Office for Nuclear Regulation

Chief Nuclear Inspector's annual report on Great Britain's nuclear industry

November 2020

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Any enquiries related to this publication should be sent to contact@onr.gov.uk

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Chief Nuclear Inspector's foreword

I am delighted to introduce my annual report on Great Britain's (GB) nuclear industry for 2019/20, which is the second annual report of its kind. It provides the Office for Nuclear Regulation's (ONR) independent, authoritative view of the nuclear industry's safety, security and safeguards performance.

Last year's inaugural report identified three challenges for the industry to focus its attention on. During the launch event last Autumn, I was encouraged to observe senior leaders from the industry readily engage and reflect on how to address these challenges in a collegiate manner. This year we highlight some of the tangible progress made, whilst emphasising the need for sustained investment in people, plant and processes.

The extensive range of interventions that we have completed during the year has provided us with a thorough understanding of the nuclear industry, and I remain satisfied that overall it has continued to meet the requisite high standards of safety and security necessary to ensure the continued protection of society.

As part of our on-going commitment to openness and transparency, we have endeavoured to improve several aspects of the report's format and content to provide greater insight and understanding of our judgements, particularly on how we have prioritised our regulatory attention. As a consequence, this report includes:

- A more detailed narrative on incidents reported to ONR, examining trends across the sector;
- Enhancements in presentational format to provide more information on the factors that have influenced the level of regulatory attention we assign to licensees and other dutyholders; and
- A specific case study, in which we detail conventional safety performance at Hinkley Point C, highlighting our view on performance at one of Europe's largest and most complex construction sites.

The COVID-19 (coronavirus) pandemic began to affect the UK and its nuclear industry at the end of the reporting period. We have included commentary on the initial response of the industry, the steps taken to ensure the safety and security of operations during this difficult period, and how it was able to demonstrate its resilience. We will work with stakeholders so that any lessons learned from the unique challenges posed by the pandemic are factored in to the continued resilience and effective stewardship of the industry.

Finally, I would like to thank those in ONR who contributed to this publication, and more broadly to all our staff for their work in delivering our vision to be a modern, transparent regulator delivering trusted outcomes and value.

Mark Foy
Chief Nuclear Inspector

Chief Executive's foreword

Great Britain has an excellent nuclear safety record. To maintain that, and protect the public we serve, ONR strives to ensure the nuclear industry continues to meet the highest standards of safety and security over its full lifecycle.

In this second annual report, our Chief Nuclear Inspector, Mark Foy, confirms that our sustained direction, effort and focus have led to tangible progress and improvements, despite the constraints arising from the global COVID-19 pandemic.

ONR is here to protect society by securing safe nuclear operations. And this role has never been more important than during this pandemic.

Last year's CNI report identified three themes requiring industry focus: management of ageing facilities; conventional health and safety performance; and delivering a holistic approach to nuclear security. In the last year, increased regulatory and industry attention in these areas has led to improvement, but there remains much to do, to improve outcomes in each of these important areas.

Towards the end of the reporting period we began our response to COVID-19. We worked closely with other regulators and with all licensees to prioritise and focus our efforts, in light of public health advice, so as to deliver regulation in new ways, to protect the public, industry workers and our own staff.

Now, following the end of the reporting period, we have resumed regulatory site presence, and been able to assure ourselves that industry has responded well to the additional challenges, with flexibility and resilience. In light of this experience, Mark now introduces a fourth theme, to consider adequate pandemic resilience arrangements.

Looking internally, ONR's operational delivery remains robust, and last year's Integrated Regulatory Review Service (IRRS) Mission to the UK provided assurance of good alignment with international safety standards and of the UK's commitment to continuous improvement.

We are grateful to all our stakeholders – dutyholders, non-governmental organisations (NGOs), and domestic and international regulators – for their support, continued feedback and input. I also thank the many people across the nuclear industry whose focus on safety culture remains the most important element of any high hazard industry.

And above all, I thank ONR's dedicated and professional staff who, time and time again, show their tremendous commitment to public service and determination to help ONR succeed – even during the most testing times.

Adrienne Kelbie
Chief Executive

1 Chief Nuclear Inspector's review

1.1 Informed by our extensive inspection and assessment activity, I am once again satisfied that, overall, the nuclear industry has continued to meet the requisite high standards of safety and security to protect workers and the public. However, where dutyholders have fallen short of these standards, we have intervened in a proportionate manner to ensure that they have plans in place to improve their performance and return to routine levels of regulatory attention in a timely manner.

1.2 From 1 January 2021, we will operate the UK State System of Accountancy and Control (SSAC) and become the domestic safeguards regulator. The Infrastructure and Projects Authority (IPA), in its latest rigorous review, has confirmed that the SSAC project is on track to deliver all its objectives, providing an effective safeguard capability for the UK.

1.3 We wish to be an exemplary regulator, and being consistent and proportionate in our regulation is an important factor in us achieving this. Based on feedback from our stakeholder survey, we have examined our approach and believe that there are areas where we can improve our consistency and proportionality. We are developing a plan, which will see us improve our performance in these areas in the next few years.

Industry progress against our key regulatory priorities

1.4 Last year, I set out three overarching themes requiring increased industry attention:

- Management of ageing facilities
- Conventional health and safety performance
- Delivering a holistic approach to nuclear security

1.5 I highlighted the need for the industry to critically review its strategies and plans and reflect on how it can work collectively to deliver better outcomes in each of these areas. All three themes featured in our planning for 2019/20 and beyond.

Management of ageing facilities

1.6 Management of ageing facilities has remained a key focus for us. This reflects the significant challenges associated with ageing facilities, for both operational plants and those in decommissioning, including systems and components that do not meet modern engineering standards.

1.7 I am pleased to report that dutyholders have made good progress in the management of ageing infrastructure and facilities during the period, although there is much work left to be done, as detailed in the main body of this report.

1.8 **Operating Reactors.** We have examined a range of significant age-related degradation problems over the reporting period across EDF Energy Nuclear Generation Limited (EDF-NGL) nuclear power stations. Some of these involve components that can be repaired or replaced, and EDF-NGL has responded well to our call for further investment in ageing management, making significant additional funding available to ensure safety requirements continue to be met across their fleet of reactors. Of particular note:

- *Dungeness B:* following enforcement action relating to corrosion in concealed systems, significant investment has been made in their inspection, repair and replacement in order to restore important safety systems back to the expected standard.
- *Advanced Gas-cooled Reactor (AGR) fleet:* for significant or life-limiting ageing mechanisms such as graphite core degradation, additional programmes of work or surveillance arrangements are in place.

1.9 **Sellafield and decommissioning sites.** At Sellafield and other decommissioning sites, we have observed a sustained focus on improvements to ageing facilities, timely retrieval of radioactive waste from those facilities and, where needed, the construction of new facilities required to safely treat, store and dispose waste. Examples include:

- Positive progress across Sellafield's ageing management programme for concealed pipework, certain concrete containment structures and electrical cables.
- Enhanced asset management as part of Sellafield's site arrangements and improvements in equipment reliability.

1.10 **Defence Sites.** The Atomic Weapons Establishment (AWE) is progressing asset improvements having undertaken a programme of periodic reviews of safety. Safety upgrades to key plant have been completed in the Burghfield Assembly Technology Centre, and are planned at other key facilities on the Aldermaston site.

1.11 The Devonport Royal Dockyard site made significant progress against its nuclear safety improvement programme, with a notable success in improvements to asset management.

1.12 During 2020/21, we will maintain our focus on the continued safe and secure operation of ageing facilities:

- *CNI themed inspection:* in late 2020, I will initiate a CNI themed inspection, which will deliver an industry-wide review of the management of ageing facilities, I will publish the outcome of this review during 2021.
- *Better use of leading indicators:* we will monitor on-going compliance and management as leading indicators and require demonstrable evidence of effective asset assessment, management and investment by licensees and other dutyholders.
- *Support cross-industry collaboration on ageing facilities management:* several dutyholders face similar challenges and there is an opportunity to learn from each other and share good practices, which we will seek to influence.

Conventional health and safety performance

1.13 Management of conventional health and safety risks (including fire safety) remains a focus for us. There is a considerable amount of work being undertaken by the nuclear sector, associated with civil nuclear reactor new build, control of major accident hazards, post operational clean out, and decommissioning of existing facilities and some demolition. These activities pose significant risks to workers and the public if not properly controlled. We have recently commissioned work to benchmark the conventional health and safety performance of the nuclear sector with other GB high hazard sectors to assess relative performance, and I hope to report on its conclusions next year.

1.14 I can report industry-led improvements in conventional health and safety performance in comparison to last year; and we are pleased that the increased efforts by industry have started to take effect:

- Last year's increase in reportable incidents has not been repeated this year; we have observed a small decrease.
- There are continued and encouraging improvements to management systems to ensure conventional health and safety is appropriately recognised and integrated. This will enable improved, holistic risk profiling and effective risk management.

1.15 However, improvements have been modest and industry performance variable. It therefore remains a priority for us to ensure that industry initiatives continue to drive further improvements in the management of conventional health and safety.

1.16 We will continue to focus regulatory attention on construction activities, commensurate with the risks such activities present and their increasing frequency. We have been working with industry to ensure it fulfils its duties under the Construction (Design and Management) Regulations 2015, whilst also enabling continued compliance with licence conditions, particularly for control and supervision of operations. An important aspect here is to ensure that future projects are effectively planned and resourced and designs are produced during the design phase take into account construction, operation and future decommissioning requirements.

Delivering a holistic approach to security

1.17 Through the development of our Security Assessment Principles (SyAPs), we have continued to encourage the civil nuclear industry to adopt a more holistic approach to nuclear security. SyAPs require dutyholders to not only achieve adequate standards in physical aspects of nuclear security, such as policing, guarding and protection systems, but also to recognise the importance of less tangible factors, including Cyber Security and Information Assurance (CS&IA), leadership, management and culture.

1.18 I am pleased to report that over the past year, there has continued to be a positive response by industry, with the majority of dutyholders now having ONR approved SyAPs-aligned security plans in place. This has influenced greater ownership by licensees and other dutyholders of security solutions, which in turn is promoting the adoption of a holistic approach to security.

1.19 Consequently, as outcome-focused nuclear security regulation becomes embedded across the industry, we look forward to being presented with innovative methods and designs for achieving required security outcomes.

1.20 The change from National Objectives Requirements & Model Standards (NORMS) to SyAPs has highlighted that there are a number of personnel working in nuclear security posts who are not suitably qualified and experienced for the roles in which they are employed. The numbers are small and we are satisfied that wider dutyholder compliance has been maintained, and that the industry remains secure. We will be working with dutyholders and other stakeholders across industry to expedite resolution of this matter.

1.21 The holistic approach to nuclear security that SyAPs is driving will present opportunities for industry. The advent of SyAPs means that we now assess licensee and dutyholder security in a similar way to how we assess safety, using our long-established Safety Assessment Principles (SAPs). This will enable dutyholders, in certain areas, to adopt a single set of arrangements to satisfy regulatory expectations for both safety and security. To facilitate this, we will continue to develop SyAPs and SAPs to improve alignment between them.

Our 2020/2021 Regulatory Priorities

1.22 Our top priority continues to be the delivery of our core regulatory functions, including holding industry to account on behalf of the public. We will also prioritise our regulatory effort on those licensed sites and other dutyholders to whom we have assigned enhanced levels of regulatory attention.

1.23 Our work during 2018/19 identified three overarching themes against which I reported industry progress earlier in this report. Last year, I stated that the three themes I identified will continue to be prominent in the years ahead; until we are satisfied that sustainable improvements have been delivered. I confirm that I am retaining these themes to ensure that levels of increased industry attention are maintained during 2020/21 on:

1. Management of Ageing facilities
2. Conventional Health and Safety performance
3. Delivering a holistic approach to nuclear security

1.24 In addition, I have added a fourth theme given the current pandemic situation associated with COVID-19:

4. Ensuring adequate pandemic resilience arrangements

1.25 The UK's nuclear industry is mature and responsible, with an excellent nuclear safety and security record. I am confident that it will continue to make responsible and conservative decisions as it continues to make progress against the existing themes and in addressing the requirements of the new one.

COVID-19 pandemic

1.26 Towards the end of the reporting period, COVID-19 emerged as a national and global pandemic. The significance of its impact in the UK required ONR to take a number of steps to gain assurance regarding the on-going safety and security of the nuclear industry, and the management of its plants and facilities.

1.27 In mid-March, I asked the industry to provide daily information on COVID-19 related absenteeism along with self-assessments for safety and security resilience during the pandemic. This information enabled us to present timely and informed assurances to national and devolved governments, alongside briefings on wider critical national infrastructure.

1.28 The industry responded responsibly, with timely implementation of their pandemic contingency plans, including shutting down nonessential facilities and activities in a controlled manner. This enabled licensees to focus their efforts on delivering safe and secure stewardship of nuclear operations in the national interest.

1.29 The unprecedented scale of the national emergency prompted us to consider the impact of certain statutory duties on licensees and other dutyholders, particularly where they place specific absolute requirements. We identified a number of areas of legislation where we would be flexible should licensees or other dutyholders approach us to say they could not reasonably achieve the required standards.

1.30 We were clear from the outset that, when considering such applications, it had to be demonstrated to our satisfaction that a short-term non-compliance with limited aspects of the law would not lead to any degradation in safety. In practice, very few such instances have arisen to date, and we are confident that there has been no material impact on safety and security (See example, paragraph 7.12).

1.31 We have worked closely with other regulators to share knowledge, primarily as part of the recently re-established UK Health and Safety Regulators Network, which also includes the Environment Agency, Health and Safety Executive (HSE), Office of Rail and Road (ORR), the Civil Aviation Authority (CAA), Care Quality Commission (CQC), and Medicines and Healthcare products Regulatory Agency (MHRA). Recent discussions have covered organisational responses, continued regulatory oversight, implementation of health protection measures and contingencies for protracted lockdown.

1.32 I am particularly proud of the effort and adaptability demonstrated by our teams during the early phases of the pandemic in maintaining regulatory oversight of the industry through remote means. We have subsequently gradually resumed our onsite presence to assure ourselves regarding safety and security compliance, including adherence to the latest public health guidance in response to the pandemic.

1.33 I am pleased with how well the UK nuclear industry responded to the challenges posed by the pandemic, reflecting the general depth and maturity of the sector's preparedness and response arrangements.

1.34 In due course, once the UK begins to emerge from the current pandemic, I will be seeking a review of industry's arrangements and resilience to more onerous pandemic scenarios or other matters that might result in similar widespread societal disruption. I intend to ask the industry to review the lessons to be learned in light of COVID-19, in particular how it has informed resilience and potential to harden against future pandemics.

1.35 Pandemic resilience arrangements will therefore constitute a further new regulatory priority for us over the coming year. We will also scrutinise emerging initiatives across other International Atomic Energy Agency (IAEA) Member States and look for emergent lessons that might have implications for international standards in the global nuclear sector and the UK.

A successful IRRS mission

1.36 I am pleased to report that, in October 2019, on behalf of the UK Government we hosted a team of international regulators, who undertook the first full-scope IAEA Integrated Regulatory Review Service (IRRS) mission to the UK. The IRRS is a peer review service offered to IAEA Member States to strengthen and enhance the effectiveness of a State's national, legal and governmental framework and regulatory infrastructure for nuclear and radiological safety.

1.37 The mission was complex, involving 12 government departments and 16 Regulatory Bodies across the UK. The IAEA IRRS mission represents an important example of the type of global initiatives that we participate in to benchmark ourselves against international good practice, and part of our openness to learning from others to improve our effectiveness.

1.38 Overall, the IRRS mission found that the UK legal and governmental framework for radiation safety and protection is in good alignment with IAEA safety standards; and that the UK is committed to continuous improvement. The review team found that the UK is committed to strengthening its regulatory framework for nuclear and radiation safety, and also concluded that we have an effective regulatory framework for nuclear safety, with clear strategies for the regulatory oversight of nuclear licensed sites.

1.39 The 2019 IRRS mission to the UK also identified areas for improvement, and its findings will enable government and regulators, including ONR, to review current approaches and will provide impetus to further enhance UK practices. The UK will consider how best to address the mission team's findings and will update the IAEA on progress at the follow-up mission, which is due to be held within the next four years.

1.40 The 2019 IRRS UK mission report is available at GOV.UK[1]

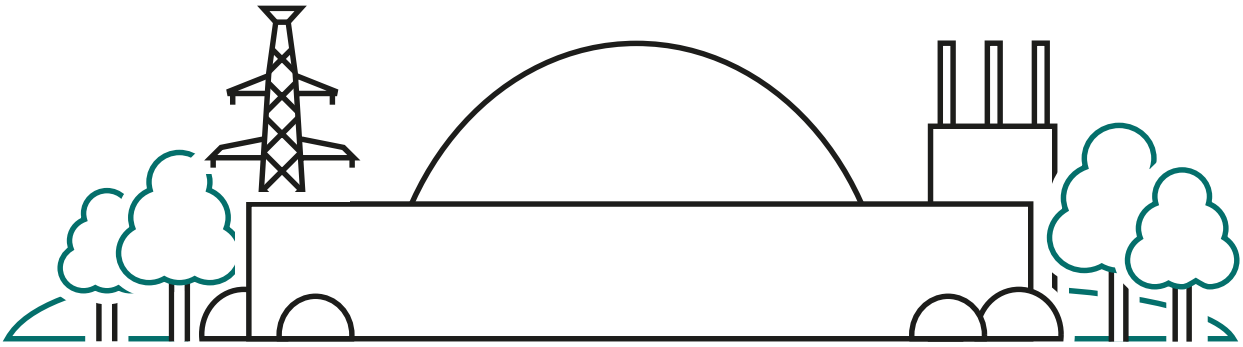
[1] https://www.gov.uk/government/publications/nuclear-and-radiological-safety-review-of-the-uk-framework-2019

A set of good practices

1.41 Our work over the past year has identified some good practices across a range of dutyholders that I wish to highlight. I am sharing the following good practices in the anticipation that they will enable our licensees and other dutyholders to learn from the respective successes.

1.42 **EDF-NGL Security Protected Plant Identification Process.** EDF-NGL has developed its Security Protected Plant Identification (SPPI) process in response to the regulatory expectations of our SyAPs. The process is underpinned by the expert knowledge of security and safety professionals, who work together to produce a repeatable process that allows EDF-NGL sites to both identify and categorise vital areas, and to then provide adequate protection. Since EDF-NGL has adopted the SPPI process, we have invariably found their submissions to be clear, accurate and conservative in their approach.

1.43 **Completion of the safe and secure transfer and consolidation of several tonnes of Dounreay plutonium inventory at Sellafield.** This good practice was the integrated and co-ordinated work by the various licensees, dutyholders and radioactive materials transport design authorities, working constructively with several external agencies, including police, regulators, and local and national governments, to ensure the work delivered by the licensees and dutyholders met national and international standards along with UK legal requirements. Effective cross-licensee staff working and interfacing with radioactive material transport authorities, enabled the timely production of safety cases, security plans and storage arrangements for the transport and near-term management of the material. A clear demonstration of good collaborative working, securing good safety and security outcomes.



1.44 **Low Level Waste Repository – completion of a significant programme to decommission five legacy buildings used to store plutonium-contaminated material (PCM).** The good practice was the large amount of work delivered safely and more than three years ahead of programme. The operators were tasked with decontaminating and size reducing alpha-contaminated structures and surfaces, and cutting and lifting over two hundred 300kg concrete sections, often working in confined spaces. This example demonstrated excellent planning, commitment, and control and supervision in challenging situations, with operators employed on multiple workfronts involving up to four facilities. The radiological conditions required operators to wear full air-fed suits for the majority of the programme duration. Over a six-year period more than 11,500 entries were made.

1.45 **Final site clean-up and revocation of the nuclear site licence from the former GE Healthcare radiopharmaceuticals site in Cardiff, Wales.** The site can now be re-used for non-nuclear purposes. The good practice was the collaborative working between the licensee, specialist contractors, Public Health England (PHE) and ONR, to agree a set of working arrangements and assumptions that ensured a common understanding of the meaning and application of complex guidance. This approach ensured a smooth path through deplanting and demolition, remediation, sampling and analysis and finally to the revocation of the site licence. Although working collaboratively, we were still able to maintain appropriate independent oversight to regulate the project effectively. This approach has now been adopted by other projects.

1.46 **Integrated Plant Safety Justification.** We have been actively engaged in discussions with the Ministry of Defence's (MOD) Submarine Delivery Agency, Rolls-Royce and Associates, and Babcock (the parent company of Devonport Royal Dockyard Ltd (DRDL); the licensee) in progressing a new and innovative approach to safety case development for the proposed Astute Deep Maintenance facility (10-dock) at Devonport Royal Dockyard. This will enable delivery of a new capability for submarine maintenance that meets required safety standards in a more cost-effective manner.

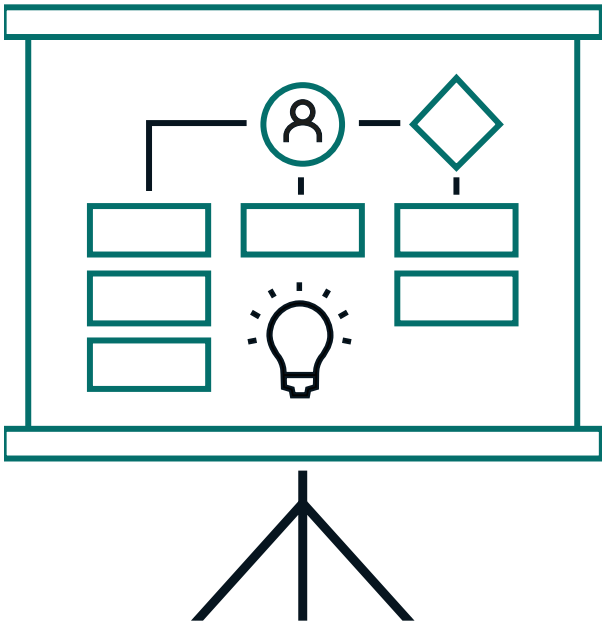
1.47 **Enabling outcomes through senior stakeholder co-operation.** Based on the successful model provided by the Sellafield G6 concept, we have been instrumental in the development and functioning of equivalent senior fora for AWE and Devonport (A6 and D6) and, more recently, for the MOD's submarine acquisition programme. These bring together appropriate senior stakeholder representatives from a range of organisations (e.g. Babcock, BAE Systems Marine Ltd (BAESM), Environment Agency, MOD, Rolls-Royce Submarines Ltd (RRSL)) to explore how to overcome barriers and deliver agreed outcomes effectively, adopting efficient and innovative approaches whilst still maintaining safety standards.

Enabling innovation and growth

1.48 The UK's goal-setting regulatory regime is technology-neutral and does not seek to prescribe design solutions, and, as such, already provides a constructive but safe environment within which innovation can thrive.

1.49 Building on our enabling approach, we have developed a clear position on innovation and have recently published our 'Approach to regulating innovation' guide.[2] It provides a number of examples where we have enabled innovation across the full landscape of the industry we regulate. It confirms that we will support the adoption of innovation and novel technologies by the industry, and be open-minded to fit for purpose solutions where they are demonstrably safe and secure and have committed to:

- Be on the front foot in reforming regulation in response to technological innovation;
- Ensure that our regulatory system is sufficiently flexible and outcomes-focused to enable innovation to thrive;
- Enable greater experimentation, testing and trialling of innovations under regulatory supervision;
- Support innovators to navigate the regulatory landscape and comply with regulation;
- Build dialogue with society and industry on how technological innovation should be regulated; and
- Work with partners across the globe to reduce regulatory barriers to trade in innovative products and services.
- We will also work with the sector to help secure improvements in other areas, such as diversity, where we believe that the creation of diverse teams can lead to better outcomes and improvements in safety, and we look forward to taking this work forward in the coming months and years.



[2] http://www.onr.org.uk/documents/2020/onr-innovation-report-2020.pdf

2 Overview of safety and security performance

Regulatory attention levels

2.1 The regulatory attention that we will apply to licensed nuclear sites for 2020/21 is summarised in Table 1. These attention levels were published in July in our Corporate Plan. 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[3] and transport purposes.

Table 1: 2020/21 Regulatory attention levels for licensed sites

Regulatory attention	Licensed site	Change in attention since 2019/20
Significantly enhanced	Sellafield – First Generation Magnox Storage Pond, Magnox Swarf Storage Silo, Pile Fuel Cladding Silo and Special Nuclear Materials Facilities, and overall site security	⟷
Enhanced	Atomic Weapons Establishment, Aldermaston	⟷
	Atomic Weapons Establishment, Burghfield	⟷
	Devonport (Devonport Royal Dockyard Ltd)	⟷ We have seen significant improvement during 2019/20, and will keep under review the continuing need for enhanced regulatory attention
	Sellafield – Remainder of estate (Sellafield Ltd)	⟷
	Hunterston B (EDF Energy Nuclear Generation Ltd)	⟷
	Dungeness B (EDF Energy Nuclear Generation Ltd)	⟷

[3] Excluding defence nuclear licensed sites

Regulatory attention	Licensed site	Change in attention since 2019/20
Routine	Dounreay Site Restoration Limited	↓ Driven by improvement in safety performance and safety culture
	Bradwell (Magnox Ltd)	↔
	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 (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)	
	Hinkley Point B (EDF Energy Nuclear Generation Ltd)	
	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)	
	Tradebe Inutec (Inutec Ltd)	
	Trawsfynydd (Magnox Ltd)	
	Winfrith (Magnox Ltd)	
	Wylfa (Magnox Ltd)	

2.2 Table 2 lists the attention level we will assign to dutyholders specifically in relation to civil nuclear security performance.

Table 2: 2020/21 Regulatory attention levels for civil nuclear security performance

Regulatory attention	Licensed site	Change in attention since 2019/20
Enhanced	DSRL (including Transport) – Security considerations only	↔
	Magnox Limited (Corporate) – Security considerations only	↔
	Harwell – Magnox Limited – Security considerations only	↑ Driven by a change in nuclear material holdings and increased resources to assess the site's SyAPs security plan
Routine	EDF Energy Nuclear Generation Ltd (Corporate) – Security considerations only	↓ Driven by improvement in safety performance and safety culture
	Direct Rail Services Ltd – Security considerations only	
	Geodis UK Ltd – Security considerations only	
	TN International Orano – Security considerations only	
	Canberra – Security considerations only	
	National Nuclear Laboratory (Windscale) – Security considerations only	

2.3 We assign regulatory attention levels through assessment against a range of safety and security indicators that broadly align with our Nuclear Safety and Nuclear Security Performance Indicator frameworks, as outlined in recently-published guidance.[4]

2.4 This year, in the later sections of the report, we have included 'radar diagrams' for sites that receive enhanced levels of regulatory attention that illustrate the factors that influenced the regulatory attention level, and which indicate the licensee's progress since last year's assessment.

2.5 **Level 3: 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.

2.6 **Level 2: Enhanced attention** describes a higher level of regulatory attention paid to the dutyholder, determined by one or more of the safety and security indicators previously mentioned.

[4] http://www.onr.org.uk/operational/other/onr-gen-gd-013.pdf

2.7 **Level 1: Significantly enhanced attention** recognises additional factors such as emergent or long-standing safety or security issues and/or the magnitude and nature of the risk associated with specific facilities. It may also reflect instances where we have substantially refocused 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.

Nuclear industry inspection performance

2.8 For all inspections that we undertake, our inspectors provide an overall rating of the performance of licensees and other dutyholders against expected standards.

2.9 We use Red-Amber-Green (RAG) 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

Compliance and system-based inspections

2.10 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 delivery of necessary improvements. In some instances, formal enforcement action has been required, in line with our Enforcement Policy Statement (EPS).

2.11 System Based Inspections (SBIs) have continued to be an important feature of our nuclear safety inspections on licensed nuclear sites. SBIs seek to establish that systems important to safety are maintained so that they perform as expected, fulfilling their safety functional requirements as required by the facility safety case.

2.12 Across the nuclear industry, we judged in 48 out of 50 SBIs (96%) that the safety systems met the requirements of the safety case. For the two systems where we considered there to be a shortfall, we were satisfied that the required improvements are now being implemented, and that adequate levels of nuclear safety have been maintained despite the shortfalls.

2.13 We record the issues arising from our inspection activities through our wellestablished regulatory issues management process. These issues are shared with the relevant dutyholder and this ensures that any corrective measures are monitored to a satisfactory conclusion so that the improvements to safety and security are adequately implemented.

Enforcement

2.14 On the occasions where we have identified shortfalls, proportionate enforcement action has been undertaken in accordance with our enforcement process. We have employed a range of enforcement tools to hold dutyholders to account, and secure sustained compliance with the law. During this period we:

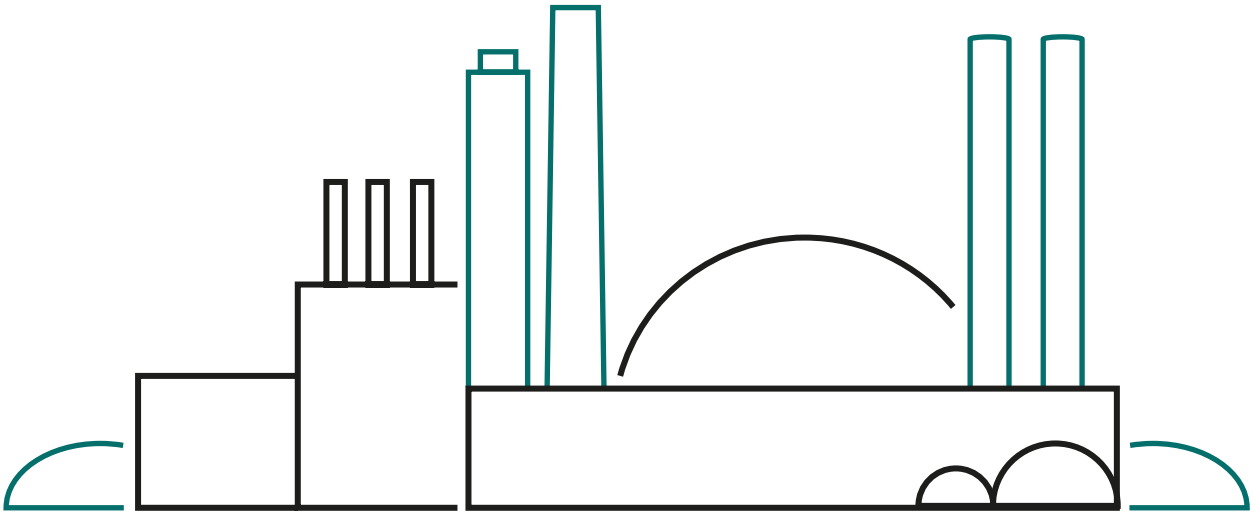
- Served three improvement notices, one of which has now been satisfactorily complied with. At the time of writing, we anticipate the remaining two will be met by dutyholders in accordance with the required schedules.

- Issued 29 enforcement letters.
- Issued one Enforcement Notice under the Regulatory Reform (Fire Safety) Order 2005.

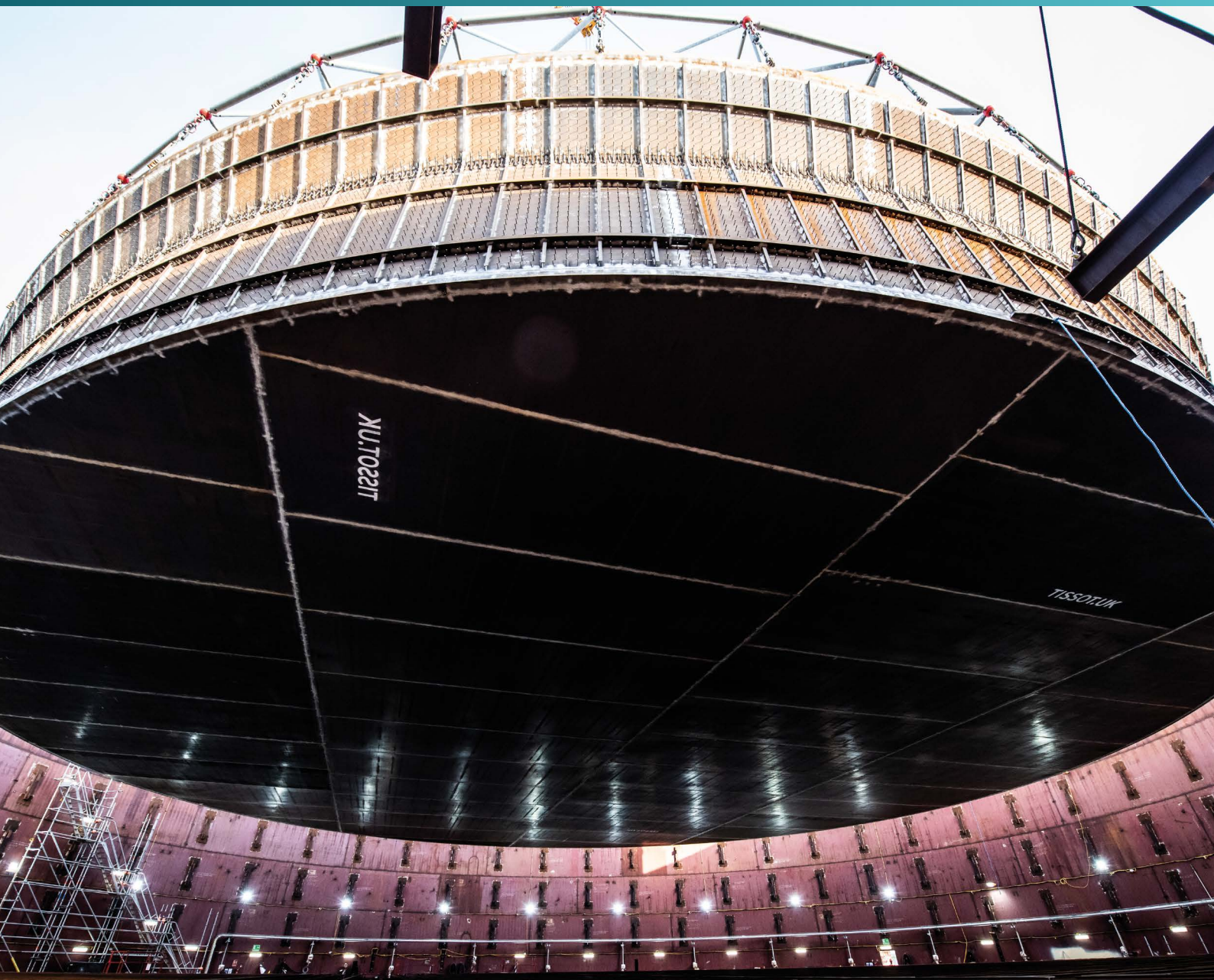
2.15 We have also instigated one prosecution, which was successful, against a licensee relating to an incident that occurred in 2018/2019. (See Table 3).

Table 3: Summary of concluded Prosecutions during 2019/20

Licensee / Dutyholder	Details of incident and charges	Outcome
Devonport Royal Dockyard Ltd	Devonport Royal Dockyard Ltd pleaded guilty on 23 July 2019 at Plymouth Magistrates Court to offences under Regulation 8 of the Lifting Operations and Lifting Equipment Regulations 1998. It followed an incident in September 2018 involving a crane at the Devonport 9 Dock facility. During a lifting operation to disassemble a stack of test weights, the weights became detached and fell towards a worker, narrowly missing him.	Devonport Royal Dockyard Ltd pleaded guilty and was fined £666,667 plus costs



3 New nuclear build



Summary of performance across new reactors

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 have continued to focus on the UK's first nuclear new build for a number of decades at Hinkley Point C (HPC), where construction is progressing well. Specifically, we are seeking evidence that the licensee, NNB Generation Company (HPC) Ltd (NNB GenCo (HPC)), is achieving high levels of assurance and quality control and has the appropriate arrangements in place to ensure equivalent standards are achieved through its supply chain.

We have examined NNB Generation Company (SZC) Ltd (NNB GenCo (SZC)) plans for Sizewell C (SZC), which submitted its Nuclear Site Licence application following the reporting period in June 2020. Its objective for SZC is to replicate as much of the design of HPC as possible. We believe that such replication will have nuclear safety benefits, enhancing the likelihood that the build will proceed right first time. It will also have benefits for operability and maintainability and could be an important factor in the potential applicability of the Regulated Asset Base (RAB) model, which is being considered by the UK Government, as a funding model for new nuclear projects.

Our assessment of the UK HPR1000 Generic Design Assessment (GDA) has also continued at pace, with increased levels of scrutiny as the project progresses through Step 4 of the GDA. In particular, we have sought evidence that the Requesting Party, CGN/GNI/EDF, understands the UK requirements and is meeting the necessary safety and security standards to make progress in the GDA.

We have supported the UK Government through our ongoing work with Advanced Nuclear Technologies (ANTs). This has enabled us to build our capability in this area, developing significant understanding of the various technologies involved and their different levels of maturity, which has also provided an insight into how we might regulate ANTs in the future.

Mike Finnerty
New Reactors Director
Deputy Chief Nuclear Inspector

New reactor landscape

3.1 We have continued to regulate the ongoing construction of NNB GenCo (HPC)'s twin UK European Pressurised Reactor™ (EPR™) at the HPC site in Somerset. Engagement has also continued with NNB GenCo (SZC) for the potential construction of a twin UK EPR at the Sizewell C site in Suffolk.

3.2 The external environment is continuing to evolve, driven by government's commitment to investment in nuclear new build, as evidenced by the recent Phase 2 ANTs funding under the Clean Growth Strategy. We will continue to work with government, other regulators, internal and external stakeholders and commercial organisations to ensure that we can deliver our regulatory functions, whilst ensuring we are adaptable to change so that we can deliver sustainable and effective regulation of advanced technologies.

Hinkley Point C

3.3 There were no significant formal regulatory permissions issued during 2019/20. Our regulatory activity has focused on retaining oversight of construction activities across the HPC site, including the nuclear island raft construction, which was completed in mid-2019.

Dutyholder performance

Development of the safety case

3.4 NNB GenCo (HPC) continues to develop its safety case. We were satisfied with its status at the point where we gave permission for nuclear construction to commence, but further development is still required to deliver a safety case fit for Unit 1 active commissioning. Consequently NNB GenCo (HPC)'s safety case development strategy proposes delivery of three interim 'Summary Safety Case Documents' before the pre-commissioning safety report. We have maintained oversight of the developing safety case and are preparing to undertake a review of the first Summary Safety Case Document when it is submitted.

Resolution of GDA assessment findings

3.5 We consider that NNB GenCo (HPC) continues to make good progress towards resolution of GDA assessment findings. At the end of GDA approximately 700 GDA assessment findings were raised (nuclear safety and security). As of March 2020, NNB GenCo (HPC) has closed 284 GDA assessment findings. The licensee continues to focus on closing out the remaining findings, which will be achieved as the site specific design continues develop.

Supply chain

3.6 As NNB GenCo (HPC)'s supply chain activities continue to ramp up, we have sought ongoing assurance that their oversight arrangements are effective in ensuring that components are produced to the required quality standards. NNB GenCo (HPC) is developing and implementing improvements based on operational experience to further enhance its arrangements, which will continue to be an area of regulatory focus.

3.7 We maintained our active regulation of the HPC primary circuit through frequent licensee engagements and a series of supplier inspections, some of which were joint inspections with overseas regulators. Through these, we assessed the capability of the major suppliers and the effectiveness of the licensee's oversight arrangements as manufacturing increased significantly during 2019. We were satisfied that the licensee responded appropriately to address some of the challenges associated with quality of component manufacture.

Construction

3.8 During 2019/20 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 as per design and quality requirements;
- Confirmed 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.

3.9 Overall, we consider that NNB GenCo (HPC) is constructing its justified design to the required quality standards.

Security at HPC

3.10 We have continue to assess the security arrangements of the major construction work at HPC to ensure these are adequate and proportionate to the activity at the site.

3.11 NNB GenCo (HPC) has continued to address the challenges presented by the dynamic nature of the project, maintaining an effective security regime and meeting the regulatory expectations in SyAPs.

3.12 We formally approved the NNB GenCo SyAPs-aligned Project Security Plan (PSP) for HPC in October 2019. This was a comprehensive and well-presented plan, which demonstrated a satisfactory understanding of the regulatory expectations in SyAPs. Mechanical, Electrical and HVAC (MEH) is the next phase of the project, and the licensee has worked effectively with the Tier 1 contractor to address potential security issues with appropriate and proportionate security arrangements.

3.13 The NNB GenCo Security Team has recently undergone a staff restructuring process in order to achieve closer alignment with EDF Nuclear Generation Limited (EDF NGL). There is effective coordination between the Site Command Centre Security staff, focused on the current construction phase, and the Delivery Command Centre Security staff who are responsible for the strategic security programme, including the development of the security regime when the facility is fully operational. NNB GenCo continues to meet regulatory expectations. The licensee is open and transparent in its regulatory engagement and proactive in identifying security issues and addressing them in a timely manner.

Forward look

3.14 The bulk installation of Mechanical Electrical and HVAC (MEH) will represent the next significant regulatory permission and we anticipate an application in 2021. We will increase our focus on NNB GenCo (HPC)'s development of its capability to manage the bulk installation of MEH equipment, successful installation is key to the project and will underpin future safe and secure operation of the plant.

Sizewell C

3.15 There has been an increased level of activity during 2019/20 and we are engaged with the licensee on a number of significant workstreams. We anticipate receiving a site licence application at the end of June 2020, potentially leading to a decision on the grant of a site licence at the end of 2021.

3.16 Sizewell C, with the exception of a small number of site-specific features, will be a replication of HPC, based on the same design reference configuration. We consider that replication will have significant benefits for nuclear safety and security. Notably, Sizewell C would make use of the significant learning from construction and commissioning of HPC.

3.17 We are monitoring the performance of the EPR™ for any learning, now that the Taishan reactor has entered commercial operation in China.

Generic Design Assessment (GDA)

3.18 In January 2017, the UK Government formally asked ONR and the Environment Agency to begin the GDA of the UK HPR1000. The UK HPR1000 is a reactor design proposed for deployment at Bradwell-on-Sea, Essex. General Nuclear System LTD (GNSL) is a UK-registered company that was established to implement the GDA on the UK HPR1000 reactor on behalf of three joint requesting parties, ie China General Nuclear Power Corporation (CGN), EDF and General Nuclear International (GNI). GNI is a UK subsidiary of CGN.

Progress through GDA steps 3 and 4

3.19 Step 3 of the UK HPR1000 GDA commenced in November 2018 and was completed in February 2020. During Step 3 we increased our regulatory scrutiny and undertook a more detailed assessment of the design focusing on the methods and approaches used by the requesting party to meet the safety and security claims.

3.20 At the end of Step 3 we had raised over 600 Regulatory Queries (RQs) and 31 Regulatory Observations (ROs). ROs are raised when we or the Environment Agency identify potential regulatory shortfalls which require action and new work by the GDA Requesting Party (RP) for them to be resolved. We publish the ROs together with the RP's Resolution Plans on our joint regulators GDA website.[5]

3.21 At the end of Step 3 we published a Summary Report[6] describing the work completed and the conclusions reached. Our assessment conducted to date has not identified any fundamental safety or security shortfalls that might prevent the issue of a Design Acceptance Confirmation (DAC) for the UK HPR1000 design. However, there is a considerable amount of work to be undertaken by the requesting parties to be able to complete GDA successfully within the current timescales. They will have to exercise a high level of control to ensure that the quality of submissions is not challenged by the need to deliver at pace.

3.22 Step 4 of GDA officially commenced in February 2020 and it is scheduled to last 23 months. The UK HPR1000 GDA requesting party published updated versions of the PCSR and GSR in its GDA website.[7] We are conducting a rigorous and in-depth assessment of these documents and of the underpinning safety and security submissions containing the evidence presented to support and form the basis of the safety and security cases. At the end of Step 4, we will judge whether a DAC should be issued for the UK HPR1000 design.

Bradwell B site

3.23 Bradwell Power Generation Company Ltd (BRB) is a joint venture between General Nuclear International (GNI) and EDF Energy created to deliver the Bradwell B Nuclear Power Plant project, based on deployment of the UK HPR1000 reactor technology (https://bradwellb.co.uk). Our UK HPR1000 regulatory team has continued to engage with BRB to ensure that it understands our expectations regarding the demonstration of site suitability and the organisational capability needed to become a holder of a nuclear site licence in GB.

5 http://www.onr.org.uk/new-reactors/uk-hpr1000/ro-res-plan.htm
6 http://www.onr.org.uk/new-reactors/uk-hpr1000/reports/uk-hpr1000-step-3-summary-report.pdf
7 http://www.ukhpr1000.co.uk/documents-library/step-4/

Advanced nuclear technologies

3.24 Advanced Nuclear Technologies (ANTs) include Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs). In 2019/20, we modernised the GDA process to enhance the efficiency and flexibility of the process, taking account of learning from previous assessments, the government's Nuclear Sector Deal and the potential for ANTs to enter GDA. The modernisation project included the consolidation of the assessment process into three steps, the ability to issue GDA statements upon completion of each step, and the publication of guidance to requesting parties in line with the modernised process.

3.25 We have held productive informal discussions with SMR designers to build our understanding of the reactor designs under development and to help familiarise prospective GDA applicants with our modernised GDA process. We aim to continue such discussions to enable prospective developers to understand the flexibility within the regulatory process and explore potential options to maximise our regulatory effectiveness; for example by progressing the majority of our design assessment via the GDA process or through our site specific activity.

3.26 Working with the Environment Agency, through the AMR Feasibility and Development (F&D) project, we jointly provided advice to the Department for Business, Energy & Industrial Strategy (BEIS) in May 2019 on the potential for proposed Advanced Modular Reactor (AMR) designs to align with UK regulatory requirements.

3.27 This followed the completion of our evaluation of submissions provided by the seven fission reactor vendors taking part in the process. The reactor technologies and vendors involved were:

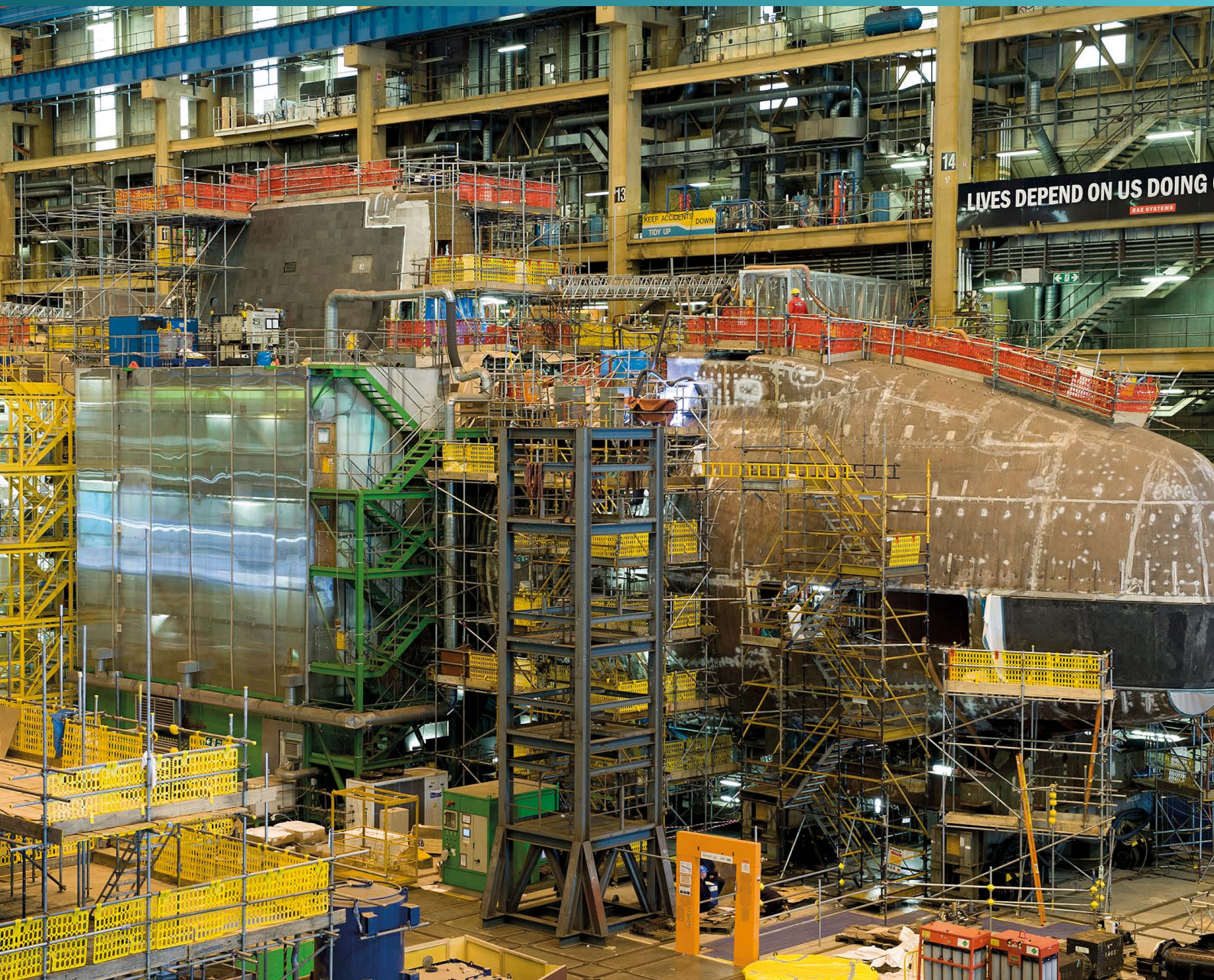
- A sodium fast reactor design by Advanced Reactor Concepts LLC;
- Three high temperature gas reactors by DBD Ltd, Ultra Safe Nuclear Corporation and U-Battery Developments Ltd;
- A molten salt reactor by Moltex Energy Ltd; and
- Two lead fast reactors by Westinghouse Electric Company UK Ltd and LeadCold.

3.28 Through additional UK Government funding to enhance our regulatory capability (the ANT Phase 1 Extension funding), we have continued to progress the implementation of our ANT training strategy and plans. We have continued to resource and enhance our internal ANT knowledge management processes and repositories in light of training and operational experience gathered to ensure that knowledge and expertise gained is incorporated in our activities and retained into the long term.

3.29 As part of the ANT Phase 1 Extension activities, we have continued to evaluate the compatibility of our regulatory guidance with ANTs, and completed research and guidance review activities on AMRs, including a preliminary review of our Safety Assessment Principles (SAPs) as well as on our expectations on defence-in-depth, shutdown systems, and fuel qualification to cite a few examples. These reviews largely concluded that our guidance is suitable to regulate these types of reactors as it is generally technology-neutral and non-prescriptive, however, further guidance may be necessary in specific areas to ensure clarity in the interpretation of those expectations.

3.30 We have developed plans to continue enhancing our regulatory capability on ANTs into 2020/21, in line with our focus on training and knowledge management, advanced manufacturing, regulatory guidance and international engagement.

4 Operating facilities



Summary of performance across operating facilities

Operating Reactors: During the year, reactor operations have continued to be underpinned by mature arrangements, implemented by the licensee, to secure compliance with Nuclear Site Licence Conditions and other legislation. Graphite ageing issues at Hunterston B have continued to have a significant impact on the operation of the two reactors at that site – Reactor 3 has remained shut down throughout the period, whilst we granted permission for Reactor 4 to operate for a period of approximately four months to December 2019. Hinkley Point B is now also at the stage where graphite ageing is having an impact on operations at the site. Graphite ageing is complex and requires 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 these reactors.

We applied enhanced regulatory attention to two civil reactor sites (Hunterston B and Dungeness B), the former due to the graphite ageing issues and the latter due to other plant ageing issues (i.e. significant plant corrosion and boiler steam system degradation).

Defence sites: Three of the defence sites that we regulate have been subject to enhanced regulatory attention for a number of years. These are:

- The two AWE licensed nuclear sites at Aldermaston and Burghfield;
- The licensed nuclear site at Devonport Royal Dockyard Limited.

We have overseen long-term improvements necessary for these sites to return to routine regulatory attention in due course.

In relation to Devonport Royal Dockyard Ltd, we have observed significant improvement during 2019/20, and we will review whether enhanced regulatory attention remains appropriate for this site.

We also note progress made in some key areas as regards the safety performance of the AWE Burghfield site.

Donald Urquhart
Operating Facilities Director
Deputy Chief Nuclear Inspector

Operating Reactors

Overview of performance across the fleet

4.1 EDF-NGL is a mature and responsible licensee, and has operated its sites, for the most part, reliably, safely and securely.

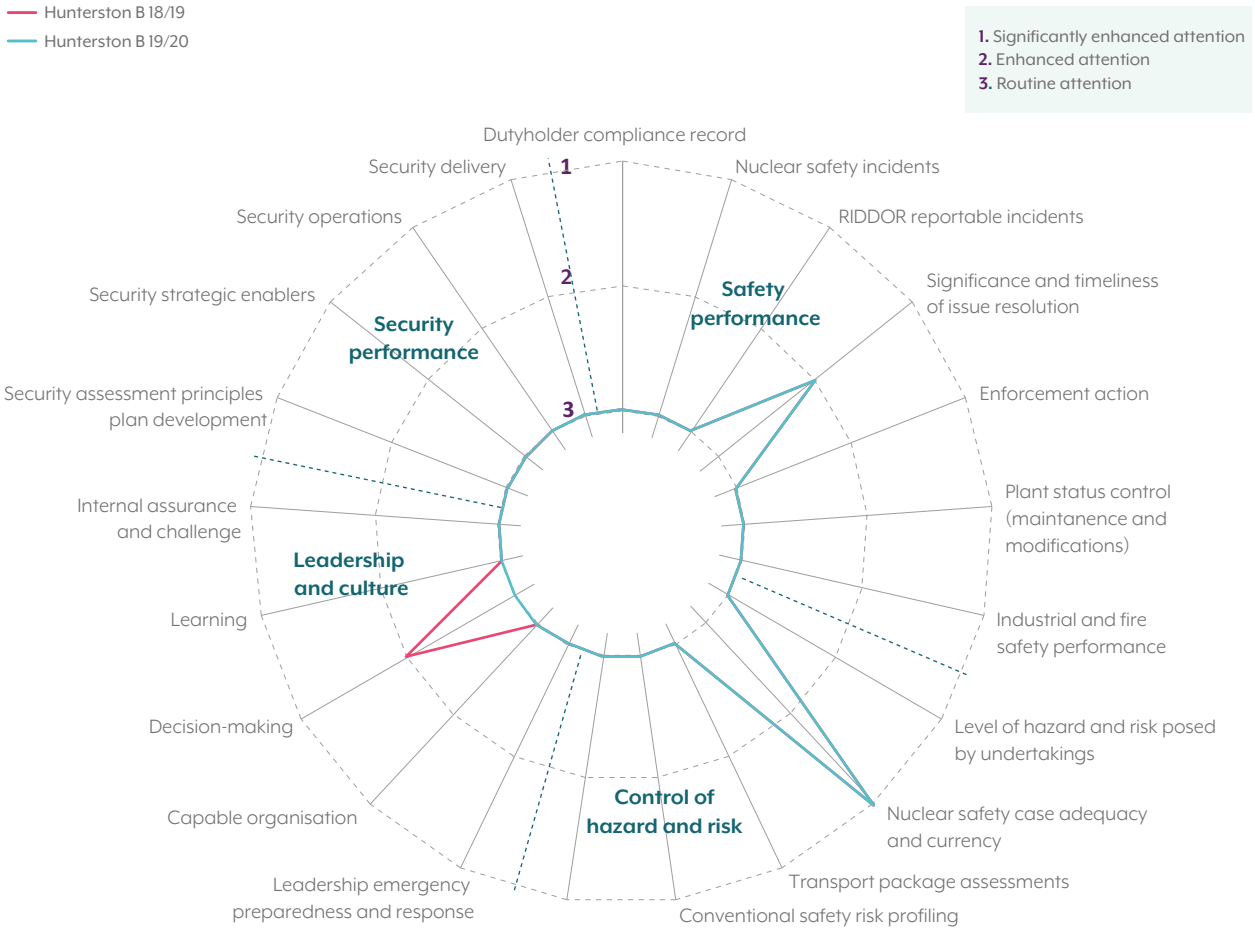
4.2 EDF-NGL has a strong safety culture, and is characteristically responsive to regulatory expectations, concerns and advice.

4.3 EDF-NGL has a substantially effective internal Independent Nuclear Assurance (INA) function, which 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 do liaise and interface constructively with INA to secure additional assurance and intelligence.

Dutyholder performance

Hunterston B

Figure 1: Hunterston B safety and security performance



4.4 Hunterston B has a long-standing good safety record, and continued to demonstrate a strong nuclear safety performance. However, we issued an enforcement letter seeking delivery of improvements under the Ionising Radiations Regulations 2017 regarding shortfalls in accountancy of radioactive sources, which are used for equipment testing. The station has responded well, and is taking positive steps to reinforce adherence to the expected standards.

4.5 The enhanced attention levels (i.e. levels 1 and 2 in the diagram above) for 'nuclear safety case adequacy and currency' and 'significance and timeliness of issue resolution' relate to known graphite ageing effects described within the safety case.

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

4.7 Reactor 3 was shut down in March 2018 and EDF-NGL has continued to develop a safety case to justify its return to service.

4.8 Reactor 4 was shut down in October 2018 and, after graphite core inspection work, EDF-NGL submitted a safety case to seek approval for a limited further period of operation. This was subject to rigorous assessment by our specialist inspectors, and resulted in us granting permission, in August 2019, for its return to service up to a cumulative core irradiation of 16.025 terawatt days of power generation. This period of operation for Reactor 4 was intended to limit the extent of cracking to less than that already observed in Hunterston B Reactor 3. The reactor was operated safely over the agreed period of power generation and it was shut down, equally safely, on 11 December 2019 for a further graphite core inspection. These inspections confirmed that cracking in Reactor 4 had indeed remained at a slightly lower level than that previously observed in Reactor 3.

4.9 Before either reactor at Hunterston B can return to service, EDF-NGL is required to produce safety cases to demonstrate that each reactor can continue to be operated safely, and be safely shut down, in all foreseeable circumstances, including that of a significant seismic event. EDF-NGL has submitted a revised safety case for the return to service of Reactor 3. At the end of the period covered by this annual report, this safety case was undergoing detailed examination by specialist ONR inspectors.

Hinkley Point B

4.10 Hinkley Point B is now at a stage where graphite ageing is having an impact on operations at the site. During 2019/20, we assessed a graphite safety case that allowed operation of Reactors 3 and 4 up to a cumulative core irradiation of 17.03 and 16.78 terawatt days respectively. These were set in order to align with the planned graphite inspections for each reactor.

4.11 Since its most recent period of operation, Reactor 4 has been inspected, and the extent of cracking was lower than anticipated. Reactor 3 has now also reached the core irradiation limit in its current safety case and has shut down for graphite core inspection.

4.12 Further operation of either reactor following their inspections will require a new safety case. EDF-NGL is developing this safety case and expects to submit it to us in summer 2020.

4.13 During 2019/20, a contractor on the site was struck by the rear blade of an excavator during work adjacent to the site boundary. This resulted in a compound fracture and could have resulted in more serious injuries. We carried out follow-up enquiries, which resulted in an enforcement letter being written to the contractor and to EDF-NGL's corporate centre relating to the need to improve compliance with the Construction, Design and Management Regulations.

Heysham 2 and Torness

4.14 We consider these sites to have an appropriate and mature safety culture, supported by well-experienced leadership teams.

4.15 We completed our assessment of the Periodic Safety Review (PSR) of the two stations, which was the third '10-yearly' review of their safety cases and of their safety to operate for a further period of time.

4.16 We concurred with the overall conclusion of these reviews; there were no serious nuclear safety issues that might threaten safe operation of the two stations until 2030. However, there are a number of improvement actions that have been identified, which we will track to completion (eg measures to ensure that operation of the four reactors remains safe and within the limits and conditions defined within the safety cases as the graphite cores age and to ensure that secondary and tertiary shutdown systems are robust).

Heysham 1 and Hartlepool

4.17 We consider these sites to have a reasonable safety performance, but they are amongst the most challenging of the AGRs to operate reliably because of the design of the reactors.

4.18 The required maintenance and operational improvements necessary to satisfy two improvement notices issued to Heysham 1 as a result of a steam valve failure in November 2018, were completed by November 2019. We have encouraged EDF-NGL to ensure these improvements are also implemented, where appropriate, across the rest of EDF-NGL's reactor fleet.

4.19 There have been two Conventional Safety events categorised by EDF as 'High Potential Events':

- In April 2019, a contractor was struck on the back by a scaffold pole that was being lowered to the workface, and which fell approximately seven metres. The individual was taken to hospital, but was discharged and returned to work the following day.
- In August 2019, a contractor was observed standing on the outside of the mid-rail of a scaffold in order to reach a valve being worked on; the potential fall was ~8m.

4.20 In both cases, we were satisfied with EDF-NGL's response to these incidents.

4.21 In October 2019, we issued an enforcement letter to both EDF-NGL and Altrad at Hartlepool, regarding the use of a flammable paint store that did not have adequate electrical provision. Immediate action was taken to isolate the electrical supply to the store, and the store was replaced with a purpose-built facility within six weeks.

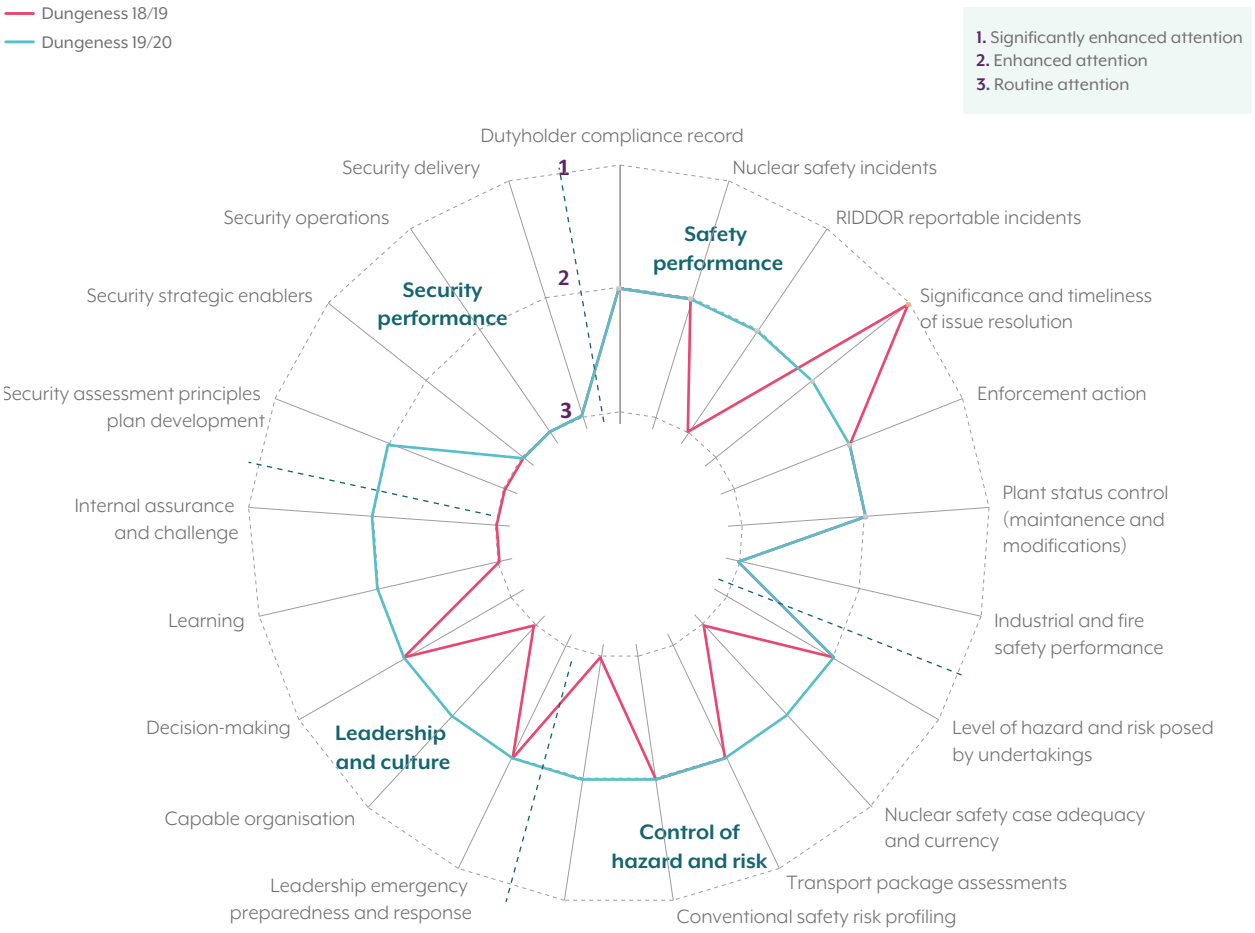
Sizewell B

4.22 Sizewell B has a good compliance record as regards health and safety legislation and requirements of the nuclear site licence conditions, confirmed through compliance, thematic and system-based inspections. The site has continued to demonstrate a good record of industrial safety performance, and there have been no INES level 1 (or higher) nuclear safety incidents in 2019/20.

4.23 Sizewell B safely completed a 'refuelling outage 16' between May and August 2019, with both nuclear safety and conventional safety being well-managed throughout the outage. The outage was a major undertaking and included the upgrading of the plant control system, which was complex but delivered without incident.

Dungeness B

Figure 2: Dungeness B safety and security performance



4.24 Dungeness B has received enhanced regulatory attention since late 2018, with both reactors having remained in a shutdown condition since the start of the reactor outage, for both reactors, in October 2018. This was due to a number of related ageing issues, including corrosion of concealed systems, which were discovered following the serving of a Direction by ONR (under LC15 (4) as described in my report last year).

4.25 Since then, cracking has been identified in valves in the main steam system, and degradation of particular key boiler tubes has also been observed. Both reactors remain shut down whilst modifications are progressed to improve the safety of the affected systems.

4.26 Since we issued this Direction, the licensee has responded positively in undertaking additional inspections, which resulted in the identification of a number of additional corrosion issues.

4.27 We also issued a number of enforcement letters during the year, relating to technical specification breaches, operating rules, operating instructions, the management of incidents on site and the control of contractors. In each case, the site took immediate action to address the short-term concerns, and we continue to engage on how the longer term aspects are to be closed out.

4.28 In comparison with other EDF-NGL sites, our inspections have continued to highlight a greater number of regulatory shortcomings at Dungeness B, which reflect the significant challenges that the leadership on this site needs to address.

4.29 We do note what we believe to be the start of positive cultural change across the site. EDF-NGL has established a wider 'Performance Improvement Programme' (PIP), which is led and sponsored by a senior manager on site.

4.30 Given the nature of the challenges at this station, our site inspection team has been bolstered by an additional inspector (a leadership and management for safety specialist) to support the site inspector. This additional inspector will focus on the strategic, longer-term aspects of improving the performance of the station.

Security performance

4.31 EDF NGL has continued to develop SyAPs-aligned site security plans. Developing the required evidence to support certain security claims and arguments has taken the company longer than anticipated, thereby delaying submission and subsequent approval of these new plans.

4.32 From our interventions, we are satisfied that there were no significant security compliance issues across the civil operating power reactor fleet. While one dutyholder was issued a Nuclear Industries Security Regulations (NISR) Direction, the site made demonstrable improvements and the Direction was successfully addressed.

4.33 From a cyber-security perspective, while significant progress has been made as regards capability, delivery of cyber security at stations remains an area that will attract further regulatory attention. We note that EDF-NGL has made improvements to cyber security and information assurance, albeit concerns remain regarding resourcing against an ambitious delivery plan. We will maintain our focus on oversight of this until we are satisfied that this has been addressed.

4.34 EDF-NGL has delivered 'personnel security' to a consistent standard across the fleet, demonstrating a positive security culture through aftercare incident reporting and its approach to resolution of staff management issues.

Defence sites

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

- Nuclear Licensed Sites: regulated by us in accordance with the standard nuclear site licence. In the specific instance of AWE plc, Licence Conditions can only be applied in so far as they do not impact on the design of the weapon.
- Authorised Sites: do not require a nuclear site licence because of exemptions relating to specific activities, or a general disapplication to activities that are under the control of the Crown (the Ministry of Defence (MOD)). In these situations, the sites are Authorised by the MOD. However, we are 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 the Enforcing Authority for HSWA in such cases, although we are the Enforcing Authority for the REPPIR 2019 and the Ionising Radiations Regulations 2017 (IRR17).

4.36 The Defence Nuclear Safety Regulator (DNSR); a non-statutory regulator internal to MOD, provides assurance to the MOD Secretary of State where these legal exemptions apply, and regulates the transport of defence-related radioactive materials. Security is regulated by the Defence Nuclear Security Regulator.

4.37 We continue to work closely and collaboratively with both these bodies to ensure proportionate and effective regulation.

Atomic Weapons Establishment sites' safety performance

Figure 3: Aldermaston safety performance

Figure 4: Burghfield safety performance

4.38 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 been subject to enhanced regulatory attention for approximately seven years due to a number of persistent safety performance issues. We have seen evidence of improved performance in some areas at the Burghfield site.

4.39 We delivered comprehensive reviews of safety performance, covering both of the AWE Aldermaston and Burghfield sites, in March and November 2019. This indicated that AWE has developed and is delivering a more holistic approach to safety management, in order to enable its eventual transition to routine regulatory attention.

4.40 These reviews were structured in a manner that allowed coherent linkage to our revised process for the assessment of regulatory attention levels. The diagram above is informed by the cumulative intelligence derived from these comprehensive reviews, and by other targeted site interactions.

4.41 These structured reviews provided evidence that AWE's performance is improving, in areas, in line with our expectations (e.g. regarding the significance and timeliness of resolution of regulatory issues and also emergency preparedness and response). These improvements are welcomed.

4.42 Improvement Notices were served on both AWE sites for shortfalls associated with Organisational Capability; one of the key areas in which we expect to see a faster rate of improvement. It is noted that improvements delivered since the issue of the Improvement Notices are not yet adequate to meet regulatory expectations. Consequently, we are continuing to engage with AWE to secure greater progress and to seek evidence of delivery of improvements.

4.43 We have also taken targeted and proportionate enforcement action to seek necessary improvements in Nuclear Safety Case Adequacy and Currency, This reflects repeated delays in the delivery of adequate Periodic Reviews of Safety, and a lack of timely closure of improvements thereby identified. The need for such enforcement, against a number of licence conditions, has contributed to our decision to continue to subject AWE sites to enhanced regulatory attention.

4.44 However, it is our expectation that AWE's more holistic approach to securing safety improvements will produce significant and sustainable improvements over the next 12-18 months. Subject to sufficient progress being made and sustained, we note the potential to restore AWE to routine regulatory attention at some point during 2021.

AWE Aldermaston

4.45 We note the ongoing incidence of industrial safety incidents at AWE Aldermaston, a number of which are related to the adequacy of control and supervision of work, including work undertaken by contractor staff. A number show similarities to previous incidents, which suggests a need to improve the investigation and implementation of learning from such incidents. Conventional safety risk profiling and learning from experience will be a focus for us over the year ahead.

4.46 An example of this relates to an electrical incident involving a contractor in June 2019. As a consequence of similar previous electrical incidents and the level of risk that such incidents present, we undertook a formal investigation to ensure that appropriate improvements are made, and which will inform appropriate enforcement action.

4.47 We also raised a regulatory issue in relation to AWE Aldermaston, to ensure that progress in delivering necessary improvements is formally tracked for Fire Safety Performance (obsolescence of the fire detection system in a facility and resultant maintenance challenges).

4.48 Late delivery of adequate Period Safety Reviews (PRS) and the pace of delivery of facility upgrades remained an area of significantly enhanced attention during the period. ONR escalated regulatory attention on this through the issue of an enforcement letter with an associated meeting.

4.49 Overall we will need assurance of an increase in the pace of delivery of sustainable safety improvements at Aldermaston before consideration can be given to routine regulatory attention. Aldermaston's current trajectory indicates that a move to routine regulatory attention is unlikely before 2022 at the earliest.

AWE Burghfield

4.50 In March 2018, on the basis of a review of AWE's second Periodic Review of Safety (PRS2) relating to its Assembly Technology Facility, we were able to permission a further period of active operations. The duration of this permission was conditional on the delivery of a number of key safety upgrades. We are pleased to note that all of these key safety upgrades have now been implemented.

4.51 During 2019/20, we were also able to release three regulatory hold points, which allow progress to be made as regards the continued construction of the modern standards 'Mensa' facility. Release of these hold points has allowed AWE to move ahead with the installation of facility plant and equipment.

4.52 Overall the site remains in enhanced regulatory attention at present though we judge that its performance is now moving ahead at an increasing pace compared to Aldermaston. Our forecast to the end of 2020 is that the site is on a trajectory towards routine attention for the majority of performance indicators, and if there is evidence that this is sustainable, Burghfield may be ready to be considered for routine regulatory attention during late 2021.

Propulsion sites' performance

Devonport Royal Dockyard

Figure 5: Devonport Royal Dockyard safety performance

4.53 Devonport Royal Dockyard is the UK's principal site for the maintenance of nuclear submarines.

4.54 The dockyard contains both a Nuclear Licensed Site and an Authorised Site, operated by Devonport Royal Dockyard Ltd, and an Authorised Site operated by MOD (HM Naval Base Devonport).

4.55 HM Naval Base Devonport is also the storage location for 13 of MOD's 20 redundant submarines. This storage location became an Authorised Site following an extension to the Authorised Site boundary during 2018.

4.56 Due to a planned increase in activity over the coming years, in relation to submarine defueling and dismantling, commission extension and basic and deep maintenance periods for current and future classes of submarine, significant infrastructure upgrade work will be delivered on the site over several years.

4.57 Devonport Royal Dockyard Ltd has been subject to enhanced regulatory attention for five years as a consequence of a number of persistent safety performance issues.

4.58 To deliver structured regulatory oversight we developed a specific strategy (2017-20), through which we have delivered a balance of compliance oversight alongside accountability and enforcement, whilst enabling improved safety performance through influence, advice and guidance. This approach has ensured that the licensee has maintained its focus on the root causes of its performance issues.

4.59 We delivered a detailed and structured 'confidence review' in January 2020, which provided strong evidence that the safety improvements are all on target to be delivered to the agreed timescales.

4.60 Particularly notable during 2019/20, are the substantial, tangible and sustained improvements we have seen in organisational culture, employee engagement, empowerment, leadership commitment to safety, and operational performance. These improvements are such that we anticipate that Devonport Royal Dockyard Ltd may be able to be returned to routine regulatory attention in the not too distant future.

4.61 In this vein, we are already engaged in the preparatory work necessary to deliver a 'fit for purpose' and safe docking solution for deep maintenance of Astute and Dreadnought class submarines.

4.62 During the year we were notified of one incident (rated INES Level 1) relating to safety systems 'tripping' on a dockside crane. We investigated the cause of the control system failure and judged that no formal enforcement action was required. The crane was subsequently safely returned to service.

Rolls-Royce submarines

4.63 The Rolls-Royce Submarines Ltd Derby site is the principal facility for the manufacture and testing of nuclear submarine fuel cores in support of the UK nuclear submarine programme.

4.64 It is comprised of two separate nuclear licensed sites: the Neptune Reactor site, which includes a 'zero energy' test reactor, and the Nuclear Fuel Production Plant (NFPP). Both licensed sites are operated by Rolls-Royce Submarines Ltd.

4.65 Overall, we are satisfied with the safety management of the two sites, and both remain in routine regulatory attention. However, during the year, the licensee took the decision to shut down operations in the NFPP site following a series of related incidents. Following an investigation, we issued an enforcement letter, requiring that safety improvements be made.

4.66 Prior to permitting recommencement of operations, we conducted a re-start 'readiness' review, and were satisfied that sufficient safety improvements had been delivered to justify the recommencement of operations. We welcome that Rolls-Royce Submarines Ltd also implemented a programme of work to promulgate these improvements to other areas of the NFPP site.

4.67 Noting schedule changes in the licensee's work, we have regulated flexibly throughout 2019/20 to ensure the timely regulatory oversight, advice and guidance across Rolls-Royce Submarines Ltd's infrastructure programme. This approach helped support the early procurement of key 'long lead' items for the Neptune reactor refurbishment project.

BAE Systems Barrow

4.68 The BAE Systems Marine Ltd site at Barrow is the principal facility for the construction and assembly of UK nuclear submarines. The site comprises a Nuclear Licensed Site (the Devonshire Dock Complex) operated by BAE Systems Marine Ltd, and an Authorised Site.

4.69 At present BAE Systems Marine Ltd is constructing both Astute and Dreadnought class submarines. Major development of the site is underway, to provide the infrastructure to complete the build and commissioning of Dreadnought Class submarines. We have focused on providing regulatory oversight of this programme, and of the remaining Astute class submarine programme.

4.70 Overall, we are satisfied with compliance and nuclear safety performance across the site.

Rosyth Dockyard

4.71 Rosyth Royal Dockyard contains a Nuclear Licensed Site operated by Rosyth Royal Dockyard Ltd. The nuclear licensed site contains a dry dock (to be used to dismantle the seven decommissioned submarines on the site) and a waste storage facility.

4.72 The first phase of submarine dismantling (low-level waste removal) is currently underway at Rosyth. The level of the nuclear safety hazard on the site remains low compared to most nuclear licensed sites, and we are satisfied with the safety performance at this site.

4.73 The licensee intends to expand its capability to undertake the next stage of submarine dismantling to remove intermediate level waste from the submarines. This will require a significant uplift in organisational capability along with development of site facilities. Work to deliver both of these is underway.

Non-licensed propulsion sites

4.74 Her Majesty's Naval Base (HMNB) Clyde, located in Faslane in Scotland, is the operational base for most of the MOD's nuclear submarine fleet, and is an Authorised Site. Our regulatory responsibility is therefore limited to the enforcement of the HSWA 1974 and its Relevant Statutory Provisions. There have been no significant safety issues of relevance to our regulatory responsibilities during 2019/20.

4.75 The Vulcan Naval Reactor Test Establishment near to Dounreay, a test facility for Naval Pressurised Water Reactors, is also an Authorised Site. The Vulcan test reactor was shut down for the final time in July 2015 and the facility is now in a long-term quiescent state. There have been no safety issues of note in the period.

4.76 We maintain close working relationships with the DNSR, undertaking joint inspections where appropriate to do so, to maintain our awareness and understanding of operational activities undertaken on these Authorised Sites, and to gain the necessary assurances on safety where required.

5 Sellafield and decommissioning, fuel and waste sites

Summary of performance across Sellafield and decommissioning, fuel and waste sites

At Sellafield, safe and secure progress has been maintained with decommissioning and remediation of its highest hazard facilities. This challenging work will endure for many decades. Hazard reduction and decommissioning work at Dounreay continues to proceed safely, as does work to decommission the fleet of shutdown Magnox nuclear power plants.

At Sellafield notable achievements include:

- Further progress in preparations for the retrievals from the legacy silos, including inactive commissioning of the Pile Fuel Cladding Silo (PFCS) waste retrievals capability, and commissioning of the Magnox Swarf Storage Silo (MSSS) active ventilation system.
- Safe receipt and storage of the remaining special nuclear material (SNM) from Dounreay.
- Implementation of capabilities to over-pack some ageing SNM packages.
- Significant reduction in legacy liquid waste held within the Analytical Service Facility, including the safe disposal of solvent waste inventory.
- Completion of key decommissioning work, such as First Generation Reprocessing Plant Stack.
- Demolition and removal of contaminated legacy plant and equipment from the SNM (North) facility.
- Cyber Security Operations Centre, the first of a kind in the industry, commenced operations.

The Sellafield site remains one of ONR's top regulatory priorities and the most hazardous areas will continue to receive significantly enhanced attention for years to come. Our focus continues to be on:

- Ensuring continued retrievals from the legacy storage ponds and safe storage of the remediated waste and spent fuel in more modern facilities.
- Securing timely retrievals from the silos and delivery of modern facilities for storage and treatment of legacy waste.
- Securing timely delivery by Sellafield Ltd of treatment and storage facilities for SNM.
- Engaging with key stakeholders to ensure that Sellafield Ltd retains the organisational capability to deliver accelerated hazard remediation and risk reduction in a safe and secure manner.

On many of the Decommissioning, Fuel and Waste licensed sites, safe and secure progress is clearly visible with decommissioning and site clean-up; some notable achievements being:

- Completion of final defuelling of the two Magnox reactors at Wylfa, with our independent confirmation that the site is now free of spent fuel;
- Following final site clean-up, revocation of the nuclear site licence for GE Healthcare's Cardiff site in December 2019; and
- Safe and secure transfer of the bulk of SNM from Dounreay to Sellafield for treatment and long-term storage.

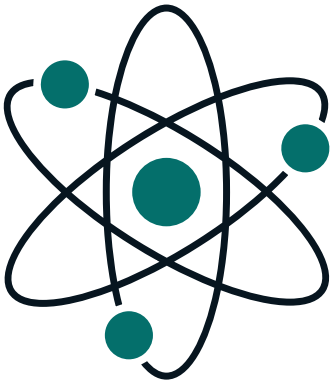
Dr Mina Golshan
Sellafield, Decommissioning, Fuel and Waste Director
Deputy Chief Nuclear Inspector

Sellafield

Overview of the site

5.1 Sellafield contains more radioactive material per square kilometre than any other nuclear site in the world. Reducing the hazard and risk on the site in a safe and timely manner is a national decommissioning priority and this is reflected within our strategy for regulation of the site. One of the most significant challenges facing the licensee, Sellafield Ltd, relates to retrieval of large quantities of higher activity waste and spent fuel from several of its legacy facilities, and associated decommissioning. Some of these facilities are many decades old and no longer meet the high standards expected of nuclear facilities. The degradation of some of these high hazard facilities means that retrieval of their radioactive inventory requires complex and innovative engineering solutions, and this will take many years of further work to complete. We continue to give these plants a high degree of regulatory attention. As the retrieval work progresses we recognise that there will inevitably be a short-term increase in risk in some areas to secure long-term safe clean-up of the site. Sellafield Ltd continues to carefully manage its risks and maintain adequate contingency measures to mitigate for any unusual occurrences, and will need to continue to do so into the future.

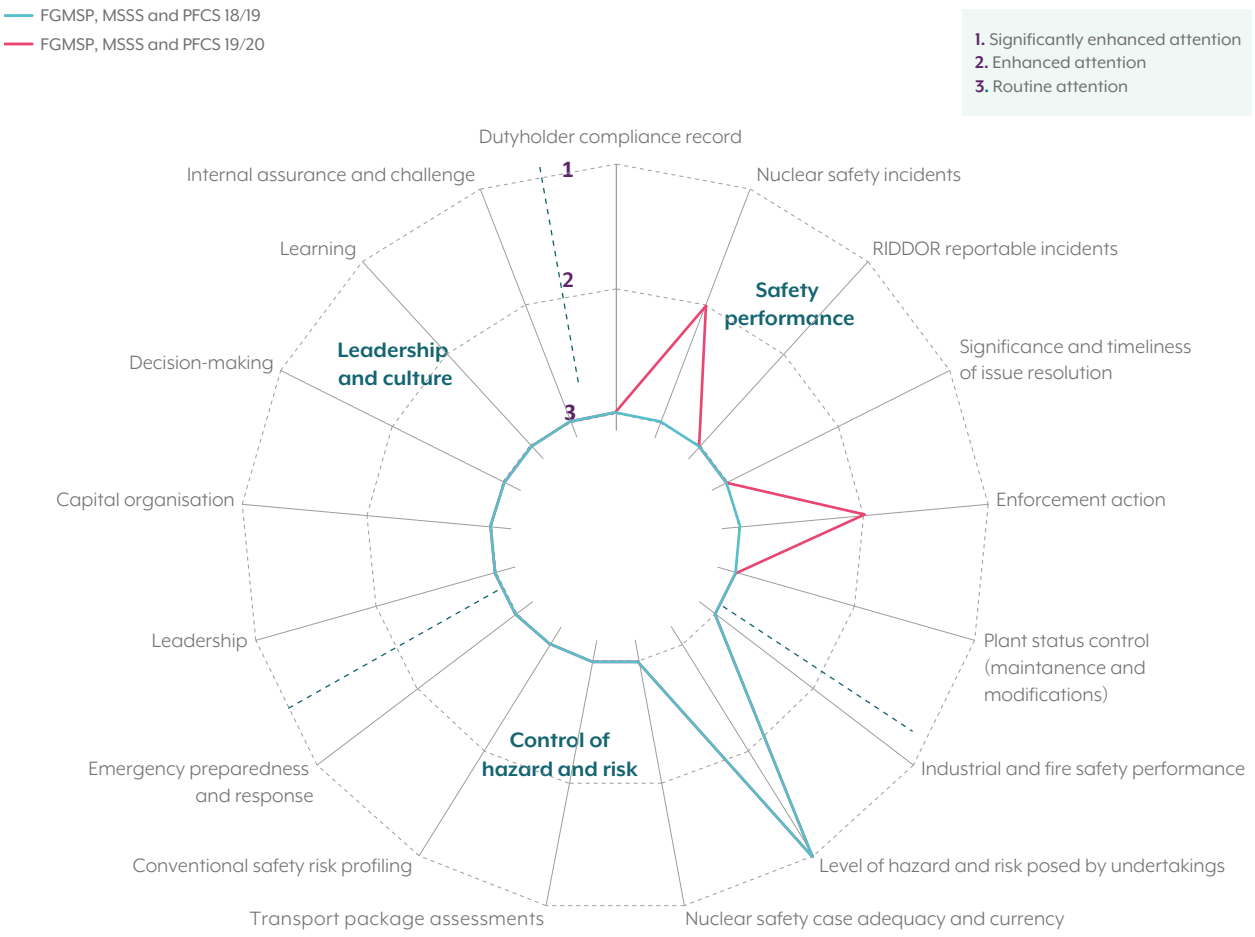
5.2 With the cessation of oxide fuel reprocessing and the planned closure of the Magnox fuel reprocessing plant, Sellafield Ltd has been making organisational changes to deliver its new mission, which will be primarily one of decommissioning and safe storage of radioactive material and waste. As there is no higher activity waste or spent fuel disposal route in the UK, radioactive material will continue to need safe and secure storage on the site, pending its ultimate disposal. The requirement to retrieve, package, and store an increasing inventory of radioactive material and waste in existing and new facilities on a congested site, adds further complexity to the already significant challenge facing Sellafield Ltd. There are also complex interdependencies between process and waste facilities that may impact progress should any facility experience operational problems.



Dutyholder performance

Legacy Ponds and Silos

Figure 6: Safety performance of Sellafield legacy ponds and silos facilities



5.3 The legacy ponds and silos remain at a significantly enhanced level of regulatory attention. We, along with Sellafield Ltd and the NDA, recognise that the work to remediate these facilities is a national decommissioning priority. This level of regulatory attention will persist for many years. This is not a reflection on the performance of Sellafield Ltd but recognition of the degraded nature of these high hazard facilities, coupled with significant challenges and timescales associated with their remediation. We continue to focus on ensuring that Sellafield Ltd maintains existing safety functions whilst making necessary improvements and preparations for safe retrievals and remediation.

5.4 The change in safety performance for two of the attention level attributes, 'Nuclear Safety Incidents' and 'Enforcement' is due to the incidents mentioned below in relation to leakage from two facilities.

5.5 Sellafield Ltd continued to make steady progress with waste and spent fuel retrievals from the legacy ponds, and in its preparations for waste retrieval from the legacy silos. In March 2020 in response to COVID-19, the retrieval activities stopped and facilities were placed into a quiescent state under close monitoring and surveillance to ensure their continued safety. Following this cessation, Sellafield Ltd commenced planning to safely resume its work on priority hazard and risk-reduction programmes to ensure continued momentum whilst adhering to social distancing measures.

5.6 The waste handling and containment modules required to retrieve waste from the PFCS have been installed and the plant and equipment for waste retrievals is undergoing inactive commissioning prior to seeking our agreement to commence active commissioning. This will be the final ONR milestone prior to commencement of waste retrievals from the PFCS.

5.7 The retrieval of waste from the MSSS is a complex undertaking, requiring several risk-reduction projects to be coordinated, as well as requiring modern facilities and containers for storage of the waste to be available to enable retrievals. The schedule for remediation of MSSS has extended because Sellafield Ltd encountered some technical engineering challenges during the year; the project requires all stakeholders to work constructively to support effective delivery. Notwithstanding this, we are content that adequate progress has been maintained and improvements to the building structure, cranes and ventilation system have been completed to enable solid waste retrievals. This includes progress made with commissioning of waste retrieval plant and equipment.

5.8 Progress also continues to be made in preparing for the necessary new long-term storage facilities for both MSSS and PFCS waste and in the development of the associated safety cases. Some delays have been experienced due to construction complexities in one of these stores – the Box Encapsulation Plant Product Store/ Direct Import Facility (BEPPS/DIF). We are satisfied that Sellafield Ltd has adequately resolved these through re-sequencing and prioritising some of the construction activities at this facility.

5.9 Safe sludge and fuel exports continue from the Pile Fuel Storage Pond (PFSP) and First Generation Magnox Storage Pond (FGMSP), along with preparations for further retrieval activities of the more challenging inventories. This work has met our expectations.

5.10 Over the next few years, waste retrieval activities will lead to a controlled temporary increase in the risk from these facilities. This is a necessary step to enable significant longer-term hazard and risk reduction, but will only be allowed if we are satisfied with the safety measures put in place.

5.11 During the year Sellafield Ltd reported a leakage of radioactively contaminated water ('liquor') from the MSSS original building. This was rated at Level 2 (Incident) on the International Nuclear and Radiological Event Scale (INES). The liquor is believed to be leaking into the ground from cracks in the below-ground structure of the original building. The potential leak mechanism is believed to be the reopening of a crack associated with a leak in the 1970s as the rate of leakage is comparable to estimated leak rates observed at that time.

5.12 There are no radiation dose consequences for the workforce or the public from the leak. There has been no detectable change to general radiological conditions at the plant. However, the leak could result in considerable additional contamination of the ground on site, which would

ultimately require clean-up. Groundwater modelling and underpinning research concludes that any migration of significant contamination through the ground would take decades. This exceeds the time it will take to remove and remediate the MSSS facility. On this basis, we are content that the extant Sellafield strategy to remove the radioactive waste remains the highest priority for the site.

5.13 We are satisfied with Sellafield Ltd's response to this matter and we continue to maintain close oversight and are seeking assurance from the licensee on its leak-to-ground risk management plan to inform future regulatory interventions.

5.14 Sellafield Ltd also reported a loss of radioactive liquid to the ground from a redundant storage tank (RST) in the legacy pond area, believed to be from an historic leak path below ground level from the RST sump. This incident was rated at Level 1 (anomaly) on the INES; we are satisfied that the risk to the workforce, the public and the environment is very low. We and Environment Agency wrote jointly to Sellafield Ltd outlining expectations in relation to terminating the leak. Sellafield Ltd has now removed the waste and debris from the RST and transferred it to a settling tank within the facility and intends to cap the RST sump with concrete. The regulators were satisfied with the response to this incident.

Special Nuclear Material (SNM) facilities

Figure 7: Safety performance of Sellafield SNM facilities

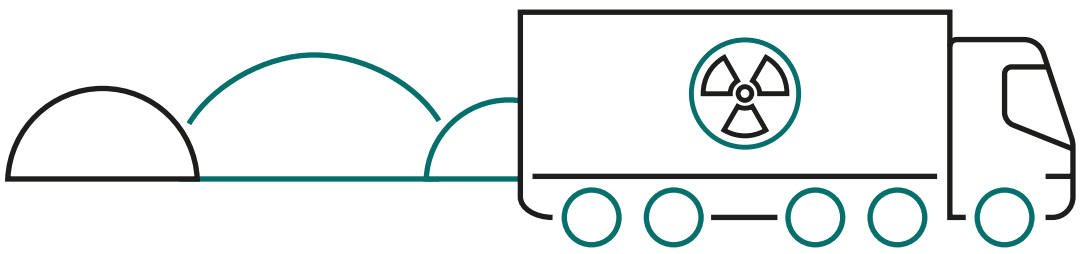
5.15 Due to the challenges faced by Sellafield Ltd (described below), we will maintain a significantly enhanced level of regulatory attention at the SNM facilities for many years to come. This reflects the magnitude and nature of the inventory and the ageing and degraded condition of their containment. Sellafield Ltd is currently developing safety cases and engineering solutions for handling and processing this material so that it is suitable for interim storage, while delivering medium term treatment options prior to a facility becoming available for final treatment. We have raised Level 1 Regulatory Issues (the most significant level) to ensure these matters are addressed and to track their progress to a satisfactory conclusion.

5.16 Since the last report there has been a change in safety performance for two of the attention level attributes, these are: 'Nuclear safety case adequacy and currency', and 'Enforcement'. Regarding the former we consider that the safety cases for the Thermal Oxide Reprocessing Plant Product Store and the Sellafield Mixed Oxide Plant Laboratory had not adequately covered certain aspects relating to condition of assets and containment of material. In both cases, Regulatory Issues were raised seeking timely resolution. We judge that adequate progress has been made against these issues during the year.

5.17 The change in enforcement attention level attribute is a result of the prosecution of Sellafield Ltd, which concluded in early April 2019. The company was fined for breaches of the law in SNM (South) in 2018 following personal contamination to an employee. We note that Sellafield Ltd has since addressed the shortfall identified.

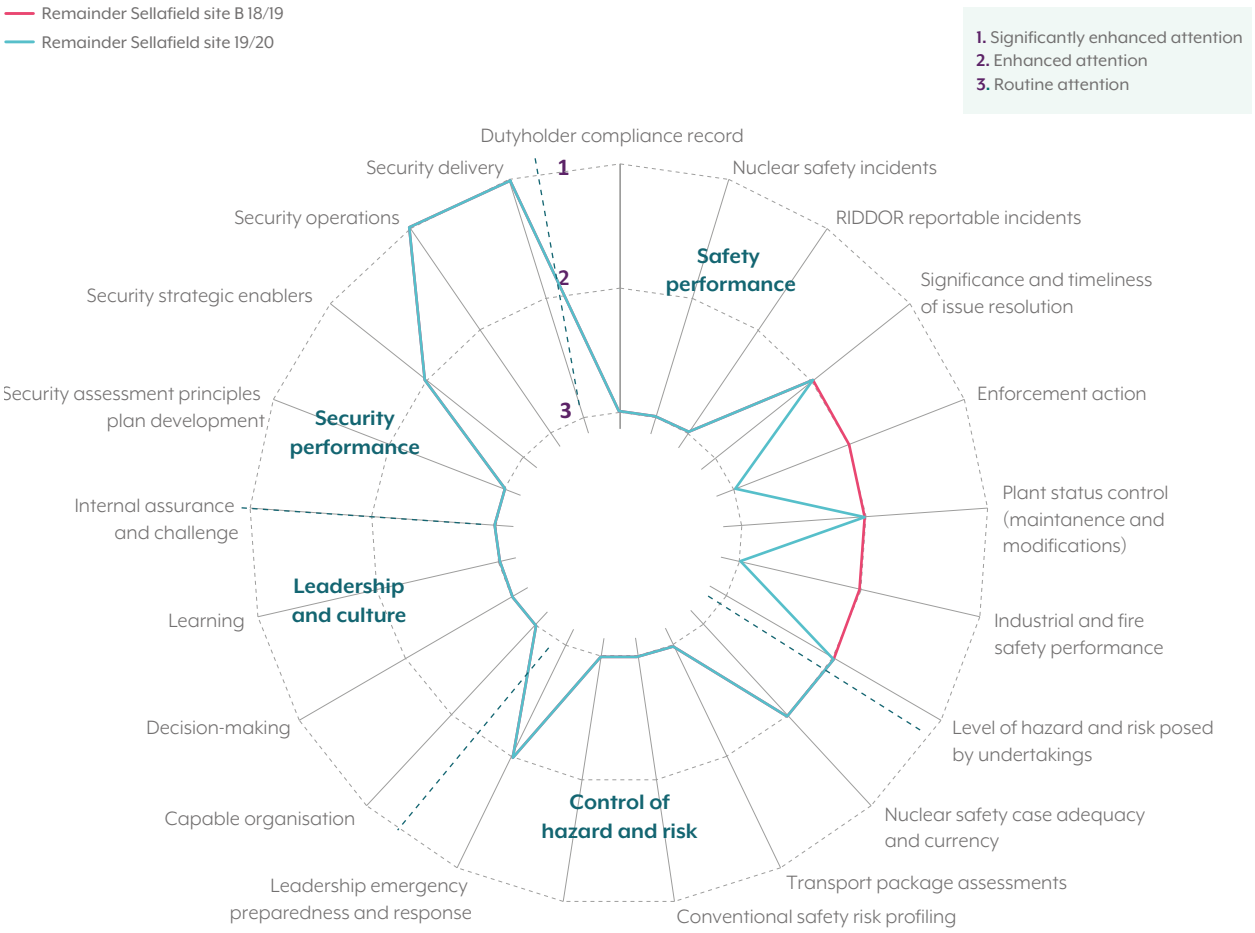
5.18 Sellafield Ltd has made tangible progress with improvements to some of the site's ageing SNM facilities. There is a continuing need to develop facilities to treat degrading SNM containers, both in light of their age and to accommodate those packages transported to Sellafield following completion of the nationally-important consolidation of SNM from Dounreay. Capability to over-pack some of the degrading containers has been delivered and is now operational. Although it has limited throughput, this is a significant step in reducing the hazards and risks, and is providing valuable learning for future repacking capabilities.

5.19 The provision of new facilities is vital to the future safe and secure management of plutonium stocks at Sellafield, and we will maintain focus on this to secure the timely availability of this capability. One significant milestone towards achieving this objective was reached when construction commenced on the new Sellafield Retreatment Plant, following our permission granted in October 2019.



Other Sellafield facilities

Figure 8: Safety and security performance across other Sellafield facilities



5.20 For the remainder of the site (except Legacy Ponds and Silos, and SNM facilities) there has been a change to two of the attention level attributes since the last report ie 'Enforcement' and 'Conventional and fire safety performance'. These are linked with improvements that were required in respect of delivery of Sellafield's Safety Report for Control of Major Accident Hazards (COMAH) and implementation of arrangements for control of legionella and asbestos.

5.21 **Reprocessing.** With the cessation of reprocessing at the Thermal Oxide Reprocessing Plant (THORP), the licensee's focus has moved to long-term storage of AGR spent fuel and post-operational clean-out (POCO). THORP has commenced systematic POCO of its reprocessing plants with associated learning captured for incorporation into future POCO activities across the site. Magnox Reprocessing continued to operate safely during the period; the facility was safely shutdown into a quiescent state at the end of the reporting year in response to the developing COVID-19 situation.

5.22 **Analytical Services.** These facilities contain some legacy waste, and provide sampling and analytical capability fundamental to support safe operations across the site. Sellafield Ltd has successfully disposed of significant accumulations of waste and delivered upgrades to the facility's key assets. A key achievement this year has been addressing Regulatory Issues by safely disposing of the legacy low level solvent waste and completion of legacy Plutonium Contaminated Material (PCM) solvent waste disposal.

5.23 **High Level Waste Plants.** The new evaporator within the Highly Active Liquor Evaporation and Storage Facility (HALES) has continued to provide feed to the Waste Vitrification Plant (WVP) to facilitate the reduction of the site's highly active liquor (HAL) stocks. Good progress continues to be made. We will maintain regulatory focus in this area to secure continued progress.

5.24 **Organisational change.** Sellafield Ltd is continuing its programme of transformational business change to support cessation of reprocessing, acceleration of hazard and risk reduction, and long-term remediation of the site. Achievements have included award of the Programme and Project Partners (PPP) contracts, to support delivery of major projects, and completion of the initial phase of development of the Sellafield Enterprise Management System (SEMS), a major re-engineering of the organisation's business processes. Sellafield Ltd is strengthening its approach to delivering organisation-wide change with an increasing focus on the people and cultural aspects of the changes. These have been areas of our regulatory focus over the past year and we are satisfied with the progress made to date.

5.25 **Conventional safety.** Sellafield Ltd continues to improve its conventional safety arrangements, in particular related to legionella, asbestos and COMAH Regulations 2015. As a result of a change in the Classification, Labelling and Packaging (CLP) of Chemicals Regulations (CLP) 2015, Sellafield became a COMAH Upper Tier site, which has necessitated the production of a Safety Report and implementation of associated arrangements. The licensee has been challenged in delivering its safety report and we continue to seek improvements in this area.

5.26 **Emergency preparedness and response.** The site's annual demonstration emergency exercise was held in April 2019; this was deemed by our inspectors to be an adequate demonstration of Sellafield's overall emergency response arrangements with learning identified to be taken forward, as appropriate.

5.27 **Incidents.** In this reporting year, four incidents on the Sellafield site were rated at INES Level 1 and one at Level 2. Two of these are mentioned above under Legacy Ponds and Silos and Annex 1 provides further information on the others. Sellafield Ltd personnel continue to report incidents on the site through their own internal processes with a relatively small number of the most significant incidents being notified to us as required. We are overall satisfied with both the level of reporting and the subsequent actions taken by the licensee.

5.28 **Investigations and enforcement.** There were two joint ONR and Environment Agency investigations initiated, relating to the leakage of radioactive liquor from the MSSS and RST.

5.29 Enforcement action has been taken as appropriate following incidents reported to us, and for two incidents formal Improvement Notices were issued. The first related to a cable strike at the Fellside Combined Heat and Power plant and the second followed an incident at the WVP involving shortfalls in the arrangements for welding flask lids. In both instances, Sellafield Ltd has responded well, providing effective action plans and has complied with the Improvement Notices.

Security performance

5.30 As part of the site's security enhancement programme, Sellafield Ltd has continued to develop a new Main Site Command Facility (MSCF). This is an important facility that brings together several command and control functions in a single location. This was due to attain an Initial Operating Capability (IOC) in 2019 but its development presented significant challenges and an extension to achieve this capability has been agreed. We welcomed the independence and thoroughness of Sellafield Ltd's investigation into the reasons for the requirement for an extension. Furthermore, we are holding the licensee to account for timely resolution of this project and have sufficient regulatory oversight and milestones providing confidence that Sellafield Ltd can deliver to the revised timeline. We are satisfied for the time being in the existing site command and control facilities.

5.31 Sellafield Ltd continues to make improvements to its security infrastructure. These cover all aspects of protective security, from the more concrete physical aspects, through less tangible strategic enablers such as security culture and leadership, to cyber security. In respect of the latter, whilst legacy systems are still prevalent, we continue to hold the organisation to account for the application of effective ongoing risk mitigation until they can be replaced or decommissioned, ensuring appropriate security outcomes are achieved at all times.

5.32 In April 2019, Sellafield was the first site to have its security plan approved against the new SyAPs regulatory regime. This is a noteworthy achievement and represents the culmination of significant work on the part of both the licensee and ourselves.

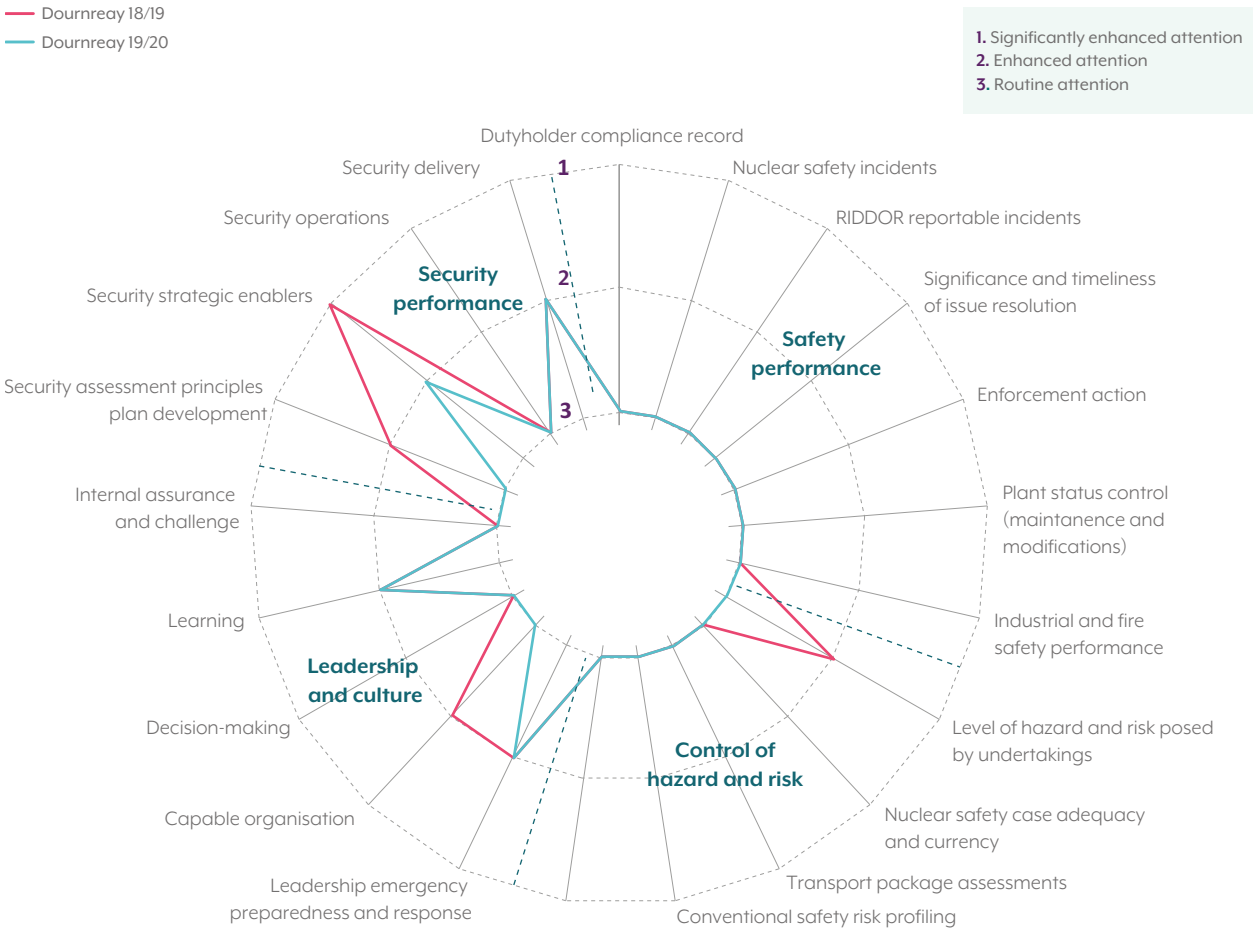
5.33 This year, a challenging counter terrorist demonstration exercise was delivered by the site, emphasising clear evidence of a strong emergency management and security response capability.

Decommissioning, fuel and waste sites

5.34 The 20 licensed decommissioning, fuel and waste sites represent a significantly lower hazard and risk profile when compared to Sellafield. Nonetheless, decommissioning redundant facilities and retrieving and packaging higher activity radioactive waste involves systematic management of risks to the operators who are undertaking the work close to the radioactive material. On some sites there are significant amounts of Intermediate Level Waste (ILW) accumulated from decades of operation that need to be retrieved and packaged for long-term storage, until a deep geological disposal facility becomes available. In addition, the nature of decommissioning work and the need to deal occasionally with unexpected occurrences mean that the licensees must continue to adopt a careful approach, whilst making adequate progress with decommissioning and the safe management of the radioactive waste arising.

Dutyholder performance

Figure 9: Safety and security performance at Dounreay



5.35 **Dounreay Site Restoration Limited (DSRL).** 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.

5.36 **Decommissioning progress.** DSRL has achieved a major milestone this year through successful completion of the high-priority materials consolidation project. This was done safely against tight timescales, demonstrating good collaborative working between DSRL, Sellafield Ltd and the transporters International Nuclear Services Ltd (INS) to gain the necessary transport approvals from ONR. The completion of this work has allowed DSRL to deploy some resource back on to its major decommissioning projects.

5.37 Good progress is now being made in support of the removal, packaging and shipment of breeder fuel from Dounreay Fast Reactor (DFR) to Sellafield; the removal of the residual metal coolant within PFR; the treatment of the residual liquors from 'historic' fuels processing activities; and the commencement of the decommissioning and demolition of DMTR. DSRL has also re-commenced design and development activities related to retrieval, characterisation and packaging of the legacy material within the shaft and silo.

5.38 **Return to routine attention for safety.** Dounreay is the only DFW site with its level of regulatory attention in the enhanced category for safety purposes. We have observed a steady improvement in safety performance and safety culture on site over the last three years with strong cooperation between the workforce and senior management implementing improvement programmes across all areas. In addition, the scale and complexity in undertaking safe removal of the bulk SNM from site represents a significant reduction to hazard and risk.

5.39 DSRL is now looking to embed the identification and implementation of learning from experience that has driven improvements in its nuclear and radiological safety performance to its conventional safety performance as the site progresses with decommissioning. The recent voluntary early release of personnel has resulted in a reduction in organisational capability in a number of areas. These are well understood by DSRL and activities are ongoing to improve the management of organisational change and deployment of resource on site.

5.40 On the basis of this overall improvement in safety performance and safety culture, DSRL moved from an enhanced to routine level of regulatory attention from April 2020. This view is supported by evidence gathered through inspections and assessments by our inspectors during routine regulatory interactions and was confirmed as part of the annual review of safety in March 2020.

5.41 **Security at Dounreay.** During the year, the Dounreay Exotics Consolidation Programme successfully concluded, representing a significant achievement from a security perspective. Remnants of special nuclear material remain on site and we continue to engage with DSRL to support their ongoing secure management and ultimate removal.

5.42 DSRL is still subject to an enhanced level of regulatory attention for security. We have been holding DSRL to account to resolve the underlying reasons for this and the majority have been closed to our satisfaction. We have noted further continuous improvement to the Cyber Security and Information Assurance function and progress in risk assessment of computer-based systems important to safety.

Magnox Limited sites

5.43 Magnox Ltd became a wholly-owned subsidiary of the NDA on 1 September 2019. The transition from the previous organisational model was well managed; we did not observe any drop in safety performance prior to, and immediately following, the transition. The NDA's Board has agreed to a notable change to the strategic approach to decommissioning the former Magnox power reactor sites. Magnox Ltd has now moved away from taking a blanket approach of deferral, ie placing all of the ex-power reactors into decades' long periods of care and maintenance, to one of phased dismantling. Magnox Ltd's plans are being developed further with Trawsfynydd in Wales being nominated as the lead site for early dismantling. For the sites at Harwell and Winfrith, work continues to progress safely towards restoring them to brownfield status and ultimately for re-use of the sites.

5.44 Magnox Ltd continues to make safe, steady progress with its decommissioning programmes across its 12 sites. Several sites continue to focus on hazard reduction through retrieval and packaging of legacy ILW gradually making the accumulations of radioactive waste passively safe for longer-term storage, and ultimately for disposal. ML is now consolidating some of its wastes on a regional basis in England. For example arrangements are in place for the safe transfer of radioactive waste from Dungeness A and Sizewell A for storage in the newly constructed Interim Storage Facility (ISF) on the Bradwell site. The evidence gathered from our inspections and assessments confirms that Magnox Ltd continues to deliver adequate safety on its sites.

5.45 **Wylfa.** Magnox Ltd completed the notable milestone of removing all the spent fuel from the two reactors and dry store cells and transporting it to Sellafield safely and securely. This is a major contribution to the UK Magnox Operating Plan. The site was declared fuel free by ONR in November 2019, effected through our formal approval of the on-site reduced scope emergency plan. As a result of being fuel free, the site no longer has any requirement for an off-site emergency plan under Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR 2019). This, together with defueling of Calder Hall, means that all of the Magnox reactors have now been defueled and the used fuel consigned to Sellafield.

5.46 **Berkeley.** The principal hazard reduction activity on the site is the removal of several hundred tonnes of ILW accumulated in three underground concrete vaults. The waste is made up of: fuel element debris from fuel route-related activities; sludge and resins from the active effluent and pond water treatment plants; and miscellaneous contaminated items. These waste streams are an accumulation from decades of operation of the power station (with a small proportion from the Technology Centre).

5.47 Progress with emptying the vaults has been steady but has not been without some difficult challenges, which are being systematically addressed by the licensee. By March 2020, approximately ~220 tonnes of ILW has been retrieved and put into ~130 ductile cast iron waste containers, which have been conditioned and stored in the site's interim waste store. Two additional retrieval lines are currently being installed to process containerised waste and sludge cans, which will increase the rate of retrievals in the future. Our inspections confirm that operations continue to be undertaken safely and that adequate progress continues to be made to retrieve the waste.

5.48 **Hunterston A.** One of the main challenges on site is the retrieval of ILW accumulated in five substantial concrete bunkers during years of reactor operations. The site has successfully operated its Solid Active Waste Bunker Retrieval (SAWBR) facility and in the last few years has safely removed, packaged and put into interim storage the waste material held in four of these concrete bunkers. The site has now broken through the wall of the fifth and final bunker. Retrieving waste from the final bunker, which contains the most hazardous waste stream, is progressing steadily and our inspections have confirmed the safety of these operations. The waste packages generated from the SAWBR facility are placed for interim storage in the site's ILW store (ILWS). This store was designed and built for the long-term storage of encapsulated ILW. Mobile ILW is being recovered and encapsulated in the Wet Intermediate Level Waste Retrieval and Encapsulation Plant, prior to storage in the ILWS.

5.49 To encapsulate all of its solid ILW, the site has constructed a new Solid Intermediate Level Waste Encapsulation (SILWE) facility; physical construction and plant and equipment installation was completed in 2019. Building this facility was part of Magnox Ltd's response to historical ONR enforcement action and we have undertaken close oversight and monitoring of the design and construction of the SILWE. There have been discussions with the licensee to determine the approach to our assessment of the site's readiness to commence active commissioning of this new facility.

5.50 **Dungeness A.** Since the reactors shut down in 2006, the civil structures, plant systems and some equipment have continued to be adversely affected by the harsh environment that prevails at the site's location (on a promontory in the English Channel.) Our inspectors have undertaken inspections that have confirmed the areas of degrading material condition. Following our assessment of Magnox Ltd's periodic review of safety, we requested that the licensee provide a commitment to accelerating the decommissioning of some specific areas of the plant. The licensee discussed with the NDA a revision to its decommissioning programme and has now amended its plans and intends to remove the eight vertical boilers, and their associated plant, earlier than originally anticipated. We welcome the commitment for early dismantling of these degrading structures.

5.51 **Security performance.** Security across the Magnox Ltd civil nuclear estate has remained adequate during the review period. However, Magnox Ltd dutyholders have been challenged by the nature of the SyAPs process and therefore the original submission schedule for new security plans has been adjusted. Additionally, there remain regulatory concerns that the Magnox Ltd estate lacks fully effective risk analysis and there has been a failure to deliver commitments that had been set out in the corporate Security Improvement Schedule (SIS), particularly those commitments and other deliverables associated with cyber security and information assurance.

Fuel cycle facilities

5.52 **Capenhurst Works.** As a result of years of enrichment operations, URENCO UK Ltd (UUK Ltd) has accumulated a backlog of material in the form of depleted uranium hexafluoride called 'Hex Tails' on the site. The new Tails Management Facility (TMF), which will de-convert this material to a more stable form, is nearing completion of an extensive programme of inactive commissioning. We have been inspecting and assessing the safety of TMF over many years and the final permission needed from us is our agreement to commence active commissioning of the de-conversion plant, due in 2020. This will then allow progressive remediation of the material contained in a large stock of ageing 'Hex Tails' cylinders on the site.

5.53 We issued an Enforcement Notice (EN) to UUK Ltd in December 2019 in relation to its failure to maintain the fire detection and alarm systems in one of its facilities. The licensee has responded well to our enforcement action, and after its own thorough investigation has decided to replace the ageing system with a modern one. We extended the date of the EN to give the licensee sufficient time to undertake the necessary work. In the interim, adequate fire mitigation measures have been implemented to our satisfaction, while the work is being completed.

5.54 **Springfields Works.** Springfields is a fuel manufacturing site. We are satisfied with the state of safety and security on this site during the period and have not identified any matters for concern.

5.55 **Low Level Waste Repository (LLWR).** The licensee has successfully completed the decommissioning of the old Magazine Retrieval Facilities on the site, which contained a substantial inventory of plutonium contaminated material (PCM). This was a 10-year programme started in 2013 and completed more than three years ahead of schedule, with no significant safety-related incidents. This work included more than 10,000 entries by operators into a heavily-contaminated environment and represents a significant reduction in hazard for the site. The transfer of drummed PCM back to the Sellafield site will continue over the next 12-18 months.

Other sites including commercial low-level waste processing sites

5.56 **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. These 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. We have not identified any safety or security matters of concern on these sites during the period.

Geological Disposal Facility (GDF)

5.57 Following the launch of a new process to identify a suitable location for a geological disposal facility (GDF) in England or Wales, Radioactive Waste Management (RWM), the developer of the GDF, continues to raise awareness of the siting process and engage with interested parties. This is a consent-based approach that requires RWM to work in partnership with communities that enter the siting process. Although not directly involved in the process for identifying a site for a GDF, we continue to advise the Government in establishing the regulatory framework it will operate within.

5.58 A future GDF will be licensed by us and to enable this, amendments are required to regulations. In preparation for Government legally prescribing a GDF for licensing, we have reconsidered our position on what constitutes "bulk quantities" (BQ) of radioactive material as cited in the Nuclear Installations Act 1965 (NIA65). The proposed revised interpretation now extends beyond storage of radioactive material and waste but also encompasses its disposal. We plan to undertake a public consultation exercise on the revised position on interpreting BQ in 2020.

Sites approaching de-licensing

5.59 The GE Healthcare licensed site at Cardiff successfully completed its final radiological clean-up to the point of being able to have its nuclear site licence revoked by ONR, which took place in December 2019. This was the first site to be completely delicensed since we were established as an independent organisation in 2014.

5.60 The Imperial College Research Reactor at Ascot continue to make good progress with decommissioning and clean-up and should reach a point in the next two years where it will be able to demonstrate to us that its nuclear site licence can also be revoked.

Advice to BEIS and the NDA

5.61 We have continued to advise BEIS and the Nuclear Decommissioning Authority (NDA) on the implementation of new government policy to improve the legislative framework for nuclear sites that are in the final stages of decommissioning and clean-up, recognising that the residual hazards on the sites in the final stage of their lifecycle do not require the full controls and requirements of the nuclear site licensing regime.

5.62 Following public consultation, BEIS is making proposals to amend NIA65 to bring the UK into line with international agreements on ending nuclear liability and to provide licensees with an alternative means of applying to us to have their site licence revoked early. Following licence revocation, the regulation of health and safety will fall under the remit of the Health and Safety Executive; the relevant environment agencies will continue to regulate environmental protection. We have started to revise our internal guidance on how these changes to legislation will be implemented, to be ready ahead of the changes coming into force. This is currently anticipated over the next two years.

6 Civil nuclear security and safeguards

Summary of Civil Nuclear Security and Safeguards performance

We are satisfied that the civil nuclear industry continued to meet its security obligations during 2019/20.

The period has been marked by the assessment and approval of a number of new SyAPs-aligned security plans from dutyholders across the nuclear industry. However, there is still much work to do in this area and we are supporting industry in its efforts in accordance with our enabling approach.

Focus will remain on the assessment of new security plans against the modern regulatory expectations of SyAPs, and continuing to enable industry to deliver organisational ownership and cultural change on security matters.

We are pleased to note that due to improvements they have put in place, no approved carrier requires enhanced regulatory attention at this time, indicating the success of the regulatory action plans we implemented.

From a safeguards perspective, we have worked closely with the international safeguards inspectorates and other stakeholders to ensure that the UK continues to fulfil its international safeguards obligations.

From January 2021, ONR will take on its responsibility as the state regulatory authority for safeguards. This will mean running the State System of Accounting for and Control of nuclear material (SSAC) as well as regulating UK operators against the domestic safeguards regulations. The Infrastructure and Projects Authority (IPA) in its latest rigorous review has confirmed that the SSAC project is fully on track to deliver all its objectives while recognising the residual work necessary to fully integrate safeguards into CNSS.

Paul Fyfe
Security and Safeguards Director
Deputy Chief Nuclear Inspector

6.1 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:

6.2 **COVID-19 impact and response.** For the final weeks of this reporting period, the UK was under lockdown due to the COVID-19 virus. Throughout this period, we were generally content that dutyholders remained compliant with approved arrangements for physical, personnel and cyber security. Where necessary, changes to security arrangements were made in a controlled and measured way whilst complying with NISR.

6.3 **Implementation of SyAPs-aligned security plans.** The challenges of introducing outcome-focused regulation were underestimated by both ourselves and industry, and both have experienced challenges with aspects of implementation.

6.4 Industry has generally struggled to deliver 'right first time' security plans, particularly in the area of Cyber Security and Information Assurance arrangements (CS&IA). This year, we have supported industry with a number of enabling activities and two workshops. More widely, the transition to outcome-focused regulation has identified issues with the numbers of personnel across the industry who are suitably qualified and experienced in the security profession. To address this challenge, which affects all levels of operation and management, we have determined the requirement for cross-industry training and development needs analysis, and an associated delivery plan, to provide suitably qualified and experienced security staff across the civil nuclear industry. We will arrange for an industry-wide training needs analysis to be conducted in the forthcoming financial year.

6.5 Notwithstanding these challenges, we have successfully approved a total of 15 SyAPs-aligned security plans over the period including the entire Category I Nuclear Material estate and Approved Carriers. We have also produced a number of internal guidance documents to support implementation, including a NISR Guidance Document that will be published in 2020/21.

6.6 Internally, we have developed new training courses for our inspectors, focusing on the knowledge, skills and procedures required for delivering effective outcome-focused regulation.

Security of approved carriers

6.7 During the year, the Dounreay Exotics Consolidation Programme successfully concluded, marking the end of a strategically significant series of special nuclear material transports. Further, every approved carrier had its SyAPs-aligned transport security statement assessed and approved. This is a major milestone and means the industry has modern arrangements. Finally, due to improvements confirmed by regulatory interventions, we have judged that no approved carrier currently requires enhanced regulatory attention, indicating the success of the regulatory action plans we implemented.

Cyber security

6.8 Cyber Security remains a key area of regulatory focus, and one in which we have invested significantly during the last year. This has resulted in a larger, more experienced team, comprised of inspectors with a diverse skill-set improving both our regulatory capability and resilience.

6.9 We have influenced dutyholders, including those in the supply chain, to develop and deliver demonstrable and effective cyber-protection capabilities that are aligned and flexible to a rapidly changing threat environment. In order to achieve this we have worked closely with colleagues across our specialisms to ensure consistency and drive safety through effective cyber security.

6.10 We have continued to support the transition to outcome-focused regulation and have seen demonstrable improvements in the cyber security posture of several dutyholders who are embracing this approach to deliver modern infrastructure, standards and practices. We have also introduced proportionate regulatory guidance for smaller dutyholders, carriers and those handling Sensitive Nuclear Information (SNI) within the supply chain.

6.11 We continue to work with government and industry in support of cross-sector initiatives such as those aimed at improving dutyholders' preparation for, and response to, cyber events. Likewise, we have contributed to efforts to improve awareness and guidance available to cyber security professionals, particularly

in respect to exercising, threat intelligence, operational technology and the supply chain through contributions to a variety of domestic and international fora and the development of good practice.

6.12 We have successfully completed the first of a three-year benchmarking exercise targeting holders of SNI across the sector's supply chain (List N). Working with contracted partners we have delivered 64 interventions across dutyholder facilities in order to assess the adequacy of arrangements and enhance our regulatory intelligence.

Safeguards – current regime

6.13 Nuclear safeguards are measures to verify that countries comply with their international obligations not to use nuclear materials for nuclear explosives. A fundamental aspect of the global regime is that it includes independent verification, performed by international inspectorates.

6.14 We have 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.

6.15 During 2019/20, we worked in co-operation with industry to ensure that the IAEA and Euratom inspection activities in the UK were undertaken both effectively (in that the IAEA and Euratom performed the activities necessary to draw their safeguards conclusions) and efficiently. In addition, we ensured that the UK operators' accountancy declarations were delivered to Euratom on time and collated information from industry to fulfil the UK's reporting requirements under its Safeguards Agreements with the IAEA.

6.16 We have also worked with the safeguards operators to collate the information and deliver the reporting required by Nuclear Co-operation Agreements with Australia and Japan, 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.

Safeguards – 2021 and beyond

6.17 As part of the project setting up a domestic safeguards regime, we have worked closely with BEIS and other key stakeholders towards establishing a fully-functioning safeguards purpose. This new function will have the capability to run the SSAC as the new state regulatory authority whilst regulating against the new domestic safeguards regulations from January 2021.

6.18 Extensive work over the past three years has resulted in the successful delivery of a new safeguards regulatory framework including a team of competent safeguards inspectors and specialists, a suite of safeguards-specific guidance and a new IT system, Safeguards Information Management and Reporting System (SIMRS) to enable receipt of UK operators' accountancy reports, processing and analysis before transmission to the International Atomic Energy Agency. Further, in preparation for starting our activities, we have developed detailed intervention plans to provide continued evidence that operators maintain adequate arrangements for accountancy and control of their qualifying nuclear material and implement these arrangements appropriately.

6.19 Following a rigorous review, the Infrastructure and Projects Authority (IPA) concluded that the SSAC project is fully on track to deliver all its objectives while recognising the residual work that remains to fully integrate the project as a new purpose within ONR's CNSS division.

7 Regulation across our integrated functions

Summary of regulation across our integrated functions

This section of the report examines the performance of our dutyholders in terms of Radioactive Materials Transport, Emergency Preparedness and Response, and Conventional Health and Safety. It also provides a summary of the results of the inspections we have performed on our licensees' vendors.

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Amendment Regulations came fully into effect on 21 April 2020. We have published guidance on our website to assist dutyholders in complying with these regulations.

Over the last year, we have responded to changes to both REPPIR 2019 and CDG regulations. REPPIR 2019 became law on 22 May 2019 and dutyholders had an implementation period of 12 months to comply with the new regulations. Under REPPIR 2019, local authorities (LAs) are responsible for preparing off-site emergency plans and setting the Detailed Emergency Planning Zones (DEPZs) as necessary, around relevant locations including nuclear sites. Prior to the introduction of the new regulations DEPZs were set by ourselves. Working with HSE, we have published an Approved Code of Practice and guidance to assist dutyholder compliance with the new regulations. We have also undertaken a sampling review of the DEPZs that have been put in place by LAs.

Over the last year, we have noted some improvement in the industry's conventional health and safety performance. However, it is too soon to determine whether this is an emerging trend and therefore we will be maintaining conventional health and safety as a regulatory priority into the next reporting year.

Our vendor inspection programme has continued over the last year to influence change in licensee and supplier management system arrangements, therefore reducing risks.

Dr Anthony Hart
Technical Director
Deputy Chief Nuclear Inspector

Radioactive materials transport performance

7.1 We are Great Britain's Competent Authority for the civil transport of Class 7 Dangerous Goods – radioactive material – and carry out a range of regulatory activities to assure the safe and secure transport of this material.

7.2 We grant approvals to the designs of packages used to carry high-hazard radioactive materials to ensure they meet exacting international safety standards; are manufactured to detailed quality assurance plans; and are correctly used and maintained. We regulate through a programme of targeted, risk-informed inspections and engagement with dutyholders.

7.3 We regulate consignors and carriers of radioactive material including hospitals and industrial users. Overall, we are satisfied that dutyholders safely and securely transport radioactive materials in Great Britain. We remain concerned, however, by the level of compliance shortfalls with the Ionising Radiation Regulations 2017 in the transport sector. We will continue to work with the industry to secure improvement and will take enforcement action if appropriate.

7.4 We have reviewed how we plan, conduct and record our inspections and how best to evaluate the results. This will ensure we are using our resources in the most effective way to enable improved industry compliance with legal requirements.

7.5 We share our learning from inspections with sector-specific stakeholder groups and professional associations through ONR-organised stakeholder events, attendance at external stakeholder events and through a growing stakeholder network. We have also taken the lead on improving collaboration with other UK transport regulatory bodies by developing closer working relationships facilitated by routine information sharing and joint inspections.

Significant incidents

7.6 There have been no significant incidents noted in this year but there have been some occasions noted where packages have been incorrectly consigned as empty but have contained radioactive material. This has been predominantly in the medical radiopharmaceutical field, where packages are regularly returned to the originating supplier, and either a full dose or waste residue has been incorrectly present in the package consigned as empty.

7.7 The incidents have occurred across multiple dutyholders and have included some non-medical packages. This will be an area of focus on a regular basis going forwards.

Significant transport package approvals in nuclear and non-nuclear sector

7.8 In 2019/20, we issued 55 transport approvals to support a broad range of transport activities. These approvals included 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 as well as for international transport of this material involving collaboration with the foreign regulatory bodies. Other approvals have supported transport of:

- Wastes, eg vitrified waste, Plutonium Contaminated Material (PCM), generated as part of reprocessing/ decommissioning activities;
- Packages for nuclear fuel production, e.g. enriched uranium oxide and uranium hexafluoride;
- Irradiated fuel from AGR sites used for UK energy production;
- A number of packages used in non-nuclear applications e.g. cancer treatments and industrial radiography.

Change in regulations

7.9 The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Amendment Regulations came fully into effect on 21st April 2020. The amended regulations require consignors and carriers to consider having an emergency plan in place before transporting radioactive materials. The aim is to restrict the radiation exposure to public and workers as a result of an emergency during transport. We have published guidance that explains this legal duty on our website, and we plan to produce further guidance aimed at helping dutyholders to achieve compliance.

Emergency preparedness and response performance

Local authority arrangements

7.10 Three inspections were planned this year at West Berkshire County Council, the Highland Council and Somerset County Council; however, only the first two were completed owing to COVID-19. 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 inspections. Reports of these inspections can be found on our website.

Progress towards development of arrangements to demonstrate compliance with new REPPIR 2019

7.11 REPPIR 2019 became law on 22 May 2019; with a 12-month transition period to allow operators and local authorities to demonstrate full compliance with the revised regulations.

7.12 Broadly, across all operators and local authorities, good progress was being made in demonstrating full compliance with REPPIR 2019. The impact of COVID-19 meant that there were a number of areas where sites were not able to demonstrate full compliance against the requirements of the regulation at the end of the transition period; however, these were all administrative in nature and none materially affects the ability to respond to an off-site nuclear incident.

Off-site Nuclear Emergency Exercises

7.13 Nine Level 2 (off-site) emergency demonstrations were observed between June 2019 and March 2020. These included demonstrations for operating reactors, decommissioning, and defence sites. In all instances, we were satisfied that the demonstration of emergency response and preparedness capability we witnessed met the requirements for protection of the public.

Transfer of Detailed Emergency Planning Zones determination

7.14 REPPIR 2019 transferred the legal requirement for the determination of Detailed Emergency Planning Zones (DEPZ) from ourselves, whereby we used to undertake the determinations, to the local authorities who are responsible for the off-site nuclear emergency arrangements.

7.15 We have undertaken a sampling review of the DEPZs that have been put in place by local authorities (ie for an operating reactor, Sellafield, decommissioning, and a defence site) to satisfy ourselves that the requirements of REPPIR 2019 are being met.

Conventional health and safety performance

Regulation of conventional health and safety

7.16 We regulate conventional health and safety (CHS) under the Health and Safety at Work etc. Act 1974 and associated secondary legislation (relevant statutory provisions). 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.

7.17 In regulating under this purpose, we have also utilised data from a number of other information sources. These include reports received from 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 that relating to pressure systems and lifting equipment.

Dutyholder CHS performance

7.18 We received 94 RIDDOR notifications from licensees and other dutyholders in 2019/20, an overall decrease of 10 since 2018/19. Of these:

- 76 related to reportable injuries, a decrease of nine since 2018/19;
- 14 related to defined dangerous occurrences, a decrease of three since 2018/19;
- four related to a reportable disease, an increase of two since 2018/19.

7.19 It is important to note that such a small data set does not allow for clear statistical trending from year-to-year, therefore these decreases should not automatically be interpreted as an improvement in health and safety performance.

7.20 We are pleased that last year's increase in reportable incidents has not been repeated this year. However, the reduction in the number of reported incidents is small and therefore it remains a priority that we ensure that industry initiatives continue to drive further improvements. Anecdotal evidence recognises the efforts industry has made to halt the decline in performance seen last year, and this is further supported by fewer significant CHS incidents subject to investigation this year. However, it is vital that there is no complacency as it is too soon to tell whether this is an improving trend. We are seeing encouraging evidence of industry making improvements to its management systems to appropriately recognise and integrate CHS. This will have the effect of driving CHS performance forward as part of an integrated risk management system.

7.21 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 working to develop new ways of integrating CHS data to ensure that trending and comparisons can be improved. This includes engagement with a major HSE-led research project, 'Discovering Safety' to apply modern data analytics to provide comparative insights on health and safety performance in mature sectors. Engagement will inform a proposal to apply similar techniques to evaluate CHS performance of the nuclear sector.

7.22 CHS performance between dutyholders varies due to differing risk profiles and their recognition of CHS hazards. We are therefore taking steps to ensure continuous improvement of standards across the industry, particularly for those sites with hazards representing the greatest CHS risks. Our Inspectors have continued to work closely across our core purposes to ensure efficient and effective regulation of areas of common interest across licence conditions and relevant statutory provisions. These include inter alia lifting operations, pressure systems, fire and explosion, and Control of Major Accident Hazards (COMAH). They also include working with industry to improve performance in the critical area of safety risks on existing facilities progressing towards end of operational life. We also continue to target regulatory effort towards manufacturing facilities, construction work, control of contractors and the management of asbestos.

7.23 We have applied greater regulatory focus to construction activities, due to the significant risks such activities pose to workers and the high number of projects. These include new and proposed nuclear reactors, Post Operational Clean Out (POCO), decommissioning of existing facilities, and demolition. We will maintain this focus moving forward. We have been working with licensees and Requesting Parties to ensure they fulfil their duties under the Construction (Design and Management) Regulations 2015. The aim of this work is to ensure that future projects are effectively planned and resourced and designs are produced that enable safe construction and operation while considering future decommissioning during the design phase.

Fire safety

7.24 Our programme of fire safety inspections on licensed sites during 2019/20 has sought and acquired confidence that the industry is adequately managing its fire risks.

7.25 We continue to monitor progress of the public inquiry into the Grenfell Tower fire. There are no fire safety implications directly applicable to the nuclear industry at this stage, but we continue to monitor Phase 2 of the inquiry and will ensure that we take account of any relevant learning.

7.26 We have also monitored the Government's responses to recommendations to the Hackitt Report including the announcement in the Queen's Speech of a Fire Safety Bill and a Building Safety Bill. We will assess any longer term potential for these to impact fire safety standards in the nuclear industry and also any impact on training and competence for fire safety professionals and regulators.

COMAH

7.27 This year we have maintained focus on industry performance around compliance with the COMAH Regulations 2015. In general, industry compliance with COMAH has been acceptable. However, variations in performance have been identified and these are being addressed.

7.28 We have taken steps to reduce the burden on licensees by aligning the assessment and regulation of COMAH with the nuclear safety case. This has been particularly effective in the regulation of ageing plant, one of our regulatory priorities. It has also resulted in the more efficient and effective production of safety cases covering the impact of major accident hazards on nuclear safety.

7.29 Similarly, efficiency gains have been made by aligning the emergency response planning for both REPPIR and COMAH, minimising the potential for duplication.

Vendor (supplier) inspections

7.30 We are 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.

7.31 We have conducted eight inspections directly with suppliers, targeting in particular those suppliers with a significant number of licensee customers. A further four 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. Evidence from the vendor inspections has identified the following trends in dutyholder performance:

- Where areas for improvement have been identified in supply chain management arrangements, vendors and licensees have responded positively and continue to put in place improvement plans to address the shortfalls where appropriate;
- Increased focus and reporting of Supply Chain and Quality related operational experience (OPEX) and awareness of Counterfeit, Fraudulent and Suspect Items (CFSI) and incidents correctly identified and reported;
- Licensees continue to identity and instigate planned improvements to nuclear safety culture within the vendors' organisations. Engagements with vendors' personnel confirmed that they generally understood the context of work they were carrying out in terms of its implications for nuclear safety, however it was recognised further improvements are required in this area;
- There is greater recognition by licensees and vendors of the significance of implementing adequate arrangements for the provision and retention of documents and records.

7.32 Three areas will require further improvement and we will apply particular attention and focus on future Licensee engagements and vendor inspections:

- **CFSI.** Notwithstanding the enhancements observed in CFSI arrangements, shortfalls were found with some vendors relating to the adequate deployment of formal CFSI processes, understanding and awareness of the risks associated with CFSI including the management of test houses and laboratories, and the need to deploy adequate management arrangements to mitigate these risks. There was also some scope for dutyholders to improve the cascade of their expectations to the supply chain with regards to their arrangements for controlling CFSI.
- **Management of deviations and non-conforming items.** It was found that dutyholders were not always managing deviations in a timely manner concurrent with manufacture and installation works. In addition shortfalls were noted in the, management arrangements, identification and segregation of non-conforming items;
- **Records management.** We noted shortfalls in the arrangements for the correct use, disposition, control and completion of records, and the provision and oversight of lifetime records.

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

8 Research statement

8.1 The Energy Act 2013 enables us 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.

8.2 Research plays an important role in our understanding of a wide-range of complex, and sometimes unique challenges. Our research is aimed at supporting our independent regulatory decision-making. We need to base our decisions on an objective, scientific and technical understanding of identified safety, security and safeguards issues.

Strategic research objectives

8.3 The main objective of our research strategy, published in September 2019, is to ensure that our inspectors are able to form their regulatory judgements confidently and effectively using sound, up-to-date scientific and technical information to support balanced decisions and avoid over-conservatism or over-optimism.

8.4 We have identified three main drivers to commission research as follows:

- We require independent advice to assist with our decision-making, particularly when the decisions we might make could be considered contentious.
- We have identified a knowledge gap that requires research, and have invited the relevant dutyholders to complete the work and share their results, but they have declined to do so, or declined to do so within acceptable timescales.
- Our specialists require greater understanding of developing innovations or emerging subjects, to enable our regulatory decisions to be based on the most up-to-date information.

How it is organised

8.5 All of our research activities are coordinated by our Research Delivery function (RDf), which manages our research budget and provides advice and support to our specialisms and project officers, who are accountable for the delivery of the research projects in their individual technical areas.

8.6 We follow a rigorous process to identify research needs and opportunities, determine associated costs, and monitor progress of delivery. Examples of research topics that meet our strategic research objectives and support our purposes under the Energy Act include:

- Research that supports our independent decision-making by giving us an independent view of a subject from the dutyholder's.
- Topics that improve the definition of relevant good practice and thus support reasonable practicability tests.
- Research to test/confirm safety and/or security case claims and arguments.
- Confirmatory research into the validity of assumptions underpinning safety, security and/or safeguards cases.
- Research to identify where models/data used by our licensees when the analyse nuclear safety or security matters may have weaknesses.
- Research into potential safety, security and/or safeguards topics associated with new technologies before their application to new or existing facilities.

8.7 It should be noted that we do not commission research either to support the commercial development of nuclear technologies, or areas in which other public bodies have regulatory responsibilities or are responsible for providing authoritative advice.

Costs

8.8 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 where it befits our research purposes to do so.

8.9 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.

8.10 In line with our strategic objectives to carry out research, our research register for 2019/20 comprised 80 specific areas of interest. Of these, 27 projects were funded and delivered by the nuclear industry while we monitored progress and provided oversight. The remaining 53 areas were developed into work specifications and have been or will be delivered by technical support organisations. The value of the contracts supporting the 53 areas amounts to approximately £2.35 million.

8.11 We aim to achieve a high degree of leverage on our investment in research, benefit from economies of scale and access research performed by international teams of experts whilst complying with the National Audit Office's 'value for money principles'. In cases where we commission research, work is awarded on a competitive tender basis against the specification. The research is progressed through our technical support framework unless specialist skills not available within the framework are required.

8.12 'Value for money' is a fundamental consideration in the management of our research portfolio, especially since we recover the costs of research from dutyholders through our regulatory charging regime.

8.13 Avoiding the duplication of research projects is also an important factor in helping us to achieve this value for money. This is another reason why we continue to engage proactively with industry, and at a wider national and international level, with other research-related institutes, councils and other organisations, sharing our regulatory research register to minimise duplication and overlap, but recognising that, at times, we require a fully-independent view of a topic to inform our regulatory decisions.

Research case studies

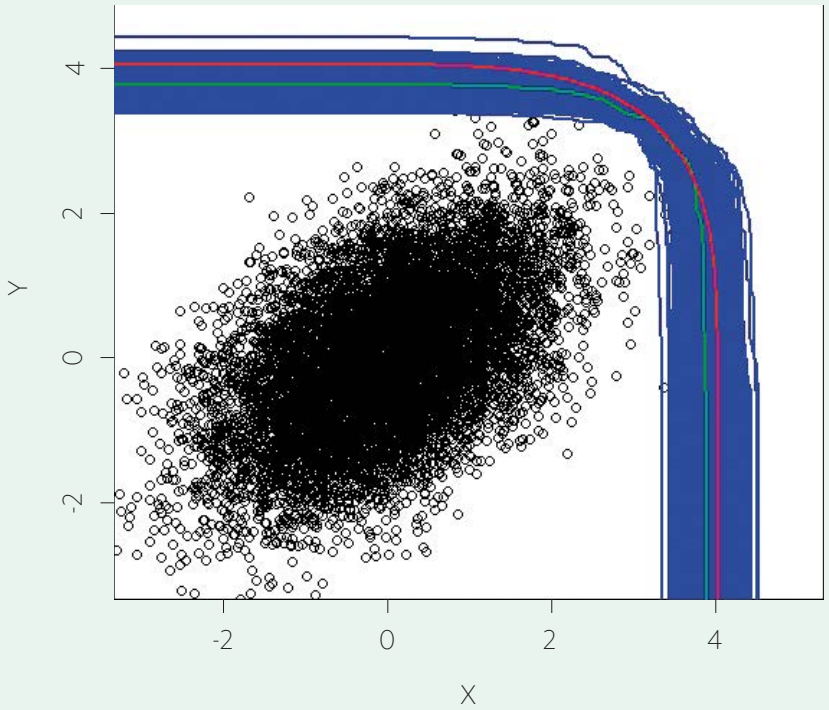
Case study 1 – Investigation into the application of multivariate hazards curves for external hazards combinations	
Challenge	• The focus of hazard characterisation studies has traditionally been limited to the consideration of individual hazards in isolation. However, it is increasingly apparent that external hazards often act in combination. Such combinations may represent a greater threat to nuclear safety than hazards acting in isolation. • The Fukushima-Daiichi accident demonstrated the importance of considering potential impacts of hazard combinations on nuclear safety. On 11 March 2011 a tsunami, resulting from a powerful earthquake, disabled the power supply and cooling of three reactors at the Fukushima-Daiichi plant, which had survived the earthquake. The loss of power and cooling led to core melt and a nuclear accident. • Whilst the threat from hazard combinations is recognised, there are no established methods for characterising hazard combinations. The purpose of this research is to consider the applicability of advanced statistical methods to enable characterisation of hazard combinations to enhance nuclear safety.
Research activity	• ONR is working with Lancaster University's four-year PhD programme in Statistics and Operational Research developed and delivered with industrial partners (STOR-i) to explore the applicability of statistical methods for integrating single hazard curves into combined hazard curves of two or more variables. The project utilises Lancaster University's extensive expertise in the specialist statistical field of extreme value theory. • ONR is sponsoring a PhD student to expand and develop the work completed by RRR-054*, a pilot study investigating the application of combined hazard curves for storms. ONR is a co-supervisor and will ensure the current work focuses on the important hazard combinations affecting nuclear safety. The project will run from 2019 through to 2022. • ONR's Expert Panel on Natural Hazards is supporting the project by providing advice and guidance on the physical phenomena that drive extreme natural hazards. *see **http://www.onr.org.uk/documents/2017/onr-rrr-054.pdf**

Case study 1 – Investigation into the application of multivariate hazards curves for external hazards combinations

Safety intelligence to be gained

- This research project will demonstrate the applicability of advanced statistical methods for the characterisation of hazard combinations, including incorporating aspects such as physical limits and changes to statistical properties of hazards over time (e.g. climate change effects).
- The project will offer an insight into the next generation of hazard combination analysis and potentially establish relevant good practice for the development of hazard curves combining multiple variables.
- This project will enhance the guidance that is utilised by our inspectors to assess safety cases submitted by Licensees to demonstrate the safety of their activities.

Comparison of Wadsworth Tawn Curve to true hazard curve



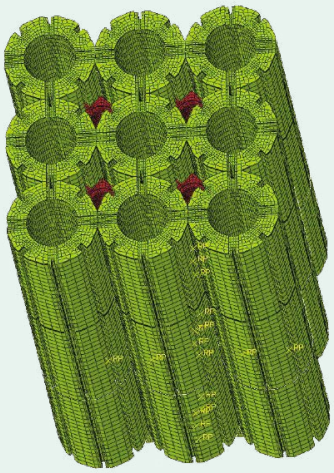
Standard bivariate normal data with rho = 0.5, p = 1/36500, n=10000

Case study 2 – Nuclear Graphite Brick Cracking predictions	
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 which induce stresses in the bricks. In addition the graphite material undergoes oxidation and loses strength. As the core ages, stresses increase, particularly in the fuel bricks, leading to the development of systematic cracks late in reactor life. • The dutyholder, (EDF NGL) makes predictions on the likely onset of brick cracking and subsequent rate. As brick cracking increases there is a risk that core distortions may increase and compromise safe operation. Hence, it is important that these predictions are reliable and conservative. • Given the significance, it is important that we understand the accuracy and uncertainty level in brick cracking predictions used by the dutyholder.
Research activity	• We have commissioned a technical support consortium, known as the Brick Cracking Network (BCN), to provide independent advice on the rate of weight loss and brick cracking. • The BCN is made up of technical experts in stress analysis, material behaviour and statistics. • With the dutyholders' reliance on the timing of the onset and rate of cracking, we tasked the BCN with providing independent estimates which can be used to understand the uncertainties and challenge the dutyholder where appropriate.
Safety intelligence to be gained	• Independent advice on the key areas of uncertainty related to weight loss and brick cracking onset and rate. • Understanding of the limitations and uncertainties of the models. • 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 B (HNB) Reactor 4.

Case study 2 – Nuclear Graphite Brick Cracking predictions

Keyway root crack in a graphite fuel brick observed during an inspection

Predicted Stress distribution within a graphite brick array



Case study 3 – Ageing and degradation	
Challenge	• Great Britain is embarking on a new era of building and operating new nuclear reactor designs. At the same time, it has older generation reactor technologies at various stages in their operational lifecycle. • In addition GB also has many historical nuclear legacy facilities, which have or are entering decommissioning or long term care and maintenance before eventual demolition. • Nuclear facilities, like other industrial plants, are subject to a range of degradation mechanisms (impacting on capability and/or efficiency), as well as competition from newer technologies. Ageing effects become increasingly prevalent and challenging as they reach their final stages of operation. Understanding the types of internal and external challenges is important to nuclear safety in order to ensure suitable and sufficient monitoring and management of ageing effects are in place. • For reactors no longer generating power and entering decommissioning, the lifecycle may include a long term period of care and maintenance. This stage in the lifecycle enables radioactive materials to decay resulting in reduced dose burden when undertaking the final stages of decommissioning, demolition and site clearance. The internal and external challenges faced by remaining structures, systems and components (SSCs) important to nuclear safety will be different to those experienced during their operational phase. Understanding and managing ageing effects over the long term will be important in predicting SSC condition and performance reliability.
Research activity	• We have commissioned a review of existing ONR guidance in the form of Safety Assessment Principles (SAPs) against established relevant nuclear and other high-hazard industry relevant good practice documentation, codes and standards. • The research* sought to confirm the ongoing fitness-for-purpose of the existing guidance, and/or identify any potential improvements to these principles. *see **http://www.onr.org.uk/documents/2019/onr-rrr-061.pdf**

Case study 3 – Ageing and degradation	
Safety intelligence to be gained	• Independent view on the suitability of ONR's extant guidance on ageing and degradation. • Greater understanding of the effects of ageing and degradation, and its effect on structures, systems and components (SSCs). • Comprehensive review of other high-hazard industry-relevant good practice and its applicability to the ONR SAPs providing additional guidance to our inspectors. • Conclusion of the research was that our extant guidance is suitable and sufficient, but suggestions for optimisation were provided. • Additional guidance on ageing and degradation will now be developed for inspectors to use when carrying out their regulatory activities.

9 Annex 1 – Incidents reported to ONR

Dutyholder requirements

9.1 Dutyholders are required to report nuclear and radiological safety incidents to us in accordance with current legislation, namely conditions made under the Nuclear Installations Act 1965, the Nuclear Industries (Dangerous Occurrences) Regulations 1965, and the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG). Dutyholders must also:

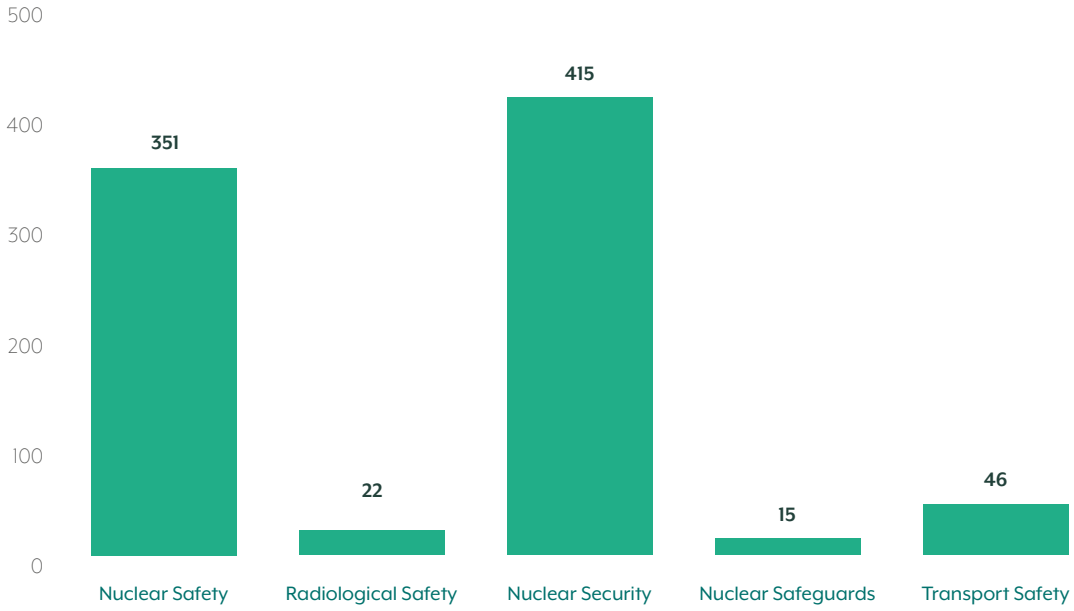
- notify ONR of civil nuclear security events or matters in accordance with duties under the Nuclear Industry Security Regulations 2003.
- report safeguards incidents to ONR in accordance with the UK/IAEA/ Euratom Safeguards Agreement, the Euratom Treaty and Euratom Regulation 302/2005.
- report conventional health and safety incidents under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations (RIDDOR) 2013.

9.2 Notwithstanding those obligations, an open and positive reporting culture for all incidents is something we strongly encourage and observe across the industry.

9.3 Our incident reporting system provides an established mechanism for industry to report relevant incidents in the following topic areas:

- Nuclear safety – covering incidents involving plant and equipment issues, typically at nuclear sites, that have a potential 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 safety – covering incidents relating to the movement of radioactive material.
- Safeguards – covering incidents where there are issues relating to the accountancy and/or control of relevant radioactive material.
- Security – covering security-related events or matters.

Figure 10: Safety and Safeguards Incidents and Security Events or Matters Reports during the Financial Year 2019/20



Incident reporting in 2019/20 across our purposes

9.4 Figure 10 presents an overview of the incidents reported to us against each of these five topic areas during the reporting period April 2019 to March 2020. Incidents are reported – as indicated below:

9.5 The level of reporting against each of our regulatory purposes remains consistent with previous years, with nuclear safety and security being the predominant subject areas. The majority of the incidents across all of our purposes are rated as minor or of no safety significance and this is explained in further detail in the 'Significance of incidents' section of the report below.

9.6 Typically for radiological and transport safety incidents reported on licensed nuclear sites, dutyholders tend to report against the potential root cause and relevant site licence conditions. Consequently, incidents that may also involve radiological safety or transport will more commonly be captured against a nuclear safety category unless the alternative transport or radiological categories are demonstrably more appropriate. The result of this approach is that all incidents are reported but numbers under Radiological and Transport Safety categories are slightly underrepresented.

9.7 Given the above observations, and as we approach the 10-year anniversary of the first issue of our incident reporting guidance, during 2020/21 we will commence a periodic review of our approach to ensure it remains fit for purpose, providing us with the information required to regulate the industry effectively and transparently while minimising unnecessary burdens on our dutyholders.

Significance of incidents

9.8 Nuclear, Radiological and Transport safety incidents are also categorised against the International Nuclear and Radiological Event Scale (INES). The INES is a communication aid to help general understanding of the significance of an incident and its impact in three specific regards: on people and the environment; on radiological controls and barriers at facilities; and on defence-in-depth.

Figure 11: The International Nuclear and Radiological Event Scale (INES) incidents reported to ONR

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

9.10 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.

9.11 For incidents to be categorised at INES 1 (an Anomaly) usually means that there have been minor problems with safety components, but with significant defence-in-depth remaining.

9.12 There are a range of criteria defined for incidents categorised at INES 2 (an Incident), including:

- Exposure of a worker in excess of the statutory annual limits, which in the UK are set out in the Ionising Radiations Regulations 2017;
- Significant radioactive contamination within a facility in an area not expected by design; and
- Significant failures in safety provisions but with no actual consequences.

Nuclear, radiological and transport safety significance

9.13 The majority of incidents (435) were categorised as having no safety significance (Below Scale /INES 0). Nine incidents were categorised as INES 1 (an Anomaly), typically as a result of minor problems with safety components with significant defence in depth remaining. There was a single INES 2 Incident which occurred at a Sellafield facility. These results are consistent with previous years' data. Incidents rated as INES 1 and INES 2 are detailed in a table below, starting at page 89. The period covered in the report is April 2019 to March 2020.

9.14 The combined number of INES notifiable incidents is consistent with the average reported over the last five years. There continues to be a low number of significant nuclear and radiological safety incidents and none of these had any detrimental effect on public safety.

Security significance

9.15 Security events or matters (as opposed to incidents) are categorised as Major, Moderate, Minor or None. Major incidents involve a total loss of defence-in-depth such that nuclear or other radioactive material, or Sensitive Nuclear Information, becomes unacceptably vulnerable to theft or sabotage, or where malicious acts have been carried out against the site. Moderate incidents are those where there has been a departure from expected standards resulting in a reduction in defence-in-depth.

9.16 Minor incidents are generally where there has been a breach of standards or procedures that are of low or negligible risk to the overall security regime, or notifications of events or matters for information, where there is not considered to be any detriment to the security regime. Due to the legal requirements set out in NISR, notifications of events or matters are made to ONR for information only, where there is not considered to be any detriment to the security regime. Over 80% of the security incidents were categorised as Minor. No Major incidents were reported.

Regulatory response to incidents

9.17 Each incident reported to us is evaluated by an inspector who identifies a proportionate regulatory response taking account of its safety or security significance. The vast majority of incidents are of minimal significance; however, the reporting of such incidents provides opportunities to identify additional actions that dutyholders can take to improve their overall performance, or help us target our regulatory interventions.

9.18 We conducted preliminary enquires in response to 18 incidents in this period, the purpose of which was to obtain sufficient information to support an informed decision on whether the matter met our investigation criteria. In response to these preliminary enquiries we applied our powers under the Energy Act 2013 to undertake formal investigations in response to five incidents. The investigations for three of these have been completed and resulted in the issue of enforcement letters. Two investigations are ongoing.

Incident analysis

9.19 Each of our divisions and technical specialisms has an appointed Regulatory Intelligence Lead inspector, who screens incidents and then facilitates further discussion, analysis and follow-up where appropriate to their regulatory area. Typically, the Regulatory Intelligence Leads produce quarterly Regulatory Intelligence reviews, which outline the results from this work.

9.20 The regulatory intelligence reviews use incident data to:

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

9.21 Some of the common themes identified and being incorporated into either divisional strategies or inspection plans are:

- Ageing management, focussing on monitoring of degraded equipment and tolerance of degraded conditions;
- Managing maintenance errors; and
- Conduct of operations.

9.22 During the reporting period, several regulatory reviews resulted in advice notes or guidance being developed to further assist our inspectors. Examples include:

- A safety culture guide to assist inspectors in evaluating dutyholder behaviours and traits during interventions; and
- An advice note on cold weather preparations for equipment important to safety.

Sector level analysis – nuclear safety incidents

9.23 Incidents are reported to us under categories according to specific criteria defined in the relevant ONR Guide. Focussing on the safety related incidents, Figure 12 provides a breakdown against these criteria. The comparison of financial year 2019/20 data with the three years (01/01/2017 to 31/12/2019) average shows consistency in all the categories of incidents.

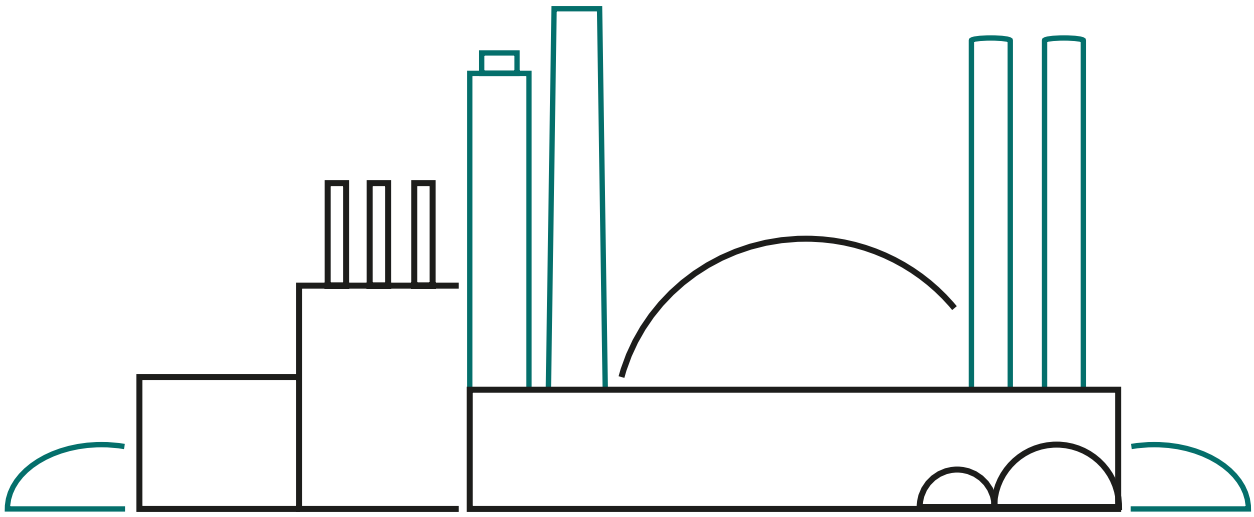
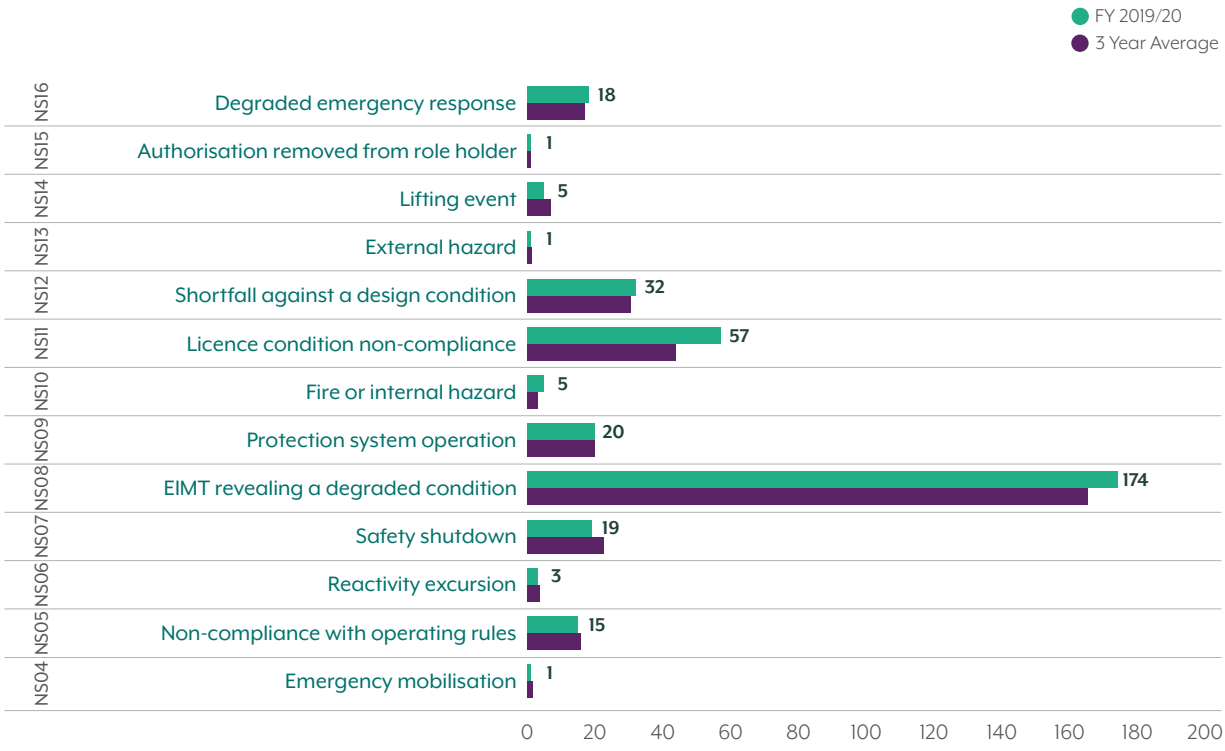


Figure 12: Breakdown of incidents related to Nuclear Safety for the Financial Year 2019/20 based on our incident categories



9.24 Figure 12 shows that largest category used for reporting of nuclear safety incidents to us is category NS08, "Any examination, inspection, maintenance, test, surveillance, alarm, alert, indication or notice that a system, structure or component reveals any matter indicating that the safe condition, including degradation of design safety barriers providing defence-in-depth or safe operation of that plant may be affected". Such a definition allows for a broad spectrum of different incidents. We will engage with dutyholders in the next 12 months to discuss revising the NS08 category definition to provide improved granularity and so enable potentially improved analysis.

9.25 The next largest group of incidents are:

- NS11, 'Significant inadequacy in or significant failure to comply with the arrangements made under a condition attached to the Nuclear Site Licence or permission granted under a Licence Instrument'; and
- NS12, 'Any problem or defect in the design, fabrication, construction, commissioning or operation of the installation that results in, or could result in, a condition that had not previously been analysed or that could significantly challenge the design basis assumptions or the safety case for operation'.

- Figure 13 presents the incidence of NS11 and NS12 incidents reported to us over the last five years. The figure shows both a significant annual variation in the number of incidents reported under these categories and that figures for the current reporting period are within the normal expected range. A cognitive review of incidents reported under NS11 during the period identified some clusters of incidents relating to inadequate implementation of plant modifications, incorrect plant configuration and failures to undertake maintenance schedule activities at some sites. These trends are informing our divisional interventions on maintenance errors and conduct of operations. No trends were identified within the NS12 category.

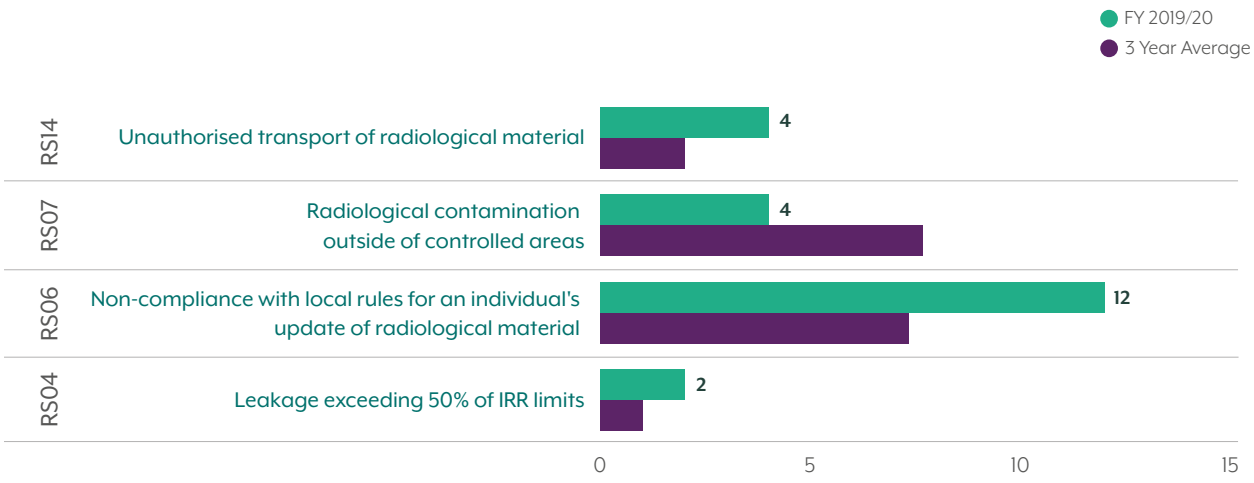
Figure 13: Five years trend for NS11 and NS12 Incidents

Sector level analysis – radiological safety incidents

9.26 Figure 14 provides a breakdown of radiological safety incidents by category reported to us during 2019/20. The data aligns with the preceding two years. There is some variation for incidents in RS06 and RS07 criteria, although overall the numbers of incidents are relatively small and all were Below Scale / INES 0. The definitions for the criteria are as follows:

- RS06 – An incident or occurrence that leads to a person receiving an intake, or suspected intake of radioactive material, above that permitted by local arrangements.
- RS07 – Discovery outside a controlled area boundary of radiation or contamination, including contamination on equipment, clothing or skin, significantly above that permitted by local arrangements.

Figure 14: Breakdown of incidents related to radiological safety for 2019/20 based on our incident categories



Note: Categories for which no events were reported during the period are ommitted

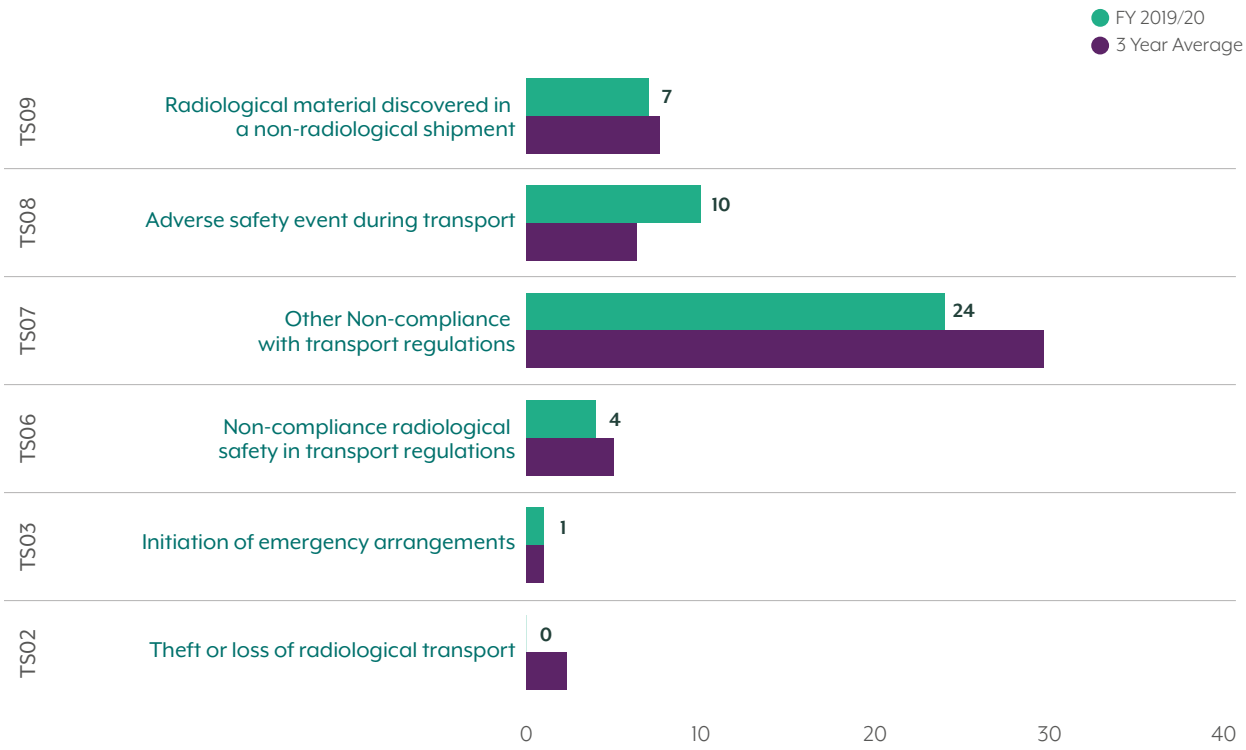
9.27 The majority of the RS06 incidents relate to one specific site due to very positive reporting culture at that site that goes beyond our the standard documented in our guidance. Fewer RS07 incidents occurred in FY 2019/20 than in previous years; although positive, this variation is not considered significant. Both RS06 and RS07 are aimed at unplanned or unexpected occurrences, which, whilst they may involve low levels of contamination or radiation that would not be considered safety significant, are a potential indication of reduced control.

9.28 Due to the relatively large number of sites and low number of incidents, it does not take much of a change to show an apparent difference against the average. Overall, we consider that the numbers of incidents reported in the period against RS6 and RS7 are within the expected range.

Sector level analysis – transport safety incidents

9.29 Figure 15 provides a breakdown of transport safety incidents by category reported to us during 2019/20. Numbers of incidents reported during this period are consistent with previous years for the majority of categories and the three year average provides a reasonable comparator in these cases. However, incidents in TS07 and TS08 have seen significant variation in three and six-year trends.

Figure 15: Breakdown of incidents related to transport safety for the financial year 2019/20 based on our incident categories



Note: Categories for which no events were reported during the period are ommitted

9.30 There are notable observations in the inter-annual trends with the incidents categorised as TS07 and 08. Specifically, numbers of TS07 incidents fell during 2019/20 compared to the previous five years. The numbers of incidents reported in the TS08 category has significantly varied in the past three years.

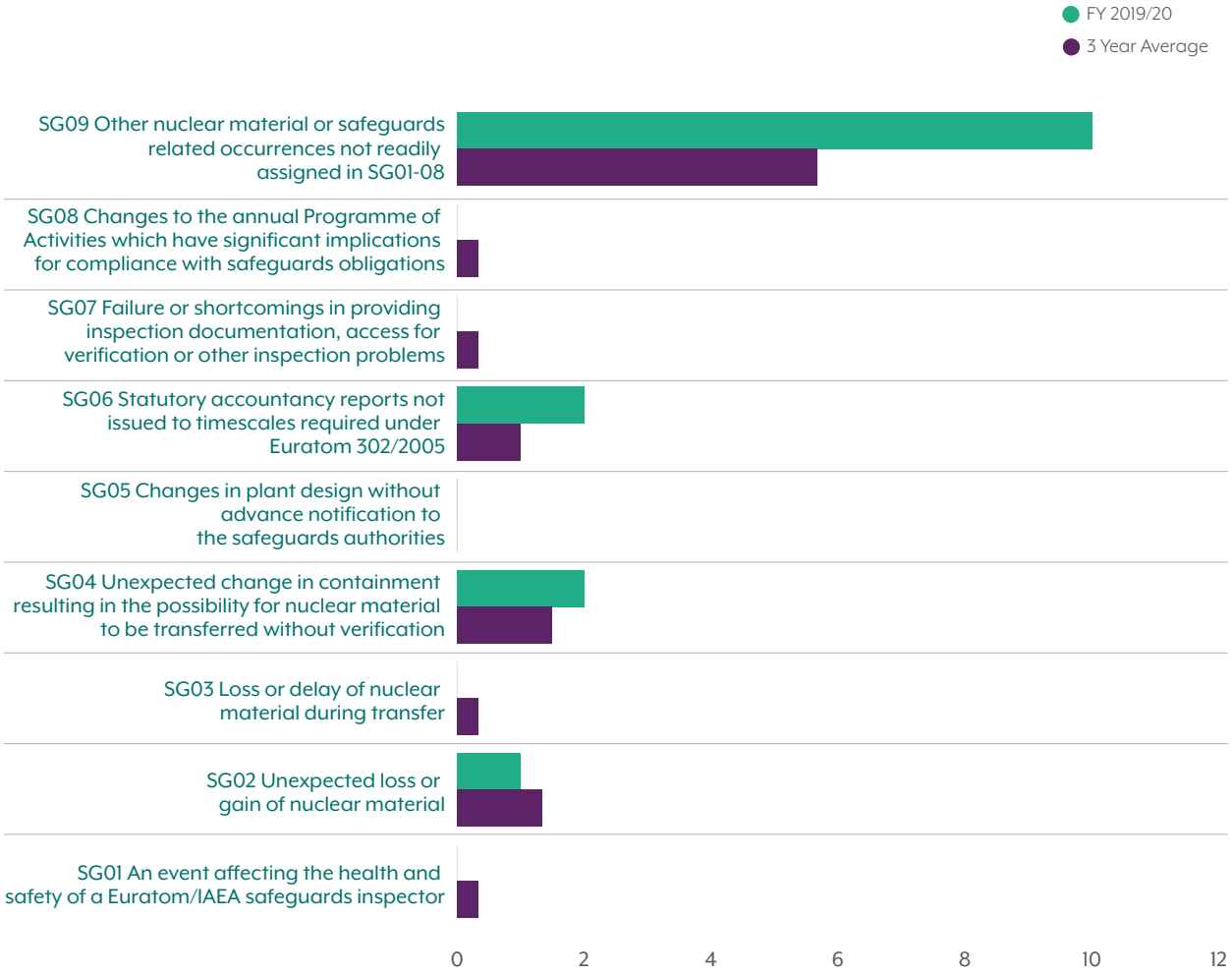
9.31 Although transport regulations require the reporting of TS01 to TS06 incidents, due to their low safety significance, there are no legal requirements for non-nuclear dutyholders to report TS07 – TS09 incidents to us. As a result, reporting against these criteria is not consistent. Due to low numbers and together with the lower safety significance of these categories, we do not consider this variation a concern. We intend to examine TS07-TS09 reporting requirements during the periodic review of our incident reporting guidance planned to commence in 20/21.

Sector level analysis – safeguards

9.32 The significance of safeguards incidents reported to us is assessed based on the implications for compliance with UK safeguards obligations. None of the safeguards incidents reported to ONR during the FY19/20, impacted on the UK's compliance.

9.33 The numbers of safeguards events reported to us during 2019/20 have increased compared with the preceding two years. While numbers of reported incidents remain small compared to our other regulatory purposes, the increased level of reporting mirrors increased engagement between ourselves and our dutyholders as we prepare to implement a domestic safeguards regime.

Figure 16: Breakdown of incidents related to safeguards for the Financial Year 2019/20 based on our incident categories



Note: Categories for which no events were reported during the period are ommitted

9.34 The increased level of reporting has occurred chiefly in the SG09 category, which is used as a general criterion for incidents that may not obviously meet other criteria. In particular, some operators use this category to notify us of an issue that does not reach the threshold/significance required for formal notification.

Significant incidents by site

INES = 2 (Incident) | Site: Sellafield

Date	12/11/2019
Event description	Loss of radioactively contaminated water from the Magnox Swarf Storage Silo (MSSS) original building primary containment. Sellafield Ltd reported the incident based on the facility's existing leak detection arrangements, the MSSS mass balance tool, a mathematical model that is inferring a loss of liquid. The loss is believed to be caused by long standing cracks re-opening in the MSSS building structure below ground level.
Dutyholder's response	Sellafield Limited is monitoring groundwater boreholes and in-ground gamma activity around the facility but to-date has not detected any signs of a leak. In addition the groundwater modelling and underpinning research conclude that any migration of contamination through the ground from a leak is predicted to be very slow. A long term programme is progressing to retrieve the waste inventory into modern standard storage facilities. This will facilitate the removal of solid and liquid waste and allow the remediation of the MSSS primary containment.
ONR's actions	The leak is primarily an environmental matter and we have therefore been working in support of the Environment Agency. From a nuclear safety perspective we consider the initial actions taken by Sellafield Ltd to be appropriate. Based on knowledge of regional and local groundwater movement, we are satisfied that there are currently no radiological consequences to the public or workforce as a result of this leak. Due to the nature of the facility and the large quantities of stored radioactive waste, we concur with Sellafield Ltd's judgement that the most effective way to remediate the leak is to continue with the long-term programme to remove the waste as a matter of priority. We have commenced an investigation jointly with the Environment Agency and both regulators continue to monitor the situation. We have published a summary of this incident in a 'Statement of civil incidents, meeting the ministerial reporting criteria, reported to ONR'.[8]

[8] http://www.onr.org.uk/quarterly-stat/2019-4.htm

INES = 1 (Anomaly) | Site: Sellafield

Date	8/1/2019
Event description	The burst pressurisation withstand of the cans stored initially within the Thorp Product Store (TPS) and then transferred to the Sellafield Product & Residue Store (SPRS) for long term storage could not be substantiated due to poor welding quality data.
Dutyholder's response	All store moves were restricted until an Operational Decision Making meeting was held to support the continued storage and movement of cans within the facilities and gain documentary confidence in the current population of cans. Targeted can inspections were carried out) to gain confidence of the current can population with no current evidence of any issues. A weld improvement group was started to facilitate improvements to weld quality and to close the gap in the current safety case. This incident had an initial rating of INES 0 that reflected the fact that there was no evidence that material had been released from any individual package due to this matter. Sellafield Ltd has judged that the INES level should be increased to 1 by applying a safety culture additional factor to reflect deficiencies in the quality assurance process. This revised rating was confirmed on 9 July 2019.
ONR's actions	ONR conducted preliminary enquiries into this incident and concluded that the ONR investigation criteria was not met. ONR formally permissioned Sellafield Ltd's modification to the safety case for the continued production, movement, and storage of Thorp packages. ONR judged that due to Sellafield Ltd's response and the historical nature of the matter, it was not appropriate to consider enforcement.

INES = 1 (Anomaly) | Site: Sellafield

Date	02/09/2019
Event description	Personnel exporting plutonium contaminated ventilation filters did not wear the correct respiratory and personal protective equipment for the task. The use of such protective equipment is a requirement of the plant safety case and the relevant written instructions for such work. No actual harm to people, plant or the environment occurred from this incident. There was no release of activity or personal contamination, and no radiological dose limits were challenged.
Dutyholder's response	Sellafield Ltd undertook a management investigation and has implemented an improvement programme to address the shortfalls identified.
ONR's actions	We conducted preliminary enquiries into this incident and concluded that the incident did not meet our investigation criteria. We were satisfied with the prompt response by Sellafield Ltd and judged that issuing Regulatory Advice was the proportionate enforcement response.

INES = 1 (Anomaly) | Site: Sellafield

Date	02/10/2019
Event description	During a plant engineering visit, a dummy plug was removed from the magazine store in Laboratory L. This operation is not permitted within the facility's safety case because it would create a potential path for migration of radioactive contamination from the Magazine Store in accident conditions. There were no actual consequences from this action. No activity was released and no dose to individuals occurred.
Dutyholder's response	Sellafield Ltd made a number of immediate improvements and carried out an investigation of the causes of the incident, which identified a number of direct actions for implementation.
ONR's actions	We conducted preliminary enquiries into this incident and concluded that our investigation criteria were not met. An Enforcement Letter was issued to ensure remediation of the identified shortfalls. We are monitoring progress against the requirements of the Enforcement Letter on a regular basis.

INES = 1 (Anomaly) | Site: Sellafield

Date	19/10/2019
Event description	A loss of radioactively contaminated water from the Redundant Settling Tank (RST) sludge sump, which exceeds or could foreseeably exceed, the limits set out in the relevant schedule of the Ionising Radiation Regulations 2017.
Dutyholder's response	Sellafield Ltd's investigation concluded that the lost contaminated water was leaking to the ground below the sump. A programme to remediate the sump and seal the source of the leak was initiated. Sellafield Ltd has safely removed the waste and debris from the RST and is in the process of sealing the RST sump with concrete.
ONR's actions	An investigation has been initiated jointly with the Environment Agency to identify the potential cause(s) of this incident and to determine if any formal regulatory action is required. We are satisfied with Sellafield Ltd's approach to dealing with the incident and we are maintaining close regulatory oversight of the progress in terminating the leak. We have published a summary of this incident in a 'Statement of civil incidents meeting the ministerial reporting criteria (MRC) reported to ONR'.[9]

[9] http://www.onr.org.uk/quarterly-stat/2019-4.htm

INES = 1 (Anomaly) | Site: Dungeness B

Date	07/04/2019
Event description	Corrosion and leak of carbon dioxide from nitrogen injection pipework, resulting in a risk of contamination for workers.
Dutyholder's response	Following a set of immediate actions for personnel protection, EDF-NGL carried out an investigation that found that the incident was caused by a failure to implement a remediation strategy that had been developed after a similar incident. Six specific problems were identified and actions taken for their resolution – including improvement of system monitoring, documentation and organisation of relevant works.
ONR's actions	A follow-up station visit found minor shortfalls against Licence Condition 7: Incidents at the site, and Licence Condition 34: Leakage and escape of radioactive material and radioactive waste. Our inspectors provided verbal advice to EDF-NGL This was judged a proportionate enforcement response, given that the majority of the pipework was found to be in good condition with a small section affected by known historic pitting degradation. The inspection of this pipeline was part of the station's response following to the recent Direction issued by ourselves, which has resulted in major investments to resolve the significant corrosion issues at the station. We have an ongoing intervention programme that is focused on ensuring EDF addresses the current corrosion issues at the station prior to its return to service.

INES = 1 (Anomaly) | Site: Dungeness B

Date	15/08/2019
Event description	As part of the station's ongoing corrosion work activities, a corrosion assessment walk down of the auxiliary cooling water system was undertaken. This identified need for seismic restraints on some of the supporting pipework. EDF-NGL found that several seismic restraints were missing and had been missing from the original installation.
Dutyholder's response	EDF-NGL's investigation concluded that these shortfalls in the pipework supporting arrangements for Reactors 21 and 22 must be rectified prior to return to service. EDF-NGL has undertaken 'extent of condition' checks of similar seismically-qualified systems to ensure all seismic restraints are present. Further investigative work was also undertaken on 20 other systems that have seismic claims upon them.
ONR's actions	The site inspector has undertaken preliminary enquiries into this incident. These concluded that EDF-NGL's response was appropriate and the incident did not meet our formal investigation criteria. We consider that the incident is symptomatic of the wider cultural and historic design issues at the station. These are being addressed by EDF-NGL via a long-term programme of work which is to be carried out under the performance improvement plan. We will continue to engage with the station to monitor these improvement activities. The site inspector has raised a regulatory issue to ensure that any shortfalls identified for the various systems that have seismic claims are properly addressed.

INES = 1 (Anomaly) | Site: Heysham 1

Date	18/07/2019
Event description	A faulty fuse caused a loss of 110 volt power supply to the 'West CO2 Plant Instrument Panel Changeover Switch'. The back-up East CO2 Plant was however promptly put into service within the prescribed safety case time constraints.
Dutyholder's response	EDF-NGL's investigation found that, although an alarm was initiated, it was not immediately obvious that a loss of power supply could be the cause. The relevant alarm guide had insufficient information to draw the operator's attention to all the parameters that could have initiated the alarm. Improvements have been made to address this finding. It was also revealed that the East CO2 plant's instructions and panel labelling were of better clarity than on the West Plant. These improvements are now being implemented for the West CO2 plant. Although the incident did not directly challenge nuclear safety, EDF-NGL's investigation found deficiencies in the surveillance programme implementation that were significant enough to raise the INES level of the incident from 0 (No safety significance) to 1 (Anomaly).
ONR's actions	The site inspector followed up the incident with the Heysham 1 Technical Safety and Support Manager. The site inspector was satisfied that EDF-NGL had responded appropriately upon realising the significance of the alarm and had promptly acted to ensure safety-related plant was put into service within the prescribed safety case time constraints, and that nuclear safety was not challenged.

INES = 1 (Anomaly) | Site: Heysham 1

Date	23/11/2019
Event description	Prior to the start-up of the Heysham 1 reactor, 10% lift tests are carried out for each of the three groups of coarse control rods, which are used to control the reactor power during operation. The instruction requires that before the test begins, the safety (bulk) control rods, used to trip the reactor in case of emergency, should be withdrawn to their normal operational position above the reactor core. In this case, the instruction was not correctly followed and the safety control rods were left inside the core.
Dutyholder's response	Once EDF-NGL became aware of the issue, the safety rods were withdrawn to restore procedural compliance. EDF-NGL's investigation found that the relevant procedure was correct, but an instruction reminding the operators to remove the safety rods before the lift test was mistakenly not followed. EDF-NGL's follow-up report identified a number of improvement actions, including on the clarity of instructions and additional staff training. Although the incident hadn't challenged directly the nuclear safety of the station, EDF-NGL's investigation found deficiencies in both the test procedures and their implementation, which were significant enough to rate the event as INES level 1 (Anomaly).
ONR's actions	The site inspector followed up this incident with two site visits. The first visit concluded that the incident did not challenge nuclear safety and did not satisfy our investigation criteria. The site inspector was therefore content to await the conclusion of the EDF-NGL's own investigation. The second visit judged that the corrective actions identified by EDF-NGL were adequate to reduce the risk of reoccurrence. Follow-up by the site inspector will continue in the frame of normal business.

INES = 1 (Anomaly) | Site: Devonport

Date	20/09/2019
Event description	Portal Crane tripped by zone protection system. The safety function of the 43t Portal Crane zone protection system is to stop the crane from manoeuvring into a position where it could present a potential hazard. The zone protection system is a high-reliability system, independent of the control system. The zone protection system activated when the driver and control system failed to halt movement.
Dutyholder's response	Immediately after the incident, Devonport Royal Dockyard Ltd took the conservative decision to stop all crane operations on the site until the causes of the incident had been investigated and properly understood. The investigation discovered that an operational override control key-switch was erroneously left in the override position following maintenance. The associated key was not identified as safety-related due to its independence from the protection system. The protection system operated as it was designed. Based on the investigation outcome, Devonport Royal Dockyard Ltd implemented an enhanced key control process for the crane and initiated packages of work to develop a means of communicating the operational override status to the crane driver. The incident was assigned INES 1 as it represented a minor degradation of defence-in-depth with significant defence-in-depth remaining.
ONR's actions	We found Devonport Royal Dockyard Ltd had appropriate control over the incident's direct cause and that a controlled return to operations was acceptable. We conducted preliminary enquiries that determined that there was no load on the crane when it tripped and therefore a dropped load incident was not possible. Furthermore, the crane protection system operated as designed. It was therefore decided that provision of verbal advice relating to configuration control and control of work was a proportionate enforcement response. A regulatory issue has been raised to monitor Devonport Royal Dockyard Ltd's response to this advice to completion.

Conventional health and safety incidents

9.35 **Improvement Notices relating to CHS.** No Improvement Notices relating to conventional health and safety were reported during the 2019/20 financial year.

RIDDOR reportable incidents

9.36 The table below provides information on the number of RIDDOR incidents reported to us occurring within the financial year 2019/20. 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[10]	Total
Amersham (Grove Centre)	1	0	0	1
AWE Aldermaston	7	1	0	8
BAE Systems Barrow Dock Complex	10	1	0	11
Bradwell	1	0	0	1
AWE Burghfield	0	1	0	1
Cyclife	1	0	0	1
Devonport Royal Dockyard	9	1	0	10
Dounreay	0	1	1	2
Dungeness B	1	0	0	1
Harwell	2	0	0	2
Heysham 1	1	0	0	1
Heysham 2	1	0	0	1
Hinkley Point B	4	0	0	4
Hinkley Point C	10	0	1	11
HMNB Clyde	5	1	0	6
Rolls-Royce Derby	1	1	0	2
Sellafield	18	5	1	24
Sizewell A	1	0	0	1
Sizewell B	2	0	0	2
Springfields Works	0	0	1	1
Torness	1	0	0	1

[10] Diagnosed within financial year 2018/19

9.37 We are now working towards integrating reports made under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations 2015 (RIDDOR) into its Operational Experience processes. This will allow us to consistently analyse CHS incidents and ensure that any potential impacts on nuclear safety are assessed. Similarly, any INF1 incident reports with CHS implications are now routinely analysed.

Case Study – Hinkley Point C conventional health and safety performance

9.38 The HPC nuclear new build site is one of Europe's largest construction projects and currently approximately 5,000 workers are employed in building two new Pressurised Water Reactors (PWRs) and the construction of necessary associated development works. We seek to ensure that conventional health and safety matters at the HPC construction site are regulated in a manner commensurate with the site's risk profile and other comparable construction projects. As such, to support our regulation of conventional health and safety matters, we utilise ONR-warranted construction specialist inspectors from the HSE to regulate conventional health and safety matters at HPC; supported and overseen by our conventional health and safety specialist inspectors.

9.39 It should be noted that the use of comparative statistics to assess performance whilst being of indicative value should be approached with caution as the nature and complexity of sites vary significantly and, even if normalised, can be misleading. Hence performance metrics are not directly comparable on a like for like basis but nevertheless can allow broad comparisons to be drawn.

9.40 Overall it is our judgement that NNB GenCo is adequately managing health and safety risks at the HPC site. This judgement is based on the qualitative on-site interventions undertaken to date and comparison with NNB GenCo's own safety performance metrics. Due to the nature of operating the HPC site around the clock, work hours change significantly over time, so, in this case HSE's guidance advises to use the Frequency Rate (FR) rather than the Incident Rate (IR).

9.41 We know the HSE statistics give the IR for Civil Engineering (SIC code 42), which includes >7 day injuries and specified injuries, as 191 injuries per 100,000 employees (Ref 2)[11].

9.42 Hence, HPC is currently below the frequency rate for the industry. Given the scale and complexity of operations at a nuclear construction site, such as HPC, compared to a typical civil engineering project, this figure is more reassuring. Our expectations of a capable nuclear site licence holder are such that it would expect such a licensee to manage conventional health and safety and all its responsibilities in a robust and comprehensive way aiming to perform to the highest standards across its business.

[11] To convert this to a Frequency Rate (FR) and then compare it to HPC's performance, we use HSE's formula (Ref 1)
Frequency Rate = Incident Rate x10/(Average Hours Per Week x Weeks in Year).
Therefore, the FR=191x10/ 37.3 x 52.1) = 0.98 per 1,000,000 hours worked for Civil Engineering sector, in 2018-19.
To now calculate the FR for HPC, we use the HSE formula (1*) FR=injuries per year/hours worked /year x1000,000.
Therefore, the FR=11 Injuries per year/ 11,923,021 hours worked per year x 1,000,000 = 0.92 per 1,000,000 hours worked for HPC, January – December 2019.

9.43 When reviewing the breakdown of HPC's RIDDOR reports January – December 2019 the following data was obtained:

Accident type	Count of type of accident	% of total	HSE industry construction stats
Slip, trip, fall same level	5	46%	25%
Injured whilst handling, lifting or carrying	1	9%	20%
Falls from height, falling/flying object	2	18%	18%
Falls from height	1	9%	12%
Cuts/nips/pinches	1	9%	No data

9.44 It can be seen that the majority of NNB GenCo's RIDDOR reports relate to slips, trips and falls on the same level. Given the scale and complexity of activities at the HPC construction site, which includes significant working at height and lifting activities, the data indicates that significant hazards tend to be under represented, and lower-level slips, trips and falls on the same level, over represented. This tends to support our view that overall significant hazards are being appropriately controlled and that many of the incidents relate to simple slips and trips when personnel are moving around the site.

9.45 However, we expect NNB GenCo to appropriately investigate all RIDDOR events (and near misses) to identify causes and actions to prevent reoccurrence. HPC, in discussion with ourselves, has recognised that High Potential Events are an area where further reassurance is required to ensure that precursor events and near misses are adequately identified and followed up. We are satisfied that HPC takes such events seriously and continues to provide assurance to the regulator.

9.46 As such we judge that the CHS performance at the HPC site is adequate and in line with expectations, noting that we expect our dutyholders to ensure performance is maintained and opportunities for further improvement are identified and implemented.

References

9.47 (1) Calculation based on HSE's formula https://www.hse.gov.uk/statistics/adhoc-analysis/injury-frequency-rates.pdf. The average hours per week has been taken from HOUR3 because it includes workers not just employees.

9.48 (2) HSE statistics 2018/19 http://www.hse.gov.uk/statistics/tables/ridind.xlsx and the Civil Engineering SIC code 42.22 This class includes construction of civil engineering constructions for power plants.

10 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 and 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 its 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.
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.

Terminology	Definition
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.
OpEx	Operating experience (OpEx) is a valuable source for learning about – and improving the safety and security of – nuclear facilities and activities. 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; when the reactor that powers the vessel is taken critical for the first time, starting off the chain reaction that generates the power. 'Physics testing' then confirms, in a controlled manner, that the performance of the reactor core is as expected. 'Power range testing' then follows; 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.