storage facilities
- Temporary structures for response coordination and staff welfare
- Mobile communications equipment, including deployable instrumentation facilities
- Inert gas supplies
- All necessary ancillary equipment required to use these facilities, including fuel stocks

6.55. Guidance to reactor operators at the AGRs on the management of beyond design basis events is provided in a series of documents called Symptom Based Emergency Response Guidelines (SBERGs). The guidelines are aimed at the prevention of an uncontrolled release and are designed to be rapidly understood during an incident.

6.56. With respect to more severe events, the low power density and high thermal capacity of the AGR design results in long grace times for protective actions. Severe Accident Guidelines (SAGs) highlight the physical phenomena of importance and identify measures to recover critical safety functions in order to avoid contamination of large areas.

Article 8b: Implementation of the nuclear safety objective for nuclear installations

Article 8b
1. In order to achieve the nuclear safety objective set out in Article 8a, Member States shall ensure that the national framework requires that where defence-in-depth applies, it shall be applied to ensure that:
(a) the impact of extreme external natural and unintended man-made hazards is minimised;
(b) abnormal operation and failures are prevented;
(c) abnormal operation is controlled and failures are detected;
(d) accidents within the design basis are controlled;

(e) severe conditions are controlled, including prevention of accidents progression and mitigation of the consequences of severe accidents;

(f) organisational structures according to Article 8d(1) are in place.

Defence-in-depth

6.57. ONR's SAP Engineering Key Principle 3 (Ref 18) states that international consensus is that the appropriate strategy for achieving the overall safety objective is through the application of the concept of defence-in-depth. This should provide a series of independent barriers (inherent features, equipment, and procedures) aimed at preventing faults in the first instance and ensuring appropriate protection or mitigation of accidents in the event that prevention fails.

6.58. Defence-in-depth should prevent faults, or if prevention fails should ensure detection, limit the potential consequences, and stop escalation. The concept of defence in depth should be applied so that:

a) deviations from normal operation and failures of structures, systems and components are prevented;
b) any deviations from normal operation are allowed for by safety margins that enable timely detection and action that prevents escalation;
c) inherent safety features of the facility, failsafe design and safety measures are provided to protect against fault conditions progressing into accidents; and
d) additional measures are provided to mitigate the consequences of accidents, especially severe accidents.

6.59. The SAPs set out the objective of each level of protection and essential means of achieving them. Defence-in-depth is generally applied in five levels, which should be, as far as practicable, independent from one another. The methodology should ensure that if one level fails, it will be compensated for, or corrected by, the subsequent level. The aims for each level are described in detail in IAEA Safety Requirements SSR2/1 (Ref. 38) on which Table 4 is based. It should be noted that Table 4 deals with the application of defence in depth in the design of a facility.

Table 4 – Defence-in-depth levels defined in ONR's SAPs

Level	**Objective**	**Defence/Barrier**
Level 1	Prevention of abnormal operation and failures by design.	Conservative design, construction, maintenance and operation in accordance with appropriate safety margins, engineering practices and quality levels.
Level 2	Prevention and control of abnormal operation and detection of failures.	Control, indication, alarm systems or other systems and operating procedures to prevent or minimise damage from failures.
Level 3	Control of faults within the design basis to protect against escalation to an accident.	Engineered safety features, multiple barriers and accident or fault control procedures.
Level 4	Control of severe plant conditions in which the design basis may be exceeded, including protecting against further fault escalation and mitigation of the consequences of severe accidents.	Additional measures and procedures to protect against or mitigate fault progression and for accident management.
Level 5	Mitigation of radiological consequences of significant releases of radioactive material.	Emergency control and on and offsite emergency response.

6.60. Safety cases for UK NPPs need to demonstrate how the defence-in-depth principle has been applied. Even if a safety measure is not formally claimed in DBA (i.e. not part of Level 3), the law requires operators and designers to do everything that is reasonably practicable to ensure that risks are reduced to ALARP to maximise the effectiveness and reliability of Level 1 and Level 2 measures. PSA is one tool used in safety case to show the contribution of these measures to safety and to inform design, modification, and maintenance decisions on the measures.

6.61. Relevant good practice for design basis measures (Level 3) as established in the SAPs is consistent with international guidance (IAEA Specific Safety Requirements SSR-2/1 or INSAG. For example:

a) Challenges to structures, systems and components delivering a safety function should be addressed by incorporation of redundancy, diversity and segregation (SAP EDR.2), including consideration of common cause failures (SAP EDR.3).
b) No single random failure, assumed to occur anywhere within the systems provided to secure a safety function, should prevent the performance of that safety function (the single failure criterion, SAP EDR.4).
c) 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 codes and standards (SAP ECS.3).

6.62. In some cases, relevant good practice established in the SAPs exceeds international guidance, for example, it is expected that all NPPs, whether operating or new, have two diverse means of delivering key nuclear safety functions for all frequent design basis faults (defined by ONR to have an initiating frequency > 1 x 10-3 per year). Both of these means need to be formally identified, claimed and substantiated in the safety case, and then maintained and tested appropriately for a Level 3 measure.

6.63. The requirement physically to contain radioactive material within a nuclear facility is well established. Fault sequence analysis (SAP FA.7) should be used to demonstrate, so far as is reasonably practicable, that the correct performance of the claimed passive and active safety systems ensures that:

- none of the physical barriers to prevent the escape or relocation of a significant quantity of radioactive material is breached or, if any are, then at least one barrier remains intact and without a threat to its integrity;
- there is no release of radioactivity; and
- no person receives a significant dose of radiation.

6.64. ONR's SAP AM.1 on accident management and emergency preparedness was substantially revised in response to the Fukushima accident. Licensed nuclear sites in the UK all need to comply with the requirements of LC11 to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and their subsequent effects. This includes emergency control to mitigate the radiological consequences on and off-site (Level 5) if other design features have failed or been ineffective. A new operator needs to demonstrate it is developing appropriate arrangements before a site licence is granted.

Application of defence-in-depth

6.65. Defence-in-depth is recognised as an appropriate strategy throughout the UK nuclear industry to achieve safety objectives. By way of illustration of this, current operating reactors incorporate defence-in-depth measures to protect against a wide range of fault conditions, whether initiated by external natural and man-made hazards, internal hazards, other internal events, or consequential combinations of these.

6.66. The AGRs employ CO2 gas to take away heat from the fuel elements in the reactor core. With regards to defence-in-depth, the key features of the AGR design include:

- **Reactor shutdown**: provided by the control rod primary shutdown system, diverse systems using nitrogen injection or tertiary systems using boron or water (details vary depending on station).
- **Post-trip cooling:** if the gas circulators fail, the fuel can be cooled by natural circulation providing feed water can be supplied to one of the boilers. All AGRs have at least two diverse and redundant post-trip feed water systems.

6.67. AGRs do not have a containment building around the pressure vessel. None of the design basis loss of coolant accidents for AGRs result in large scale fuel failure and the plant is designed to be capable of retaining the bulk of any radioactive material that might be released from the fuel. The AGRs massive concrete pressure vessel together with the large mass of graphite in the core provide hours of heat sink in case of total loss of post-trip cooling.

6.68. The UK also operates a single Westinghouse-designed four-loop PWR, located at Sizewell B. This plant also incorporates defence-in-depth measures:

- Reactivity control is achieved by the rod cluster control assemblies, which in the event of a trip fall under gravity into the core. The emergency boration system provides a diverse means of achieving reactor shutdown.
- For intact primary circuit faults, post-trip cooling can be provided by main feed water systems, backed up by the diverse auxiliary system powered by emergency diesel generators and a turbine-driven system. For loss of coolant accident faults, the emergency core cooling system provides decay heat removal by way of high and low head safety injection pumps and pressurised accumulators. The heat sink for the post-trip cooling systems is provided by the seawater-cooled essential service water system or the air-cooled reserve ultimate heat sink, powered by the diesel generators.
- The containment building limits the release of radioactivity should a beyond design basis fault occur. Heat is removed and pressure reduced by fan coolers and reactor building spray systems.

6.69. ONR's SAPs provide numerical targets to judge whether radiological hazards are being adequately controlled and risks reduced to ALARP. The targets quantify ONR's risk policy. More specifically, the targets are guides to inspectors to indicate where additional safety measures may need to be considered and, in the case of permissioning decisions, to help judge whether risks are tolerable. In assessing the safety of nuclear facilities, inspectors examine the safety case to judge the extent to which the targets are achieved. Some of the targets are in the form of dose levels; others are expressed as frequencies or risks. Each is set in terms of a basic safety level and a basic safety objective. It is ONR's policy that a new facility or activity should at least meet the basic safety levels, however, even if the levels are met, the risks may not be ALARP. In such cases, the designer / dutyholder must reduce the risks further. Basic safety objectives form benchmarks that reflect modern standards and expectations and mark the start of the broadly acceptable levels. Separate targets are defined for normal operations, design basis fault sequences, individual risks, accident frequencies and societal risk.

Consideration of fault and accident conditions

6.70. Nuclear facilities in the UK require safety cases which assess the risks from both normal operation and from fault and accident conditions. Fault analysis is required comprising of suitable and sufficient DBA, PSA and SAA to demonstrate that the risks are ALARP. It is ONR's expectation that these three complementary techniques are applied to nuclear facilities to demonstrate the adequacy of the design and activities being undertaken, whether this is for an existing facility or a new design.

6.71. DBA should be carried out to provide a robust demonstration of the fault tolerance of the engineering design and the effectiveness of the safety measures. Relevant good practice in the UK is that the design basis should include internal faults in the facility that have an initiating frequency down to 1 x 10-5 per year and natural hazards that conservatively have a predicted frequency of down to 1 x 10-4 per year.

6.72. ONR has not chosen to prescribe terminology such as 'design extension conditions'. However, through the rigorous application of DBA, PSA and SAA techniques, it is ONR's expectation that a modern safety case will consider the full scope of operational occurrences, design basis events, low frequency fault sequences beyond the design basis and severe accident damage states. In all cases, the requirement is to demonstrate that risks have been reduced to ALARP.

6.73. The NPP operators and reactor designers proposing new plants provide comprehensive PSA evaluations of their facilities/designs, consistent with ONR's expectations. PSA should assist the designers in achieving a balanced and optimised design. PSA should enable a judgement to be made of the acceptability, or otherwise, of the overall risks against numerical targets and should help to demonstrate that the risks are, and remain, ALARP.

6.74. The 2014 SAPs do not vary significantly with regard to their requirements to the application of beyond design basis / SAA from the earlier revision. However, for the first time, an expectation was set that SAA should form part of a demonstration that potential severe accident states should be 'practically eliminated'.

Consideration of external and internal hazards

6.75. To demonstrate ALARP, ONR will assess the site's safety case against its SAPs which requires the identification of potential internal hazards and that hazard effects be considered in safety assessments. Internal hazards are defined as hazards which originate within the site boundary, and where the licensee has control over the initiating event in some form. Internal hazards include internal flooding, fire, toxic gas release, collapses, dropped loads, impacts from vehicular transport and explosion/missiles. It is recognised that internal hazards may originate from plant failures, mal-operation of the plant, or from other hazards, including external hazards (as discussed earlier).

6.76. Detailed knowledge of the plant and site layout is required for internal hazards assessment. Hazard identification and impact assessment involve a facility and site review together with event tree analysis. Multi-facility sites would require appropriate interface arrangements to deal with the potential subsequent effects of internal hazards.

6.77. The SAPs require that the risk from internal hazards be minimised by attention to plant layout, by adopting good engineering standards and design, keeping inventories of hazardous (for example, combustible and toxic) materials to a minimum, and thereafter through good safety management practices.

6.78. In addition, the safety assessments must demonstrate that threats from external hazards are removed, minimised or mitigated. For each type of external hazard identified as applicable to a particular site, a design basis event is defined. Regarding the severity of the design basis event for natural hazards, a frequency of 1x10-4 per year (conservatively defined) is considered reasonable in the UK (SAP EHA.4). However, due attention should be paid to providing adequate capacity for events beyond the design basis, and 'cliff edge' effects should be avoided as far as practicable.

6.79. There are some special features of external hazards that set them apart from internal hazards or internal plant faults and require special consideration. Most external hazards, especially natural hazards, are significant common cause fault initiators, meaning that several (for example, seismically initiated) faults may be initiated at the same time by the same event. This can place additional burdens on post-event operator recovery actions and emergency arrangements response.

6.80. Natural hazards, for example, earthquake, extreme weather, external flood, etc. are characterised by hazard curves describing a range of frequency/hazard severity possibilities. The design bases defined conservatively at 1 x 10-4 per year are therefore only a partial description of the hazard – essentially a surrogate description solely for the purposes of feeding into the design process.

6.81. For extreme weather and flood hazards, it is usual for several hazards to affect the plant simultaneously for example, storm weather creates an environment for high wind and high rates of

precipitation at the same time. In the case of seismic events there may be possible consequential effects, for example, tsunami. ONR inspectors look for licensees to have accounted for credible combinations of external hazards in their safety analyses (SAP EHA.6).

6.82. It is also the case that external hazards may cause internal faults (for example, plant failures) or internal hazards (for example, seismic and consequential fire, seismic and consequential internal flooding). ONR inspectors recognise that these combinations may challenge multiple safety functions and locations simultaneously. The hazards identification and characterisations process (SAP EHA.1) should include reasonably foreseeable combinations of hazards and consequential events.

Nuclear Safety Culture

Article 8b
Implementation of the nuclear safety objective for nuclear installations

2. In order to achieve the nuclear safety objective set out in Article 8a, Member States shall ensure that the national framework requires that the competent regulatory authority and the licence holder take measures to promote and enhance an effective nuclear safety culture. Those measures include in particular:

(a) management systems which give due priority to nuclear safety and promote, at all levels of staff and management, the ability to question the effective delivery of relevant safety principles and practices, and to report in a timely manner on safety issues, in accordance with Article 6(d);

6.83. The UK national regulatory framework requires the regulator and licence holder to promote and enhance an effective nuclear safety culture, including the specific items mentioned in Article 8b.2 (a) to (d), through the following provisions:

- TEA13, which establishes the ONR as the competent regulatory authority for nuclear safety.
- The Nuclear Site Licence Conditions, specifically:
  - LC7 (Incidents on the site);
  - LC10 (Training);
  - LC 12 (Duly authorised and other suitably qualified and experienced persons);
  - LC13 (Nuclear Safety Committee); and
  - LC17 (Management systems).
- The SAPs, which contain ONR's expectations on leadership and management for safety, including safety culture (principles MS.1 to MS.4)
- The TAGs which support ONR inspectors in making regulatory judgements and decisions against the SAPs and Licence Conditions. These include for example:
  - NS-TAST-GD-072, Function and content of the safety management prospectus (includes safety culture);
  - NS-INSP-GD-017, Management Systems; and
  - NS-INSP-GD-070, Safety Culture Guide for Inspectors.
- Other published guidance, e.g.:
  - ONR-OPEX-GD-001, Notifying and reporting incidents and events to ONR.

6.84. Practical examples of how the provisions of this article are implemented include:

- ONR:
  - ONR arrangements for initial training of inspectors, warranting and periodic re-warranting.
  - ONR guide to enabling regulation in practice (includes principles and examples of the type of relationship ONR cultivates with licensees and the influence this has on safety).

    - ONR Management System Manual (Ref. 58).
- Licensees:
    - UK nuclear industry guidance, e.g. the Safety Director's Forum guidance for the periodic review of leadership and management for safety (including safety culture) (Ref. 59).
    - Individual licensee management arrangements for compliance with the nuclear site licence conditions, including implementation and assurance thereof.

6.85. LC17 requires licensees to establish and implement management systems which give due priority to safety.

6.86. ONR's SAPs (principle MS.1 - leadership) expects directors, managers, and leaders at all levels in the licensee to:

a) provide direction, governance, and oversight to establish and foster a positive safety culture that underpins safe operation; and
b) monitor and regularly review safety performance and culture. Expectations of a questioning attitude by all staff and contractors is part of principle MS.3 (decision-making).

6.87. LC7 requires the licensee to make and implement adequate arrangements for the notification, recording, investigation and reporting of incidents occurring on the site. The guidance supporting Licence Condition 7 (NS-INSP-GD-007) includes expectations for timely reporting of events, including notification to ONR in accordance with the timescales specified in ONR-OPEX-GD-001.

Arrangements for documenting and sharing operating experience

> *Article 8b*
> *2. (b) arrangements by the licence holder to register, evaluate and document internal and external safety significant operating experience;*

6.88. Recognising that effective organisational learning is an important element of a strong nuclear safety culture, ONR's SAPs set out specific regulatory expectations for nuclear licenses' operating experience feedback programmes. One of the SAPs (MS4) requires that organisations have effective and systematic processes for: seeking out; analysing; and acting upon lessons from a wide range of sources within the licensee's organisation. Information should also be actively sought from external sources, including those from beyond the nuclear sector to identify learning and improvement opportunities. Identified lessons should be embedded through a structured system for implementing corrective actions in a timely manner.

6.89. Under LC 6, the licensee is required to make adequate records to demonstrate compliance with all licence conditions (including the safety case). The licensee must make adequate arrangements for keeping records of documents which relate to the licence requirements – these arrangements are also subject to ONR approval. In addition, ONR may request the licensee to provide copies of any document which ONR may require and information needed for carrying out its functions under section 97 of TEA13.

6.90. In addition, LC23 requires licence holders to produce an adequate safety case for any operation that may affect safety. The safety case demonstrates the safety of the operation and identifies the conditions and limits necessary in the interests of safety (the ORs). The TIG for LC23 states that "The licensee's arrangements should ensure that records demonstrating compliance with Operating Rules are made and stored. These records should be evaluated and then retained in accordance with the licensee's LC6 arrangements. The evaluation process should be used to provide further assurance, in addition to that from the time of the operations, that the Operating Rules were indeed complied with. The evaluation process should be undertaken by persons independent of those who were responsible for the original records. The evaluation process should also include regular periodic reviews to ensure that the Operating Rules remain pertinent in the light of operating

experience (at this facility and elsewhere), modifications to the facility and any relevant wider developments in science or technology, and then changed as necessary".

6.91.LC14 is also relevant. It requires licence holders to 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. The TIG for LC14 makes it clear, at paragraph 6.9, that "there should be links between the safety case process and the licensee's operating experience and learning process(es), to ensure that relevant information on events and near misses is fed back into safety cases (extant and under development). This provides a reality check for safety cases (testing assumptions, claims and supporting analyses etc.)".

6.92.LC14 is also relevant. It requires licence holders to 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. The TIG for LC14 makes it clear, at paragraph 6.9, that "there should be links between the safety case process and the licensee's operating experience and learning process(es), to ensure that relevant information on events and near misses is fed back into safety cases (extant and under development). This provides a reality check for safety cases (testing assumptions, claims and supporting analyses etc.)"

6.93.LC7, which relates to safety cases also applies here. The TIG for LC7 highlights, at paragraphs 4.2, A2.1, S2.8, A4.1, A5.8, and A5.9, the need to record external safety significant operating experience.

Reporting of events by licence holder

> *Article 8b*
> *2. (c) the obligation of the licence holder to report events with a potential impact on nuclear safety to the competent regulatory authority; and,*

6.94.In the UK, licensees are required to notify incidents with potential to impact safety to ONR in accordance with conditions made under NIA65 (principally LC7) , and regulations including the Nuclear Industries (Dangerous Occurrences) Regulations 1965, and the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG).

6.95.ONR has published guidance, setting out the criteria for notification of incidents covering all of its purposes including civil nuclear security, safeguards and transport in addition to nuclear safety.

6.96.ONR maintains an electronic reporting system mechanism to enable industry to report relevant incidents promptly and efficiently. Each incident submitted is evaluated by an inspector who identifies a proportionate regulatory response taking account the safety or security significance.

6.97.Each of ONR's Divisions and Specialisms have an appointed Regulatory Intelligence Lead inspector, who screens incidents related to the division's or specialism's work and distributes the relevant information for internal discussion, analysis and follow-up as appropriate. The output of this work is used to:

- Inform intervention strategies
- Search for, and identify, common themes in industry performance.
- Improve our regulatory practices.

Article 8b
2. (d) arrangements for education and training, in accordance with Article 7.

6.98. Information provided under Article 7 gives extensive information on training and education for both the staff of the regulatory authority and the licence holder. Please refer to that section of the report to avoid duplication of information here.

Article 8c: Initial assessment and periodic safety reviews

Article 8c
Member States shall ensure that the national framework requires that:
(a) any grant of a licence to construct a nuclear installation or operate a nuclear installation, is based upon an appropriate site and installation-specific assessment, comprising a nuclear safety demonstration with respect to the national nuclear safety requirements based on the objective set in Article 8a;

Siting Process

6.99. The siting of new nuclear power stations in the UK is governed by several distinct frameworks, particularly the nuclear site licensing regime, the environmental permitting regime and the wider planning process set out in the Planning Act 2008.

Nuclear site licensing

6.100. As described under Article 4.1, NIA65 sets out that no site can be used for the purpose of installing or operating a nuclear installation unless a nuclear site licence is currently in force. Each nuclear site license is unique to its site. The factors that are considered in assessing sites cover three main aspects:

a) 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;
b) external hazards that might preclude the use of the site for its intended purpose; and
c) the suitability of the site for the engineering and infrastructure requirements of the facility.

6.101. Factors relating to the radiological risk to people, external hazards and engineering and infrastructure requirements are considered within the licensee's safety case. The safety case is required to demonstrate that the risks presented to persons both on and off the site are both below the risk targets specified within the ONR SAPs (Ref. 18) and as low as reasonably practicable.

6.102. To support the request for a site licence for a new site, the prospective licensee must provide a safety submission to justify, amongst other things, the suitability of the site for the nuclear installation. ONR assesses this as part of the process to determine whether to grant the site licence. As with all safety case assessments ONR uses its SAPs for nuclear facilities (Ref. 24) and associated TAGs (Ref. 25) as a framework for assessing the adequacy of the licensee's application.

6.103. The IAEA safety requirements for siting, set out in 'Site Evaluation for Nuclear Installations' (NS-R-3 Rev 1) (Ref. 39) and a wide range of supporting guidance specific to NPPs are addressed within the regulatory assessment of siting and the subsequent assessment of licensees' safety case submissions.

6.104. SAP ST.1 requires ONR to provide development control planning advice that is aligned with the government siting policy. SAPs ST.3 – ST.6 set out principles relating to how the physical location of a facility can affect its safety, including local physical aspects, site suitability, effect on other hazardous installations, and interactions between facilities on multi-facility sites.

6.105. When siting the UK's existing nuclear installations, account was taken at the time of natural and man-made hazards in the area in line with relevant good practice at the time of siting. Many external hazards, particularly earthquake, were not considered at all, or considered in a way that would not meet modern standards today. The PSR process has been used extensively to capture such shortfalls on existing nuclear sites and identify practicable enhancements implemented subsequently as modifications under LC 22.

6.106. The siting of future installations will consider external hazards and relevant good practice current at that time.

Environmental Permitting regime

6.107. The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR99) (Ref. 60) require the submission of an environmental impact assessment (EIA) for new nuclear power stations, during the application for development consent. The EIA must include (among other things):

a) an estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed development.
b) A description of the relevant aspects of the current state of the environment
c) a description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.
d) a description of the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development
e) a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.

6.108. The EIA is subject to public consultation, and consultees may make representations regarding application.

The UK planning regime

6.109. Nuclear power stations in the UK are Nationally Significant Infrastructure Projects (NSIP) as defined in the Planning Act 2008. A proposed new nuclear power station project would therefore have to make an application for the necessary development consent to the SoS. The Planning Inspectorate (PINS) is responsible for considering whether the application should be accepted for examination and, if accepted, carrying out the examination of the application on behalf of the Secretary of State. When an application is made, it would be published on the relevant project page of the PINS National Infrastructure Planning portal and there would be an opportunity for anyone who wishes to make representations about the application to do so. Once PINS examination of the application is complete, it would then submit a report on the project with findings and recommendations to the SoS who would decide whether or not to grant development consent for the project.

6.110. Under the Planning Act 2008 (the "Planning Act"), a National Policy Statement (NPS) can set out the basis for determining development consent applications for specific nationally significant infrastructure projects. In 2011 the Government published an overarching NPS for Energy (EN-1) (Ref. 61), in conjunction with five technology-specific NPSs including one on Nuclear Power (EN-6) (Ref. 62). EN-6, taken together with EN-1, provides a framework for decisions on development consent applications for new nuclear power stations at sites which are capable of deployment by the end of 2025.

6.111. The Town and Country Planning Act regime requires planners to seek and consider views from ONR, HSE and MoD where they have a role, function, interest, or responsibility relevant to the planning application, as part of the planning application process. It is for ONR, HSE or MoD to consider whether they wish to provide a view or make any representations for their planning decision or recommendation. In practice, this means that where a planning application for a substantive development or proposal is made which falls within an emergency planning zone under REPPIR 2019, then ONR or HSE as the regulator for the site, or MoD where it is a licensed and authorised Defence site, must be consulted by the planners. Being within an emergency planning zone is not a blocker to proposed developments in and of itself; emergency planning zones exist to ensure that appropriate public protection arrangements are in place for any population that fall within them. The decision on proposed developments is ultimately one for local planners. Any approval for a substantive development may therefore prompt a review and update of onsite and offsite emergency plans to ensure they remain appropriate.

Design and construction

6.112. The UK applies the internationally endorsed principle of defence-in-depth to the design and operation of its nuclear installations and to reducing risks where reasonably practicable; these principles are firmly embedded in ONR's SAPs, which have been benchmarked against IAEA Safety Standards. An overview of the UK's arrangements and regulatory requirements relating to the design and construction of NPPs is presented below.

6.113. ONR's inspectors use SAPs (Ref.24), together with supporting TAGs (Ref.25), to guide their regulatory judgements and recommendations when undertaking technical assessments of existing nuclear site licensee's safety submissions and also new reactor designs considered through the GDA process.

6.114. ONR and the EA have developed a GDA process for new reactor designs. Under the GDA process, ONR assesses the safety case for the generic design of a specific type and make of reactor. The GDA process may be applied where ONR is asked to assess a new reactor's safety case in advance of an application for a nuclear site licence being made. GDA is non site-specific but can give a prospective new build operator a clear indication of whether the design would in principle meet regulatory requirements in the event that a licence application was made for the installation of a nuclear power station based on that design.

6.115. If ONR is content with the safety case and security aspects of the generic design, it will provide the prospective new build operator with a design acceptance confirmation (DAC). The provision by ONR of a DAC for a design will mean it is confident that, based on the submitted information on safety and security, the generic design is capable of being built and operated in the UK, on a site bounded by the generic site envelope in a way that is safe and secure. GDA does not replace the licensing process but will make a significant contribution to ONR's assessment of the licence applicant's safety case. As the latter involves consideration of wider issues, a DAC does not guarantee that a site licence will subsequently be granted. If a GDA has been completed, ONR will also consider:

- site-specific aspects not covered by the GDA; and
- other changes to the design or safety documentation since GDA.

Initial assessment

6.116. ONR's standard site licence conditions require the licensee to put in place arrangements to ensure that an adequate safety case is produced and maintained before construction and throughout the life of a nuclear installation. The conditions require verification that the installation is operated and maintained within the limits and conditions of the safety case.

6.117. In particular, the licence conditions most relevant to safety assessment and/or safety verification are:

- LC14 (Safety documentation)
- LC15 (Periodic review)
- LC16 (Site plans, designs and specifications)
- LC19 (Construction or installation of new plant)
- LC20 (Modification to design of plant under construction)
- LC21 (Commissioning)
- LC22 (Modification or experiment on existing plant)
- LC23 (Operating rules)
- LC24 (Operating instructions)
- LC27 (Safety mechanisms, devices and circuits)
- LC28 (Examination, inspection, maintenance and testing)
- LC29 (Duty to carry out tests, inspections and examinations)
- LC30 (Periodic shutdown)

6.118. In addition, LC10, LC12, LC26 and LC36 deal with competency, capability and control and supervision of personnel who are involved in safety assessment and/or safety verification. See Article 6.1c for further details of safety cases.

6.119. During the operational and decommissioning phases, the NPP safety case is updated as necessary to reflect changes to plant or procedures and respond to challenges arising from operational experience, new safety analysis techniques, research findings and the outcome of PSRs.

6.120. The licensee must also have arrangements for compliance with relevant statutory provisions of the HSWA74 (Ref. 40). Examples include the MHSWR (Ref. 41) (which require the licensees to make assessments of the health and safety risks of their activities) and the IRR17 (which provide for the protection of all workers and members of the public from ionising radiations) (Ref. 42), as well as other appropriate legislation (see Article 4 for further details).

Article 8c Periodic Safety Reviews

> *Article 8c*
> *Member States shall ensure that the national framework requires that:*
> *(b) the licence holder under the regulatory control of the competent regulatory authority, re-assesses systematically and regularly, at least every 10 years, the safety of the nuclear installation as laid down in Article 6(c). That safety reassessment aims at ensuring compliance with the current design basis and identifies further safety improvements by taking into account ageing issues, operational experience, most recent research results and developments in international standards, using as a reference the objective set in Article 8a.*

6.121. The legal basis for PSRs in the UK is embodied in the conditions that are attached to the nuclear site licence. LC15 requires licensees to "make and implement adequate arrangements for the periodic and systematic review and reassessment of safety cases." PSR is therefore a well-established practice in the UK. ONR's TAG (Ref. 26) sets out what ONR expects to see in the PSR.

6.122. 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. At all times, the safety case must remain valid and must therefore be updated and revalidated as appropriate. Complementary to this ongoing process, the PSR process is designed to ensure that a thorough and comprehensive review of the totality of the safety case is made at regular intervals throughout the power plant's life.

6.123. A key objective of a PSR is to compare against current standards for new plant, identify and evaluate gaps, and implement reasonably practicable improvements. Therefore, the review addresses relevant advances in safety standards, practices and scientific and engineering knowledge. Any significant shortcomings should be identified and any improvements which are reasonably practicable should be introduced, taking the expected future life of the plant into account.

6.124. Another essential element of the review is for all systems, structures and components susceptible to ageing or degradation to be reviewed, and failure mechanisms, together with any life-limiting features, identified. These various factors then have to be evaluated, particularly for aspects that may eventually result in unacceptably reduced levels of safety, and ultimately dictate the safe working life of the nuclear installation.

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

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

6.127. In addition to PSRs, major safety reviews are undertaken every one-and-a-half, two or three years to coincide with reactor periodic shutdowns, carried out in accordance with LC30 for the purpose of enabling examination, inspection maintenance and testing (LC28). The review findings are used to update the nuclear power plant safety case and provide a justification for a further period of operation (until the next periodic shutdown). The focus is on plant inspection results and any modifications

completed during the outage, to demonstrate that adequate safety margins will continue to exist throughout the subsequent operating period.

6.128. The periodic reviews of safety conducted for the NPPs in the UK meet the second principle of the Vienna Declaration, which requires that comprehensive and systematic safety assessments be carried out periodically and regularly for existing installations throughout their lifetime. This is in order to identify - and implement in a timely manner - safety improvements to prevent accidents with radiological consequences and mitigate such consequences should they occur.

6.129. The results of the PSRs have produced, and continue to produce, worthwhile improvements to safety. A number of projects arising from previous periodic reviews, or from event-driven reviews have delivered improvements in nuclear safety at EDF NGL power stations. Examples include:

- A series of fire-related improvements in the gas circulator and boiler houses at Dungeness B. These include:
    - additional fire barriers to prevent potential oil spray fires affecting sensitive plant;
    - reduction in potential ignition sources;
    - changes to oil systems to reduce the amount of oil available in potential fires; and
    - re-engineering and re-optimisation of water deluge systems including modifications to introduce a film forming agent to water sprayed onto a horizontal surface.
- Completion of a work programme to provide an enhanced nitrogen secondary hold-down system for Hinkley Point B and Hunterston B arising from commitments in the second round of decennial PSRs (PSR2).
- A project is underway to renew, replace and reposition the CO2 storage tanks and distribution system at Hunterston B, initiated from a company review of the hazards from missiles in the event of tank failure.
- Completion of a programme of work of fire improvements instituted after the second PSR for Hinkley Point B and Hunterston B against a potential oil spray fire in the gas circulator house, covering improvements in prevention, protection and mitigation. The work includes reducing potential ignition sources, intercepting oil sprays by flange guarding, protecting sensitive areas of the plant such as penetrations, and a new foam fire system as a defence-in-depth mitigation against oil fires outside bunded areas.
- On a number of AGR stations, increased awareness of the potential for steam leaks either from weld failures or from corrosion mechanisms has led to improvements in plant surveillance procedures to detect early failures before these grow to pipe failures.
    - The UK's most recent periodic safety review was at Heysham 2 and Torness power stations at the end of 2019. The ONR report assessing EDF NGL's Heysham 2 / Torness periodic safety review can be found on ONR's website (Ref. 42).

Article 8d: On-site emergency preparedness and response

Article 8d
1. Without prejudice to the provisions of the Directive 2013/59/Euratom, Member States shall ensure that the national framework requires that an organisational structure for <u>on-site emergency preparedness and response</u> is established with a clear allocation of responsibilities and coordination between the licence holder, and competent authorities and organisations, taking into account all phases of an emergency.

Civil Contingencies Act 2004

7.1.The Civil Contingencies Act 2004 (CCA), and accompanying non-legislative measures, deliver a single framework for civil protection in the UK. The CCA arrangements provide the underpinning approach to all emergency response activity in the UK, which is then enhanced with further specific arrangements, including regulation, for some emergency types (including civil nuclear).

7.2.The CCA establishes a clear set of roles and responsibilities for those involved in emergency preparation and response at the local level. It identifies "Category 1 responders", who must assess the risk of an emergency occurring and maintain plans for dealing with that emergency. They include the GB environmental regulators, local authorities and the emergency services.

7.3.Emergency planning is at the heart of the civil protection duty on Category 1 responders under the CCA. The Act requires Category 1 responders to maintain plans for preventing emergencies, reducing, controlling, or mitigating the effects of emergencies, and taking other action in the event of emergencies. Requirements also include:

- training key staff;
- exercising the plan to ensure it is effective; and
- reviewing the plan periodically and keeping it up to date.

Plans should draw on risk assessments and should have arrangements to warn, inform and advise the public at the time of an emergency.

On-site emergency arrangements

REPPIR19

7.4.REPPIR19 sets out the emergency preparedness and response requirements for operators and other dutyholders in GB. It covers the requirements of Article 8d. 1 for the urgent response and response phases of an emergency as set out above under Article 6(1)(e).

7.5. All UK civil nuclear sites are also licenced by ONR under NIA65. The provisions of NIA65 enable ONR to set requirements on licensees through licence conditions. In particular, LC11 requires the licensee to make and implement adequate arrangements for dealing with any accident or emergency arising on the site and its effects.

7.6.The operator is required to provide ONR with details of the onsite emergency plan where requested. ONR may then scrutinise it and has a broad range of regulatory powers to ensure the onsite emergency plan meets requirements. REPPIR19 sets out what information must be in the plan, including:

- The arrangements to set emergency procedures in motion;
- The arrangements to co-ordinate the on-site mitigatory action;
- For conditions or events which could be significant in bringing about a radiation emergency, a description of the action which should be taken to control the conditions or events and to limit their consequences, including a description of the safety equipment and resources available;
- The arrangements for limiting the risks to persons on the premises including how warnings are to be given and the protective action persons are expected to take on receipt of a warning;
- The arrangements for providing early warning of the incident to the responder or responders identified in the local authority's off-site emergency plan to set the off-site emergency planning in motion, the type of information which should be contained in an initial warning and the arrangements for the provision of more detailed information as it becomes available; and
- The arrangements to prioritise keeping doses within the reference levels; and what protective action is proposed to be taken, and how far each such action extends within any detailed

emergency planning zone. REPPIR19 requires licensees to co-operate with local authorities in the production and implementation of off-site emergency arrangements.

7.7. In addition, ONR obtains a view of all the licensee's arrangements through the use of on-site emergency planning and response capability maps. These maps assess both the security and safety aspects of each site's emergency response, identify any improvements that may be required, and provide a transparent, proportionate, and consistent regulatory approach across the UK nuclear industry.

7.8. The emergency arrangements for all nuclear installations are subject to inspection, and revision as appropriate. ONR observes the demonstration of the emergency plan at every reactor site on an annual basis.

Consistency of On-site emergency preparedness and response arrangements

> *Article 8d*
> *2. Member States shall ensure that there is consistency and continuity between the on-site emergency preparedness and response arrangements required by the national framework and other emergency preparedness and response arrangements required under Directive 2013/59/Euratom*

7.9. REPPIR19 and the Carriage of Dangerous Goods (Amendment) Regulations 2019 were made to transpose the emergency preparedness and response requirements within Directive 2013/59/Euratom for civil nuclear and radiological sector sites, and for nuclear or radiological emergencies that occur during civil transport by road, rail and inland waterway.

7.10. UK Officials have also attended international events hosted by the European Commission to share learning, provide feedback to the Commission and present on the approach taken by the UK. For example, the Workshop on Emergency Preparedness and Response: Requirements and practical implementation held in Luxembourg in December 2018.

7.11. The UK has completed the transposition of the emergency preparedness and response parts of Directive 2013/59/Euratom (Ref. 63) and provided the required transposition materials to the Commission. A publicly available copy of our transposition note can be found alongside REPPIR 19, which also covers the Carriage of Dangerous Goods (Amendment) Regulations 2019.

Article 8e: Peer reviews

> *Article 8e*
> *1. Member States shall, at least once every 10 years, arrange for periodic self-assessments of their national framework and competent regulatory authorities and invite an international peer review of relevant segments of their national framework and competent regulatory authorities with the aim of continuously improving nuclear safety. Outcomes of such peer reviews shall be reported to the Member States and the Commission, when available.*

7.12. The UK completed its first full scope IRRS mission in October 2019. This covered all aspects of radiological safety i.e. occupational exposures, nuclear safety, medical and non-medical exposures, environmental exposures and transport safety. The mission team's report is

available at https://www.gov.uk/government/publications/nuclear-and-radiological-safety-review-of-the-uk-framework-2019.

7.13. The UK is committed to continuous improvement of its regulatory framework for safety and is taking forward the mission team's findings. It will report on progress at the IRRS follow up mission which is due within four years.

7.14. Three partial scope IRRS missions to the UK have also taken place, with a follow up mission took place in 2014. These focused on specific areas of nuclear safety - for example, the 2006 mission reviewed ONR's preparations for regulating new reactor build.

Topical Peer Reviews

Article 8e
2. Member States shall ensure that, on a coordinated basis:
(a) a national assessment is performed, based on a specific topic related to nuclear safety of the relevant nuclear installations on their territory;
(b) all other Member States, and the Commission as observer, are invited to peer review the national assessment referred to in point (a);
(c) appropriate follow-up measures are taken of relevant findings resulting from the peer review process;
(d) relevant reports are published on the above mentioned process and its main outcome when results are available.

7.15. The revised Nuclear Safety Directive introduced a European system of topical peer review (TPR) in 2017. Peer review forms an important part of delivering continuous improvement across the nuclear sector, and the UK was pleased to be an active participant in the 2017 TPR organised by ENSREG.

7.16. ENSREG selected ageing management as the topic for the first review. In response ONR produced a national assessment of Ageing Management of Nuclear Power Plants. This concluded the UK's operating reactors and reactors under construction had adequate ageing management programmes, appropriate to the stages that they were at in their lifecycles. However, a number of secondary but beneficial improvements were identified and programmes for improvement were developed and agreed.

7.17. ONR participated in the written peer review of the European countries National Assessment Reports and the subsequent TPR workshop. These identified a number of findings that needed to be addressed by the participants. The UK identified nine actions to address the findings from the peer review process. As in the national assessment, none of the actions indicate a significant shortfall in ageing management, but are secondary, beneficial improvements. ONR and its licensees are committed to implementing these actions and published a programme for their completion in September 2019.

Article 8e
3. Member States shall ensure that arrangements are in place to allow for the first topical peer review to start in 2017, and for subsequent topical peer reviews to take place at least every six years thereafter.

7.18. See paragraph 6.17.

Article 8e

4. In case of an accident leading to situations that would require off-site emergency measures or protective measures for the general public, the Member State concerned shall ensure that an international peer review is invited without undue delay.

7.19. No such incident has occurred in the UK so no further reporting is required here. The UK would thoroughly investigate any accident which required off-site protective measures to identify learning for continuous improvement in the UK and international nuclear sector. We would work with the international nuclear community as part of the peer review that follows an accident to see what further learning could be identified and shared.

Annex 1 Glossary and abbreviations

ACOP	Approved Code of Practice
AGR	Advanced gas-cooled reactor
ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable
ANTs	Advanced nuclear technologies
AR	Assessment report
ASN	Autorité de Sûretée Nucleaire (ASN)
BEIS	Department for Business, Energy and Industrial Strategy
BSSD	Basic Safety Standards Directive 2013
BSO	Basic Safety Objectives
CCA	Civil Contingencies Act 2004
CDG	Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009
CEO	Chief Executive Officer
CNI	Chief Nuclear Inspector
CNSC	Canadian Nuclear Safety Commission
COMAH	Control of Major Accident Hazards
DAC	Design acceptance confirmation
DAP	Duly authorised person
DBA	Design basis assessment
DBUE	Deployable Back Up Equipment
DEPZs	Detailed Emergency Planning Zones
DFR	Demonstration Fast Reactor
DSRL	Dounreay Site Restoration Ltd
Duty-holder	Anyone who has a responsibility under UK legislation such as HSWA74 or TEA13
DWP	Department for Work and Pensions
EC	European Council
EA	Environment Agency
EA95	Environment Act 1995 (Ref. 17)
EASR18	Environmental Authorisations (Scotland) Regulations 2018
EC	European Council
EIA	Environmental impact assessment
EIADR99	Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999
EIRs	Environmental Information Regulations 2004
EMM	Enforcement Management Model
ENSREG	European Nuclear Safety Regulators Group
EP&R	Emergency preparedness and response
EPR	European Pressurised Water Reactor
EPR16	Environmental Permitting (England and Wales) Regulations 2016
EPS	Enforcement Policy Statement
FANR	Federal Authority for Nuclear Regulation
FCA	Fuel Cycle Area
FINAS	Fuel Information Notification and Analysis System
FOI	Freedom of Information Act 2000

GB	Great Britain
GDA	Generic design assessment
GDF	Geological Disposal Facility
GIAA	Government Internal Audit Agency
HERCA	Heads of the European Radiological Protection Competent Authorities
HLW	High level waste
HPC	Hinkley Point C
HSE	Health and Safety Executive
HSWA74	Health and Safety at Work etc. Act 1974 (Ref. 3)
IAEA	International Atomic Energy Agency
IIS	Integrated Intervention Strategy
ILW	Intermediate level waste
INES	International Nuclear and Radiological Event Scale
INPO	Institute of Nuclear Power Operations
INRA	International Nuclear Regulators' Association
INSA	Independent nuclear safety assessment
IPPAS	International Physical Protection Advisory Service
IRR99	Ionising Radiations Regulations 1999
IRR17	Ionising Radiations Regulations 2017 (Ref. 6)
IRRS	Integrated Regulatory Review Service
IRS	International Reporting System for Operating Experience
IRSRR	Incident Reporting System for Research Reactors
LC	Licence condition
Licensee	A specific body who holds a nuclear site licence under NIA65
LI	Licence Instrument
LLW	Low level waste
LLWR	Low Level Waste Repository
MHSWR99	Management of Health and Safety at Work Regulations 1999
MoD	Ministry of Defence
MoU	Memorandum of understanding
mSv	Millisieverts
NDA	Nuclear Decommissioning Authority
NEA	Nuclear Energy Agency
NGO	Non-governmental organisation
NIA65	Nuclear Installations Act 1965 (Ref. 5)
NISRs	Nuclear Industries Security Regulations 2003
NNR	National Nuclear Regulator
NNSA	National Nuclear Safety Administration
NPP	Nuclear power plant
NPS	National Policy Statement
NRA	Nuclear Regulation Authority
NRW	Natural Resources Wales
NSD	Nuclear Safety Directive 2014
NSIP	Nationally Significant Infrastructure Projects
NSSG	Nuclear Skills Strategy Group
OECD	Organisation for Economic Cooperation and Development

OEF	Operating experience feedback
ONR	Office for Nuclear Regulation
OPZs	Outline Planning Zones
OR	Operating rules
PAA	Panstwowa Agencja Atomistyki
PAR	Project assessment report
PARs	Passive Autocatalytic Recombiners
PCPV	Pre-stressed concrete pressure vessel
PFR	Prototype Fast Reactor
PHE	Public Health England
PINS	Planning Inspectorate
PSA	Probabilistic safety assessment
PSR	Periodic safety review
PWR	Pressurised water reactor
RCF	Regulatory competence framework
RDR	Regulatory Deployment and Resilience Group
REPPIR19	Radiation (Emergency Preparedness and Public Information) Regulations 2019
RPA	Radiation Protection Adviser
RPII	Radiation Protection Institute of Ireland
RPV	Reactor pressure vessel
RSA	Radioactive Substances Act 1993
RSG	Radiological Safety Group
R2P2	Reducing risks, protecting people (Ref. 19)
SAA	Severe accident analysis
SAGs	Severe Accident Guidelines
SAPs	Safety assessment principles
SBERGs	Symptom Based Emergency Response Guidelines
SBI	System-based inspections
SEPA	Scottish Environment Protection Agency
SFAIRP	So far as is reasonably practicable
SGHWR	Steam-Generating Heavy Water Reactor
SNI	Sensitive nuclear information
SoS	Secretary of State
SQEP	Suitably qualified and experienced person
SSM	Swedish Radiation Safety Authority
STEM	Science, technology, engineering and mathematics
STUK	Radiation and Nuclear Safety Authority
SWPG	Strategic Workforce Planning Group
SyAPs	Security Assessment Principles
TAGs	Technical Assessment Guides
TEA13	Energy Act 2013
THORP	Thermal offsite reprocessing
TIGs	Technical inspection guides
TPR	Topical Peer Review
TSC	Technical Support Contractors
UK	United Kingdom
USNRC	United States Nuclear Regulatory Commission
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators' Association

Annex 2 – UK Civil Nuclear Installations

Nuclear Power Plants

Site	Plants	Status	Spent fuel storage
Nuclear power plants – advanced gas-cooled reactors (AGR)			
Dungeness B	2x615 MWe AGR	Operating	1 pond
Hartlepool	2x655 MWe AGR	Operating	1 pond
Heysham 1	2x625 MWe AGR	Operating	1 pond
Heysham 2	2x680 MWe AGR	Operating	1 pond
Hinkley Point B	2x655 MWe AGR	Operating	1 pond
Hunterston B	2x644 MWe AGR	Operating	1 pond
Torness	2x682 MWe AGR	Operating	1 pond
Nuclear power plants – pressurised water reactors (PWR)			
Sizewell B	1250 MWe PWR	Operating	1 pond
Hinkley Point C	2x EPR™	Planned	1 pond
Nuclear power plants – Magnox reactors			
Berkeley	2 x Magnox	Decommissioning	None
Bradwell	2 x Magnox	Decommissioning	None
Calder Hall	4 x Magnox	Defueled	None
Chapelcross	2 x Magnox	Decommissioning	None
Dungeness A	2 x Magnox	Decommissioning	None
Hinkley Point A	2 x Magnox	Decommissioning	None
Hunterston A	2 x Magnox	Decommissioning	None
Oldbury	2 x Magnox	Defueling	None
Sizewell A	2 x Magnox	Defueling	
Trawsfynydd	2 x Magnox	Decommissioning	None
Wylfa	Reactor 1 – 500 MWe	Permanently shut down	3 dry storage cells
	Reactor 2	Permanently shut down	
Reprocessing plants			
Sellafield	Magnox fuel reprocessing plant	Operating	See footnote[2]

[2] The original Windscale reactor pond built between 1948 and 1952 was subsequently modified to handle Magnox fuel from the Calder Hall reactors, which it did until 1960.

	Oxide fuel reprocessing plant	Operating	
Dounreay	Prototype Fast Reactor (PFR)	Defuelled	Some fuel stored in pond Fuel pond has been emptied

Nuclear research facilities and research reactors

Site	Plants	Status	Spent fuel storage	Comments
Nuclear research facilities				
Harwell	BEPO research reactor	Care and maintenance	Small amount of research reactor fuel	All reactors have been decommissioned to a state where they can be left for radioactive nuclides to decay before final decommissioning
	PLUTO research reactor	Care and maintenance		
	DIDO research reactor	Care and maintenance		
Winfrith	Steam-generating heavy water reactor (SGHWR)	Decommissioning	None	
	DRAGON research reactor	Decommissioning	None	
Research reactors				
Imperial College	CONSORT II research reactor	Decommissioning	None	

A second pond operated from 1960 until 1986 as a receipt, storage and de-canning facility for Magnox fuel. An adjacent pond has operated since 1965 for the storage of oxide fuel, comprising receipt facilities, services and storage pond with bays built between 1965 and 1982. It also stores empty high-integrity, multi-element bottles that have been used in LWR fuel transport and storage, prior to their disposal. A further separate pond has operated since 1982 for the storage of AGR fuel received directly from the power stations or from FHP. Fuel is stored prior to processing, after which dismantled fuel is dispatched to THORP Receipt and Storage ponds in internal transit flasks. The FHP pond opened in 1984 comprising three bays, two of which are currently used for Magnox fuel storage and one for AGR fuel. Magnox fuel is typically stored for six months to allow radioactive decay of short-lived isotopes. AGR fuel is stored for some years before being sent to THORP for reprocessing. Storage arrangements are carefully designed to eliminate the potential for criticality events. The THORP Receipt and Storage Ponds opened in 1988 and act as a temporary store for AGR fuel and LWR fuel en-route to reprocessing.

Enrichment plants and nuclear fuel plants

Site	Plants	Status	Spent fuel storage
Enrichment plants			
Capenhurst	Fuel enrichment plant	Operating	None
Nuclear fuel fabrication plants			
Springfields	Magnox fuel production plant	Decommissioning	None
	Oxide fuel production plant	Operating	None

Annex 3 Licence Instruments for Hinkley Point C

Licence Instrument Number	Type of Licence Instrument	Title	Date
LI500	APPROVAL	Approval under Licence Condition 13(2) of Hinkley Point C Nuclear Safety Committee Terms of Reference **Superseded by LI 502**	27 November 2012
LI501	Not Used	Not Used	Not Used
LI502	APPROVAL	Approval under Licence Condition 13(3) of Amended Hinkley Point C Nuclear Safety Committee Terms of Reference **Superseded by LI 512**	17 December 2013
LI503	APPROVAL	Approval under Licence Condition 13(11) of Hinkley Point C Nuclear Safety Committee Terms of Reference (Urgent Safety Proposals) **Superseded by LI 513**	27 March 2014
LI504	SPECIFICATION	Specification issued under Licence Condition 19(4) specifying that the licensee shall not commence First Nuclear Safety Concrete… without the consent of the ONR	10 October 2016
LI505	SPECIFICA|TION	Specification issued under Licence Condition 19(4) specifying that the licensee shall not commence Nuclear Island Concrete… without the consent of the ONR	10 October 2016
LI506	CONSENT	Consent issued under Licence Condition 5(1) for consignment of relevant matter not being excepted matter or radioactive waste) to a suitably permitted facility	21 October 2016
LI507	CONSENT	Consent issued under Licence Condition 5(1) for consignment of relevant matter (not being excepted matter or radioactive waste) to a laboratory (other than on or being a relevant site) for analysis, in samples of such quantity as is reasonably necessary to enable such analysis at such a laboratory	21 October 2016

LI508	SPECIFICATION	Specification issued under Licence Condition 19(1) specifying that the licensee shall not commence Start of Pumping Station… without the agreement of the ONR (**Derived Power LI**)	15 November 2016
LI509	CONSENT	Consent issued under Licence Condition 19(4) to the commencement of First Nuclear Safety Concrete	06 March 2017
LI510	SPECIFICATION	Specification issued under Licence Condition 19(1) specifying that the licensee shall not commence Receipt of First Major Nuclear Steam Supply System Shipment to Site, without the agreement of the ONR. (Derived Power LI)	15 February 2018
LI511	AGREEMENT	Agreement issued under Licence Condition 19(1) to the start of construction of the unit 1 pumping station (Derived Power LI)	26 July 2018
LI512	APPROVAL	Approval issued under Licence Condition 13(3) approving alteration or amendment to the Hinkley Point C Nuclear Safety Committee terms of reference	09 September 2018
Li513	APPROVAL	Approval issued under licence condition13(12) approving alteration of amendment of the Hinkley Point C Nuclear Safety Committee's arrangements for obtaining consideration, or advice on urgent safety proposals	09 September 2018
LI514	AGREEMENT	Agreement under arrangements made under condition 20(1) to the implementation of modifications to the Hinkley Point C reference configuration design during the period of construction as described in "modification of the diverse openings on the fuel path, the fuel transfer tube and associated civil works to cope with the design basis analysis (dba) of a gross failure	13 February 2019
LI515	AGREEMENT	Agreement under arrangements made under condition 20(1) to the implementation of modifications to the Hinkley Point C reference configuration design during the period of construction as described in 'dry store impacts on HK building	13 February 2019
LI516	AGREEMENT	Agreement under arrangements made under condition 20(1)	04 March 2019

		to the implementation of modifications to the Hinkley Point C reference configuration design during the period of construction as described in PS architecture modification	
LI517	AGREEMENT	Agreement under arrangements made under condition 20(1) to the implementation of modifications to the Hinkley Point C reference configuration design during the period of construction as described in 'hvac plateau redesign of dvl & del (rc1.2)'	13 February 2019
LI518	CONSENT	Consent issued under Licence Condition 19(4) to the commencement of unit 1 nuclear island concrete	08 November 2018

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