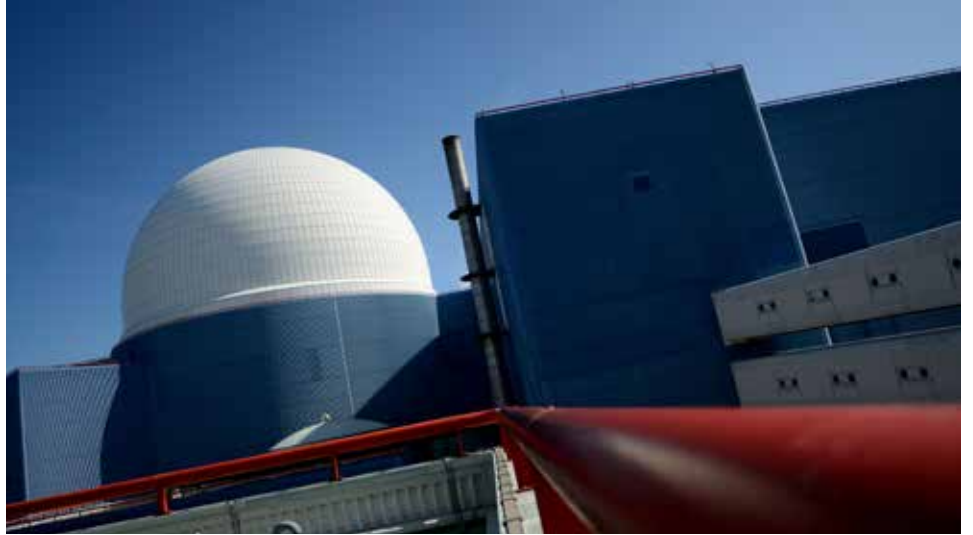




Office for  
Nuclear Regulation

# CHIEF NUCLEAR INSPECTOR'S ANNUAL REPORT ON GREAT BRITAIN'S NUCLEAR INDUSTRY

OCTOBER 2019





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# FOREWORD

- 1 I am delighted to present for the first time my Chief Nuclear Inspector's report on Great Britain's nuclear industry for the period April 2018 to March 2019.
- 2 The report provides an independent, authoritative view of the nuclear industry's safety, security and safeguards performance. It underpins our commitment to being open and transparent and aligns ONR to similar practice by other UK regulators and our international peers.
- 3 It complements our Annual Report and Accounts, published in June this year, but provides a much greater insight into industry performance and ONR's associated regulatory interventions.
- 4 Informed by our extensive inspection and assessment activity, I am satisfied that the nuclear industry has overall continued to meet the requisite high standards of safety and security to protect workers and the public.
- 5 However, where dutyholders have fallen short of such standards, we have focussed our attention accordingly to ensure that they have plans in place to improve their performance and return to routine levels of regulatory attention in a timely manner.
- 6 The nuclear landscape has continued to evolve at pace this year. In this report, we recognise notable progress in the industry's management of the nation's historic nuclear legacy, as well as specific challenges arising from ageing operational facilities across the power generation and nuclear weapon and propulsion estates. We have further recognised the inherent uncertainties across the new nuclear build programme.
- 7 The report also presents our annual statement on research and our analysis of safety incidents notified to us between January 2018 and March 2019. This replaces previous standalone reports on research and incidents, supporting our commitment to ensure that this information is accessible in one place.
- 8 This report is testimony to the collective efforts of everyone in ONR and I recognise and thank those individuals external to ONR for their insight and advice in ensuring this publication is accurate and reflects the current state of the nuclear industry.

## **Mark Foy**

Chief Nuclear Inspector







# CHIEF NUCLEAR INSPECTOR'S REVIEW

## OVERALL PERFORMANCE DURING 2018/19

- 9 Our enabling regulatory philosophy has remained at the forefront of our approach to securing safety and security outcomes across the sector. I am pleased to highlight a number of notable successes in the context of this approach:
- **Good progress towards hazard and risk reduction at Sellafield:** Continued focus from Sellafield Limited during 2018/19 has led to several high-priority projects coming to fruition, specifically in the preparation for early waste retrieval on the site. Successful remediation of the site will, however, demand many decades of sustained national focus.
  - **Safe and secure transport of special nuclear material:** 2018/19 saw the largest inventory of special nuclear material (SNM) safely transported from Dounreay to Sellafield in-year, as part of a wider national consolidation programme. This work also saw the successful and safe transfer of SNM from Dounreay to the United States, enabled by extensive cooperation between government, industry and regulators.
  - **Bradwell (Magnox Limited) entry into Care and Maintenance:** The Bradwell site successfully entered into its Care and Maintenance phase. This first-of-a-kind transition sets precedent for the UK and for the Magnox reactor fleet, and I recognise the considerable amount of preparatory and decommissioning work undertaken over the last 15 years to reach this point.
  - **First 'nuclear concrete' pour at Hinkley Point C:** During the year we issued formal Consent to enable NNB GenCo (HPC) Limited to commence the concrete pour for Unit (Reactor) 1's nuclear island common raft and we agreed to the licensee commencing construction of Unit 1's pumping station.
  - **First SyAPs-aligned nuclear site security plans:** Since publication of our Security Assessment Principles (SyAPs) in 2017, dutyholders have been preparing new Nuclear Site Security Plans, culminating in a successful pilot during 2018/19. I am confident this will encourage a more holistic approach to security, while improving ownership and understanding of security arrangements by dutyholders.
- 10 The ageing infrastructure across the industry remains a challenge for dutyholders and regulators:
- The variable age and condition of facilities on defence weapons and propulsion sites has demanded our increased attention during 2018/19, notably at Devonport and the Atomic Weapons Establishment (AWE). Aldermaston and Burghfield sites. There are a large number of programmes underway or planned to upgrade facilities, however several of these have experienced significant delay.

- We have observed shortfalls in AWE's organisational capability to deliver on time adequate periodic reviews of safety for key ageing facilities, along with the necessary safety upgrades. I welcome AWE's commitment to make fundamental changes to the way it operates and manages safety on these sites. In response to our concerns, AWE has developed and is now implementing a structured programme of work to improve the safety of operations on both the Aldermaston and Burghfield sites.
  - Graphite ageing effects in the reactor cores at Hunterston B power station have resulted in the shutdown, during 2018/19, of both reactors (Reactors 3 and 4) for a protracted period. Such ageing symptoms have always been predicted to occur but are nonetheless complex to assess, and have required significant safety case development work by EDF Nuclear Generation Limited (NGL).
  - In August 2019, we subsequently gave permission for EDF NGL to implement a new safety case that will enable restart of Reactor 4 for 16.025 terawatt days of power generation, approximating to an operating period of four months. We based this decision on an extensive assessment and were satisfied that Reactor 4 can be safely shut down in all foreseeable circumstances, including that of a significant seismic event
  - Both reactors at Dungeness B have been shut down for much of this period due to a range of complex age-related issues that require remediation; this has required increased regulatory oversight that will inform our decision making on their readiness for a return to service.
- The ageing plutonium storage facilities at Sellafield require sustained investment and focus by the licensee, the Nuclear Decommissioning Authority (NDA) and government, recognising that a decision on ultimate disposition of national stocks has yet to be made. I am pleased with the commitments made by government to expedite investment to enable timely delivery of upgraded assets that will facilitate long-term safe storage.
- 11 Where dutyholders have failed in their duties, we have undertaken balanced and proportionate enforcement action to secure sustained compliance and hold industry to account. We instigated prosecution proceedings in four cases where we considered it right and in the public interest to do so. Three of these were concluded in this period with guilty verdicts. Three of the four cases related to significant conventional health and safety (CHS) incidents occurring on licensed sites.
  - 12 In addition, during 2018/19, we received 104 notifications under Reportable Injuries, Diseases and Dangerous Occurrence Regulations (RIDDOR); an overall increase of 23 from the previous year. Annex 1 of this report provides further detail of these.
  - 13 Findings from our wider interventions across the sector, allied with recent prosecution cases and the increased number of reportable injuries, are indicative of a decline in CHS performance. I emphasise the need for increased industry focus to reverse this trend, at a time when the risks from conventional health and safety hazards are increasing as major new build construction projects gather pace. The transition of existing reactor sites into defueling and decommissioning phases of their lifecycles in the coming years will demand commensurate focus on the shift towards a CHS hazard profile.

14 The total number of nuclear safety incidents reported to us in this period was consistent with the average reported over the last five years and I am satisfied with the open and positive reporting culture across the industry. However, the absolute number of incidents emphasises the need for sustained and continuous attention on safety and security.

## A DYNAMIC NUCLEAR LANDSCAPE

15 This year, in support of the Government's Clean Growth Strategy and Nuclear Sector Deal<sup>1</sup>, we have continued to prepare for the future regulation of Advanced Nuclear Technologies (ANTs), growing our capability and capacity. This has enabled us to provide government with our views on proposed advanced modular reactor (AMR) designs to develop assessment criteria and guidance for vendors.

16 Effective innovation will be essential if the industry is to successfully address the challenges and opportunities set by the Nuclear Sector Deal. I recognise the important role that regulators have in minimising regulatory uncertainty around innovation and I am confident the UK's goal setting regulatory regime, which is technology neutral and does not seek to prescribe design solutions, will continue to provide a healthy environment in which innovation can thrive.

17 We recognise the important role that we have in enabling industry to realise the benefits of new technology and novel approaches, and we will continue to provide a stable regulatory environment that supports cost-effective safety.

Our Corporate Plan for 2019/20 includes a commitment to develop and publish ONR's Innovation Plan in the spring of 2020, which will set out what we will do to regulate and enable innovation in the industry, but also where we are seeking to be innovative as a regulator ourselves.

18 As a result of the Government's decision to withdraw from the European Atomic Community (Euratom) upon leaving the European Union (EU), the UK must establish a domestic safeguards regime to ensure that it continues to meet its international safeguards obligations that are currently delivered by Euratom.

19 The UK Government committed to delivering a domestic safeguards regime to be implemented by ONR that is equivalent in effectiveness and coverage to that currently provided by Euratom. The associated legal framework is defined by The Nuclear Safeguards (EU Exit) Regulations 2019 that will come into force once the UK leaves the EU. I am grateful for the invaluable operational perspectives provided by industry during our development of the UK system, which ensured that ONR has stood ready to deliver the UK's international safeguards obligations for material accountancy and control since 29th March 2019.

20 We will continue to work in 'parallel' with Euratom until the UK's exit from the EU, facilitating Euratom and International Atomic Energy Agency (IAEA) inspections to ensure that safeguards obligations in the UK are met in a proportionate manner. We are currently establishing our safeguards inspection capability, in order to deliver a domestic safeguards regime equivalent in effectiveness and coverage to that currently provided by Euratom, by the end of December 2020.

<sup>1</sup> [www.gov.uk/government/publications/nuclear-sector-deal](http://www.gov.uk/government/publications/nuclear-sector-deal)

## OUR REGULATORY PRIORITIES

- 21 Our top priorities continue to be delivery of our core regulatory functions, including holding industry to account on behalf of the public, as set out in our 2019/20 Corporate Plan. We will also prioritise our regulatory effort on those licensed sites and other dutyholders to whom we have assigned enhanced levels of regulatory attention.
- 22 Notwithstanding this, our work during 2018/19 has identified three overarching themes that I consider warrant increased industry attention:
- i. Management of ageing facilities
  - ii. Conventional health and safety performance
  - iii. Delivering a holistic approach to nuclear security

### 1. Sustainable programmes for the management of ageing facilities:

It is evident that there are significant challenges associated with ageing facilities and infrastructure approaching the end of their operational life, as well as systems and components that do not meet modern engineering standards. Continued safe and secure operation of ageing facilities warrants:

- Sustained focus and commitment to ongoing investment in plant, people and processes.
- Effective strategies for characterisation, monitoring, trending and analysis of ageing - at facility, system and component level.
- A commitment to ensure the right level of organisational capability to sustain specialist safety case and other technical capability to substantiate on-going safe operation.

### 2. Conventional health and safety performance:

There is a considerable amount of work being undertaken associated with civil reactor new build, post operational clean out, decommissioning of existing facilities and demolition. These activities pose significant risks to workers if not properly controlled. We have observed that certain sectors of the industry have experienced a reduction in conventional health and safety performance and renewed efforts are required by industry to ensure this performance improves and the trend reversed.

### 3. Realising the benefits of SyAPs to deliver a holistic approach to security:

The implementation of SyAPs enables ONR to regulate nuclear security in an outcome-focussed manner. Industry will only realise the benefits of this approach if it can deliver organisational ownership and cultural change on security matters. This will require:

- Improved organisational leadership and management for security.
- Suitably qualified and experienced nuclear security staff that understand and take ownership of all security risks.
- Nuclear security regimes underpinned by capable and effective internal assurance functions.

ONR inspectors will be seeking to ensure that dutyholders take the right steps to improve security understanding and ownership and consolidate an effective security culture in their organisations.

23 I highlight the need for the industry to critically review their strategies and plans and to reflect on how they can work collectively, to deliver improved performance in each of these areas.

Each of these themes feature within our planning for 2019/20 and will continue to be prominent in the years ahead, until we are satisfied that suitable improvements have been delivered.

## REGULATORY ATTENTION LEVELS



24 The regulatory attention that we will apply to licensed nuclear sites for 2019/20 is summarised in Table 1. The attention level assigned for each site is based on its performance over the past 12 months and our understanding of the challenges faced by each site.

It also reflects an overall judgement across nuclear safety, conventional health and safety, security<sup>2</sup> and transport purposes.

**TABLE 1: 2019/20 REGULATORY ATTENTION LEVELS FOR LICENSED SITES**

<b>Significantly enhanced</b>	
<b>Licensed site</b>	<b>Change in attention since 2018/19</b>
Sellafield – First Generation Magnox Storage Pond, Magnox Swarf Storage Silo and Pile Fuel Cladding Silo	↔
Sellafield – Overall Site Security (Sellafield Ltd)	↔
<b>Enhanced</b>	
<b>Licensed site</b>	<b>Change in attention since 2018/19</b>
Atomic Weapons Establishment, Aldermaston & Burghfield (AWE plc)	↔
Devonport (Devonport Royal Dockyard Ltd)	↔
Dounreay (Dounreay Site Restoration Ltd)	↔
Sellafield – Remainder of estate (Sellafield Ltd)	↔
Hunterston B (EDF Energy Nuclear Generation Ltd)	↑ Driven by increased regulatory attention on return to service safety cases
Dungeness B (EDF Energy Nuclear Generation Ltd)	↑ Driven by both safety performance and control of hazard and risk factors

<sup>2</sup> Excluding defence nuclear licensed sites

Routine	
Licensed site	Change in attention since 2018/19
Bradwell (Magnox Ltd)	 All sites
Berkeley (Magnox Ltd)	
Barrow (BAE Systems Marine Ltd)	
Capenhurst (Urenco UK Ltd)	
Chapelcross (Magnox Ltd)	
Consort Reactor, Ascot (Imperial College of Science, Technology and Medicine)	
Derby (2 sites) (Rolls Royce Marine Power Operations Ltd)	
Dungeness A (Magnox Ltd)	
GE Healthcare, Amersham and Cardiff (GE Healthcare Ltd)	
Hartlepool (EDF Energy Nuclear Generation Ltd)	
Harwell (Magnox Ltd)	
Heysham 1 (EDF Energy Nuclear Generation Ltd)	
Heysham 2 (EDF Energy Nuclear Generation Ltd)	
Hinkley Point A (Magnox Ltd)	
Routine	
Licensed site	Change in attention since 2018/19
Hinkley Point (EDF Energy Nuclear Generation Ltd)	 All sites
Hinkley Point C (NNB Genco HPC Ltd)	
Hunterston A (Magnox Ltd)	
Low level Waste Repository (LLW Repository Ltd)	
Metals Recycling Facility, Lillyhall (Cyclife UK Ltd)	
Oldbury (Magnox Ltd)	
Rosyth (Rosyth Royal Dockyard Ltd)	
Sizewell A (Magnox Ltd)	
Sizewell B (EDF Energy Nuclear Generation Ltd)	
Springfields (Springfields Fuel Ltd)	
Torness (EDF Energy Nuclear Generation Ltd)	
Trawsfynydd (Magnox Ltd)	
Winfrith (Magnox Ltd)	
Wylfa (Magnox Ltd)	

**TABLE 2: 2019/20 REGULATORY ATTENTION LEVELS FOR OTHER DUTYHOLDERS (NOT LICENSED SITES)**

Regulatory attention	Dutyholder	Change in attention since 2018/19
Enhanced	National Nuclear Laboratory (Windscale) – Security considerations Only	↔
	Magnox (Corporate) – Security considerations only (Increased from Routine)	↑
	EDF Energy Nuclear Generation Ltd (Corporate) – Security considerations only	↔
	Direct Rail Services Ltd – Security considerations Only	↔
	Geodis UK Ltd – Security considerations Only (Increased from Routine)	↑
	TN International Orano – Security considerations Only (Increased from Routine)	↑
	DSRL (Transport) – Security considerations Only	↔
	Canberra (Tenant on Harwell site) – Security considerations Only	↑

- 25 Table 2 lists the attention level we will assign to other dutyholders, specifically in relation to civil nuclear security performance.
- 26 We assign attention levels through assessment against a range of safety and security indicators that broadly align with ONR's Nuclear Safety Performance Indicator framework, as outlined in recently-published guidance<sup>1</sup>.
- 27 Routine attention applies to those sites, facilities or organisations where we consider that no additional attention is needed over and above that which would normally apply<sup>3</sup>.
- 28 Enhanced attention describes a higher level of regulatory activity paid to the dutyholder, driven by one or more of the safety and security indicators previously mentioned. This may also include sites where a specific regulatory strategy is required to secure timely return to compliance.
- 29 Significantly enhanced attention is based upon the factors above; however, it recognises additional factors such as emergent or long-standing safety or security issues and/or the risk associated with the facilities in question. It may also reflect instances where we have substantially re-focused our regulatory strategy to secure a specific outcome, such as accelerated hazard and risk reduction at Sellafield. We might in other circumstances assign such an attention level where the dutyholder has persistently failed to address long-standing regulatory issues.

<sup>3</sup> <http://www.onr.org.uk/operational/other/onr-gen-gd-013.pdf>

## NUCLEAR INDUSTRY INSPECTION PERFORMANCE

- 30 For all inspections that we undertake, our inspectors provide an overall rating of the performance of licensees and other dutyholders against expected standards.
- 31 We use Red-Amber-Green inspection ratings to track performance; the rating system is calibrated against the action that we propose to take in response to inspection findings, namely:
- Green – No formal action;
  - Amber – Seek improvement;
  - Red – Demand improvement.
- 34 Across the nuclear industry, we judged in 65 out of 69 such inspections (95%) that systems fulfilled their safety functional requirements. For each of the four systems where we considered there to be a shortfall, we were satisfied that the required improvements had subsequently been made or scheduled.
- 35 We record the issues arising from our inspection activities through our issues management process. This ensures each one is recorded, as well as tracking implementation of the required safety and security improvements.

## COMPLIANCE AND SYSTEM BASED INSPECTIONS

- 32 We have rated the majority of compliance inspections that embody nuclear safety, nuclear security, nuclear transport and conventional health and safety, as Green. For the small number of inspections rated Amber or Red, our inspectors have sought or demanded delivery of necessary improvements including, requiring in some instances, enforcement action in line with ONR's Enforcement Management Model (EMM).
- 33 System Based Inspections (SBIs) have continued to be an essential element of our overall interventions across nuclear licensed sites. SBIs consist of a series of inspections to establish that the safety systems and structures are fit for purpose and that they will fulfil their safety functional requirements. During such inspections, we evaluate those systems for compliance against a range of licence condition arrangements.



## ENFORCEMENT

- 36 On the occasions where we have identified shortfalls, proportionate enforcement action has been undertaken in accordance with our Enforcement Policy Statement (EPS). We have employed a range of enforcement tools to hold dutyholders to account, and secure sustained compliance with the law. During this period we:
- Served 9 improvement notices, six of which have been satisfactorily complied with. We anticipate the remaining three will be met by dutyholders in accordance with required schedules;
  - Issued 35 enforcement letters;
  - Issued one Direction under Licence Condition 15. This is addressed specifically in Section 4.
- 37 We have instigated successful prosecutions against three licensees and one other dutyholder, relating to three incidents that occurred during 2017/18. (See Table 3)

TABLE 3: SUMMARY OF CONCLUDED PROSECUTIONS DURING 2018/19

Licensee / Dutyholder	Details of Incident and Charges	Outcome
Sellafield Ltd	Offence under Health & Safety at Work etc. Act 1974, in connection with contamination of a worker at the THORP plutonium finishing line in February 2017.	Sellafield Ltd fined £380,000 plus costs
AWE plc	Offences under the Health & Safety at Work etc. Act 1974 in relation to an electrical incident at Aldermaston in June 2017, which resulted in injury to an employee. The incident was a conventional health and safety matter and there was no radiological risk to workers or the public.	AWE plc. fined £1m plus costs
EDF Energy NGL	Offences under the Health & Safety at Work etc. Act 1974 in relation to an incident in April 2017 at Hinkley Point B which resulted in injury to a Doosan Babcock Ltd employee. The incident was a conventional health and safety matter and there was no radiological risk to workers or the public.	EDF Energy NGL fined £200,000 plus costs
Doosan Babcock Ltd	Offences under the Work At Height Regulations 2005, Regulation 4(1) for the aforementioned incident at Hinkley Point B	Doosan Babcock Ltd fined £150,000 plus costs



# SELLAFIELD AND DECOMMISSIONING, FUEL & WASTE SITES

## SUMMARY OF PERFORMANCE

There has been considerable progress with hazard and risk reduction and decommissioning across the nation's 21 decommissioning, fuel and waste sites.

At Sellafield notable points include:

- Removal of volumes of radioactive waste and spent fuel from legacy ponds
- Significant progress in preparations for the retrievals from the legacy silos
- Major facility improvements at the Special Nuclear Material (North) Complex.

There remain decades of work to deal with the legacies of the past at Sellafield. The site will therefore continue to receive significantly enhanced attention for years to come. Our focus will continue to be on:

- Securing timely retrievals from the silos and delivery of modern facilities for storage of legacy waste and special nuclear material
- Engaging with key stakeholders to ensure that Sellafield retains the organisational capability to deliver safe and accelerated hazard remediation and risk reduction.

Across the decommissioning and waste management sites, there has been further notable progress towards decommissioning and hazard-reduction objectives.

- Entry of Bradwell into a period of Care and Maintenance
- Significant work towards addressing the legacy waste at Hunterston A and Berkeley
- Construction of a new facility at Capenhurst for storage of depleted uranium oxide
- Consolidation of a significant proportion of special nuclear material from Dounreay to Sellafield in support of UK government policy.

## SELLAFIELD

### OVERVIEW OF THE SITE

38 The Sellafield site is one of the largest and most hazardous nuclear facilities in Europe. Reducing the hazard and risk on the site in a safe and timely manner is a national decommissioning priority and is our highest regulatory priority.

39 One of the most significant challenges relates to the waste retrieval from, and decommissioning of, some of the above legacy facilities that are degrading, and fall well below the high standards of modern nuclear facilities. Such has been the degradation of some of these high hazard facilities that retrieval of their radioactive inventory requires complex, novel and intrusive interventions over a period of many years.

- 40 Furthermore, Sellafield Limited has begun to prepare for a post-reprocessing era, in which 2018 heralded the end of oxide reprocessing in THORP, while Magnox reprocessing is due to cease in 2020. This means the site's mission will become predominantly safe storage, decommissioning and clean-up.
- 41 A further challenge to the magnitude and nature of the nuclear hazards at Sellafield is the congested layout of the site with facilities in close proximity to one another. There are also complex interdependencies between process and waste facilities that can impede progress should any facility experience operational problems.
- 42 These factors - as well as the need to characterise, package and safely store a large inventory and variety of radioactive material in existing and new facilities - further exacerbate these difficulties. As there is no highly active waste disposal route in the UK, radioactive material will continue to accumulate on the site pending its ultimate disposal in a deep geological disposal facility in line with government policy.

## DUTYHOLDER PERFORMANCE

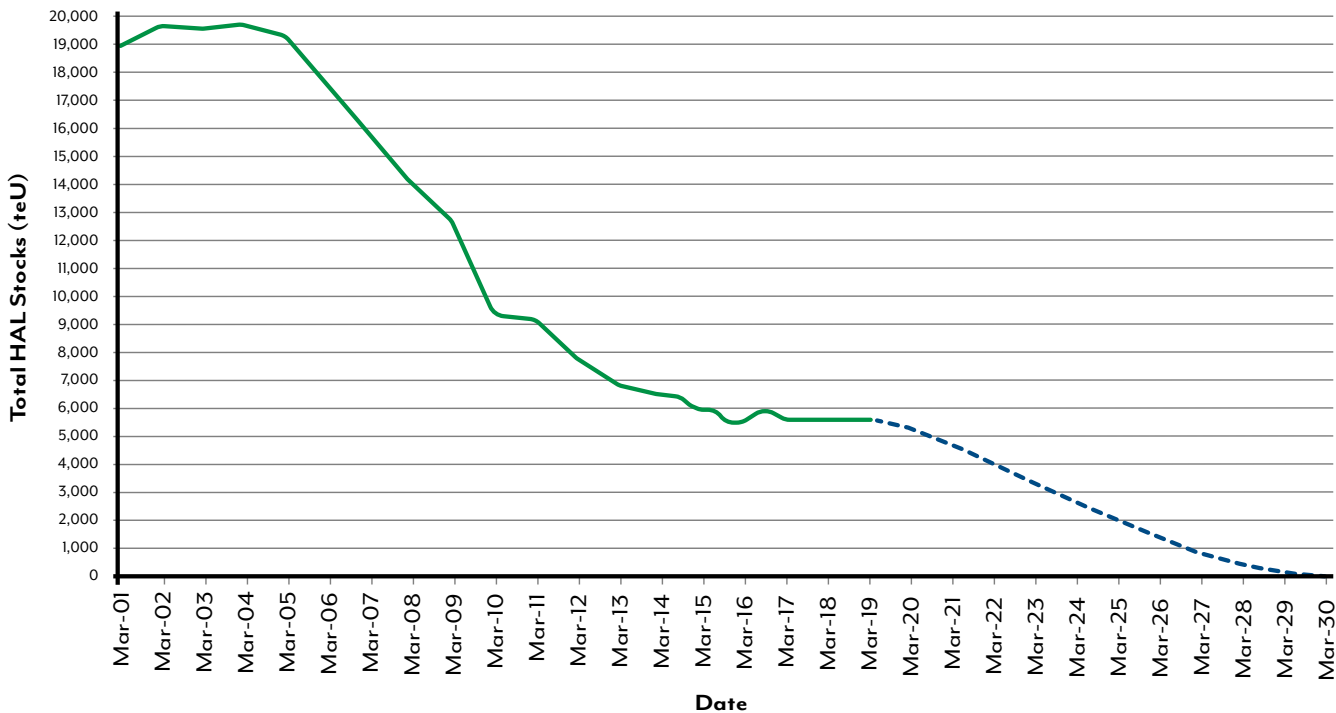
### SAFETY PERFORMANCE

- 43 **Legacy Ponds and Silos:** Sellafield Limited is making good progress with preparatory and remediation work in the legacy ponds and in the preparations for waste retrieval from the Pile Fuel Cladding Silo (PFCS).
- 44 This has included deployment of innovative, fit-for-purpose solutions, including robotics and virtual reality techniques to improve operational effectiveness and efficiency, as well as human-machine interface enhancements to characterise and safely handle the waste. Additional silo retrievals modules have been added onto the existing facility; these mark an important milestone towards the commencement of waste retrievals.
- 45 The remediation of waste from the Magnox Swarf Storage Silo (MSSS) is more complex, requiring several risk-reduction projects, as well as readiness of modern facilities and containers for storage of the waste following its retrieval. The timeline for remediation of MSSS continues to be challenging and will require all stakeholders to work together to support effective delivery.



- 46 Good progress has been made in preparing for waste retrievals and in the development of safety cases for new long-term safe storage facilities for both MSSS and PFCS wastes.
- 47 Continued sludge and fuel exports from the Pile Fuel Storage Pond (PFSP) and First Generation Magnox Storage Pond (FGMSP) have met regulatory expectations, along with preparations for further retrieval activities of the more challenging inventories.
- 48 Over the next few years these activities will lead to a controlled temporary increase in the risk from the facilities. This is a necessary step to enable significant longer-term hazard and risk reduction, but will only be allowed if we are satisfied in the safety measures and defence in depth in place.
- 49 **Special Nuclear Material (SNM) facilities:** Sellafield Limited has made tangible progress with improvements to some of the site's ageing SNM facilities. There is a need to develop facilities to treat degrading SNM containers on the site, in light of their age and a national imperative to consolidate material from Dounreay. The provision of new facilities is vital to the future safe and secure management of plutonium stocks at Sellafield and we will continue to exert influence to ensure this remains a funding priority.
- 50 **Reprocessing facilities:** With the cessation of reprocessing at the Thermal Oxide Reprocessing Plant (THORP), Sellafield Ltd's focus has moved to long-term storage of AGR spent fuel and post-operation clean-out (POCO) of its reprocessing plants. We have scrutinised the details of its transition plan and we granted permission to enable its implementation during the latter part of 2018.
- 51 Following ONR enforcement action in 2015, Sellafield Ltd has made significant improvements to its operational practices at the Magnox reprocessing plant, enhancing operational safety and asset condition. These improvements have resulted in better plant reliability and progressive reduction of on-site hazards as well as continued reprocessing of the remaining Magnox fuel from Wylfa.
- 52 **Analytical Services:** These facilities contain a considerable volume of legacy waste, and provide sampling and analytical capability fundamental to supporting safe operations across the site in support of hazard and risk reduction. I am pleased that Sellafield Ltd has successfully disposed of significant accumulations of waste and delivered upgrades to the facility's key assets.
- 53 **High Level Waste Plants:** The start of operation of a new evaporator within the Highly Active Liquor Evaporation and Storage Facility (HALES) with a higher potential throughput than the existing evaporative capacity is welcomed; this facility has continued to provide feed to the highly active waste vitrification plant to support safe management and reduction of the site's highly active liquor (HAL) stocks. We are pleased to report that since 2001, over 70% of the HAL stocks have been vitrified and made passively safe. Figure 1 (p.22) indicates a period of steady stock levels for the last few years due to a number of operational issues, but it is anticipated that HAL stock reduction will now continue and we will maintain focus in this area to secure continued progress.

**FIGURE 1 - ACTUAL (2019) AND PROJECTED HAL STOCKS TO 2030**  
(COURTESY OF SELLAFIELD LIMITED)



54 **Organisational capability:** Sellafield Ltd has embarked on a major programme of organisational change to ensure it is prepared for the change to its mission in accordance with its duties under the site licence; this includes ensuring it has the right leadership and organisational capability required to continue with its accelerated hazard and risk-reduction programme.

55 **Emergency preparedness and response:** The site’s annual demonstration emergency exercise was held in July 2018; this was deemed by our inspectors to be an adequate demonstration of Sellafield’s overall emergency response arrangements. However a partial re-demonstration on certain elements of the site’s arrangements was required, and subsequently completed to our satisfaction.

56 **Incidents:** In this reporting year there has been one incident on the Sellafield site rated at Level 1 on the International Nuclear and Radiological Event Scale (INES). (See Annex 1). We have observed an overall decline in the number of significant incidents notified to ONR and reported through Sellafield’s own internal processes, we are satisfied with the level of reporting.

57 **Investigations and enforcement:** Our inspectors completed two formal investigations in the period. One related to an incident that occurred in 2017 whereby a glovebox operator sustained a puncture wound to one of his hands and consequently received a dose of radiation well above the annual legal limit. This investigation led to Sellafield Limited being prosecuted. The second investigation was in relation to the management and control of legionella bacteria in various water systems on the site. This matter was already subject to an improvement notice in September 2016, which has now been complied with.

58 We took formal enforcement action following a cable-strike incident involving a 132KV electrical supply between site and the Fellside Heat and Power facility. We issued an Improvement Notice that required improvements to secure sustained compliance with the Construction (Design and Management) Regulations 2015.

## SECURITY PERFORMANCE

59 As part of the site's security enhancement programme, Sellafield Limited has continued to develop a new Main Site Command Facility (MSCF), which was due to attain an Initial Operating Capability (IOC) in 2019. The MSCF will bring together several command and control functions in a single location. The development of the new MSCF has nevertheless presented significant challenges and we now anticipate further delay to the site realising this capability. We will undertake this year our own enquiries into the reason for this delay; but we nevertheless remain satisfied in the interim with the existing site command and control capabilities.

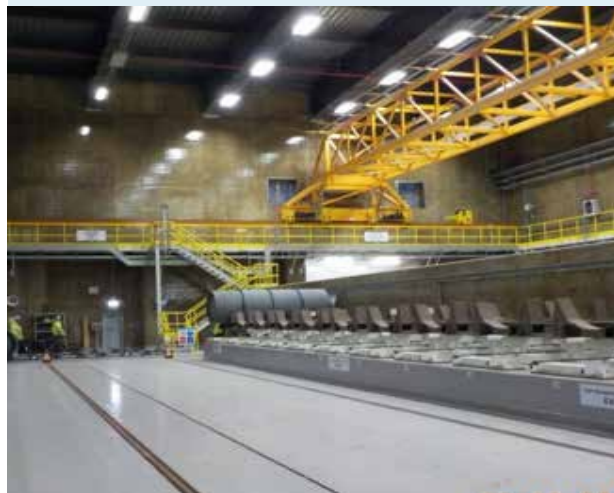


- 60 Sellafield also completed various security upgrades to support receipt and storage of material at the site as part of the Dounreay Exotics Consolidation Project (DECP), which also required ONR's approval of the associated Transport security plans.
- 61 With respect to cyber security, legacy systems are prevalent across the dutyholder estate, there is a significant task to manage or update infrastructure in order to maintain an effective security posture and we will be focusing on delivery of the necessary upgrades by the Sellafield Ltd.
- 62 **Security Incidents:** Sellafield has continued to demonstrate a robust and positive approach to security reporting. There were a number of incidents or matters relating to Sellafield which have been reported to ONR. However, such occurrences are not unusual for a site of such size and complexity and any reports made because of security issues were judged to be of negligible risk due to the overall defence in depth of the measures in place.
- 63 **Security emergency response:** This year, a challenging and complex Level 1 security demonstration exercise was delivered by the site, emphasising clear evidence of a strong emergency management capability, which included a demonstration of the site's Cyber Security Operations Centre (CSOC).

## DECOMMISSIONING, FUEL AND WASTE SITES

- 64 The majority of decommissioning, fuel and waste sites (DFW) sites present little off-site nuclear risk to the public, but some sites do still have significant radiological and conventional safety hazards that need systematic and careful management to ensure protection of the workers as hands-on decommissioning work progresses.

- 65 As the radiological hazard progressively diminishes through the lifecycle phases of decommissioning sites, the potential for worker exposure and on-site releases of contamination are substantially reduced or removed, and the need for regulatory attention will decrease; ultimately to the point where the site may apply to have its licence revoked.



## DUTYHOLDER PERFORMANCE

### DOUNREAY

- 66 Dounreay Site Restoration Limited (DSRL) manages the closure programme of what was the UK's centre for fast reactor research and development until 1994. The Dounreay Material Test Reactor (DMTR) has been de-fuelled and has been in an interim state of care and maintenance; DSRL initiated a project in late 2018 to dismantle the reactor. The Prototype Fast Reactor (PFR) has been de-fuelled and its bulk liquid metal coolant removed, with fuel currently stored within the PFR complex pending characterisation and preparation for interim storage.



67 **Decommissioning progress:** There is a need for continued regulatory focus on decommissioning projects at the DFR and PFR facilities and the Fuel Cycle Area (FCA) where the fuel reprocessing plants and higher activity waste management facilities are located. Notably at DFR, breeder fuel removal rates have been slower than anticipated due to some plant ageing and consequent reliability issues. We are satisfied that DSRL has now improved the situation and rates of safe fuel removal have demonstrably increased.

68 **Special Nuclear Material (SNM) Consolidation:** A high priority is being given to the work to transport SNM off the site in pursuit of the Government's policy for materials consolidation at Sellafield. Significant technical challenges have been encountered in preparation for transporting this material. These have been addressed to our satisfaction and at the time of writing, a significant proportion of the material has been successfully transported to Sellafield under the DECP. Due to its much higher priority, this has slowed work on some of the site's other decommissioning projects.

69 **Security at Dounreay:** DSRL will continue to receive an enhanced level of regulatory attention from a security perspective. This is due to the challenge in meeting certain security requirements, changes to key security staff appointments and other shortfalls. We have observed tangible areas of improvement in the area of Cyber Security and Information Assurance (CS&IA) including effective response to regulatory issues and enhancements made to the identification, classification and risk assessment of computer based systems important to safety.

## MAGNOX LIMITED SITES

70 The NDA strategy for the former Magnox power reactor sites is that they are progressively decommissioned to the point that they can be placed into a quiescent safe state lasting several decades, known as Care and Maintenance (C&M); prior to final dismantling and site clearance. Bradwell was the first UK nuclear site to enter C&M in November 2018.

71 Overall, decommissioning work on all Magnox Ltd sites has continued to progress to agreed programmes this year with no significant safety issues being identified as a result of our inspections or from incidents on the sites. This was a busy year for all the Magnox Limited sites in relation to Intermediate Level Waste (ILW) retrieval and packaging projects; these projects are essential enablers to making the radioactive waste accumulations on the sites passively safe for longer-term storage, and ultimately for disposal.

72 **Organisational Change:** Magnox Ltd is undergoing significant organisational change as a result of the NDA's decision to bring an end to their contract with Cavendish Fluor Partnership, the Parent Body Organisation (PBO), at the end of August 2019. Magnox Ltd will then become a wholly owned subsidiary of the NDA. We reviewed the transition arrangements and consider them to be mature and will continue to monitor their implementation into 2019/20.

73 **Wylfa:** This is the only Magnox power reactor site with used fuel still in its reactor cores; the fuel continues to be systematically and safely removed and transported to Sellafield for reprocessing. Defuelling is important to successful completion of the UK Magnox Operating Programme (MOP), which includes reprocessing of all the remaining Magnox used fuel at Sellafield. By March 2019, 90% of the used-fuel had been removed from the two reactor cores.

- 74 **Bradwell:** We ensured that regulatory expectations were met before issuing consent in November 2018 for the site to enter its Care and Maintenance stage. This first-of-a-kind transition sets a precedent for the UK and for the Magnox reactor fleet. A considerable amount of enabling and decommissioning work has been undertaken over many years to reach this point.
- 75 **Winfrith:** The site is the lead NDA-owned licensed nuclear site intended to be restored to brownfield status. The current NDA plan is that Winfrith will be returned to heath-land in the second half of the 2020s. Some site remediation has already been successfully undertaken with a number of areas of the original Winfrith site now de-licensed. We were pleased to observe that Magnox Ltd has now acquired its licence as an asbestos competent organisation in its own right. Our site inspections have confirmed that safe progress continues to be made on the site.
- 76 **Security performance:** Security across the Magnox estate has been adequate throughout the period. Magnox Ltd has continued to embrace the adoption of our new Security Assessment Principles (SyAPs) with the principal effort being the development of new site security plans. We consider that increased regulatory attention in the period has also secured an overall improvement in cyber-security on the sites.

## FUEL CYCLE FACILITIES

- 77 **Capenhurst Works:** Urenco UK Ltd (UUK) owns and operates the Capenhurst site to enrich uranium for civil nuclear fuel manufacturing purposes. In addition to the UUK material, there is a substantial stock of legacy uranium hexafluoride, known as 'Hex Tails', owned by the NDA and currently stored in transport packages. Urenco Chemical Plants (UCP) has now completed construction, and is undertaking inactive commissioning of the Tails Management facility (TMF), within which de-conversion of Hex Tails will take place.
- 78 We are satisfied that construction and inactive commissioning activities have been undertaken safely, principally in relation to duties under Control of Major Accident Hazards (COMAH) regulations that relate to non-nuclear chemical safety, throughout the design and construction phases.
- 79 **Springfields Works:** This year our inspections on this fuel manufacturing site have not identified any safety or security matters of concern and the site will continue to receive a routine level of regulatory attention.

## LOW LEVEL WASTE REPOSITORY (LLWR)

- 80 The LLWR site in Cumbria currently has two key operational activities. The first of these involves grouting waste into concrete for subsequent storage/disposal of these containers to the sub-surface vaults, which has been done satisfactorily during the period. The second relates to operations associated with the decommissioning of facilities historically used for the processing and storage of Plutonium Contaminated Material (PCM). Significant work has been undertaken by LLWR in these facilities and decommissioning of the redundant PCM facilities is scheduled to be complete in 2019, with transfer of material back to the Sellafield site continuing over the next two years.

## COMMERCIAL LOW-LEVEL WASTE PROCESSING SITES

- 81 Cyclife UK Ltd operates a small licensed site in Cumbria which processes and recycles radioactive metals. Inutec Ltd owns and operates radioactive waste handling facilities on the Winfrith site, offering treatment of contaminated metals. Inutec Ltd was for many years a tenant on the wider Magnox Ltd licensed site, and in February 2019 we granted the company a site licence in its own right.
- 82 The above sites form part of the UK LLWR framework, which continues to successfully reduce the demands on the LLWR site, thereby extending its operating life considerably. The UK diverts around 95% of the LLW it generates to other routes with the remainder going to the LLWR for disposal. The UK's implementation of the waste hierarchy for LLW gained international recognition as good practice in the triennial Joint Convention review meeting in Vienna in May 2018.

## GEOLOGICAL DISPOSAL FACILITY (GDF)

- 83 In November 2018, we published, jointly with the Environment Agency, an assessment report of Radioactive Waste Management (RWM) Limited's 2016 generic Disposal System Safety Case. It stated that we have not identified any fundamental issues that would prevent RWM developing an adequate safety case in due course. However, there remains much work to do to develop a site-specific safety case and security plan. The search for a volunteer community to host a GDF was launched by the Department for Business, Energy and Industrial Strategy (BEIS) in December 2018. To supplement the necessary changes to regulations to prescribe a GDF as a licensable activity under the Nuclear Installations Act, we have begun work to review and revise our position statement on storage of bulk quantities of radioactive material, so that it also encompasses criteria for its deep disposal.

## SITES APPROACHING DE-LICENSING

- 84 The Imperial College Research Reactor site at Ascot and the GE Healthcare site at Cardiff have continued to make good progress with decommissioning and we anticipate them reaching a point in the near future where they will be able to apply to ONR to have their nuclear site licences revoked. This means that they will need to demonstrate that the sites have been cleaned up to the point where they present no danger from ionising radiation.



# OPERATING FACILITIES

## SUMMARY OF PERFORMANCE

Three of the sites that we regulate have received 'enhanced regulatory attention' for several years:

- The two Atomic Weapons sites at Aldermaston and Burghfield
- The nuclear licensed site at Devonport Royal Dockyard

We are implementing clearly defined strategies to secure the long-term improvements necessary for these sites to return to routine regulatory attention.

We considered it necessary to undertake formal enforcement action in the following instances:

- Prosecutions of AWE and EDF NGL relating to serious conventional safety incidents at Aldermaston and Hinkley Point B respectively. Following this action, we are satisfied that each dutyholder has delivered the improvements to safety arrangements necessary to minimise the likelihood of a re-occurrence; and
- A Direction issued to EDF NGL in light of regulatory concerns relating to concealed corrosion at Dungeness B, in order to ensure the issue was fully characterised and the required improvements delivered.

Graphite ageing effects at Hunterston B have resulted in both reactors at the station being shut down for a significant period of time. Such ageing effects are expected but complex, and require significant safety case development work by EDF NGL and careful assessment by our specialist inspectors, before decisions can be made on whether to allow further operation of the reactors. Hunterston B and Dungeness B will both receive enhanced regulatory attention this year, the latter due to significant plant corrosion issues identified by the licensee.

## OPERATING REACTORS

### OVERVIEW OF PERFORMANCE ACROSS THE FLEET

86 EDF Energy Nuclear Generation Ltd (EDF NGL) is the licensed operator of seven twin-reactor Advanced Gas-cooled Reactor (AGR) sites, and a single Pressurised Water Reactor (PWR). Over recent years, we consider that EDF NGL has continued to develop as a mature and responsible licensee, and has operated its sites for the most part, reliably, safely and securely.

87 During the year, operation has continued to be supported by mature arrangements for compliance with Nuclear Site Licence Conditions and other legislation. EDF NGL has a strong safety culture, and is characteristically responsive to regulatory expectations and advice.

88 EDF NGL has a mature and substantially effective internal Independent Nuclear Assurance (INA) function. This has provided robust scrutiny and challenge to EDF NGL's safety performance and the development and content of its safety cases. Whilst we are wholly independent of this function, our inspectors liaise and interface positively with it to secure additional assurance and intelligence.

## DUTYHOLDER PERFORMANCE

### SAFETY PERFORMANCE

#### HUNTERSTON B

89 Hunterston B has a long-standing good safety record. There have however been a number of conventional health and safety incidents during the year, following a previous 10-year period without a 'lost time' accident. Accordingly, we issued an enforcement letter seeking delivery of improvements under 'working at height' regulations. The station has responded well, and is taking positive steps to reinforce the expected standards.

90 During reactor operation, the graphite bricks which make-up the reactor core age and their properties change due to interaction with the radiation environment and the reactor coolant. This can lead to the development of cracks in the graphite bricks, which is a well-known phenomenon and has been the subject of significant interest by the industry, academics and the regulators for many years.

91 In March 2018, EDF NGL reported that additional cracks had been found during planned inspections of the graphite bricks that make up the reactor core at Hunterston Reactor 3. This is the lead reactor across the AGR fleet for the development of cracks in graphite bricks (known as keyway root cracking) as it has operated for longer than the rest of the fleet. EDF NGL took the decision to delay the return to service of the reactor pending further inspection work, and to allow it time to develop a safety case for a further period of operation.

92 In October 2018, Hunterston B Reactor 4 was taken out of service to allow further graphite core inspection work to be undertaken. Although it has operated for a slightly shorter period than Reactor 3, it has also been subject to potentially significant graphite cracking.

93 Before either reactor can return to service, EDF NGL was required to produce safety cases to demonstrate that each can continue to be operated safely for a further period. These safety cases have been subject to detailed examination by specialist ONR inspectors, and we will only agree to further operation of either Hunterston reactor when we are satisfied that it is safe to do so.

94 In August 2019, we subsequently gave permission for EDF NGL to implement a new safety case that will enable restart of Reactor 4 for 16.025 terawatt days of power generation, approximating to an operating period of four months. We based this decision on an extensive assessment and were satisfied that Reactor 4 can be safely shut down in all foreseeable circumstances, including that of a significant seismic event

#### HINKLEY POINT B

95 Following an incident in April 2017, where a contractor (a Doosan Babcock employee) fell through a skylight and received serious injuries, we decided to prosecute both EDF NGL and Doosan Babcock, both of whom pleaded guilty to offences under the Health and Safety at Work etc. Act 1974 and the Work at Height Regulations 2005 respectively. Separate to the court case, we served two Improvement Notices (one each on EDF NGL and on Doosan Babcock) requiring that they make improvements to their arrangements for safe management of working at height. Both dutyholders met these requirements in full.

**HEYSHAM 2 AND TORNESS**

- 96 We consider these sites to have a healthy and mature safety culture, supported by well-experienced and stable leadership teams. At Heysham 2, EDF NGL has recognised that conventional health and safety performance needs to be enhanced further in light of a number of minor incidents that resulted in industrial injuries and others that were regarded as near misses.
- 97 We were notified of an INES Level 1 'anomaly', in which an irradiated fuel flask despatched from Torness was found to have a number of lid bolts fastened less tightly than specified. In light of our follow-up enquiries we were satisfied that the incident was being adequately investigated and appropriate event recovery actions and subsequent process improvements were identified and implemented.

**HEYSHAM 1 AND HARTLEPOOL**

- 98 EDF NGL notified ONR of one INES Level 1 incident at Hartlepool during this period, having identified a theoretical potential compromise to the adequacy of segregation of electrical supplies to key nuclear safety significant equipment under certain plant configurations (See Annex 1). Our inspectors continue to follow-up this incident.
- 99 A steam valve failure occurred at Heysham 1 in November 2018; our investigation identified the need for EDF NGL to improve its operation and maintenance of steam systems on the site and we subsequently issued two Improvement Notices.

**SIZEWELL B**

- 100 Sizewell B has a good record of compliance with health and safety legislation and requirements of the nuclear site license conditions, confirmed through compliance, thematic and system based inspections. The site has continued to demonstrate a good record of industrial safety performance.

We have observed that the site proactively analyses operating experience and implements improvements to site operations.

- 101 Historically, Sizewell B has not allocated sufficient attention to the management of corrosion on tanks, pipework and structural supports and we welcome the fact that EDF NGL has committed to a programme of work for remediation of the site's condensate storage tanks and their timely replacement.

**DUNGENESS B**

- 102 The two Dungeness B reactors are undergoing major improvements to increase the levels of protection during potential reactor faults. In particular, modifications are underway to improve safety in the unlikely event of a major leak from the boilers into the reactor (notably moisture in air detection capability); new nitrogen plant is being provided with the capacity to provide improved reactor hold-down capability for both reactors at the same time, which will remove the requirement to store propane at the site.
- 103 In comparison with other EDF NGL sites, our inspections have highlighted a greater number of regulatory issues at this site, which reflects the challenges it is experiencing in managing a range of complex issues. We issued enforcement letters seeking improvements to the management of radioactive waste, updating the site Emergency Handbook, Management of Incidents on Site and Operating Instructions. In each case, the site took immediate action to address the short-term concerns and we continue to engage on the longer term aspects of these findings.

- 104 We took further enforcement action at Dungeness B in the form of a Direction under the nuclear site licence, requiring EDF NGL to review and reassess safety in relation to safety-related systems where corrosion may reside, due to evident concerns in this area. The licensee responded by undertaking a number of additional inspections, which resulted in the identification of a wide range of corrosion issues. The collective significance of these findings was elevated to an INES Level 2 incident. Since we took enforcement action, EDF NGL has responded positively, and has undertaken a major programme of inspection, repair and replacement actions which will significantly enhance safety at this site.
- 105 During the station's statutory maintenance outages, scheduled inspections of the main steam lines identified a number of instances of stress corrosion cracking and thermal fatigue on pipework and valves; this has required a major programme of remediation by EDF NGL ahead of any return to service of the reactors.
- 108 From a cyber-security perspective, while significant progress has been made regarding capability, delivery at stations remains an area of further regulatory attention. EDF NGL has made improvements to cyber security and information assurance, albeit concerns remain regarding resourcing against an ambitious delivery plan and we will continue to focus on ensuring that this is addressed.
- 109 EDF NGL has delivered personnel security to a consistent standard across the fleet, demonstrating a positive personnel security culture through aftercare incident reporting and its approach to resolution of staff management issues.

## SECURITY PERFORMANCE

- 106 EDF NGL has continued to develop SyAPs-aligned site security plans. Developing the required evidence to support certain claims and arguments has taken the company longer than anticipated, thereby delaying submission and subsequent approval of these new plans.
- 107 From our interventions, we are satisfied that there were no significant security compliance issues across the various operating power stations.





## DEFENCE SITES

110 There are three types of nuclear sites used for defence purposes:

- **Nuclear Licensed Sites**, which we regulate in accordance with the standard nuclear site licence. In the sole instance of AWE plc, Licence Conditions do not apply to the extent that they impact on the design of the weapon.
- **Authorised Defence Sites** that do not require a nuclear site licence; this is because of exemptions relating to specific activities or a general dis-application to activities that are under the control of the Crown, in this case the Ministry of Defence (MoD). In these situations, the sites are authorised by the MoD. However, ONR is appointed as the enforcing authority for the Health and Safety at Work Act etc. 1974 (HSWA) and its relevant statutory provisions.

- **Nuclear Warship Sites**, the Health and Safety Executive is appointed as the enforcing authority for enforcing HSWA. ONR is specifically appointed as the Enforcing Authority for the enforcement of Radiation (Emergency Preparedness and Public Information) Regulations (REPPiR) 2019 and the Ionising Radiation Regulations 2017 (IRR17).

- 111 The Defence Nuclear Safety Regulator (DNSR), part of the MoD's Defence Safety Authority, is specifically required to regulate the design of, and Design Authority arrangements for, submarine reactors and nuclear warheads. Security regulation at defence sites is the responsibility of the DNSR. We have continued to work closely with both these bodies to ensure proportionate and effective regulation.
- 112 Defence regulators are responsible for regulating all defence nuclear security matters, the transport of defence related radioactive materials and safeguards associated with defence activities.



## ATOMIC WEAPONS ESTABLISHMENT SITES SAFETY PERFORMANCE

113 AWE plc operates the AWE sites at Aldermaston and Burghfield. These sites deliver the design, manufacture, maintenance and support of the UK arsenal of nuclear warheads. Both sites have received enhanced regulatory attention for approximately six years. Historically, this was due to safety and compliance concerns, and the continued undertaking of operations in ageing facilities due to delays to the delivery of modern standard replacement facilities.

### DUTYHOLDER PERFORMANCE

114 In response to these and other issues, we welcome that AWE has recognised it needs to make fundamental changes to the way it operates and manages safety. During 2017, AWE began to develop a comprehensive Structured Improvement Programme (SIP) focused on delivering sustainable improvements in safety and compliance across both sites, by addressing the root causes of performance shortfalls, whether recent or historical in nature.

115 The AWE SIP is now at the implementation phase and ONR notes that it continues to receive support and commitment at all levels throughout AWE. We are supportive of this wide-ranging approach and recognise that it is a long-term programme that includes a significant element of cultural change. While we recognise the benefit of this long-term programme, short-term challenges remain.

### AWE ALDERMASTON

116 Following a conventional safety incident in Aldermaston during 2017 that occurred during live electrical working, we undertook a formal investigation, which resulted in a decision to commence legal proceedings for offences relating to Section 2 of the Health and Safety at Work Act. AWE pleaded guilty to these offences, and committed to improve procedural controls and risk assessments in support of future live electrical working across its wider estate.

117 During the year, AWE deferred the delivery of plant upgrades, identified as necessary from the site's 10-yearly Periodic Review of Safety (PRS); this highlights the challenges that AWE is experiencing in delivering parallel PRS projects across its wider estate.

118 Following our enforcement from a previous year, AWE has begun to improve radioactive waste storage arrangements and, in cooperation with other stakeholder organisations, to reduce the total quantity of stored radioactive waste on the Aldermaston site.

## AWE BURGHFIELD

- 119 The Burghfield Assembly Technology Centre (ATC) comprises a number of ageing facilities that AWE had planned to replace with the modern standards Mensa facility by 2016. However, the contracted completion date for Mensa is now 2023 due to construction delays. AWE undertook a PRS in 2016 to justify continued use of the existing ATC for the next 10 years, which identified that a significant number of safety upgrades were required to support the extended lifetime of the facility.
- 120 We have worked closely with AWE to ensure that the licensee implements these safety upgrades in a timely manner. We welcome that AWE has prioritised its focus and key technical resources on delivering the ATC upgrade projects, and are satisfied with progress being made to date.
- 121 Recognising that AWE has a programme of work in place to improve safety performance, the nature of improvements required, and the time they will take to deliver and embed, the AWE sites will remain under enhanced regulatory attention until we are satisfied that sufficient progress has been demonstrated. Maintaining its current trajectory, we expect that AWE should be in a position to demonstrate evidence to support a move into routine regulatory attention during 2021.

## PROPULSION SITES PERFORMANCE

### DEVONPORT

- 122 Devonport contains a Nuclear Licensed Site (Devonport Royal Dockyard) and an authorised Defence Nuclear Site, which are operated by Devonport Royal Dockyard Limited (DRDL). There is also an Authorised Defence Site operated by HM Naval Base Devonport that provides support to the UK's fleet of operational submarines. Devonport Royal Dockyard is the UK's principal site for the refuelling and deep maintenance of submarines. HM Naval Base Devonport now houses 13 of MoD's 20 redundant submarines on its Authorised Defence Site, following an extension to the Authorised site boundary during 2018.
- 123 We are pleased that DRDL is undertaking a number of strategic infrastructure upgrade projects across the licensed site, including improvements to the 14 Dock and 15 Dock facilities, and development work on the upgrades required to provide an appropriate maintenance facility for the Astute and Dreadnought classes of submarine.
- 124 DRDL has received enhanced regulatory attention for 5 years based upon a number of safety performance factors. Our regulatory strategy is built around an enabling approach including the provision of advice and guidance. The success of this strategy is predicated on commitment and delivery by the licensee.



- 125 Our focus this year has been on building DRDL's capability and knowledge, using experience from across the nuclear sector in organisational change, culture improvement and business reengineering and transformation.
- 126 We have developed clear regulatory criteria against which DRDL can monitor its progress as it works towards a position where, at some future point, sufficient progress has been made to warrant its return to 'routine regulatory attention'. Within these are requirements for DRDL to implement improvements to existing arrangements to ensure clearer accountabilities for nuclear safety, an effective approach to learning from experience, self-assessment and benchmarking, and for it to develop an organisational culture to underpin high reliability and safe operations.
- 127 **Improvement programme:** DRDL has a nuclear safety improvement programme that it considers once delivered will provide evidence to support a move into routine regulatory attention. However, progress over the last year has not delivered the improvements we would have expected due to poor delivery against its improvement programme.
- 128 Our inspectors undertook reviews of the licensee's progress in August 2018 and March 2019. The August review highlighted a lack of focus on governance, accountability and tangible delivery of milestones, together with an under-resourced programme subject to ambiguous project management and leadership. Subsequently, we have observed significant improvements to leadership commitment and delivery that we anticipate will begin to have a major positive impact on the site.
- 129 Noting progress made since December 2018, we have confidence that significantly better progress will be achieved and sustained over the coming year.
- 130 Investigations and enforcement: During the year we were notified of two incidents rated INES Level 1, both relating to crane maintenance and operation. As a consequence, and noting a poor compliance history regarding the safety of crane operations, we initiated a formal investigation in September 2018. This concluded in February 2018 and resulted in a decision to prosecute DRDL for offences under the Lifting Operations and Lifting Equipment Regulations 1998.
- 131 While berthed on the HM Naval Base Devonport site, we note that defueling of the redundant submarines, which pose a lower level of radiological hazard and risk, at Devonport has not yet received the level of attention or priority we had anticipated. We have therefore engaged with MoD to consider how this work can be accelerated.

#### ROLLS-ROYCE SUBMARINES LIMITED (RRSL)

- 132 The Rolls-Royce Submarines site at Derby is the principal location for the manufacture and basic testing of nuclear submarine fuel cores to support the UK Nuclear Submarine programme. It contains two separate nuclear licensed sites - the Neptune Reactor site, which includes a 'zero energy' test reactor; and the Nuclear Fuel Production Plant. Both licensed sites are operated by RRSL.
- 133 We are satisfied with the general levels of safety on the two sites. During the year, we permissioned the installation of plant and equipment into the Product Assembly Building, and the procurement of the Neptune reactor tank and nucleonic detector equipment. Our priority for the year ahead remains the Neptune reactor refurbishment in recognition of its national strategic importance in supporting the Dreadnought programme.

## BAE SYSTEMS BARROW

- 134 Nuclear submarines are constructed at BAE Systems in Barrow. The site contains a Nuclear Licensed Site (Devonshire Dock Complex), which is operated by BAE Systems Marine Ltd, and an Authorised Defence Site. The nuclear risk profile of the Barrow site is unusual in that, for the majority of time, the nuclear safety risk is low. However, during reactor testing in new submarines, the risk is significantly increased.
- 135 Major site development work is underway to provide the infrastructure to build and commission Dreadnought Class submarines. In order to support this work, BAE applied for an extension to the licensed site boundary. This was assessed by ONR and a revised Site Licence issued in October 2018.
- 136 Submarine construction necessitates 'hot work' such as welding and grinding. Housekeeping and safe systems for control of work are intended to prevent such hot work from causing fires. During 2018, BAE Systems experienced a series of minor fire incidents from hot work, which led to an enhanced focus and a series of interventions from ONR. The licensee took the right course of action by electing to cease operations whilst improvements to management of work arrangements were made.

## ROSYTH DOCKYARD

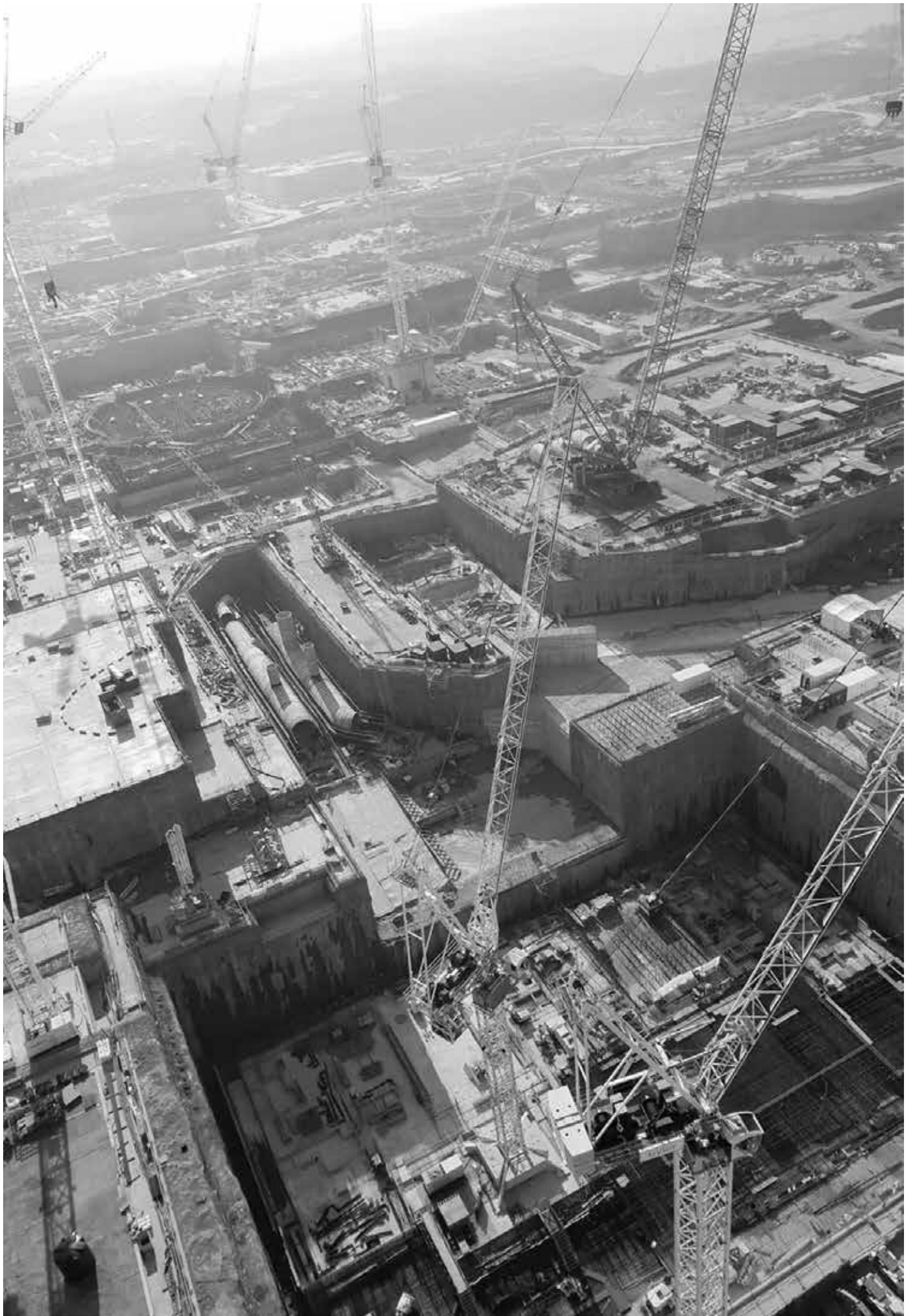
- 137 Rosyth Dockyard contains a Nuclear Licensed Site, which is operated by Rosyth Royal Dockyard Limited (RRDL). The Nuclear Licensed Site houses a dry dock, used to dismantle decommissioned submarines, and a waste storage facility. The dockyard houses seven redundant submarines, which are stored off the nuclear licensed site. The first phase of submarine dismantling (low-level waste removal) is currently underway at Rosyth.

The level of the hazard on site is low compared to most licensed sites, and we are satisfied with the safety performance at this site.

RRDL intends to expand its capability to undertake the next stages of submarine dismantling and to remove intermediate level waste from the vessels. This will require a significant uplift in organisational capability along with development of site facilities, and work to deliver this is underway, which ONR will oversee.

## NON LICENSED PROPULSION SITES

- 138 HM Naval Base Clyde, located in Faslane in Scotland, is the operational base for most of the MoD's submarines and contains an Authorised Defence Site. As an Authorised Defence Site, ONR's responsibility is limited to the enforcement of the HSWA and its Relevant Statutory Provisions.
- 139 The Vulcan Naval Reactor Test Establishment near to Dounreay is an Authorised Defence Site. It was a test facility for Naval Pressurised Water Reactors. The Vulcan test reactor was shut down for the final time in July 2015 and the facility is now considered to be in a long-term quiescent state.
- 140 We maintain close working relationships with both the defence nuclear safety and security regulators, undertaking a number of joint inspections, to continue our awareness and understanding of operational activities undertaken on the Authorised Sites and gaining the necessary assurances on these where required.



# NUCLEAR NEW BUILD

## SUMMARY OF PERFORMANCE

We are satisfied that the enabling approach we are taking in our New Reactors Division has ensured that positive outcomes have been secured across civil reactor new build projects, ensuring that they achieve the high levels of safety and security required in the UK.

We were pleased to be able to issue the Consent to enable the NNB GenCo to commence construction of the nuclear island at Hinkley Point C. In taking this decision, we have confidence that NNB GenCo is achieving the high levels of assurance and quality control necessary to build a nuclear reactor and has the appropriate arrangements in place to ensure similar standards are achieved through its supply chain.

Our assessment of the Chinese UK HPR1000 Generic Design Assessment (GDA) process continues. During the period, the move to GDA Step 3 confirms that the Requesting Party, General Nuclear System Ltd (GNS), understands the UK requirements and is meeting the necessary safety and security standards to continue to progress in the GDA.

## NEW REACTOR LANDSCAPE

- 141 We have continued to regulate the ongoing construction of NNB Generation Company (HPC) Limited's (NNB GenCo HPC) twin UK European Pressurised Reactor™ (UK EPR) at the Hinkley Point C (HPC) site in Somerset. We have also started to engage with NNB Generation Company (SZC) Limited (NNB GenCo (SZC)) for the potential construction of a twin UK EPR at the Sizewell C site in Suffolk.
- 142 Prior to suspension of the development programme, our focus in 2018/19 included completion of the Generic Design Assessment (GDA) of the UK ABWR® design and assessing Horizon's application for a Nuclear Site Licence to construct and operate two UK ABWRs® at the Wylfa Newydd site on the island of Anglesey in North Wales. However, our work on this project has now stopped.
- 143 We are assessing the UK HPR1000 design under the GDA process and engaged early on the potential deployment of HPR1000 reactors on the Bradwell site in Essex.

## HINKLEY POINT C

- 144 We made two significant permissioning decisions during 2018/19:
- Agreement under Licence Condition 19(1) to allow the start of construction of Unit 1 pumping station at HPC. The pumping station is a partially buried reinforced concrete structure that houses systems that supply filtered sea water to the nuclear island and conventional island cooling systems.
  - Consent under Licence Condition 19(4) to allow the pouring of concrete for the Unit 1 nuclear island common raft to commence.
- 145 In both cases, we concluded that NNB GenCo (HPC) had adequately justified its design and that its site performance and organisational capability is sufficiently mature. We were further satisfied through our interventions that its contractors had the ability to deliver the structures in accordance with NNB GenCo (HPC)'s design and quality requirements.



## DUTYHOLDER PERFORMANCE

### REFERENCE CONFIGURATION 2

146 NNB GenCo (HPC) reached a major milestone in late 2018 with the scope of Reference Configuration 2 (RC2) being frozen. RC2 is the name of the design configuration that will be constructed and commissioned at HPC. This has taken into consideration relevant modifications that arose from commissioning the other EPRTM projects (in France, Finland and China). We do not believe that RC2 will yield significant design modifications and consider further new significant modifications post RC2 freeze are unlikely.

### RESOLUTION OF GDA ASSESSMENT FINDINGS

147 We consider that NNB GenCo (HPC) has made good progress towards resolution of GDA assessment findings. At the end of GDA approximately 700 GDA assessment findings were raised (nuclear safety and security). Of these, 192 were identified as requiring closure before nuclear island concrete. As of March 2019, NNB GenCo (HPC) has closed 263 GDA assessment findings. We consider that GDA assessment findings were adequately addressed prior to commencement of nuclear island concrete, others will be required to be addressed as the project progresses.

### SUPPLY CHAIN

148 Our supply chain management assessment has this year continued to focus on development, deployment and effectiveness of NNB GenCo (HPC)'s arrangements and their implementation against ONR's expectations, so as to ensure the quality and provenance of items supplied to the project.

149 The Chief Nuclear Inspector's (CNI) Inspection of NNB GenCo (HPC)'s supply chain management arrangements, conducted in early 2018, identified shortfalls in a number of areas. Based on our detailed assessment ahead of nuclear island concrete consent, we were satisfied that NNB GenCo (HPC) had taken the appropriate steps to address these matters.

150 We also examined NNB GenCo (HPC)'s arrangements for overseeing and controlling the manufacture of the nuclear steam supply system components by Framatome. We considered these arrangements in light of operational experience (OPEX) from Flamanville 3 relating to the main steam line and auxiliary pipework where poor quality of welding and non-destructive testing has resulted in significant rework.



- 151 We consider that NNB GenCo (HPC) has responded appropriately to this operational experience through a series of measures aimed at ensuring similar problems do not occur on the equivalent HPC components.

### CONSTRUCTION

- 152 During 2018/19 NNB GenCo (HPC) commenced construction of a number of safety significant structures at HPC. We have:
- secured assurance that NNB GenCo (HPC) is constructing and installing the structures and systems at HPC as per design and quality requirements;
  - considered that contractors are appropriately managing conventional health and safety and conventional fire safety during construction;
  - verified that NNB GenCo (HPC) is appropriately implementing relevant security requirements at the HPC site.
- 153 Overall, we consider that NNB GenCo (HPC) is adequately constructing its justified design to the required quality standards.

### SECURITY AT HPC

- 154 We have assessed the security dimensions of the major construction work at Hinkley Point C to ensure these are adequate and proportionate to the activity at the site.
- The dynamic nature of the project has presented certain challenges to the maintenance of an effective security regime. The dutyholder has, however, continued to address these and deliver satisfactory outcomes. NNB GenCo (HPC) has submitted a SyAPs-aligned site security plan, which we will assess during 2019/20.

### FORWARD LOOK

- 155 The bulk installation of mechanical, electrical and heating (MEH), ventilation and air conditioning (HVAC) will represent the next significant regulatory permission on the nuclear island; we anticipate an application in the second half of 2020.
- 156 We will increase our focus on NNB GenCo (HPC)'s development of its capability to manage the bulk installation of MEH equipment, which is scheduled to commence in 2020.

### SIZEWELL C

- 157 We anticipate Sizewell C will be a replication of HPC, using the same design reference configuration. We consider that replication will also have significant benefits for nuclear safety and security; notably Sizewell C would make use of the significant learning from construction and commissioning of HPC.
- 158 The UK Government (BEIS) is considering the use of the Regulated Asset Base (RAB) model of funding for new nuclear projects, which may include Sizewell C. The Government in its consultation states that, by providing regulated returns to investors, a RAB model has the potential to reduce the cost of raising private finance for new nuclear projects, thereby reducing consumer bills and maximising value for money for consumers and taxpayers.
- 159 Prior to Final Investment Decision (FID) for Sizewell C, the EPRTM will have had the opportunity to demonstrate it is a successful technology, particularly now that Taishan has entered commercial operation in China.

160 Stage 3 consultation commenced in January 2019. Following this public consultation, we anticipate the Sizewell C project will make an application for development consent. We anticipate that our focus will likely progressively increase to enable the Sizewell C project to make a Nuclear Site Licence application during 2020.

### BRADWELL B – UK HPR1000

161 The UK HPR1000 is a reactor design proposed for deployment at Bradwell-on-Sea, Essex. General Nuclear System Limited (GNS) is a UK-registered company that was established to implement the on-going GDA on the UK HPR1000 reactor on behalf of three joint requesting parties, i.e. China General Nuclear Power Corporation (CGN), EDF and General Nuclear International (GNI). GNI is a UK subsidiary of CGN.

### GDA

162 Along with the Environment Agency, we completed GDA Step 2 of the UK HPR1000 in November 2018. During Step 2 we commenced our technical assessment and focused on understanding and assessing the fundamental safety and security claims, and the acceptability of the UK HPR1000 within the UK regulatory regime. The UK HPR1000 safety and security claims were presented within the Preliminary Safety Report (published on GNS' GDA website<sup>5</sup>) and its supporting references.

163 During Step 2 of GDA, we raised 152 Regulatory Queries (RQs) and five Regulatory Observations (ROs). We also identified numerous technical matters for follow-up during Step 3 of GDA. ROs are raised when ONR or EA identify potential regulatory shortfalls which require action and new work by the GDA Requesting Party (RP) for them to be resolved.

164 Our Step 2 assessment did not identify any fundamental safety or security shortfalls that might prevent the issue of a Design Acceptance Certificate (DAC) for the UK HPR1000 design. At the end of Step 2 we published 19 Assessment Reports and a Summary Report<sup>6</sup> describing the work done and the conclusions reached.

165 Step 3 of GDA commenced in November 2018. In Step 3 we have increased our regulatory scrutiny and are undertaking a more detailed assessment of the design focusing on the methods and approaches used by the Requesting Party to meet its safety and security claims.

### BRADWELL B SITE

166 Bradwell Power Generation Company Ltd (BRB) is a joint venture between General Nuclear International (GNI) and EDF Energy created to deploy the UK HPR1000 reactor technology. Our UK HPR1000 team has engaged with BRB to ensure it understands our expectations in the demonstration of site suitability and organisational development to become a capable prospective licensee.

### ADVANCED NUCLEAR TECHNOLOGIES

167 In October 2017, as part of the Clean Growth Strategy<sup>7</sup>, the Government announced that it would invest up to £7 million to further develop the capability and capacity of the nuclear regulators to support and regulate the development of Advanced Nuclear Technologies (ANTs). In this context, ANTs include advanced modular reactors (AMRs) and small modular reactors (SMRs), based on light water reactor technology.

<sup>5</sup> [www.ukhpr1000.co.uk/documents-library/step-2/](http://www.ukhpr1000.co.uk/documents-library/step-2/)

<sup>6</sup> [www.onr.org.uk/new-reactors/ukhpr1000/reports.htm](http://www.onr.org.uk/new-reactors/ukhpr1000/reports.htm)

<sup>7</sup> [www.gov.uk/government/publications/clean-growth-strategy](http://www.gov.uk/government/publications/clean-growth-strategy)

- 168 To meet the objective set by government, ONR has continued during 2018/19 to implement a programme of work with the following objectives:
- develop ONR capability and capacity to regulate ANTs;
  - review ONR's guidance and processes to ensure that they are fit for regulating ANTs;
  - provide advice to government's advanced modular reactor (AMR) feasibility and development programme;
  - increase engagement with international regulators.
- 169 Development of our capability and technical expertise in ANTs is a long-term objective, but we have started the process of ONR's ANT capability growth and are establishing the foundations for future development. We have identified ONR's skill gaps on ANTs and have developed and implemented a training strategy to address this.
- 170 In 2018/19, we have continued to review our guidance to check its adequacy and sufficiency for regulating ANTs. In general, we concluded that our guidance is suitable to regulate these types of reactors; this is not surprising as it is generally technology-neutral and non-prescriptive. However, some recommendations to expand our guidance, for example on passive safety and consideration of relevant good practice for advanced reactors, have been raised from this work.
- 171 We are also planning to undertake a focused review of our guidance on licensing nuclear installations<sup>8</sup> to ensure that it takes into account that there may be ANT deployment models which are different to those we have licenced so far in Great Britain.
- 172 ONR, alongside the Environment Agency, has supported the government by providing views on the potential of the proposed AMR designs to align with our regulatory expectations. For this, we have developed assessment criteria and guidance for vendors, and have begun to assess the regulatory submissions for the seven fission reactor designs:
- a sodium fast reactor by Advanced Reactor Concepts LLC;
  - three high temperature gas reactors by DBD Ltd, Ultra Safe Nuclear Corporation and U-Battery Developments Ltd;
  - a molten salt reactor by Moltex Energy Ltd;
  - two lead fast reactors by Westinghouse Electric Company UK Ltd and LeadCold.
- 173 During 2018/19, we have developed and implemented a three-stage programme of engagement with vendors of SMRs of a more mature type (light water reactors). This has enhanced:
- understanding by the SMR vendors of the key regulatory expectations and requirements of the safety, security and environmental justifications that would need to be submitted to the regulators ahead of future deployment in the UK (e.g. in support of regulatory design assessment);
  - understanding by the regulators of the technologies, their proposed deployment and operation and the current status of the vendors' safety, security and environmental assessments and justifications.

<sup>8</sup> [www.onr.org.uk/licensing-nuclear-installations.pdf](http://www.onr.org.uk/licensing-nuclear-installations.pdf)



# CIVIL NUCLEAR SECURITY AND SAFEGUARDS

## SUMMARY OF PERFORMANCE

We are satisfied that the civil nuclear industry continued to meet its security obligations during 2018/19.

The period has been marked by the development and assessment of a number of new, Security Assessment Principles (SyAPs)-aligned, security plans from nominated sites across the nuclear industry. These have provided valuable information that has been shared among dutyholders and with safety and safeguards colleagues within ONR. The lessons from this work will be taken forward in the forthcoming year as all dutyholders seek to produce SyAPs-compliant security plans.

Despite many positive advances in the year, certain dutyholders continue to attract enhanced or significantly enhanced levels of regulatory attention in a security context. In most cases this due to a combination of factors that include continued development of security arrangements, competence, capability and capacity and continuing work on the movement and storage of nuclear material.

Focus will remain on the implementation of SyAPs-aligned security plans, and assisting dutyholders to achieve a routine level of regulatory attention.

175 The preceding sections of this report have referenced site-specific security matters. The following paragraphs describe common security delivery themes that we have identified over the year:

176 **Development of SyAPs-Aligned Security Plans:** We have supported the development and production by the pilot sites of SyAPs-aligned security plans and work by other dutyholders to prepare for submission of plans in the next 12 months. Our original assessments of the time and effort we and industry required to support this work were somewhat optimistic; the lessons learned and experience gained have contributed to a more considered and robust programme for the forthcoming year.

177 **Security Leadership and Culture:** There have been improvements in industry's recruitment, development and retention of competent and capable staff throughout the year, but challenges remain. The security expertise within some organisations remains limited and the need to consider adequate succession planning to develop a similar depth of knowledge to safety counterparts continues to be an area of future focus. Linked to capability and capacity, there is also room for improvement in dutyholder internal assurance arrangements for security.

**178 Regulatory Issue (RI) Management:**

An emerging theme has been making better use of regulatory issues to bring about decisive effect. A review of security RI across the industry is underway, with the intent of addressing and reprioritising matters in order to more effectively oversee issues through to closure.

**179 Cyber Security and Information Assurance (CS&IA):**

Key CS&IA improvements have been delivered through targeted activities on assurance of 'List N' (sensitive nuclear information held in the supply chain) and cyber-security improvement technical support contracts. This work has enhanced capacity, enabled the development of good practice in threat intelligence use by dutyholders and assisted in the development of cyber-security exercising expectations.

## SECURITY OF APPROVED CARRIERS

180 We regulate 19 approved carriers of nuclear material. Support to Dounreay Exotics Consolidation Project activity has continued to be the major activity in transport security in the period and it is likely that it will continue to demand additional regulatory attention in the next year. Consequent to this work and the requirement to assess a new SyAPs-aligned transport security statement, two Class A approved carriers, Direct Rail Services (DRS) and Dounreay Site Restoration Ltd (DSRL), will be subject to 'enhanced' regulatory attention during 2019/20.

181 Of the Class B carriers, Geodis UK Ltd and TN International (France) will be subject to 'enhanced' regulatory attention as a result of increased transport activity and to address requirements arising from previous regulatory engagements respectively

Action plans have been agreed and there is no indication that additional regulatory resources will be required at this time. All other carriers will receive a routine level of regulatory attention in the coming year.

## CYBER SECURITY

182 Cyber security is a key issue for governments, businesses, communities and individuals that has increased in prominence over the last few decades, following a series of high profile attacks on large-scale enterprises. ONR regulates the cyber security of civil nuclear sites. We also regulate those organisations in the civil nuclear supply chain that hold or process sensitive nuclear information, such as that relating to the movement of nuclear materials.

183 ONR's Security Assessment Principles specifically cover preparation for and response to cyber security incidents. Broader defence in depth through complementary security and safety measures remains necessary to minimise the impact of an attack. Diversity, redundancy and segregation of key systems remain key underpinning principles.

184 We have continued this year to apply outcome-focussed regulation to cyber security in the same manner as we do for other areas of nuclear security and nuclear safety. There have been significant improvements in cyber security over the past five years, however sustained focus by industry is required within an ever-changing cyber landscape and to maintain an organisational control of risk exposure, based on the above principles.

## SAFEGUARDS

- 185 Nuclear safeguards are measures to verify that countries comply with their international obligations not to use nuclear materials for nuclear explosives. A fundamental principle of the safeguards regime is that the verification is independent of the country, and is performed by international inspectorates.
- 186 ONR has worked with UK organisations subject to safeguards requirements, the international safeguards inspectorates and other stakeholders so that safeguards obligations for the UK are met effectively and efficiently. During 2018/19, we worked in co-operation with industry to ensure that IAEA and Euratom inspection activities in the UK were undertaken efficiently and allowed the IAEA and Euratom to collect the evidence they require to draw their safeguards conclusions.
- 187 In addition, we ensured that the UK operators' accountancy declarations were delivered to Euratom on time and collated information from industry to produce obligated reports to the IAEA in accordance with the Voluntary Offer Agreement (VOA) and the Additional Protocol (AP). These inspections and reports have enabled the IAEA and Euratom to provide international assurance that the UK has complied with its obligations as set out in the VOA and AP.
- 188 We have also worked with the safeguards operators to collate the information and deliver the reporting required to Australia and Japan through the Nuclear Co-operation agreements, providing assurance that all of their safeguarded materials currently in the UK are accounted for and continue to be managed as required by the agreements.







# REGULATION ACROSS OUR INTEGRATED FUNCTIONS

## SUMMARY OF PERFORMANCE

Over the last year we have further integrated our transport and conventional health and safety processes to better align our regulation of these purposes with those for nuclear safety, security and safeguards. This has included bringing the regulation of Control of Major Accident Hazards (COMAH) on nuclear sites 'in-house' rather than buying-in this service from the HSE.

To support the Government's implementation of the Basic Safety Standards Directive in the UK, we have worked closely with BEIS, the HSE and MoD to advise on Radiation (Emergency Preparedness and Public Information) Regulations (REPPiR)19 and the amendments to the Carriage of Dangerous Goods regulations (CDG). Our focus over the coming year will be to help operators and local authorities to comply with REPPiR19 and the CDG regulations, which includes the provision of an Approved Code of Practice (ACoP) and guidance.

The IAEA's IRRS Mission to the UK in October 2019 is an important opportunity for us to benchmark against international safety standards and identify any improvements needed to our regulatory framework and approach. We have led the UK's preparations for the mission, resulting in improved co-operation between UK's nuclear and radiation safety regulators, especially in the transport arena.

## RADIOACTIVE MATERIALS TRANSPORT PERFORMANCE

- 189 ONR is Great Britain's Competent Authority for the civil transport of Class 7 - radioactive material, and carries out a range of regulatory activities to assure the safe transport of this material.
- 190 We grant approval for the designs of packages used to carry high-hazard radioactive materials to ensure they meet exacting international safety standards; are built to robust quality assurance plans; and are correctly used and maintained. We regulate through a programme of targeted, risk-informed inspections and engagement with dutyholders.
- 191 We have continued to inspect consignors and carriers of radioactive material, including hospitals involved in transporting sealed and unsealed radioactive sources for diagnosis and treatment, industrial users involved in non-destructive testing and oil exploration, and carriers of radioactive material such as road hauliers and couriers.
- 192 We have shared information on shortfalls and good practices identified during our inspections with sector specific stakeholder groups and professional associations to maximise learning from, and the impact of, our inspections. Overall, we are satisfied that transport has been carried out safely and securely.

## SIGNIFICANT INCIDENTS

- 193 There have been two incidents reported to us, relating to the transport of material in 2018/19 that we have investigated:
- Airport Transit of Sources, INES Level 2 event: relating to the transit of packages, each containing a high activity sealed radioactive source via Heathrow airport. (Annex provides further detail.)
  - Transport of source, inadequate risk assessment: During a routine inspection of an organisation using radioactive sources for non-destructive testing we determined that the company had not carried out a risk assessment in relation to their work with ionising radiations, specifically the activity of transporting radioactive material. Following our investigation, we served an Improvement Notice to secure improvement in the legal non-compliance identified during our inspection.

## SIGNIFICANT TRANSPORT PACKAGE APPROVALS IN NUCLEAR AND NON-NUCLEAR SECTOR

- 194 In 2018/19, we issued a number of package design and associated shipping approvals allowing the transfer of special nuclear materials from Dounreay to Sellafield in support of the national material consolidation exercise (DECP).

## EMERGENCY PREPAREDNESS & RESPONSE PERFORMANCE

### LOCAL AUTHORITY ARRANGEMENTS

- 195 We conducted three inspections this year at Cleveland (Hartlepool), Cumbria (Sellafield) and Lancashire (Heysham). These inspections revealed a number of good practices, as well as potential areas for improvement. We did not identify any significant issues requiring any follow-up intervention. Reports of these inspections can be found on our website.

- 196 We observed examples of relevant good practice at a number of local authorities. We have shared examples of good practice with other dutyholders where there were opportunities to improve existing arrangements. Although we identified some areas for improvement, these are generally minor in nature.

### OFF-SITE NUCLEAR EMERGENCY EXERCISES

- 197 We have observed the exercising of a range of off-site emergency plans this year. In all instances, we were satisfied that the demonstration of emergency response and preparedness capability we witnessed met the requirements of REPPiR Regulation 9 1 (for local authorities) for protection of the public.

167

### CHANGE IN REGULATIONS

- 198 The UK Government has legislated to enact a new REPPiR in 2019 (REPPiR19) to implement the Euratom Basic Safety Standards Directive (BSSD) 2013, which applies learning following the Fukushima Daiichi accident. REPPiR19 places new duties on licensees and local authorities, and will contain transition arrangements for one year to allow dutyholders to develop arrangements for compliance over this period.
- 199 Under the new regulations, responsibility for setting detailed emergency planning zones will move from ONR to the local authorities. We are drafting an ACoP, along with associated guidance to support compliance with REPPiR19. We are working closely with government (BEIS), HSE and MoD to ensure this guidance is available to dutyholders as soon as possible after REPPiR19 comes into force.

## CONVENTIONAL HEALTH & SAFETY PERFORMANCE

### REGULATION OF CONVENTIONAL HEALTH & SAFETY

- 200 We regulate conventional health & safety (CHS) under the Health & Safety at Work etc. Act 1974 and associated secondary legislation (relevant statutory provisions).
- 201 We have taken into account trending information gathered from regulatory interventions with licensees and other dutyholders, including inspections, progress reports, periodic meetings, and arrangements made under health and safety management systems.
- 202 In regulating under this purpose, we have utilised data from a number of information sources. These include reports to ONR by licensees and other dutyholders under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations 2015 (RIDDOR), as well as statutory examination defect reports provided under specific legislation, including pressure systems and lifting equipment.

### DUTYHOLDER CHS PERFORMANCE

- 203 We received 104 RIDDOR notifications from licensees and other dutyholders in 2018/19, an overall increase of 23 since 2017/18. Of these:
- 85 related to reportable injuries, an increase of 17 since 2017/18;
  - 17 related to defined dangerous occurrences, an increase of 5 since 2017/18;
  - 2 related to a reportable disease, an increase of 1 since 2017/18.
- 204 It is important to note when considering this data that such a small data set does not allow for clear statistical trending from year-to-year, therefore these increases should not automatically be interpreted as a decrease in health and safety performance.

For example, variables such as reporting culture within and between dutyholders can play a part in skewing the data.

- 205 Nevertheless, we consider the total number of reportable injuries is too high and it remains a priority for ONR to secure further improvements from the industry. Comparisons of the performance of the nuclear industry with other sectors is similarly challenged by the relatively small data sets involved, as well as the different methods of data collection and processing techniques used by other regulatory bodies and industry. We are considering ways in which to manage this data to build a better picture over time, and give a greater insight into trends and comparisons.
- 206 CHS performance between licensees can be variable, and we are taking steps to ensure continuous improvement of standards across the industry, particularly for those sites with hazards representing the greatest CHS risks. These include asbestos management, construction activities, working at height, and control of contractors.
- 207 Anecdotal evidence suggests a decrease in health and safety performance in some areas, as evidenced by a number of significant CHS incidents that have been subject to investigation this year, resulting in enforcement action including Improvement Notices and in some cases prosecution.
- 208 Our programme of fire safety inspections on licensed sites during 2018/19 has sought and acquired confidence that the industry is adequately managing its fire risks.

### FIRE SAFETY AND GRENFELL

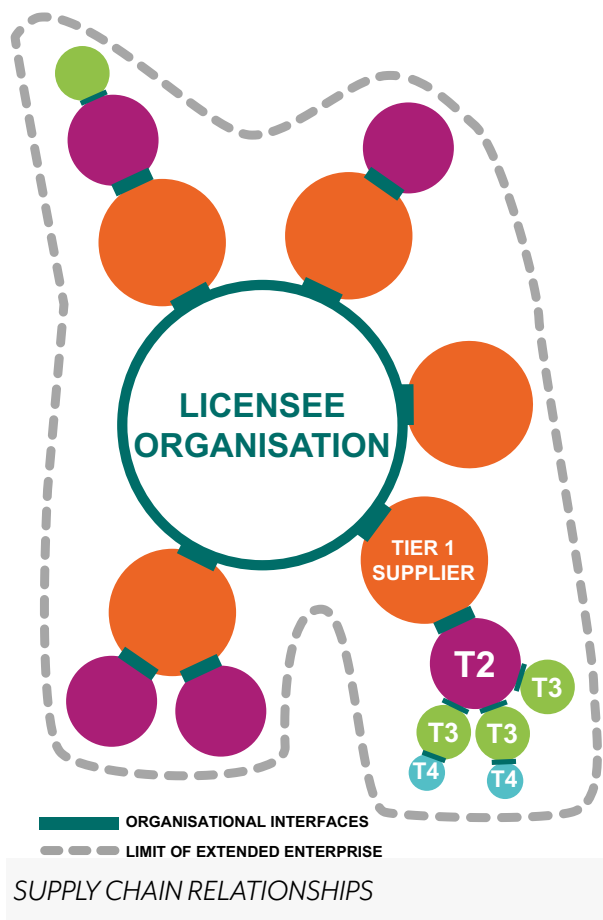
- 209 In light of the Grenfell Tower fire, the nuclear industry has proactively reviewed for the presence of combustible cladding materials, confirming to us that there are no significant risks, either to life safety or from the effects of fire on nuclear safety, although in some cases the learning has led to changes to further enhance fire safety.
- 210 In addition, we have reviewed the recently published Hackitt Report to ensure that we take account of the regulatory implications of this tragedy, both on those fire engineers assessing the fire risks and those regulating them.

### COMAH

- 211 This year there has been an increasing focus on industry performance around compliance with the Control of Major Accident Hazards Regulations 2015 (COMAH). As a result, we have taken steps to improve our direct oversight and coordination of COMAH regulation to ensure full alignment with ONR’s divisional regulatory strategies.
- 212 Construction activities can, if not properly managed, pose particularly high risks. Across the nuclear industry there are a considerable number of construction projects, including for new nuclear reactors, post operational clean out, decommissioning of existing facilities, and demolition. We will therefore apply greater regulatory focus in areas such as project management, lifting operations, control of contractors, and asbestos management and licensed removal.
- 213 The risks from conventional health and safety hazards will increase as the existing facilities progresses towards end of operational life. This is an area of increasing scrutiny and focus for ONR, reflected by improving capacity and resilience of our regulatory capability. We will work with industry to improve performance in this critical area.

### VENDOR (SUPPLIER) INSPECTIONS

- 214 ONR is the Enforcing Authority for Section 6 (General Duties of Manufacturers) of the Health and Safety at Work Act 1974, under certain circumstances, for product and services supplied to nuclear facilities. We have conducted vendor inspections to consider the adequacy of licensees’ supply chain management arrangements in relation to nuclear safety.



- 215 We have conducted 10 inspections directly with suppliers, targeting in particular those higher risk suppliers with a significant number of licensee customers. Other vendor inspections have been indirect, in which we observed the effectiveness of the licensee’s own oversight of their supplier as part of their supply chain management arrangements.

216 Evidence from our vendor inspections has identified the following trends in dutyholder performance:

- There was enhanced understanding of nuclear safety culture within the vendors' organisations, whose staff recognised the nuclear safety implications of their work;
- Vendors had an enhanced understanding of ONR's regulatory expectations and all expectations were properly cascaded through the contracts in place;
- Dutyholders were improving their risk-based approach to supply chain risks and improving their oversight and inspection of vendors.

217 Two areas will require further improvement and particular ONR attention on future Licensee engagements and vendor inspections:

- Counterfeit, fraudulent and suspect items (CFSI). We identified certain shortfalls with a minority of vendors relating to the understanding of the risks associated with CFSI and their need to deploy adequate arrangements to mitigate these risks. There was also some scope for dutyholders to reinforce their expectations around controlling CFSI;
- Operating experience and learning (OPEX). Some dutyholders were not always making vendors aware of pertinent OPEX and, similarly, vendors were not always passing on OPEX to dutyholders.

218 We have provided feedback to all Licensees represented at the Safety Directors' Forum, Supply Chain Quality Group, to enable continuous improvement across the industry.





Office for  
Nuclear Regulation

# 2019 RESEARCH STATEMENT

- 219 The Energy Act 2013 enables ONR to carry out or commission research in connection with our purposes and requires us to publish the results if we consider it appropriate to do so.
- 220 The main objective of our research strategy is to ensure that ONR's inspectors are able to form their regulatory judgements confidently and effectively using sound, up to date scientific and technical information to adequately underpin their decisions and avoid over-conservatism or over-optimism. With this, we have identified three main drivers for when we might commission research. These are where:
- i. ONR requires independent advice to assist with our decision-making, particularly when the decisions we might make could be considered contentious.
  - ii. ONR has identified a knowledge gap that we judge requires research, and where the dutyholder has been reluctant or slow to conduct this research.
  - iii. ONR specialists require greater understanding and oversight of developing innovations or emerging subjects.
- 221 We follow a rigorous process to identify research needs and opportunities, determine associated costs and monitor progress of delivery. Examples of criteria which might justify such research are available on our website. We seek to gain maximum value from our research activities by partnering with other key national and international research institutions, and joining existing national and international research projects.
- 222 For a modest annual contribution, this approach enables us to gain access to the results of multi-million pound, cutting edge research that helps to support our assessment activities. In addition, ONR's research register<sup>9</sup> for 2018/19 comprised 70 specific areas of interest. The nuclear industry funded and delivered 38 under ONR supervision. The remaining 32 areas were delivered by technical support organisations. These contracts amounted to approximately £2.5 million.
- 223 We aim to achieve a high degree of leverage on investment in research, complying with the National Audit Office's 'value for money principles'. In cases where ONR commissions research, work is awarded on a competitive tender basis against the specification. The research is progressed through ONR's technical support framework where appropriate.
- 224 The ageing of graphite cores is a major part of our research budget and it provides independent input into our decision making around emerging issues such as graphite cracking, discussed earlier in the report.
- 225 Avoiding the duplication of research projects is an important factor in helping us to achieve value for money, sharing our regulatory research register to minimise duplication and overlap, but recognising that at times we will require a fully independent view of a topic to inform our regulatory decisions.
- 226 We also have an important final 'close-out' step in our research process, which is the evaluation of completed research projects to determine their success and the extent to which they have provided the knowledge originally sought.

## RESEARCH CASE STUDIES

### CASE STUDY 1 - NUCLEAR GRAPHITE MATERIALS MODELS

#### CHALLENGE

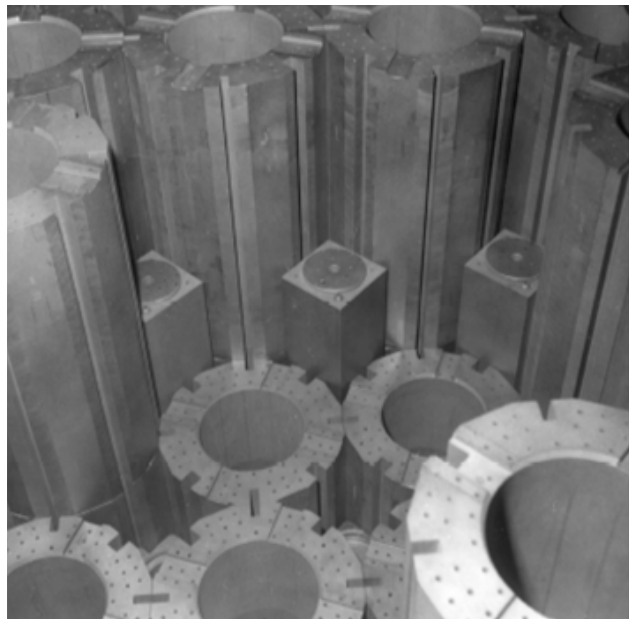
- The core of an advanced gas-cooled reactor (AGR) is a large assembly of graphite components.
- Due to the service conditions, graphite undergoes material property and dimensional changes. As the core ages, these changes weaken the graphite components, particularly the fuel bricks, leading to the development of cracks.
- Numerical models have been developed by the duty holder, EDF NGL, that describe these changes. The models are then utilised to predict the onset and rate of cracking. This in turn predicts the core state during a defined period of operation.
- The models are applicable across the AGR fleet. Therefore, it is important for ONR to understand the uncertainty level in the graphite models used by the duty holder.

#### RESEARCH ACTIVITY

- ONR has commissioned a Graphite Technical Advisory Committee (GTAC) to provide independent advice on novel aspects of the duty holder's work supporting its graphite safety cases.
- GTAC is a group of leading academics and senior professionals with expertise in the behaviour of nuclear graphite.
- Following recent changes to the duty holder's graphite material model, ONR asked the GTAC to review the model and advise ONR on areas of uncertainty in the model.

#### SAFETY INTELLIGENCE GAINED

- Independent advice on the key areas of uncertainty in the graphite material model used by the duty holder.
- Greater understanding of the effects of the recent changes made to the material model.
- Understanding of the limitations and uncertainties of the model.
- This understanding is utilised by ONR inspectors assessing the graphite core safety cases of the different reactors, such as the return to service safety case for Hunterston Point B (HNB) Reactor 4.



AGR GRAPHITE COMPONENTS



## CASE STUDY 2 - LAND QUALITY MANAGEMENT

### CHALLENGE

- Land quality management (LQM) is defined by ONR to include the prevention of new contamination and the management of existing contamination of both land and groundwater, and extends to remediation, including control and monitoring. ONR regulates radioactively contaminated land on nuclear sites; in order to make effective regulatory judgements in this area, ONR requires technical knowledge of remediation techniques that may be utilised in the nuclear sector. ONR has identified knowledge gaps in this area which represents a regulatory risk to ONR.
- ONR carried out an internal review of the remediation techniques applicable to radioactively contaminated land, both currently implemented and in development, to mitigate the identified gap in ONR's understanding of the topic and to ascertain the scope for further work and if external research in this area was required.
- ONR identified the need for a review of the internal ONR report by an external organisation with expertise in radioactively contaminated land remediation in order to fully identify the gaps in ONR's current understanding of the topic. The output of this review would then be used to develop guidance on LQM for ONR inspectors.

### RESEARCH ACTIVITY

- ONR engaged TUV-SUD Nuclear Technologies to carry out the external evaluation of the ONR internal review against industry guidance and information on remediation techniques currently used, and in development, to identify gaps and opportunities for improvement in the ONR internal review.
- The key recommendations from the review related to the placing of each identified LQM technique in the context of the UK nuclear sector, and clearly highlighting the constraints and opportunities to implementation. The report also focused on the increased use of diagrams, flow charts and matrices and proposed a common template to present information and increase the usability of the guidance.
- Nuclear Technologies also made initial contact with industry groups and have confirmed a willingness to engage and assist in the provision of information and context and case studies for the report. This will assist in developing guidance that is focussed on the UK situation and therefore directly relevant to ONR's vives.

### SAFETY INTELLIGENCE GAINED

- The outcome of this project has informed ONR's understanding of the remediation techniques for radioactively contaminated land in the UK nuclear industry. The review of the internal report has provided the scope and way forward in the development of guidance on LQM for ONR inspectors to use when carrying out their regulatory activities. This will be undertaken in Phase 2 of the project.

## CASE STUDY 3 - BEYOND DESIGN LIFE REGULATORY EXPECTATIONS FOR THE SUBSTANTIATION OF STRUCTURES, SYSTEMS AND COMPONENTS IMPORTANT TO SAFETY AND SECURITY

### CHALLENGE

- Structures, Systems and Components (SSCs) are typically designed to a design life which takes account of the operational demands and expectations throughout that period in order to achieve the performance characteristics.
- SSCs rarely have an unlimited life expectancy and are likely to contain materials or components with wear out characteristics which require consideration when entering beyond design life operations.
- Re-validation of SSC design may become necessary
- The regulatory expectations against beyond design life substantiation can be, on occasion, judgement led with limited internal guidance.
- There is limited relevant good practice to underpin the assessment processes for beyond design life substantiation.

### RESEARCH ACTIVITY

ONR has engaged with industry experts to:

- Consider the implications and appropriateness of ONR Safety Assessment Principles (SAPs) for beyond design life regulatory expectations for substantiating mechanical SSCs.
- Consider the implications and appropriateness of ONR Technical Assessment Guides (TAGs) and Technical Inspection guides (TIGs) for beyond design life regulatory expectations for substantiating mechanical SSCs.
- Review existing codes, standards and good practice guides to identify beyond design life substantiation of different classes and types of mechanical SSCs.

### SAFETY INTELLIGENCE GAINED

- Relevant good practice for beyond design life substantiation of mechanical SSCs has been identified within the nuclear sector.
- ONR's internal guidance contains information that relates to beyond design life substantiation for mechanical SSCs. This also relates to identified relevant good practice. However, this information is generic and disjointed.
- This research has determined the established methods for performing beyond design life substantiation in preserving the reliability and performance of different classes and types of mechanical SSCs important to safety.

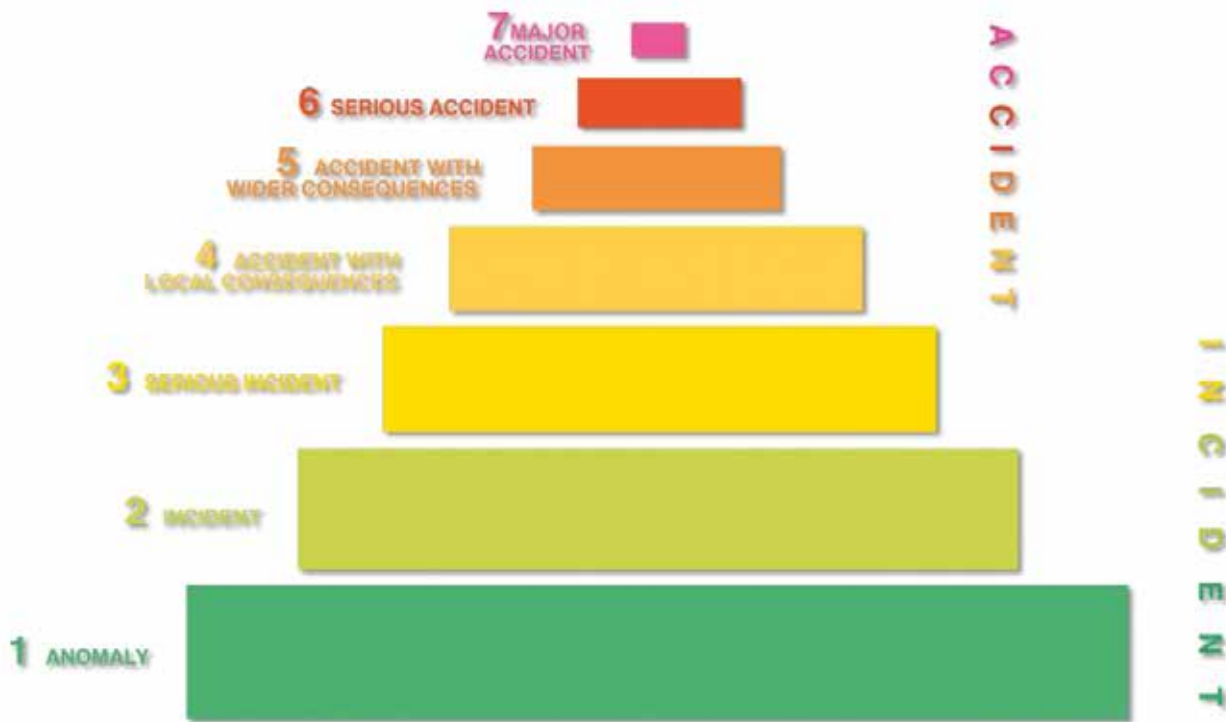
Further phases of this research project will look to:

- Benchmark against other high hazard industries' good practice in beyond design life substantiation
- Determine the established ageing mechanisms for mechanical SSCs
- Determine the risks from and types of obsolescence for mechanical SSCs

# ANNEX 1 - NUCLEAR SAFETY AND RADIOLOGICAL INCIDENTS REPORTED TO ONR

## DUTYHOLDER REQUIREMENTS

- 227 Dutyholders are required to report nuclear and radiological safety incidents in accordance with current legislation, namely the Nuclear Installations Act 1965 and the Nuclear Industries (Dangerous Occurrences) Regulations 1965. Dutyholders must also notify ONR of civil nuclear security incidents in accordance with duties under the Nuclear Industry Security Regulations 2003.
- 228 Notwithstanding those obligations, an open and positive reporting culture for all incidents is something we strongly encourage across the industry.
- 229 Incidents relating specifically to civil nuclear security are outside of the scope of this report. While a single security incident may not undermine the overall security and safety at a licensed site, the information surrounding a security incident may be useful intelligence to hostile actors. Consequently, we do not routinely release information about specific security incidents.
- 230 This report also summarises conventional safety incidents reported to ONR in accordance with the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations (RIDDOR) 2013 and provides a list of conventional health and safety incidents that resulted in our issuing improvement or prohibition notices.
- 231 We have taken proportionate regulatory action to the incidents notified to us, taking account of their safety significance. The vast majority of incidents are of no safety significance; however, the reporting of such incidents may still provide opportunities to identify additional actions that dutyholders can take to improve their performance.
- 232 Incidents reported to us fall into one of five categories:
- Nuclear safety - covering incidents involving plant and equipment issues, typically at nuclear sites, that have an impact on nuclear safety
  - Radiological safety - covering incidents where personnel have been involved or could have been potentially exposed to radiation exceeding normal working levels
  - Transport - covering incidents relating to the movement of radioactive material
  - Safeguards - covers incidents where there are issues relating to the control of and accountancy for relevant radioactive material
  - Security - covers security related incidents



*THE INTERNATIONAL NUCLEAR AND RADIOLOGICAL EVENT SCALE (INES)*

233 The tables below provides a report of the incidents reported to ONR by our dutyholders, with particular focus on the more significant incidents, as measured using the International Nuclear and Radiological Event Scale (INES). It provides details of incidents rated as INES 1 and also summarises the incidents reported to ONR categorised as having no safety significance. The period covered in this report is January 2018 to March 2019, including all incidents reported to us since our last published report.

234 The INES is a communication aid to help general understanding of the nuclear safety significance of an incident and the impact it has had in three different respect areas: on people and the environment, on radiological controls and barriers at facilities, and on defence in depth.

235 The INES ranges from 0 to 7, with 7 being the most significant. At the lowest level, the incidents are categorised and reported at INES 0 / below scale if they have no safety significance.

236 However, these incidents may nonetheless be important in identifying potential weaknesses in defence in depth and radiological controls and barriers at facilities. It is by analysing these incidents that dutyholders are able to maintain and improve safety performance. For the incidents reported at INES 1 - (Anomaly), this usually means that there have been minor problems with safety components but with significant defence in depth remaining.

237 Defence in depth comprises a series of independent physical and/or non-physical 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. Defence in depth should prevent faults, or if prevention fails should ensure detection, limit the potential consequences and stop escalation.

238 For incidents reported at INES 2 – (Incident) there are a number of criteria that may have been met including:

- exposure of a worker in excess of the statutory annual limits, namely the Ionising Radiations Regulations 2017;
- significant radioactive contamination within a facility in an area not expected by design; and/or
- significant failures in safety provisions but with no actual consequences.

- ONR was notified of the following incidents by the nuclear industry during this reporting period:
- 494 incidents rated at INES Level 0 (no safety significance),
- 18 incidents rated at INES Level 1 (Anomaly),
- 1 incident rated at INES Level 2 (Incident).

239 In relation to transport-related notifications by other organisations, there were:

- 35 INES Level 0 incidents,
- 0 INES Level 1 incidents,
- 1 INES Level 2 incident.

240 The combined number of INES notifiable incidents and those reported by licensees that fall below INES scale (INES 0) is consistent with the average reported over the last five years. This shows a continued commitment by the industry to having an active reporting culture to help improve safety performance. There continues to be a low number of significant nuclear and radiological safety incidents reported and none of the incidents in this report had any detrimental effect on public safety or the environment.

## INCIDENTS (ALL INES LEVEL 0 AND ABOVE) REPORTED TO ONR – JANUARY 2014 TO MARCH 2019



## SIGNIFICANT INCIDENTS BY SITE

### ATOMIC WEAPONS ESTABLISHMENT PLC.

#### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
05/07/2018	Inconsistencies were found in training records on the Learning Management System that meant that individual training records could not be adequately accessed or verified.	<p>The dutyholder stood down all operations on site until it could be confirmed that operators had the appropriate in-date training to undertake tasks.</p> <p>The dutyholder undertook an investigation into how the inconsistencies had arisen which, to a large part, was due to ineffective implementation of a new learning management system. A series of actions to address the shortfalls identified has been put in place.</p>	ONR considered the initial actions taken by the dutyholder to be appropriate. Implementation of the actions to address the shortfalls is being monitored via routine site interventions.

**DEVONPORT ROYAL DOCKYARD LIMITED (DRDL)****SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY**

<b>Date</b>	<b>Event Description</b>	<b>Dutyholder Response</b>	<b>ONR Action</b>
26/04/2018	<p>During the preparation for changing of ropes used in lifting, the dutyholder found inadequate lifetime quality records for the batch of ropes used by a particular crane.</p> <p>Without adequate records it was not possible to ensure ropes used for lifting were in an appropriate condition.</p>	The crane in question was taken out of service until shortfalls in the adequacy of lifetime quality records were rectified.	ONR considered that the corrective action undertaken by the dutyholder was appropriate and further examined the adequacy of lifetime quality records in a separate intervention.
14/09/2018	<p>The movement of a type of Transfer Trolley (known as a RTU/LLTT) required infills to be put in place in order to use track of a wider gauge. After moving the trolley, four of the six temporary infills were left in place, in breach of operating instructions.</p> <p>Subsequently a travelling crane using the same track automatically stopped due to the infills being left in place.</p>	All portal crane and RTU/LLTT operations in the area were immediately suspended by the dutyholder on discovery of the reason for the obstruction and remained suspended until completion of the subsequent investigation.	<p>ONR was satisfied with the immediate response to the incidents by the dutyholder. ONR undertook readiness reviews to allow the phased restart of crane operations, which were allowed to restart under Enhanced Interim Arrangements.</p> <p>The event was subject to formal ONR investigation, resulting in the issue of an Enforcement Letter.</p>

## DUNGENESS B

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
12/12/2018	<p>In September 2018, as part of ONR's regulatory intervention on external corrosion management (see also the events below dated 06/04/2018 and 19/09/2018), ONR issued a Direction under Licence Condition 15(4) for Dungeness B nuclear power station to carry out a review and reassessment of safety, addressing the corrosion of concealed systems that fulfil a safety function.</p> <p>The dutyholder commenced the inspections during the planned shutdown period for both reactors in August 2018. Inspections carried out by the dutyholder in response to the Direction identified that seismic restraints, pipework and storage vessels associated with multiple systems providing a safety function were corroded. This condition would have been present while the reactor was at power, although, the affected systems were not called upon to perform a safety function.</p>	<p>The reactor was already shutdown at the time of these inspections as part of a planned maintenance outage. Rectification of much of the degradation has been undertaken by the licensee during the shutdown period, which has resulted in replacement of more than 300m of pipework associated with reactor cooling systems. The renewal of numerous seismic pipework supports has also been undertaken, together with remediation of carbon dioxide storage vessels, other tanks, pipework, electrical cabling supports and civil structures associated with trenches.</p> <p>Both reactors at Dungeness B remain shutdown as part of an extension to the licensee's planned shutdown period to deal with this issue and other emergent work.</p>	<p>ONR is monitoring the dutyholder's recovery activities and will not allow the reactors to return to service until we are satisfied that the dutyholder has completed the necessary work to ensure safe operation.</p> <p>This event met Ministerial Reporting Criteria</p>



Date	Event Description	Dutyholder Response	ONR Action
06/04/2018	<p>A section of pipework and associated pipe supports for part of the cooling water system for the fuel buffer store were found to be corroded during planned corrosion management inspections.</p> <p>Although still intact, the corroded pipes were potentially below their minimum required thickness and the pipe supports were damaged.</p>	<p>The dutyholder judged that the system could still fulfil its safety function during normal operations but could be compromised during a significant seismic event.</p> <p>Arrangements were put in place to restore cooling to the buffer stores should the pipework fail.</p> <p>A number of pipe support replacements and pipe repairs will be required to return the plant to its previous seismic qualification.</p>	<p>ONR undertook follow up enquiries which confirmed that:</p> <p>Appropriate action will be taken to implement recovery arrangements if a seismic event did occur.</p> <p>Pipe supports are being fabricated and action is being taken to repair corroded pipework</p> <p>No further irradiated fuel will be transferred to the buffer stores until this issue is rectified</p> <p>The dutyholder's response to recovery and restoration of the situation is being monitored through a specific ONR intervention on corrosion management at the site.</p>
19/09/2018	<p>During a programmed visual inspection of a branch weld on boiler steam pipework, indications of thermal fatigue damage were found.</p>	<p>Initial meetings were held with engineers, Nuclear Safety Group and technical specialists to discuss this further.</p> <p>Initial Structural Integrity calculations indicate potential issues for the pipework integrity.</p> <p>The boiler was returned to service for shutdown cooling providing that the pipework downstream was kept depressurised and isolated.</p>	<p>ONR has kept close oversight of this issue as the dutyholder has completed its inspections and repair options are developed and implemented. ONR will also review the safety case before either reactor can return to service.</p>

## HARTLEPOOL

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
17/10/18	<p>The dutyholder identified that the cables installed during recent projects had bypassed a fire stop in the Reactor Basement (the cable material used did however have fire protection properties, ensuring it would continue to carry out its function under fire conditions).</p> <p>The installed cabling was specified and tested to conform to the appropriate British standards. In this instance, the number of cables installed potentially exceeds the test specification, and this was not recognised during installation.</p>	<p>The dutyholder investigated the issue and has implemented additional controls to ensure safety pending completion of remedial repairs. These repairs will be implemented during the next statutory outage in August 2019.</p>	<p>ONR undertook follow up enquiries into this event and was satisfied with the initial response and with the dutyholder's safety case for continued operation pending repair in the next Statutory Outage.</p> <p>ONR is following up on this event as part of normal regulatory activities to ensure that both remedial repairs are completed and that the licensee completes any further investigations necessary to identify and address the causes of this event</p>

## HEYSHAM 1

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
14/12/2018	<p>Repairs to Reactor 1's firefighting suppression system for the gas circulator lube oil package were being undertaken. Procedures for the repair work required a fire watcher to be in place. Following a short break in undertaking the work a fire watcher was not reinstated leading to a breach of the required procedures.</p>	<p>The situation was rectified and a formal investigation undertaken by the dutyholder.</p> <p>As a result of the investigation further training and focussed briefings were initiated to reinforce the absolute requirement to follow all aspects of safety procedures</p>	<p>ONR was satisfied with the initial response of the dutyholder and has monitored the implementation of the measures put in place to prevent any reoccurrence of this event.</p>

## HUNTERSTON B

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
22/03/2018	Cracking of the graphite bricks in Advanced Gas-cooled Reactors is predicted as the reactors age. On 9 March 2018, Reactor 3 was safely shut down for a planned inspection to determine the extent of the progression of cracking in the graphite bricks of the core of the reactor. The safety functions of the graphite core are to maintain the correct geometry for coolant gas flow over the reactor fuel and to maintain clear channels for control rod insertion to allow the reactor to be safely shut down. These inspections found a larger than predicted number of cracks.	The number of cracks found during the inspection of Reactor 3 led, on 2 May 2018, to EDF Nuclear Generation Ltd confirming that Reactor 3 will remain shut down whilst further inspections of the core are carried out, and to allow preparation of a robust safety case that justifies a further period of safe operation.	<p>ONR is satisfied that Reactor 3 at Hunterston B remains safely shutdown with adequate cooling being provided.</p> <p>We will not permit return to service of Hunterston B Reactor 3 until an adequate safety case has been provided by EDF NGL, demonstrating that the reactor can continue to be operated safely. If satisfied, ONR will provide formal consent to the restart of the reactor through the provision of a Licence Instrument.</p> <p>ONR is content that there are no immediate safety concerns for the remaining reactors in the AGR fleet, but the on-going inspections of Reactor 3 influenced the planned outage and inspections for Hunterston B Reactor 4, which was shut down in October 2018 for graphite inspections. This event met Ministerial Reporting Criteria</p>

Date	Event Description	Dutyholder Response	ONR Action
11/04/2018	During a shut down for a planned core inspection, a steam leak was discovered in the Reactor 3 Decay Heat System (DHS). The purpose of the DHS is to remove residual heat from the reactor once it has shut down.	<p>The system was isolated and alternative cooling was provided to Reactor 3 via a diverse system. A project team was established to repair the leak, investigate the condition of other welds on the R3 DHS and determine the likely fault mechanism.</p> <p>Reactor 4 was operating at power at the time and the project team considered the potential for the same defect to be present. An interim availability assessment demonstrated the continued safe operation of Reactor 4 pending inspection of the R4 DHS.</p>	<p>ONR's Structural Integrity specialists carried out an assessment of the dutyholder's investigation and repair strategies and concluded that the structural integrity of the DHS had been adequately justified for return to service of Reactor 3</p> <p>A Regulatory Issue was raised to address the follow up actions proposed in the repair strategy and interventions are on-going to monitor licensee progress against this issue.</p>
30/10/2018	During a review of the safety case for the irradiated fuel disposal (IFD) facility a minor vulnerability was identified in the analysis of the arrangements to deal with a dropped fuel assembly.	This current uncertainty with respect to the ability to perform post fault actions, when handling irradiated fuel at the IFD cell, means that further work will be required to provide a revised safety case for handling of irradiated fuel at the IFD cell.	ONR discussed this event with the station Nuclear Safety Group Head and confirmed that fuel element operations within the IFD cell were suspended whilst a Justification for Continued Operations (JCO) was prepared.

## TORNESS

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
30/10/2018	<p>During a review of the safety case for the irradiated fuel disposal (IFD) facility, a shortfall was identified with respect to the ability to cool fuel with boronated water in the event of a dropped fuel assembly. There is a possibility that the shock loading on the tube during such a drop, coupled with the weight of water from the post-fault action to flood the tube, could lead to leaking of water from the tube and a failure to maintain enough water flow in the tube to cool the fuel.</p> <p>There were no immediate consequences to this event as the IFD cell was not in use and no fuel was being handled.</p>	An embargo was placed on handling of irradiated fuel at the IFD until further work could be done to enhance the safety case for operation of the facility.	ONR undertook further enquiries regarding this event. We are satisfied with the licensee's immediate response and the commitment to embargo fuel handling until a suitable Justification for Continued Operations (JCO) is prepared. We are monitoring progress via our normal site inspection activities.

## SELLAFIELD

## SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
06/02/2018	<p>An operator was performing housekeeping operations that involved posting waste material out of a glovebox.</p> <p>During a posting out operation, items fell from the bag onto the floor of the cell. It was later found that the bag did not have a closure weld and was therefore open ended.</p>	<p>The operator made the area safe, withdrew from the area and called for assistance.</p> <p>The operator was decontaminated and subject to radiological monitoring, which confirmed no internal exposure to radioactive material.</p> <p>A survey of the affected area was undertaken to identify the extent of contamination and appropriate decontamination activities were then performed by the dutyholder.</p>	<p>ONR undertook follow up enquires into this event. The enquiries concluded that the spread of contamination was primarily due to inadequate procedural adherence from both the individual undertaking the work and those responsible for managing the inventory of posting port bags.</p> <p>ONR issued an enforcement letter to the dutyholder requiring adequate arrangements be implemented to prevent any recurrence. A follow up inspection confirmed that the dutyholder had implemented appropriate corrective actions to address the non-compliances identified.</p>
1/03/2018	<p>During a period of extremely cold weather, an overhead clean water supply pipe failed and water subsequently flowed into an active pipe trench and the basement of a contaminated redundant building. This resulted in slightly contaminated water from the flooded basement flowing into a concrete compound on the side of the building and along a redundant trench. Some this water escaped into the ground at both locations.</p>	<p>The remainder of the contaminated water was pumped, by installed systems and by the fire brigade, into site effluent management systems.</p>	<p>ONR confirmed that the radionuclide release was very low, equating to 1/50,000 of the annual total authorised sea discharge limit for the Sellafield site.</p> <p>ONR is supporting the Environment Agency, who has primacy for such incidents, to ensure that appropriate steps are taken by the dutyholder to prevent any reoccurrence.</p> <p>This event met Ministerial Reporting Criteria</p>

Date	Event Description	Dutyholder Response	ONR Action
06/11/2018	<p data-bbox="421 320 965 424">During maintenance work a hole was discovered in an external ventilation duct. The hole, caused by corrosion, was in a position not readily visible.</p> <p data-bbox="421 448 965 515">No leakage of radioactivity was detected by health physics surveys of the immediate area.</p>	<p data-bbox="987 320 1532 424">A temporary repair was made to the duct. Operations involving radioactive materials were suspended pending a permanent repair.</p>	<p data-bbox="1554 320 2098 560">This incident had the potential for a minor unauthorised gaseous discharge through defects (holes) in the ventilation ducting. This area falls primarily within the vires of the Environment Agency (EA) who took the regulatory lead in this case and carried out an investigation into the incident.</p> <p data-bbox="1554 584 2098 1038">The investigation found the primary cause of the defects (holes) to be due to corrosion which results from an inadequate asset care and maintenance programme. The EA issued an enforcement notice to Sellafield Ltd requiring them to remedy the associated defects, improve maintenance and develop an appropriate programme of inspection and repair of the wider site ventilation ductwork. This enforcement action was intended to bring Sellafield Ltd back into compliance with its Environmental Permit and reduce the risk of a similar event happening again.</p> <p data-bbox="1554 1062 2098 1331">Taking into consideration the investigation and enforcement action taken by the EA, ONR did not consider it proportionate or warranted to carry out further formal investigation or enforcement. However ONR is engaging with the EA and Sellafield Ltd on asset care and management programmes to ensure that the wider learning is taken from this incident and across the site.</p>

## WYLFA

## SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
02/05/2018	During an inspection of incoming (i.e. empty) flasks it was noted that an outer seal on a flask was incorrectly fitted. The inner seal, which provides primary containment, was however unaffected.	<p>The dutyholder took a number of interim steps to address the event including:</p> <p>Introducing additional temporary operating instructions (including physical checks on seals supported by photographic evidence).</p> <p>Additional briefing of operating staff undertaking this work.</p> <p>An investigation was carried out by the dutyholder to identify the causes of the event and implement corrective actions.</p>	ONR specialist transport inspectors reviewed the dutyholder's response to this event. ONR was satisfied with the interim steps taken by the dutyholder, its investigation and the resulting modifications undertaken to prevent repeat occurrences. Implementation of the revised arrangements was monitored during routine site interventions.



## CAPENHURST

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
02/05/2018	<p>A Type 30B cylinder was received onto site. The goods inwards inspection identified that the cylinder did not conform with the design standard (ANSI N14.1).</p> <p>This standard requires that there should only be between 1 and 6 threads visible on the valve which screws into the main cylinder body to ensure the valve is fully engaged. The cylinder being inspected had 7 threads visible.</p> <p>This was a heeled cylinder (therefore empty).</p>	<p>The consignee was made aware of the event. The cylinder was impounded pending changes to make the cylinder compliant with the design standard.</p> <p>The consignee has informed the cylinder's fabricator of this issue.</p>	<p>ONR reviewed the immediate action taken by the dutyholder, which was considered adequate and in line with regulatory expectations. ONR ensured the Competent Authority for the consignee is aware of this incident.</p>

## SPRINGFIELDS

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 1 – ANOMALY

Date	Event Description	Dutyholder Response	ONR Action
31/05/2018	<p>During sorting of redundant items in the Oxide Fuel Complex (OFC), a bag transferred to the OFC decontamination facility was found to contain fuel pellets and fragments. This was immediately reported to the supervisor and the bag transferred directly to a Safe Geometry Container (SGC).</p>	<p>The dutyholder's Criticality Safety Section visited the area and discussed the finding with the plant management and operators. A full review of associated areas was undertaken by plant management and no similar findings were made.</p> <p>An investigation by the dutyholder into the root causes of this event identified housekeeping and difficulties with authorised routes for dealing with plant waste as causal factors.</p> <p>Improvements were made to procedures to address the causal factors</p>	<p>ONR undertook follow up enquiries and was satisfied with the dutyholder's response and actions taken to help prevent a reoccurrence. The immediate actions taken returned the pellets to compliance with criticality safety controls. The event relates to the pellets being held in the plastic bag and subsequently transferring this bag to the decontamination facility. Although criticality controls were degraded in this instance, significant margins of safety remained given the quantity involved, its enrichment and other materials present.</p>

## TRANSPORT INCIDENTS NOT RELATED TO NUCLEAR LICENCED SITES

During the reporting period 36 transport related incidents were reported to ONR by organisations not operating nuclear facilities. One of these incidents was rated as an INES 2 Incident and the remainder were rated as having no safety significance. Details of the event rated as INES 2 and the action taken by ONR are given below.

### SIGNIFICANT INCIDENTS REPORTED TO ONR: INES RATING 2 - INCIDENT

Date	Event Description	Dutyholder Response	ONR Action
24/09/2018	<p>Two packages, each containing a high activity sealed radioactive source, were being transited via Heathrow airport. The sources involved are a type commonly used in industrial applications throughout the world, including oil well logging, oil refining and construction.</p> <p>The two sources safely arrived at a storage and distribution hub close to the airport, before being consigned to a nearby storage depot. They were transported by two logistics companies that did not have the required safety procedures in place, therefore breaching UK legal requirements.</p>	When the sources were delivered to the storage depot, the nature of the packages was identified and arrangements made for their safe transfer to an appropriate facility.	There were no safety consequences to people or the environment as a result of this incident. ONR took enforcement action, issuing a number of Improvement Notices to the two companies concerned in order to secure improvements against the shortfalls and legal non-compliances highlighted by the incident, and to prevent any reoccurrence. Details of this enforcement action have been published on the ONR website.

## INCIDENTS CATEGORISED AS INES 0: BELOW SCALE/NO SAFETY SIGNIFICANCE

Site	Nuclear Safety	Radiological Safety	Transport	Safeguards	ANO1	Total	Site	Nuclear Safety	Radiological Safety	Transport	Safeguards	ANO1	Total
AWE	29	1			13	43	Hinkley Point B	17	1				18
BAE SYSTEMS BARROW DOCK COMPLEX	2				1	3	Hinkley Point C	3				3	6
Berkeley	1					1	Hunterston B	10					10
Chapelcross			1			1	Lillyhall			4			4
DRDL	25					25	LLWR	1	1	1			3
Dounreay			1		1	2	ROLLS-ROYCE DERBY	5					5
Dungeness A		1	3			4	Rosyth	2					2
Dungeness B	19					19	Sellafield	219	5	8	3	2	237
GEH AMERSHAM		1	5	1		7	Sizewell A				1		1
GEH Cardiff			1			1	Sizewell B	12		1			13
Harwell	2		1			3	Springfields			4			4
Hartlepool	14					14	TRANSPORT SECTOR			35			35
Heysham 1	15		2			17	Torness	10				1	11
Heysham 2	15				1	16	URENCO CAPENHURST	6	9	1		1	17
Hinkley Point A	2	1		1		4	Wylfa			1	1	1	3

## CONVENTIONAL HEALTH AND SAFETY INCIDENTS

### IMPROVEMENT NOTICES RELATING TO CONVENTIONAL HEALTH AND SAFETY

Date	Dutyholder and site	Description of Breach and required improvement
21/11/2018	EDF - Heysham 1 Power Station	<p>The incident occurred when a valve failed on a steam system causing injury to three EDF Energy employees. There was no release of radioactive material and the two reactors remained operational following the incident.</p> <p>ONR served two notices relating to the Pressure Systems Safety Regulations (2000) requiring EDF Energy to improve instructions provided to staff operating steam systems and to also ensure steam systems are properly maintained.</p>
13/12/2018	Sellafield Ltd, Sellafield	<p>On 07 September 2018 the Sellafield site experienced a short duration power dip caused by an earth fault on one of the two 132kV underground power cables running between the Sellafield site substation and the Fellside Combined Heat and Power (CHP) facility.</p> <p>The Notice was issued in response to a significant electric cable strike incident in September 2018 during construction activities on the Fellside Steam Generating Plant. It requires improvements to be made in Sellafield Ltd's Principal Contractor arrangements for Construction Design and Management and relates specifically to construction activities in the proximity of underground high voltage electrical cables.</p>

## RIDDOR REPORTABLE INCIDENTS

The table below provides information on the number of RIDDOR incidents reported to ONR occurring within the financial year 2018/19. The data presented includes all RIDDOR incidents reported at the site, and thus includes those reported by contractors and tenants as well as by licensees. It is important to note that such a small data set does not allow for clear comparisons in health and safety performance. Variables such as size of the undertaking; range and type of activity being performed; and reporting culture can play a part in the number of incidents reported. As such, no trend analyses are reported here.

Site	Injuries	Dangerous Occurrences	Diseases <sup>11</sup>	Total
AWE	6	1	-	7
BAE SYSTEMS BARROW DOCK COMPLEX	12	-	-	12
Bradwell	-	1	-	1
Capenhurst (Urenco)	-	-	-	0
HMNB Clyde	6	-	-	6
DRDL	7	-	-	7
HMNB Devonport	1	1		2
Dounreay	1	1	1	3
Dungeness B	3			3
Hartlepool	-	-	-	0
Heysham 1	5	-	-	5

Site	Injuries	Dangerous Occurrences	Diseases <sup>11</sup>	Total
Heysham 2	3	1	-	4
Hinkley Pt A	1	-	-	1
Hinkley Pt B	2	-	-	2
Hinkley Pt C	10	-	-	10
Hunterston B	3	-	-	3
Rolls-Royce Derby	-	-	-	0
Sellafield	22	10	1	33
Sizewell B	1	-	-	1
Springfields	-	2	-	2
Torness	1	-	-	1
Winfrith	1	-	-	1

<sup>11</sup> Diagnosed within financial year 2018/19

# ANNEX 2 - GLOSSARY

Terminology	Definition
Borated water	Borated water is used as a coolant during normal operation of pressurised water reactors (PWRs) as well as in their Emergency Core Cooling Systems
Care & Maintenance	A term used to describe decommissioned and defueled nuclear reactors placed in a safe and secure state for several decades in order to allow radiation levels to naturally decay over time
Decay heat	Decay heat is the heat released as a result of radioactive decay. This heat is produced as an effect of radiation on materials: the energy of the alpha, beta or gamma radiation is converted into the thermal movement of atoms
Generic Design Assessment	Design assessment process used by ONR and the environment agencies to assess new nuclear reactor designs ahead of site-specific proposals.
Graphite core	The graphite core of AGR reactors acts as moderator slows down the speed of neutrons produced during nuclear fission and helps to sustain the chain reaction so that the heat can be used for electricity production. The core is constructed from thousands of interlocking graphite bricks which also form a large number of important channels.
High Level Waste	High Level Waste (HLW) is waste where the temperature may rise significantly because of their radioactivity. The design of waste storage or disposal facilities has to take this into consideration. Less than 1% of all radioactive wastes (by volume) are in the HLW category. HLW is produced as a by-product from reprocessing spent fuel from nuclear reactors. HLW typically
INES	The International Nuclear and Radiological Event Scale (INES) was introduced in 1990 by the International Atomic Energy Agency (IAEA) in order to enable prompt communication of safety significant information in case of nuclear accidents.
Intermediate Level Waste	Intermediate Level Waste (ILW) exceeds the upper boundaries for Low Level Waste (see Low Level Waste below) but does not generate a significant amount of heat. About 6% of all radioactive wastes (by volume) are in the ILW category. The major components of ILW are nuclear reactor components, graphite from reactor cores and sludges from the treatment of radioactive liquid effluents.
Keyway root cracking	This phenomenon will ultimately limit the lifetime of most of the AGRs. The origin of keyway root cracking is caused by the graphite at the outer surface of the bricks moving into tension due to changes in the internal stress of the brick. This mechanism can only occur later in life as it is dependent on the total amount of irradiation received by the graphite. It can consequently progressively crack many bricks across the core.
Low Level Waste	Low Level Waste (LLW) contains relatively low levels of radioactivity. Most comes from the operation and decommissioning of nuclear facilities. The waste includes items such as scrap metal, paper and plastics. Some smaller amounts of LLW also come from hospitals and universities. About 94% of all radioactive wastes (by volume) are in the LLW category.
Nuclear concrete	Terminology used in the construction of new nuclear power stations, referring to the concrete used to construct them being of the very highest quality

Terminology	Definition
OPEX	Operating experience (OPEX) is a valuable source for learning about and improving the safety and security of nuclear facilities and activities. As part of any OPEX; it involves collection of information from incidents and events occurring in nuclear facilities.
Power Range Testing	Active commissioning of submarine reactor plant comprises several distinct stages. The first is referred to as initial criticality, which is when the reactor which powers the vessel is taken critical for the first time, starting off the chain reaction which generates the power. 'Physics testing' then confirms, in a controlled manner, that the performance of the reactor core is as expected. 'Power range testing' follows, which is the testing of the reactor up to full power
Special Nuclear Material	Special nuclear material (SNM) is Plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing, but excluding radioactive source material.
SSCs	Structures, systems and components (SSCs) important to safety in nuclear power plants
Stress Corrosion Cracking	Stress corrosion cracking (SCC) is the growth of crack formation in a corrosive environment. It can lead to unexpected sudden failure of normally ductile metal alloys subjected to a tensile stress, especially at elevated temperature. SCC is highly chemically specific in that certain alloys are likely to undergo SCC only when exposed to a small number of chemical environments.
Thermal fatigue	Thermal fatigue is a specific type of fatigue failure mechanism that is induced by cyclic stresses from repetitive fluctuations in the temperature of equipment. The degree of damage is affected by the magnitude and frequency of the temperature swings.
Vitrification	Vitrification is used in disposal and long-term storage of nuclear waste. Waste is mixed with glass-forming chemicals in a furnace to form molten glass that then solidifies in canisters, thereby immobilising the waste







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