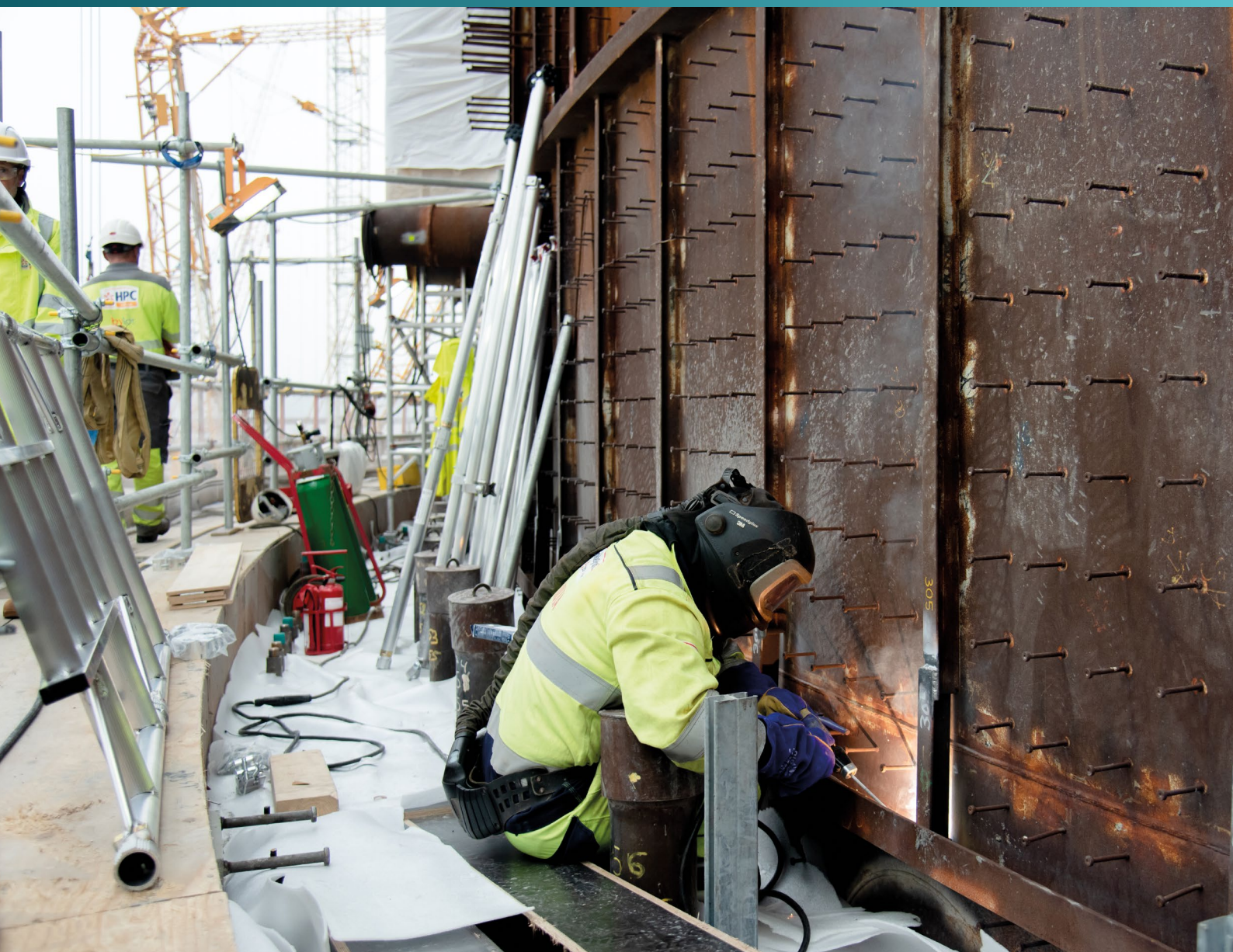
Office for Nuclear Regulation

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

October 2022



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Chief Executive and Chief Nuclear Inspector foreword

I am pleased to report that overall, during 2021/22, Great Britain's (GB) nuclear industry has once again achieved the high standards of safety, security and safeguards compliance that we expect. At the same time, my inspectors and corporate staff delivered successfully against our key priorities to achieve our mission: 'to protect society by securing safe nuclear operations'.

While the COVID-19 pandemic continued to have an impact, as we approached the end of the reporting period a long-anticipated 'return to normal' began to materialise. Throughout, we adopted a cautious and measured approach, reinforcing our priority to protect our own staff and organisational resilience. This was crucial to enable us to regulate effectively, while continuing to obtain suitable assurances that our licensees and dutyholders were adequately resourced to deliver their activities safely, securely and in accordance with safeguards requirements. I remain satisfied that we maintained an effective regulatory footprint, with no significant change to safety and security resilience within the industry across the sites and operators we regulate.

I am satisfied that all regulatory interventions during the year have had, or are having, the desired effect and that adequate levels of compliance have been maintained. While there have been challenges, I have also observed good practices amongst our licensees and dutyholders, notably in collaborative and partnership working, lessons learned and embracing innovation.

In parallel, the industry continued to put significant effort into addressing the key regulatory priorities I set out in the last report. Sustained effort is still required to deliver long-term improvements in some areas – from management of ageing facilities to the safety of workers on major project construction sites, and leadership and culture for safety and security. In the year ahead, we will retain a focus on these themes, supported by a targeted strategy that drives continued regulatory effort to influence cross industry improvements.

In addition, I have asked my team to focus the next Chief Nuclear Inspector (CNI) themed inspection on climate change. This is to reaffirm the continued adequacy of industry arrangements to maintain safety in the face of climate change impacts, taking account of the latest scientific advice. This focus will be to provide additional assurance to me on how external hazards are being mitigated at nuclear facilities, given the growing challenge climate change may present, as well as the significant public interest in this area.

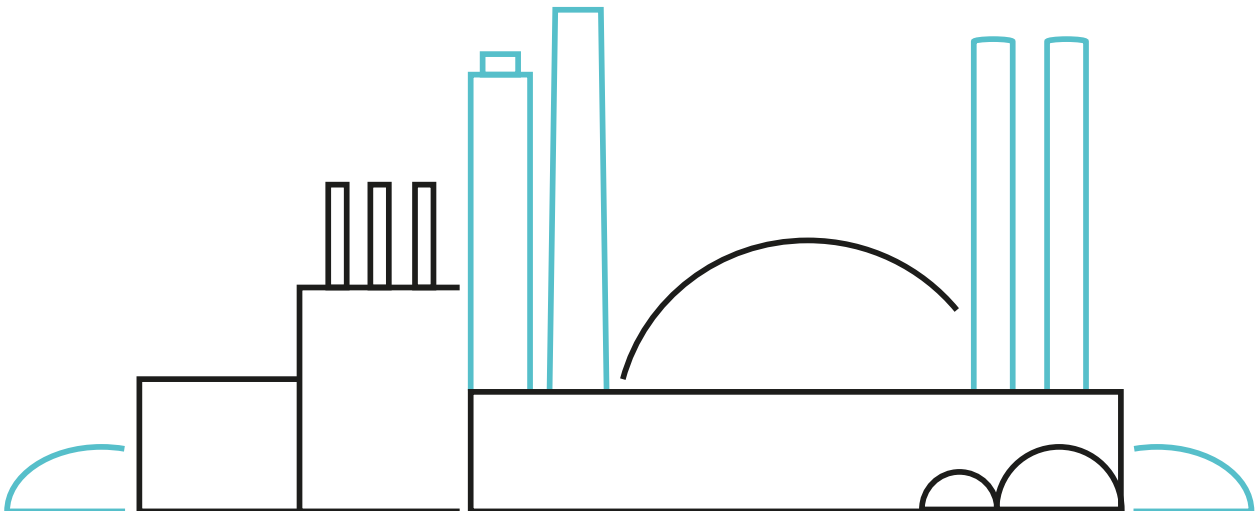
During the period, we completed our first financial year as the UK's domestic safeguards regulator, for which we took accountability in January 2021. Industry has responded positively to these changes and safeguards operators adjusted well to the new regime, enabling the UK to meet international safeguards obligations.

Also notable during 2021/22 was the Post Implementation Review (PIR) of ONR, conducted by the UK government. The PIR considered how we perform our functions and involved engagement with many stakeholders, including industry. The review concluded that we are effectively delivering our regulatory purposes, that we follow a modern, enabling regulatory approach, and that we are respected for our technical ability and regulatory performance. It also validated our commitment to progress further in our modernisation journey, so that we can regulate even more effectively and efficiently, in pursuit of our vision 'to be a modern, transparent regulator delivering trusted outcomes and value'.

The figures presented throughout this report provide a detailed picture of the nuclear industry's performance. Despite some variability by exception, which my inspectors have promptly addressed to secure improvements, I remain satisfied with the good performance of the industry of the whole.

I commend the nuclear industry's resilience as we emerge and recover from the pandemic, and its overall focus on achieving safe and secure outcomes. I would also like to thank my highly capable and professional staff – they are exceptionally committed to our mission, vision, and effective regulation. It is their dedication that enables us to ensure the nuclear industry achieves the high standards of safety, security and safeguards that the public expects.

Mark Foy
Chief Executive and Chief Nuclear Inspector



Executive Director of Regulation foreword

Having been in post for more than 18 months, I concur fully with Mark's assessment in noting what has been, overall, a strong safety, security and safeguards performance across the UK nuclear industry over the last year. This is a direct result, not only of the hard work and commitment of the industry that we regulate, but of the robust, independent and professional regulation of ONR and the support of a broad range of national and international stakeholders. My thanks to all who have contributed to this over the year past.

The coronavirus pandemic and the industry's response to it has continued to represent a focus of our attention, and I can report that my colleagues have worked diligently and effectively across our statutory purposes[1] to ensure that the safety and security of workers and the public has been maintained throughout.

Our extensive programme of inspections, covering the entirety of the UK nuclear industry, has provided me with confidence that dutyholders have, in the large majority of cases, remained compliant with the requirements of safety, security, and safeguards legislation. In the small minority of cases where this has not been so, our inspectors have taken appropriate action (including formal enforcement where necessary) to secure a timely and sustainable return to compliance.

Over the last year, amongst many achievements, we have successfully delivered our design assessment of the UK Hualong Pressurised Water Reactor (UK HPR1000) proposed for construction at Bradwell, have permissioned the next and vital construction phase at Hinkley Point C and the commencement of retrievals from legacy facilities at Sellafield, have worked with dutyholders to deliver compliant site security plans that align with our Security Assessment Principles, and have provided regulatory oversight of the preparation for defueling of shut down reactors and of the ongoing safe operation of EDF Nuclear Generation Limited (NGL)'s reactor fleet.

In addition, our safeguards team has worked, tirelessly but successfully, to deliver and maintain a state system of accountancy and control that fully meets the commitments given to Euratom by the UK government.

Of particular note is the return to 'routine' regulatory attention of the EDF NGL Dungeness B reactor site and of the Atomic Weapons Establishment site at Burghfield, as a consequence of sustained improvements in safety performance. Equally, I note and welcome the return to 'routine' regulatory attention of the Magnox corporate centre from a strategic security perspective. In each case, this represents substantial work, over an extended period of time, by dutyholders and regulator alike.

However, there are a small number of sites still receiving 'enhanced' regulatory attention for safety and/or security performance reasons, for which I will expect to see significant progress over the next year. I recognise that, for some cases (e.g. most notably the remediation of legacy facilities Sellafield), the actions necessary to achieve this will take many decades to deliver. In such cases, our focus is to ensure continued safe and timely progress to this end.

Over the year, we have increased our focus on cyber security, to ensure that the industry maintains an appropriate focus on this dimension of safety and security threat. This will remain an area of regulatory priority into the future.

1 ONR's five regulatory purposes are: nuclear safety; nuclear site health and safety; nuclear security; nuclear safeguards; and safety of transport of nuclear and radioactive materials www.onr.org.uk/aims-and-objectives.htm

As regards to the themes emerging from previous Chief Nuclear Inspector (CNI) reports, I note that good progress has been made across many of these areas although, for some (e.g. ageing management, conventional health and safety), additional and continued focus by ONR will be necessary to secure the standards that we expect.

For leadership for safety and security culture, I am pleased to note good progress in our work with the Alliance Manchester Business School and dutyholders, to develop better means of assessing the quality of these attributes. Feedback from dutyholders has been positive, and our collective work will inform opportunities to develop this into the future.

In addition, we have made strong progress in developing arrangements by which we can engage with the nuclear sector to promote beneficial innovation. Early and effective engagement with such innovations is a means by which we can support better, safer, more secure, and more cost-effective approaches to delivering nuclear facilities, operations, etc. This is an objective that is consistent with public and worker safety and in the interests of both.

As regards modernising how we regulate, we have made substantial progress in simplifying and digitising our regulatory processes. Once complete, this will drive improved consistency in regulation across our statutory purposes and easier access to information necessary to inform proportionate regulatory decision-making.

Over the year ahead, we plan to increase our focus on how the nuclear industry is protecting itself from, and achieving resilience to, the potential long-term effects of climate change. To this end, we will commission a series of cross industry reviews to provide confidence that this is being adequately considered.

Last but not least, I would like to thank the ONR team for its unstinting hard work over the last year. I have every confidence that my colleagues, with their characteristic professionalism, objectivity and integrity, will continue to influence proportionate improvements to keep workers and the public safe; to ensure that Great Britain's nuclear facilities, information and other assets remain secure; and the relevant nuclear material remains appropriately safeguarded.

Donald Urquhart
Executive Director of Regulation

1 Chief Nuclear Inspector's review

Industry progress against our key regulatory priorities

1.1 Last year, I set out three overarching key regulatory priorities requiring increased industry attention:

- management of ageing facilities
- conventional health and safety performance
- leadership for safety and security culture

Management of ageing facilities

1.2 The management of ageing facilities continues to be an area of regulatory focus for us. The themed inspection that I commissioned reviewed a representative sample of the industry, to determine whether they have demonstrable and sustainable programmes in place for the management of ageing facilities.

1.3 After reviewing the inspection's draft findings and the performance of each licensee we judge that, although safe and secure operations are being maintained, the adequacy of arrangements varies across licensed sites, as does performance against those arrangements. We found that licensees have improved their programmes for the management of ageing assets, and continue to do so; each licensee remains on a journey of further strengthening their existing arrangements in this area.

1.4 We identified three areas of common challenge associated with ageing management, which are likely to affect much, if not all, of the remainder of the nuclear estate.

These relate to:

- ensuring sustainable capability and capacity for the management of ageing assets
- implementation of sustainable funding models to deliver effective ageing management
- the integration of management of ageing security assets into wider ageing management plans

1.5 This themed inspection should be viewed as an important part of our wider strategy for influencing improvements and an additional means by which we continue to promote and assess, the sustainable improvements that must be made across the industry for the management of ageing facilities. As well as engaging with our licensees through industry working groups on the draft findings of the themed inspection, we are developing a targeted strategy to ensure that regulatory focus continues to influence cross industry improvements.

Conventional health and safety performance

1.6 Performance in conventional health and safety (CH&S) remains variable, with some dutyholders' performance remaining static or declining. Consequently, we are increasing regulatory oversight in targeted areas, and taking enforcement action where we consider it appropriate to do so. Management of working at height risks has improved this year in response to specific and targeted interventions. However, we have seen a continued rise in the number of electrical incidents and near misses, as well as a number of fire events reported across the industry.

1.7 None of these events had any radiological or nuclear safety consequences. In response, we are rolling out an integrated programme of targeted interventions to influence improvements in electrical safety and a greater dutyholder focus on the risks of fire.

1.8 Sustained effort is required to deliver the improvements needed in some strategic areas, such as safety leadership, and hazard and risk identification, prioritisation, and reduction. This is crucial to delivering sustained improvements to CH&S performance, particularly around risk profiling, which is essential to reflect the status of sites undergoing major changes, such as new nuclear build and nuclear sites planning for defueling and/or decommissioning. CH&S, including fire safety, will therefore remain a priority for us, so that we can be assured that industry initiatives continue to deliver the sustainable improvements necessary to protect workers on nuclear sites.

1.9 There is a considerable amount of construction work being undertaken across the nuclear industry, associated with major projects. This has the potential, if not properly managed and controlled, to present further CH&S risks. Therefore, we will maintain our targeted oversight of these operations over the coming year, with increased focus on the design, planning and management of construction risks, as well as decommissioning activities involving demolition.

Leadership for safety and security culture

1.10 My inspectors are conducting assessments to examine the effectiveness of dutyholder leadership and culture for safety and security. These assessments are vital to ensure safe operations at nuclear sites and are providing valuable insights into the current quality of leadership and culture. This will, in turn, be used to target future regulatory activities, and influence positive change in the industry.

1.11 We have worked with the Alliance Manchester Business School to enhance the competence of our inspectors when undertaking assessments of dutyholders' safety and security culture. This has helped us to develop new guidance[2] to aid our inspectors' assessments of culture, culture change and capability to diagnose organisational factors with the potential to affect safety and security.

1.12 Feedback from dutyholders about safety and security culture assessments since we have adopted our new guidance has been positive. They have found the findings from our assessment reports to be insightful and helpful in understanding where they can improve their own safety and security culture. The assessments are also helping to inform our regulatory decisions and inspection plans.

1.13 This year we will develop a model and measure of safety and security culture that is more appropriate for the UK nuclear industry context, which will provide a common language for communicating safety and security culture across the industry. It will provide a validated measure of safety and security culture, which licensees may choose to use to assess their own.

2 Examining Culture in Organisations: Guidance on Using Qualitative Methods in Organisational Research': www.onr.org.uk/operational/other/td-hoc-gd-001.pdf

Future regulatory priorities

1.14 In last year's report I stated that the future resilience of the industry's pandemic response arrangements would receive some regulatory focus during 2022/23. However, the ongoing UK COVID-19 public inquiry and any subsequent review on critical national infrastructure resilience may affect our approach when considering industry pandemic resilience. I have asked my team to capture emerging findings, which will inform how we appropriately characterise the resilience required to effectively respond to future pandemics. Consequently, our own work on the industry's future pandemic resilience will be delayed until the UK's national review is complete.

1.15 I am retaining the existing regulatory themes for the year ahead, with one minor title change to better reflect the intended focus. We will therefore ensure that, during 2022/23, levels of increased industry attention are maintained on:

- management of ageing facilities
- conventional health and safety performance
- leadership and culture for safety and security

Climate change

1.16 Recognising the growing challenges presented, potential external hazards to nuclear sites, and the significant public interest in climate change, my next CNI themed inspection will focus on this area. The purpose will be to provide assurance on the continued adequacy of industry's arrangements to maintain safety in the face of climate change impacts, taking account of the latest scientific advice.

COVID-19 pandemic

1.17 We require all licensed sites to determine the minimum staffing levels necessary to ensure safe and secure operations, and to have robust contingency arrangements to ensure the ongoing safety and security of their sites if these levels are not met. This condition is specifically designed to ensure that industry can adequately manage and control events (such as the COVID-19 pandemic) that could impact on nuclear safety and security under all foreseeable circumstances.

1.18 During this reporting period, and throughout the pandemic, we adopted a cautious and measured approach, reinforcing our priority to protect our own staff and safeguard our organisational resilience to enable us to regulate effectively. We continued to obtain assurance that nuclear site licensees and other dutyholders were adequately resourced to continue to carry out their activities safely and securely, despite the impact of the COVID-19 pandemic.

1.19 We continually assessed our on-site presence in line with government guidance and our business needs, ensuring a balanced portfolio of on-site inspections and interventions to support effective regulation across our purposes – maintaining an effective regulatory 'footprint' and gaining suitable assurance on the continued safety and security of the sites and activities we regulate.

1.20 We remained satisfied with industry's response throughout, with no significant change to dutyholders' safety and security resilience to report.

Modernising how we work

1.21 To minimise the costs of our regulation to the public purse and industry, efficiency has been, and continues to be, a major focus. This was also identified as a priority in the PIR. In parallel, we will continue to effectively apply a targeted and proportionate approach to regulation. We have started to see some benefits, with our leadership driving the necessary culture to support change.

1.22 We have made further significant progress to modernise the way we deliver and manage our regulatory activities. Moving into the final phases of delivery, our Well-Informed Regulatory Decisions (WIReD) project will provide simplified digital regulatory processes as part of a modern integrated information management system, with real-time regulatory management information and a secure dutyholder portal.

1.23 I am pleased that we have continued to enhance collaboration and co-operation across our five statutory purposes. This has seen closer working between our regulatory divisions, more consistent approaches, and more joint activities involving multidisciplinary teams of inspectors, to deliver a comprehensive and holistic assessment of dutyholders' arrangements.

1.24 We have also made substantial progress over the last year in developing a clear, transparent, and accessible approach as to how we can proactively support and encourage innovation within the nuclear industry and its supply chain, while ensuring that high standards of safety and security are maintained. We have engaged with the nuclear industry on this and are working on a range of potentially beneficial initiatives. I recognise that further work in this area is needed in the years ahead, as new and novel approaches are considered, and highlight our ongoing commitment to supporting this.

Promoting good practices

1.25 In line with my previous reports, I have taken the opportunity to highlight good practices in the industry that have been identified by my inspectors as part of their regulatory activities during the year. Examples of these are included here for wider consideration by the industry.

1.26 **Security risk assessments across Magnox Ltd.** Magnox Ltd has undertaken work to review and re-assess the security risk profile across its nuclear licensed sites as part of the transition to Security Assessment Principles (SyAPs) aligned site security plans. This work required revisions to the assessment of the security vulnerabilities, together with a commensurate change in the cultural mindset of those responsible for delivery of security across Magnox Ltd. Magnox Ltd has developed a revised methodology that can be applied across the former generating sites to deliver revised site security plans for assessment and approval.

1.27 **Managing transitions in plant lifecycle stages for EDF Energy Nuclear Generation Ltd.** The end of electricity generation at a nuclear power station means the licensee needs to manage and implement significant changes in plant, people, and processes. After a power station ceases generation, the principal hazard is dominated by operations on the fuel route where, for example, defueling presents different hazards to those experienced during refuelling operations, including new fault sequences.

1.28 At Hunterston B and Hinkley Point B, the transition has led EDF to identify the new challenges to nuclear safety and ensure that robust controls are in place to provide sufficient protection. We are pleased to see that the lessons learned are being shared with other AGR stations to ensure that as subsequent stations cease generation, they can develop safety cases more efficiently and ensure the availability and resilience of plant required for defueling.

1.29 There are also organisational changes for EDF to consider, in terms of capacity, capability and structure to deliver safe and efficient defueling, which has been the subject of early consideration by EDF. EDF has also had extensive, early discussions with us on their arrangements for managing changes before seeking to implement them.

1.30 EDF is working together with the Nuclear Decommissioning Authority (NDA)/Magnox to develop plans for the post-defueling phase when the sites will transfer to the NDA/Magnox for deconstruction. To avoid a delay to this work at transfer, EDF is seeking to ensure that the plans are properly conceived and can be executed to deliver further hazard reduction. This level of proactive multi-stakeholder collaboration and co-operation will provide a strong foundation for the future safe transfer of the sites to the NDA.

1.31 **Increased focus on management of radioactive waste within the industry and development of Geological Disposal Facility (GDF).** There are numerous challenges associated with a GDF, including the safety case, design, construction, community engagement, and associated costs. The siting is dependent on suitable geology and hydrology, the size of the inventory to be disposed and having a willing host community, as well as the logistics associated with safe waste transfer related to the location of the eventual site of the GDF. In addition, disposal is not a prescribed activity under the Nuclear Installations Regulations 1971, hence they need to be amended before a GDF can be licensed under the Nuclear Installations Act 1965, and its nuclear safety subject to regulation by ONR.

1.32 Given the numerous challenges associated with a GDF, we are pleased that a pre-application advice and scrutiny programme has been set up by the Department for Business, Energy and Industrial Strategy (BEIS) and NDA/Nuclear Waste Services (NWS) , to both find a suitable site for a GDF and work with local communities to inform them of the overall process and what hosting a GDF will entail. Although it is many years away, NWS is also developing an understanding of the organisational capabilities needed to hold a nuclear licence, which will help to ensure that challenges around design, siting, and licensing are properly considered and addressed satisfactorily.

1.33 **Strengthening collaboration and capability through 'One NDA'.** The NDA has taken back direct ownership of decommissioning sites across GB that were previously managed and operated on its behalf by different Parent Body Organisations (PBOs). All the sites are now under its organisational and governance structure, under the 'One NDA' model, allowing it to link together, what had previously been separate businesses entities, to realise the benefits of greater learning, sharing and support across the totality of its business. Under the subsidiary model, the NDA has been able to facilitate routine collaboration and co-operation between its licensees, dutyholders and stakeholders, on a range of key safety and security issues, for example, waste management and supply chain resilience following the COVID-19 pandemic.

1.34 **Hinkley Point C mechanical, electrical and heating, ventilation and air conditioning (MEH) Alliance (Partnership).** The MEH Alliance is delivering the mechanical, electrical and heating and ventilation works during the installation phase of Hinkley Point C's construction. The Alliance brings together NNB GenCo in partnership with a joint venture (JV) formed of four major UK industrial erection companies: Altrad, Balfour Beatty Bailey, Cavendish Nuclear, and Doosan Babcock, supported by a network of strategic suppliers. This innovative alliance model allows different contractors to work as a single entity to deliver the complex installation of cabling and pipework across the 4,000 rooms and 75 buildings of Hinkley Point C.

1.35 This co-ordination was a challenge at Flamanville 3, and contractors effectively competed to get access to the spaces. Experience at Taishan has shown the benefits of bringing contractors into a single organisation where collaboration is incentivised and skills and expertise shared, focused on a common set of objectives.

1.36 The alliance brings together the skills of the individual partners to establish a broader delivery capability for the project. This is underpinned by an integrated Project Management Office, which plans all the activities of the partners into a single work schedule, enabling effective delivery co-ordination across the many buildings and rooms at Hinkley Point C. In forming the alliance, there has been a significant focus on building the right behaviours, which resulted in a Charter of Shared Values and enabling commercial arrangements.[3]

1.37 We have recently assessed the arrangements relating to commencing bulk MEH installation and were content to permission the start of activities in November 2021. We will continue to seek assurance as the scale of the work increases over 2022 into 2023.

1.38 **Innovation.** It is a positive step that the nuclear industry has started to lead in collaborative work to identify topics and initiatives for discussion on innovation. This will maximise opportunities for the successful introduction of innovative and novel solutions, and the realisation of the associated benefits. Industry has also responded well to our plan for delivering our approach to innovation, which was agreed during the reporting period.[4]

3 NEC4 Option E – cost reimbursable contract

4 Further case studies are published on our website: www.onr.org.uk/regulating-innovation.htm and https://news.onr.org.uk/2022/03/looking-to-the-future-artificial-intelligence-in-nuclear/

Case study 1

Artificial Intelligence

Challenge

We routinely assess the potential for new technologies to support UK nuclear industry goals. One such assessment identified artificial intelligence (AI) as having considerable potential to enhance safety and security on nuclear sites, but it was unclear how feasible it would be to deploy the technology on a nuclear site where the consequences of failure could be significant.

Follow-up work identified that AI is being successfully deployed in a wide range of non-nuclear applications, and while there is a large amount of research into AI for use in nuclear applications and evidence of significant benefits, there was no indication of its actual deployment in nuclear safety or security applications anywhere in the world. It was unclear why this was the case.

We recognised the need to understand what was preventing the adoption of AI in nuclear applications and the associated benefits being realised and how these could be overcome.

Research activity

We addressed the challenge by taking two different research approaches; to identify how successful AI applications had been realised, but also to explore why AI applications had not been successfully deployed in the nuclear industry, and crucially to explore whether regulation could be a blocker.

By commissioning independent research into how AI is being developed and used internationally in a wide range of applications, we were able to better understand what benefits it could bring, and consequent challenges. We worked with the researchers to develop our own knowledge of the topic, and to ensure that we understood how our existing regulatory approaches and guidance could be challenged by AI.

We also supported a research consortium of ten UK universities and industry bodies developing AI robotic applications to solve real nuclear industry problems. This research deployed robots on several sites, including Chernobyl, Fukushima, and in the UK, to gather real-world data on performance in particularly demanding locations. Again, we worked with the researchers to understand the results from these real-world applications, and to consider how these robots could be demonstrated to be adequately safe through the development of formal safety argumentation.

Intelligence gained

The research found that AI has considerable potential to enhance nuclear safety and security in several areas, including through the analysis of data to detect anomalies and shortfalls on operating nuclear plant. Also, AI has the potential to improve quality and consistency on new build and existing nuclear sites, and to accelerate the remediation of nuclear waste sites.

The research also found that while our regulatory approach and guidance is generally fit for purpose, there is likely to be a need to enhance this for the full benefits of AI to be realised. There is a particular need for different technical disciplines, such as human factors and control and instrumentation specialists, to work together to ensure that safety demonstrations for AI are robust and supported by good evidence.

We have provided and discussed the outcome of the research to several interested nuclear site licensees, and more widely on our website[5], providing them with the insight it offers, and confidence in how the regulator will assess AI.

As a result of the research, we have been able to develop a staged process (a route map) by which AI can be deployed on nuclear sites in applications that can have safety consequences, while ensuring that risks remain adequately controlled.

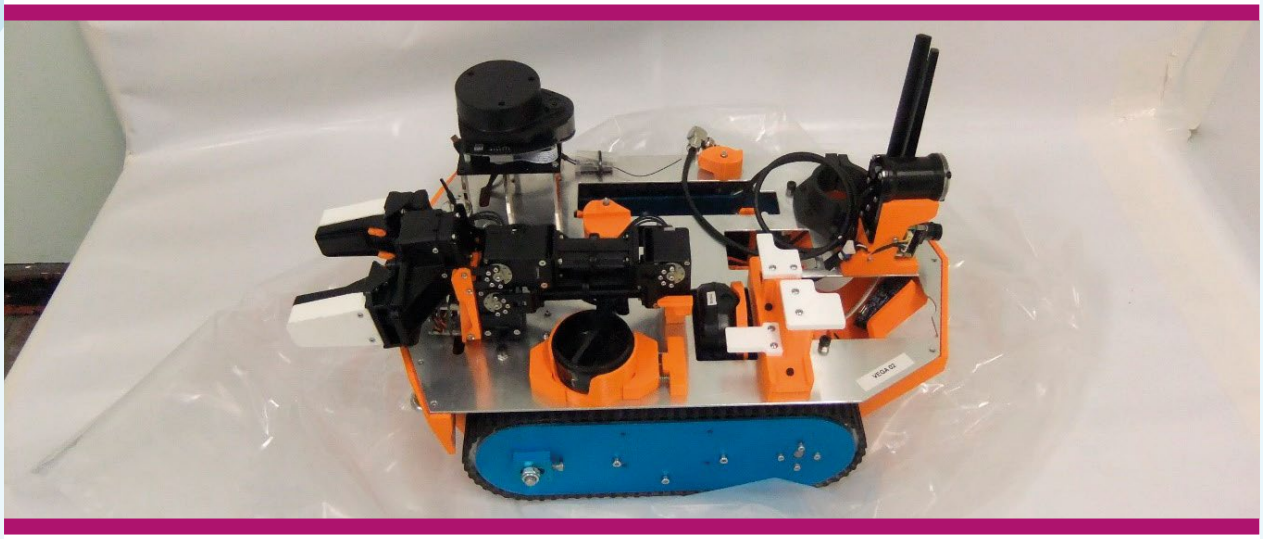
To enable the early deployment of AI systems, and the benefits this brings, we have used our innovation hub[6] to explore how new technologies may be deployed, and how they will be demonstrated to be adequately safe.

5 ONR-RRR-121- Research into the potential uses of Artificial Intelligence and Machine Learning on UK nuclear licensed sites, and approaches to their substantiation – Phase 1

6 Further case studies are published on our website: www.onr.org.uk/regulating-innovation.htm and https://news.onr.org.uk/2022/03/looking-to-the-future-artificial-intelligence-in-nuclear/

This 'sandbox' approach will enable the challenges to successful deployment to be identified in a safe space before we step back to allow the licensee the space to develop adequate safety demonstrations.

We have shared the outcomes of the research with two other national regulators and are working with them to develop a common approach to the regulation of AI that is aimed at removing differences in the way AI is regulated in the respective countries, enabling AI developers to be clear what the regulatory expectations will be, with consistent expectations across the three countries.



Autonomous tracked surveying robot

Deployment of an autonomous robot to survey a duct

2 Overview of safety, security, and safeguards performance

Regulatory attention levels

2.1 The regulatory attention that we are applying to licensed nuclear sites during 2022/23 is summarised in tables 1, 2 and 3. The attention level assigned for each site is based on our assessment of its overall performance over the past 12 months, considering a broad range of safety and security considerations, and/or the operational issues being addressed by each site. It also reflects an overall judgement across our nuclear safety, conventional health and safety, civil nuclear security, and transport purposes. Attention levels may differ between safety and security for the same licensed site and may be allocated to specific parts of larger sites.

2.2 We have not yet assigned safeguards attention levels to individual sites, as we continue to gather operational experience regulating nuclear material accountancy, control and safeguards in the UK. All sites are therefore considered to be under routine attention at this time. This position will be reviewed and reported upon in future publications.

Level 3

Routine attention applies to those sites, facilities or organisations that we consider require no additional regulatory focus or effort over and above that which we would normally apply.

Level 2

Enhanced attention describes sites that, either by virtue of their safety and security performance or due to specific technical safety and security challenges, will be subject to a greater level of regulatory attention than would otherwise be the case.

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 fundamental shortcomings in its safety or security performance or has failed to address long-standing and significant regulatory issues.

Table 1: Regulatory attention levels for safety for licensed sites from 31 March 2022

Regulatory attention	Licensed site	Change in attention since 2020/21
Significantly enhanced	Sellafield (Sellafield Ltd): First Generation Magnox Storage Pond, Magnox Swarf Storage Silo, Pile Fuel Cladding Silo and Special Nuclear Materials Facilities	No change
Enhanced	Atomic Weapons Establishment (AWE Plc), Aldermaston	No change
	Devonport (Devonport Royal Dockyard Ltd)	No change
	Sellafield (Sellafield Ltd), remainder of estate	No change
Routine	Atomic Weapons Establishment (AWE Plc), Burghfield	↓ Return to routine attention driven by significant and sustained safety improvements.
	Bradwell (Magnox Ltd)	No change
	Berkeley (Magnox Ltd)	No change
	Barrow (BAE Systems Marine Ltd)	No change
	Capenhurst (Urenco UK Ltd)	No change
	Chapelcross (Magnox Ltd)	No change
	Derby (Rolls-Royce Marine Power Operations Ltd), 2 sites	No change
	Dounreay Site Restoration Limited (DSRL)	No change
	Dungeness A (Magnox Ltd)	No change
	Dungeness B (EDF Energy Nuclear Generation Ltd)	↓ Return to routine attention driven by improvements to address long standing concerns.
	GE Healthcare Amersham (GE Healthcare Ltd)	No change

Regulatory attention	Licensed site	Change in attention since 2020/21
Routine (continued)	Hartlepool (EDF Energy Nuclear Generation Ltd)	No change
	Harwell (Magnox Ltd)	No change
	Heysham 1 (EDF Energy Nuclear Generation Ltd)	No change
	Heysham 2 (EDF Energy Nuclear Generation Ltd)	No change
	Hinkley Point A (Magnox Ltd)	No change
	Hinkley Point B (EDF Energy Nuclear Generation Ltd)	No change
	Hinkley Point C (NNB Generation Company (HPC) Ltd)	No change
	Hunterston A (Magnox Ltd)	No change
	Hunterston B (EDF Energy Nuclear Generation Ltd)	No change
	Low Level Waste Repository (LLWR)	No change
	Metals Recycling Facility (Cyclife UK Ltd), Lillyhall	No change
	Oldbury (Magnox Ltd)	No change
	Rosyth (Rosyth Royal Dockyard Ltd)	No change
	Sizewell A (Magnox Ltd)	No change
	Sizewell B (EDF Energy Nuclear Generation Ltd)	No change
	Springfields (Springfields Fuel Ltd)	No change
	Torness (EDF Energy Nuclear Generation Ltd)	No change
	Tradebe Inutec (Inutec Ltd)	No change
	Trawsfynydd (Magnox Ltd)	No change
	Winfrith (Magnox Ltd)	No change
	Wylfa (Magnox Ltd)	No change

Table 2: Regulatory attention levels for civil nuclear security performance from 31 March 2022

Regulatory attention	Licensed site/premises/new build	Change in attention level since 2020/21
Significantly enhanced	Sellafield (Sellafield Limited)	No change
Enhanced	Berkeley (Magnox Ltd)	↑ Raised to enhanced attention due to additional work required to assess revised security plans.
	EDF Energy Nuclear Generation Ltd (Corporate)	↑ Raised to enhanced attention due to identified shortfalls requiring further attention.
	Harwell (Magnox Ltd)	No change
Routine	Bradwell (Magnox Ltd)	No change
	Cavendish Nuclear	No change
	Capenhurst (Urenco UK Ltd)	No change
	Centronic	No change
	Chapelcross (Magnox Ltd)	No change
	Dounreay Site Restoration Ltd (DSRL)	No change
	Dungeness A (Magnox Ltd)	No change
	Dungeness B (EDF Energy Nuclear Generation Ltd)	No change
	Hinkley Point C (NNB Generation Company (HPC) Ltd)	No change
	Sizewell C (NNB Generation Company (SZC) Ltd)	No change
	The Grove Centre (GE Healthcare)	No change
	Hartlepool (EDF Energy Nuclear Generation Ltd)	No change
	Heysham 1 (EDF Energy Nuclear Generation Ltd)	No change

Regulatory attention	Licensed site/premises/new build	Change in attention level since 2020/21
Routine (continued)	Heysham 2 (EDF Energy Nuclear Generation Ltd)	No change
	Hinkley Point A (Magnox Ltd)	No change
	Hinkley Point B (EDF Energy Nuclear Generation Ltd)	No change
	Hunterston A (Magnox Ltd)	No change
	Hunterston B (EDF Energy Nuclear Generation Ltd)	No change
	Tradebe Inutec (Inutec Ltd)	No change
	Low Level Waste Repository (LLWR)	No change
	Magnox Ltd Corporate	↓ Return to routine attention driven by improvements to the company's strategic security outputs.
	Metals Recycling Facility, Lillyhall (Cyclife UK Ltd)	No change
	National Nuclear Laboratory (Sellafield Central Labs)	No change
	National Nuclear Laboratory (Preston)	No change
	National Nuclear Laboratory (Windscale)	No change
	Oldbury (Magnox Ltd)	No change
	Sizewell A (Magnox Ltd)	No change
	Springfields (Springfields Fuel Ltd)	No change
	Sizewell B (EDF Energy Nuclear Generation Ltd)	No change
	Torness (EDF Energy Nuclear Generation Ltd)	No change
	Trawsfynydd (Magnox Ltd)	No change
	Winfrith (Magnox Ltd)	No change
	Wylfa (Magnox Ltd)	No change

Table 3: Regulatory attention levels for civil nuclear security performance of approved carriers from 31 March 2022

Regulatory attention	Approved carrier	Change in attention level since 2020/21
Routine	CTS Logistics (GB)	No change
	David Watts Transport Ltd	No change
	Dounreay Site Restoration Limited (DRSL)	No change
	EDF Energy Nuclear Generation Ltd	No change
	Express Transport SA (Spain)	No change
	Nuclear Transport Solutions (NTS) [includes: Direct Rail Services (DRS); International Nuclear Services (INS); and Pacific Nuclear Transport Services (PNTL)]	No change
	ORANO NCS GmbH (Germany) [formerly Daher NT GmbH]	No change
	Sellafield Ltd	No change
	Société de Transports Spéciaux Industriels (STSI) (France)	No change
	Springfields Fuels Ltd	No change
	TN International (France)	No change
	Transrad (Belgium)	No change
	WH Bowker Ltd	No change

Nuclear industry inspection performance

2.3 For all inspections undertaken across our purposes, we allocate a rating of the observed performance of licensees and other dutyholders against expected standards for the aspects of safety or security management under review.

2.4 We use red-amber-green (RAG) inspection ratings to track performance; the rating system being assigned against the action that we propose to take in response to inspection findings:

- Green – No formal action
- Amber – Seek improvement
- Red – Require improvement

Compliance and system-based inspections

2.5 During the reporting period, we have rated most compliance inspections as green. This is a positive outcome and an indication of the good degree of compliance and the adequate safety and security standards achieved, overall, by our dutyholders.

2.6 For inspections that were rated as amber or red, our inspectors have raised the need for improvements to be made by the licensee and obtained their commitment to do so. In some instances, where we have felt it necessary and proportionate, we have taken formal enforcement action in line with our enforcement policy statement (EPS).[7]

2.7 During the reporting period, we have undertaken 43 system-based inspections (SBIs) which continue to be an important regulatory activity 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's safety case.

2.8 Our new regulatory framework for safeguards also utilises the SBI approach to gain regulatory confidence that systems, structures, and components that fulfil a key role in nuclear material accountancy, control and safeguards, perform in line with the dutyholder's accountancy and control plans. In line with our 5-year targeted plan, we undertook six safeguards SBIs.

2.9 The issues arising from our inspection activities are recorded through our well-established regulatory issues management process.[8] These issues are shared with the relevant dutyholder, and our inspectors ensure that any corrective measures are monitored to a satisfactory conclusion so that appropriate improvements to safety, security and safeguards are delivered.

Enforcement

2.10 Over the last year, we have employed a range of enforcement actions[9] to hold dutyholders to account and to secure a return to sustained compliance with the law.

7 www.onr.org.uk/enforcement.htm
8 www.onr.org.uk/operational/tech_insp_guides/onr-ri-gd-003.pdf
9 www.onr.org.uk/enforcement.htm and https://news.onr.org.uk/enforcement-action/

During this period, we:

Issued **2** security related directions under the Nuclear Industries Security Regulations 2003 (NISR);

Issued **7** security related enforcement letters;

Issued **1** safety related direction under Licence Condition (LC) 15: Periodic Review;

Issued **38** safety related enforcement letters for compliance with site licence conditions and conventional safety regulations;

Served **3** improvement notices for conventional safety non-compliances, one of which has now been satisfactorily complied with;

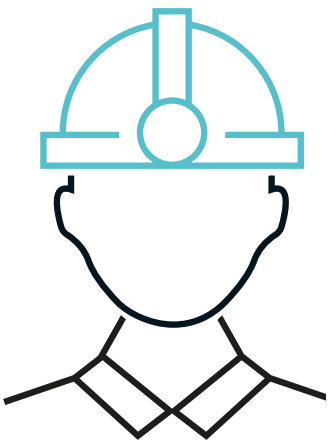
Served **2** transport related enforcement letters; and

Served **1** improvement notice for an inadequate radiation risk assessment for the transport of material, which has now been satisfactorily complied with;

Served **6** safeguards related enforcement letters.

2.11 Most of our enforcement actions were in response to individual occurrences. Where we considered there to be shortfalls, we were satisfied that the required improvements are now being implemented, and that, overall, adequate levels of compliance have been maintained despite some shortfalls.

2.12 We have not initiated any prosecutions during this reporting period.



3 Civil nuclear security and safeguards

Summary of performance

3.1 Despite some significant challenges, the civil nuclear industry continued to meet its physical security obligations throughout the reporting period. We have, however, identified issues related to cyber security in relation to certain dutyholders. We have continued our work to assess and approve the remaining SyAPs-aligned site security plans and are confident that all dutyholders will have approved plans in place by the end of 2022.

3.2 The number of dutyholders in significantly enhanced or enhanced levels of regulatory attention for security has increased by one within this period, with all approved nuclear carriers remaining at a routine regulatory attention for transport security matters.

3.3 There are dutyholders at which cyber security arrangements have not yet reached the expected level of maturity. We recognise that dutyholders are applying significant effort to enhance their cyber security posture and resilience, but we will maintain an appropriate level of regulatory oversight to ensure that their capability is sufficient to manage this important aspect of security.

3.4 There is a wider issue in relation to limited numbers of suitably qualified and experienced personnel (SQEP) in cyber security and continuing gaps in professional training specific to the UK nuclear security industry. This will continue to be a key security focus of industry leaders.

3.5 With regards to security vetting of personnel, work continues to support the delivery of the vetting modernisation programme and the transition of certain responsibilities to United Kingdom Security Vetting (UKSV).

3.6 In our first full year as the state regulatory authority for safeguards, we have enabled the UK to meet its international safeguards obligations in full, have facilitated International Atomic Energy Agency (IAEA) safeguards activities in the UK and have worked constructively with domestic safeguards operators to assist them in adjusting to the new regime.

Protective security

3.7 Due to the restrictions imposed because of the COVID-19 pandemic, we approved a number of temporary security arrangements to address potential staffing shortfalls and national guidance on social distancing, which continued to maintain adequate standards of security. As conditions have improved to allow a return to normal operations, we have worked with all dutyholders to re-adopt their original security arrangements in a timely manner, with increasing numbers of on-site inspections and face-to-face regulatory engagement.

3.8 Our continued focus for the forthcoming period is to address matters affecting those dutyholders that remain in enhanced or significantly enhanced levels of regulatory attention.

3.9 The challenges of introducing outcome-focussed (as opposed to prescriptive) regulation remain. The shortage of nuclear security SQEP within the dutyholder security functions and limited understanding of outcome-focussed security regimes remain key challenges to the delivery of revised SyAPs-aligned site security plans and any associated revisions in delivering the required security outcomes.

3.10 Despite our continued engagement with industry, there has been little progress with industry developing a comprehensive suite of nuclear security training courses and this, along with completing our assessments of the remaining SyAPs-aligned security plans, remains a priority area for the forthcoming year.

3.11 We have developed a new NISR guidance document that has been made available to all dutyholders. This document captures operational experience and learning from working under the regulations, providing detailed advice and information to assist dutyholders with their correct interpretation and implementation.

3.12 SyAPs Revision One was published in the reporting period. The revision includes harmonisation of safety and security approaches to human performance management. In addition to strengthening security design expectations, this harmonised approach will allow dutyholders to develop single sets of arrangements to satisfy both purposes. The revision also refines the key security plan principle concerning the categorisation of security functions and classification of security systems, structures and components, and the introduction of a principle on the management of changes to security standards, procedures and arrangements.

Cyber security

3.13 The increase in the number of cyber security inspectors, combined with contractor support for supply chain assessment, has enabled greater opportunities to assess the effectiveness of cyber security arrangements across the industry. Many dutyholders now recognise the need to invest further to protect against the ever-evolving cyber security threat landscape. However, through increased regulatory engagement, we have identified areas that require more immediate mitigation and are continuing to work with dutyholders to address these.

3.14 We have worked alongside government, the National Cyber Security Centre (NCSC) and industry to develop a sector-wide cyber security strategy[10] to ensure the civil nuclear industry continues to effectively manage and mitigate cyber risk in a collaborative and mature manner, is resilient in responding to and recovering from incidents, and achieves an effective and inclusive culture. Consequently, our priority in the forthcoming period is to increase our focus on regulating cyber protection capabilities, particularly at the more complex and hazardous sites.

3.15 We have now completed the benchmarking exercise of supply chain (List N[11]) dutyholders, gaining significant understanding from around 140 assessments on how sensitive nuclear information is handled. To further enhance our capability in this area, we have developed an online portal that will be populated by dutyholders. The portal will provide a basis for targeting and proportionality of regulatory activity across the supply chain, enabling us to implement a more effective and efficient approach to interventions, and allowing us to adopt a more risk-informed and intelligence-led approach to inspections.

10 Civil nuclear cyber security strategy 2022 – www.gov.uk/government/publications/civil-nuclear-cyber-security-strategy-2022

11 List N refers to the clearance that companies are required to hold before handling Sensitive Nuclear Information (SNI) classified at OFFICIAL-SENSITIVE or above.

Transport security

3.16 There has been no change in the levels of regulatory attention across the approved carriers. As a result of the impact of COVID-19, we have conducted fewer, better targeted inspections of non-UK-based carriers than in recent years. During the forthcoming period, we will increase our attention on international carriers, supported by our contribution to the European Nuclear Security Regulators Association transport security working group, which enables the sharing of regulatory intelligence.

3.17 One noteworthy item has been our leading role in ensuring the UK understands and manages the cyber security risks of the new European Train Control System (ETCS), which affects the management of all rail traffic across the UK.

Safeguards

3.18 Over the reporting period, we have enabled the UK to meet its international safeguards obligations, with all required reporting IAEA delivered on time. We have worked closely with safeguards operators throughout the period to assist them in adjusting to the new regime, and to ensure that our regulatory expectations are clear.

3.19 Under the UK's Voluntary Offer Agreement (VOA) with the IAEA, the UK is obliged to facilitate IAEA safeguards inspections and site visits at facilities in the UK that have been designated for that purpose. Throughout the period, we worked with dutyholders to facilitate IAEA safeguards inspection activities with significant success. We have also successfully facilitated the installation of IAEA safeguards equipment at UK sites where required.

3.20 The COVID-19 pandemic presented significant challenges to the delivery of IAEA safeguards activities in the UK. We worked with IAEA, BEIS and dutyholders to ensure that all necessary actions could be undertaken. The flexibility and adaptability shown by all parties meant that all planned IAEA safeguards activities in the UK were completed.

3.21 As part of our domestic safeguards regime, we targeted our inspection and assessment activities across the major safeguards dutyholders. We completed several assessments of dutyholder's accountancy and control plans and basic technical characteristics documents. This is part of our outcome-focused approach of the industry utilising our safeguards principles as set out in our guidance on Nuclear Material Accountancy, Control and Safeguards. Overall, we are content that dutyholders arrangements meet our expectations in these areas. We are working constructively with a small number of dutyholders to address gaps in their accountancy and control plans and basic technical characteristics documents in a timely manner.

3.22 Under the Nuclear Safeguards (EU Exit) Regulations 2019 (NSR19), qualifying nuclear facilities with limited operation (QNFLOs) are eligible for a reduced nuclear material accountancy reporting regime. Throughout this reporting period, we have addressed a large volume of applications from these organisations for the reduced reporting regime and continue to encourage the small number of eligible organisations, who have not yet applied, to do so. For these organisations, we employ the same regulatory framework to achieve compliance with NSR19, adopting a proportionate and targeted approach.

Case study 2

Safeguards: One Year of Operations

We became the State Regulatory Authority for safeguards from 31 December 2020, following the UK's departure from Euratom. Implementing the new domestic safeguards regime to enable the UK to meet its international safeguards obligations was a significant challenge, particularly considering the impact of the COVID-19 pandemic on both our preparations to take on the new responsibility and on our delivery.

We implemented a robust nuclear material accountancy system, which has enabled us to analyse and process hundreds of nuclear material accounting reports from across the civil nuclear estate and submit these to the IAEA in accordance with the UK-IAEA safeguards agreements.

We developed and implemented a new IT platform – Safeguards Information Management and Reporting System (SIMRS) – as part of the UK's new safeguards regime. SIMRS is the secure central repository of nuclear material accounting declaration data submitted by UK operators under the requirements of NSR19. SIMRS transforms and exports this data into the agreed content and format for reporting on to the IAEA to meet international safeguards obligations.

We have a mature programme of work and the necessary measures in place with our suppliers delivering ongoing development of the SIMRS software through scheduled releases. These continue to address identified issues and a prioritised set of ongoing enhancements to deliver technical capability improvements and value for money.

We have effectively facilitated IAEA safeguards activities in the UK and have delivered our planned assessment and inspection activities. The IAEA Annual Review of Safeguards Implementation in the UK was completed in November 2021. The primary purpose of the review is for the IAEA to assess whether the UK is meeting its international safeguards obligations in accordance with its international agreements.

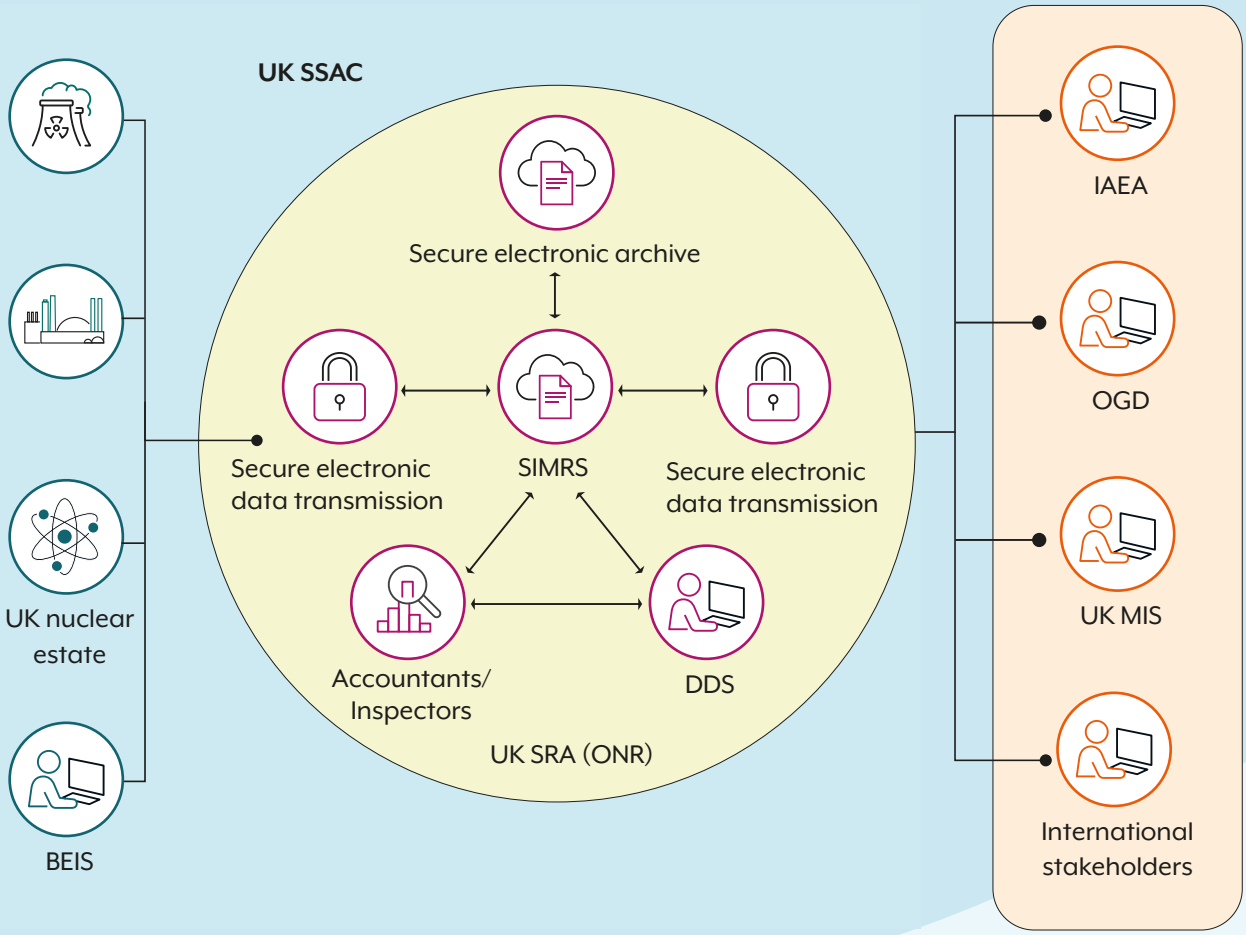
We are pleased to report that the IAEA delegation confirmed that the UK had met all its necessary reporting and facilitation requirements, noting that we had exceeded expectations in our first year.

The new domestic safeguards regime is a major change in safeguards regulation, that the civil nuclear industry in the UK has seen for decades. Owing to a collaborative approach between all major stakeholders, the civil nuclear industry in the UK has responded well with no major compliance challenges. Our safeguards inspectors continue to work in an enabling manner in collaboration with nuclear safety and security colleagues, to enable dutyholders to make the necessary improvements in areas where there are compliance gaps. These tended to be mainly in the quality of the Accountancy and Control Plans (ACPs), safeguards equipment obsolescence issues and longer-term resilience of safeguards specialist staff.

We have delivered our safeguards international engagement strategy, taking advantage of opportunities to increase our visibility as a domestic safeguards regulator and to engage and influence other nuclear operators, state regulatory authorities, and international safeguards regulators.

In the coming year, we will seek to build on our work to date, maintaining our focus on further developing and maturing our capability alongside delivery of our regulatory activities.

Information flow through ONR's Safeguards Information Management and Reporting System (SIMRS)



Key

UK SSAC – UK State System of Accountancy for and Control of Nuclear Material
BEIS – Department for Business, Energy and Industrial Strategy
UK SRA – UK State Regulatory Authority
SIMRS – Safeguards Information Management and Reporting System
ONR DDS – ONR Divisional Delivery Support
IAEA – International Atomic Energy Agency
OGD – Other government departments
UK MIS – (UK Mission) in Vienna

Safeguards in numbers

20+

safeguards reports on UK behalf to IAEA and other international partners' behalf

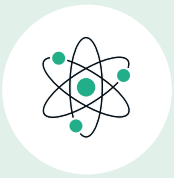
10

safeguards ONR assessments of Accountancy and Control Plans (ACP) and Basic Technical Characteristics (BTC)

24

IAEA safeguards inspections facilitated at UK selected facilities

1,182



nuclear material accountancy reports delivered to IAEA

41

safeguards inspections undertaken at UK operator premises by ONR

615

internal ONR reports including assessment and decision records

4 New reactors

Summary of performance

4.1 In addition to our regulation of new nuclear projects at Hinkley Point C (HPC) and Sizewell C (SZC), we have concluded the Generic Design Assessment (GDA) of the UK HPR1000 reactor technology and supported government in its thinking and policy development around new nuclear reactors. We are content with the new reactor sector's performance across our purposes; this is supported by the lack of significant events at HPC, its performance status of routine regulatory attention, and the absence of regulatory issues arising from the GDA. We continue to engage internationally, and see potential in greater collaboration, on safety and security, between nations interested in developing the same nuclear reactor technology on similar timescales.

4.2 Our aim has been – and will continue to be – to provide proportionate, well targeted regulation, and sound advice and expert input to enable government and new nuclear developers to achieve their ambitions in the UK. Through this enabling approach, we intend to maximise the benefits of our innovation work to streamline, simplify and accelerate our processes where we can, while maintaining the high standards of safety, security, and safeguards that we expect of the industry.

UK HPR1000 GDA

4.3 Step 4 of GDA for the UK HPR1000 concluded in January 2022, following a rigorous five-year assessment, resulting in a Design Acceptance Confirmation (DAC) being issued to the requesting party for the UK HPR1000 generic design. There were no GDA issues attached to the DAC, which is a national regulatory position that the reactor is suitable for deployment in the UK (subject to licensing, site-specific assessment and permissioning).

4.4 A comprehensive 'review, learn and improve' exercise has been carried out to inform future GDAs. Recommendations included ensuring there is a consistent approach used across the safety, security and environment cases, demonstrating robust configuration control of the safety case, and ensuring greater collaborative working across the technical reviews.

Advanced Nuclear Technologies (ANTs)

4.5 We have continued to develop our internal capability and engage internationally to provide an appropriate regulatory framework for the development of ANTs, including Small Modular Reactors (SMRs) and Advanced Modular Reactors (AMRs) in the UK.

4.6 We are active in several international arenas, notably the IAEA's SMR Regulators' Forum, and have strengthened direct links with overseas regulators to explore areas for greater regulatory co-operation and harmonisation.

4.7 Following a consultation process, which was informed by our review of prospective ANTs reactor designs, BEIS announced its decision to support the development of a High Temperature Gas Reactor (HTGR) demonstrator by the mid-2030s. As an enabler for this, we have provided support to BEIS for a competition aimed at helping industry put forward ideas for the size, type, cost, and delivery method for a HTGR demonstrator.

Rolls Royce SMR GDA

4.8 We provided input to the assessment of the application to commence GDA from Rolls-Royce SMR Ltd, and we were asked by BEIS to commence the work earlier this year. The modernised and simplified three-step GDA process, applying learning and efficiencies identified from previous GDAs, is scheduled to commence for the Rolls-Royce SMR design in April 2022.[12]

4.9 Although the technology for pressurised water reactors is well understood, this will be our first assessment of a modular reactor that will be extensively manufactured and commissioned in a factory setting. Also, it will be the first GDA where the reactor has not been assessed by another regulatory regime. The objective of the first step of this GDA will be to explore these issues and develop appropriate scopes and schedules for the assessment.

Hinkley Point C (HPC)

4.10 During the reporting period, our interventions and assessment of HPC focused on the start of Unit 1 bulk mechanical, electrical and heating, ventilation and air conditioning (MEH) component installation. Following in-depth assessment and inspection we were satisfied with NNB GenCo (HPC)'s readiness to start this activity and, as a result, the licence instrument permissioning this activity was issued in November 2021.

4.11 This marks the start of the transition from predominately civil engineering to installation. It will take three years to complete this phase, which will see a significant increase in work areas, interfaces, and complexity on site. We have revised our regulatory strategy and increased our presence on the site in recognition of the increased complexity and activity.

4.12 We have continued to oversee activities on and off the HPC site to provide oversight of construction and fabrication activities, and manufacture of components across the supply chain to ensure these meet the highest quality standards. We have also continued to provide oversight of conventional health and safety, where performance remains generally good. In cases where shortfalls were identified, enforcement action has been taken, and in all cases NNB GenCo (HPC) and its contractors have responded positively and made improvements where required. Based on this performance, we intend to maintain a routine level of regulatory attention at this stage of the project.

4.13 We have engaged regularly with overseas nuclear regulators in China, Finland and France as well as NNB GenCo (HPC) to discuss and understand the Taishan fuel operating experience, including any implications for HPC. NNB GenCo (HPC) has made good progress in understanding the cause of the fuel rod clad failures in Taishan, and it is anticipated that it will propose modifications to the fuel assembly design over 2022/23 to address the learning. This will be subject to our regulatory scrutiny, ahead of the start of manufacture of the fuel assemblies.

4.14 From a security perspective, we have concluded that the project has the capability and capacity to manage the current construction phase and that it remains aligned with our regulatory expectations. The project security plan has been revised by EDF to reflect a recent vital area study and the proposed development of the future security regime and is currently subject to ONR assessment.

12 https://news.onr.org.uk/2022/04/rolls-royce-smr-limited-to-enter-step-1-of-gda/

4.15 Despite the challenges of a dynamic construction project, HPC has provided satisfactory assurance that it continues to comply with the approved security arrangements in accordance with NISR 2003. Therefore, from a security perspective, we have also maintained a routine level of regulatory attention.

Sizewell C (SZC)

4.16 We have made significant progress in assessing the NNB GenCo (SZC) nuclear site licence (NSL) application, which was submitted in June 2020. This has included detailed assessment of the application and the supporting evidence, focused on site suitability as well as an intensive programme of interventions to gather evidence on the capability of NNB GenCo (SZC) to hold a NSL and the adequacy of their licence condition arrangements. We remain on target to decide on whether to grant a nuclear site licence in July 2022.[13]

4.17 We continue to engage with BEIS, Ofgem and the Environment Agency (EA) on the development of legislation and guidance relating to a Regulated Asset Base (RAB) model, which provides a framework for financing new nuclear. Our focus is to ensure our independent regulation is unhindered in the context of RAB, an effective working relationship with other regulators is maintained, and safety and security remain paramount.

4.18 Capacity and capability for security within the project is increasing, and we expect the operational tempo to increase throughout 2022. The approved construction site security plan sets out the security arrangements for the current phase of the project, meeting the requirements of NISR 2003 to ensure that this construction activity does not jeopardise the security of the adjacent Sizewell B site. NNB GenCo (SZC) has maintained compliance with those security arrangements.

4.19 Furthermore, NNB GenCo (SZC) has submitted its first site security plan, to mitigate the risk of malicious introduction of latent defects and to demonstrate organisational capability to transition to an operational facility. This captures learning from the HPC project, utilising the principle of intelligent replication to support its site licence application, which is currently[14] subject to regulatory assessment.

Bradwell B (BRB)

4.20 As a result of government focus on the SZC development, our small HPR1000 licensing team's engagement with BRB was limited and subsequently paused during the reporting period.

13 Update provided outside the reporting period: Progress update: Sizewell C site licence – Office for Nuclear Regulation – News Office for Nuclear Regulation – News (onr.org.uk)

14 At the time of publication of this report, the arrangements in this plan had been judged as adequate against regulatory expectations in our Security Assessment Principles and we anticipate that formal approval will be granted imminently. www.onr.org.uk/syaps/security-assessment-principles.pdf

5 Operating facilities

Summary of performance

5.1 We continue to regulate the operating nuclear power stations and the safety of defence sites that form the integral capability for the delivery and maintenance of the UK's nuclear deterrent.

5.2 These sites are of strategic importance because of the essential contribution made by civil reactors to the security of UK energy supply, and of defence sites to delivering national defence policy (for example, UK Continuous At Sea Deterrent). This means that much of our work in this area is of interest across a range of stakeholders.

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

- **Nuclear licensed sites:** which we regulate in accordance with the standard nuclear site licence, including the Atomic Weapons Establishment (AWE) sites, Devonport Royal Dockyard Limited (DRDL), Rolls Royce Marine Power Operations Limited (RRMPOL), BAE Systems Barrow and Rosyth Royal Dockyard Ltd (RRDL). In the sole instance of AWE Plc, ONR regulates against licence conditions up to a point where the design of a weapon may be affected.
- **Authorised sites:** which 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, under the Ministry of Defence (MoD). In these situations, the sites are Authorised and regulated by the MoD. However, we are appointed as enforcing authority for the Health and Safety at Work Act (HSWA) 1974 and its relevant statutory provisions; and
- **Nuclear warship sites:** for which the Health and Safety Executive (HSE) is appointed as the enforcing authority for HSWA. We are the enforcing authority for the enforcement of Radiation (Emergency Preparedness and Public Information) Regulations 2019 (REPPIR19) and the Ionising Radiations Regulations 2017 (IRR17).

5.4 During this period, significant progress was made in delivering safety improvement plans at AWE Burghfield and Dungeness B, allowing both sites to move from enhanced to routine regulatory attention. We have also strengthened relationships with MoD, positioning us well to achieve a pragmatic and enduring solution to the defence vires review work.

5.5 The review of regulatory vires across the defence sector was a significant legal and policy review to provide assurance to the CNI that ONR is discharging its statutory safety purposes in an appropriate, full, transparent, and demonstrable manner. The review concluded in November 2021, providing the necessary assurances, and it also ensured all parties had a greater clarity of each other's areas of responsibility.

5.6 The review highlighted some areas where further constructive working between us and the Defence Nuclear Safety Regulator (DNSR) would be beneficial, to enable more efficient and effective regulation of the defence sector. Specific areas of regulatory activity have been identified that will benefit from this constructive approach between us and DNSR, and this will be reinforced and captured, where appropriate, as specific case-studies in the production of a new General Agreement between us and MoD.

5.7 A further output from the review has led to the creation of a pan-enterprise strategic forum, attended by senior representatives from dutyholders, MoD and regulators, that is fostering a more positive working relationship and helping to cement further our effective regulation of the sector.

5.8 Across the Advanced Gas-Cooled Reactors (AGR) fleet, there has been a wide range of challenges relating to graphite degradation and other ageing issues, notably stress corrosion cracking. Hunterston B submitted the defueling safety case, which we subsequently assessed, that will enable the station to commence defueling in accordance with its declared plans. Sizewell B responded to unexpected control rod thermal heat shield issues, and we completed a timely assessment of the safety case to enable the station's prompt and safe return to service.

Overview of performance across the reactor fleet

Dungeness B

5.9 We have overseen an extensive programme of corrosion remediation work at Dungeness B. This included wider performance improvements to address concerns about safety management and culture at the site through an extensive and wide-ranging performance improvement programme.

5.10 In February 2022, we carried out a major intervention to gather evidence concerning the current safety culture on the site. We undertook observations and interviewed staff and contractors from all levels and all safety-related functions. From this we found there had been significant improvement and strong evidence that all the criteria we had agreed with the station for exit from enhanced attention had been met. As a result, we have transferred this site from enhanced to routine regulatory attention.

5.11 EDF announced it would not resume generation at Dungeness B in June 2021. There is more to be done to ensure that future defueling operations are carried out safely, but the site is now in a much better position to achieve this. We will continue to challenge and support the station to ensure this is delivered.

Heysham 2 and Torness

5.12 These sites continue to adjust to a new operational rhythm following a safety case anomaly identified on the Fuelling Machine at Heysham 2 in February 2021. This followed an investigation relating to the fuelling machine make-up shield unexpectedly depressurising while preparing for operation. The anomaly has meant that the safety case for low power refuelling is challenged and so both sites are now shutting down each reactor every few months to refuel in depressurised conditions.

5.13 Following revised graphite data analysis, the licensee is now forecasting 2028 for the end of generation at Heysham 2 and Torness. Heysham 2 identified the first two keyway route cracks (KWRCs) on Reactor 7 during the 2021 statutory outage. The graphite brick design at Heysham 2 and Torness is different from other AGRs and there is potential for the creation of debris following the formation of KWRCs. The site carries out regular inspections of the graphite core during outages to support continued operations and there will be a planned increase in the graphite core inspections at Heysham 2.

5.14 The inspection findings are currently within EDF predictions; plant improvements and safety case work to support the ageing graphite cores continues and we have oversight of the programme of work which is progressing to plan.

Heysham 1 and Hartlepool

5.15 In July 2021, a National Grid current transformer located offsite at Heysham failed. The resultant loss of 400kV offsite supplies caused both Heysham 1 reactors to automatically shut down (trip) and enter a period of post trip cooling, powered by independent onsite supplies. We were on site at the time and observed site teams responding to the incident.

5.16 Although effective post trip cooling was automatically established and the reactors were safely shutdown, several post trip safety-related issues were revealed, which were adequately managed by personnel at the site. We investigated the event, which was rated as INES level 2, and completed a return to service readiness inspection to gain assurance that the licensee had implemented reasonably practicable improvements to systems and arrangements in preparation to restart both reactors.

5.17 We issued an enforcement letter to Hartlepool following a routine compliance inspection of the station's nuclear baseline, the latter identifies the numbers and capability of people needed to ensure the safe operation of the site. During this inspection, we considered there to be shortfalls in the station's management of change process and the management of organisational capability.

5.18 We will ensure that the associated regulatory issues are appropriately progressed, and a follow up inspection will take place during 2022 to confirm the necessary improvements have been implemented in this area.

Hunterston B

5.19 Hunterston B has a long-standing good safety record and continued to demonstrate a strong nuclear safety performance during the year. In April 2021 we approved a final six-month period of power generation for Reactors 3 and 4. On 26 November 2021, Reactor 3 ceased operating and Reactor 4 followed on 7 January 2022. Both units continued to operate safely and compliantly throughout their final operating periods.

5.20 Our programme of activity for Hunterston B during 2021/22 has focussed on the safe and permanent shutdown of the reactors, the readiness to commence defueling, the regulation of the efficient transfer of the site licence to the NDA, and to monitor development of the Hunterston B decommissioning plan.

Hinkley Point B

5.21 Our inspections at Hinkley Point B have not identified any significant issues during the period requiring formal enforcement action. Hinkley Point B has a planned end of generation date of July 2022.[15] During the reporting period there have been a small number of unplanned trips, which may lead to the core burn up limit not being reached and may result in a short extension to generation.

5.22 A significant proportion of our effort on this site has been directed towards the preparations to move the site from power generation operations to the defueling stage. This required an updated safety case, which was agreed in March 2022. This safety case requires modifications to the facility before defueling can commence, the majority of which will take place in a pre-defueling outage once generation has ceased.

Sizewell B

5.23 Overall, we consider Sizewell B to have a good compliance record as regards health and safety legislation and requirements of the nuclear site licence conditions, confirmed through compliance and system-based inspections.

15 Hinkley Point B moved into end of generation on 1 August 2022.

5.24 Nevertheless, a refuelling outage had to be extended from April to August 2021 due to issues relating to a failure of the auxiliary cooling water (ACW) inlet pipework and the discovery of a detached thermal sleeve. EDF NGL's robust demonstration that the issues had been adequately resolved was a key factor informing our decision to grant consent to restart of the reactor.

Security and Safeguards performance

5.25 Although EDF's performance in protective security has been generally adequate, we have identified some shortfalls requiring further attention across other security disciplines. Given the limited resources within EDF to address the identified issues and the significant additional effort required by us to bring the dutyholder back into compliance, we have determined that EDF be subject to an enhanced level of regulatory attention for security.

5.26 In safeguards, we targeted our regulatory attention on:

- embedding the new ONR regulatory framework at EDF nuclear licensed sites
- ensuring that EDF sites continue to provide timely and accurate submissions of their nuclear material accountancy reports across the fleet
- influencing improvements to the accountancy and control plans and basic technical characteristics (BTC) to ensure they are fit for purpose and meet legal requirements

5.27 EDF has responded constructively and professionally to progress areas where gaps have been identified. We continue to work with EDF on several issues identified through inspection, including changes to their reporting system, non-fuel fissile material, and competence management of safeguards personnel.

Overview of performance across the defence sites

5.28 The Defence Nuclear Safety Regulator (DNSR), part of the MoD's Defence Safety Authority, provides assurance to the MoD on nuclear safety for defence facilities where legal exemptions from regulation under the civil nuclear regulatory regime apply, and for the transport of defence related radioactive materials. Security is regulated by the Defence Nuclear Security Regulator. We have continued to work closely with both these bodies to ensure proportionate and effective and joined up regulation.

Aldermaston

5.29 Areas of significant challenge at Aldermaston include ageing facilities management and facility upgrades. During the reporting period, improvements have been demonstrated in the timely delivery of adequate safety documentation, although further improvements are still to be realised.

5.30 Overall, Aldermaston is making improvements in line with our expectations, with delivery of outcomes on AWE's Structured Improvement Programme expected to be realised throughout 2022 and 2023. A suitable period of sustained improvements will be sought before Aldermaston is considered for a move to routine regulatory attention for safety performance.

Burghfield

5.31 Due to demonstrable and sustained progress in safety performance, and with the leadership team showing a proactive approach to safety management and culture, the AWE plc Burghfield licensed site has returned to routine regulatory attention. We will maintain our enabling approach to ensure that the safety improvements demonstrated at Burghfield continue to be sustained and will continue to hold Burghfield to account should it fall short of expected standards.

Devonport Royal Dockyard Limited (DRDL)

5.32 DRDL is in enhanced regulatory attention for a number of safety performance reasons and is subject to a clear and agreed plan to deliver improvements in accountability for safety, maintenance of safety related equipment and sustained improvements in the safe conduct of work. The plan is being delivered by DRDL under our regulatory oversight and, to date, DRDL has demonstrated varied progress and improvement in dealing with the respective issues. We are focusing additional regulatory effort and attention on areas where progress has not been as we expected.

BAE Systems, Barrow

5.33 We have seen good progress around the small number of regulatory issues extant at Barrow, as well as good compliance against licence conditions. We have engaged successfully with the Defence Nuclear Safety Regulator (DNSR) which has provided assurance around aspects of the Dreadnought class submarine reactor plant safety.

Rolls-Royce Submarines Limited (RRSL)

5.34 The redevelopment of the Neptune test reactor has attracted a good degree of regulatory attention, as delivery of timely facility upgrades remains a significant challenge. We will continue to engage with RRSL to expedite these in as timely a manner as is practicable.

6 Sellafield, decommissioning, fuel and waste sites

Summary of performance

6.1 The Sellafield Ltd site remains a high regulatory priority and the most hazardous areas will continue to receive significantly enhanced regulatory attention for many years to come.

6.2 While safe and secure progress continues to be made with remediation of the highest hazard facilities on site, there have been some delays to hazard and risk reduction projects during the year. These result from technical difficulties and the issues associated with making complex safety cases, including making provisions for the safe retrieval and storage of radioactive waste from the Magnox Swarf Storage Silo (MSSS).

6.3 Notwithstanding this, there has been noteworthy progress over the year, including completion of a number of specialist assessments of Sellafield Ltd safety cases whereby we have agreed to allow Sellafield Ltd to:

- commence construction and installation of the SIXEP Continuity Plant in May 2021
- commence the emptying of Special Nuclear Material North SNM (N) Store 17 inventory (Phase 1 Material), which was completed by Sellafield Ltd in December 2021
- commence the Pile 1 diffuser collar demolition, which was completed by Sellafield Ltd in January 2022
- conduct active commissioning and subsequent retrievals from the Pile Fuel Cladding Silo (PFCS) in February 2022
- conduct active commissioning of the Encapsulated Product Store Waste Transfer Route for MSSS waste in February 2022

6.4 At the Decommissioning, Fuel and Waste (DFW) sites, we are satisfied that steady progress has been made with decommissioning and safe management of radioactive waste. However, almost all sites were, to some extent, affected by continued COVID-19 restrictions, with subsequent unavoidable delays to planned work. Noteworthy progress has been made in relation to DFW sites including:

- agreement to commence shaft and silo construction at Dounreay
- agreement to the LLWR Transition (LC36)
- revocation of the Nuclear Site Licence at the Imperial College Reactor Centre site near Ascot

Sellafield Ltd dutyholder performance

Legacy Ponds and Silos

6.5 Sellafield Ltd has continued to make progress with waste and spent fuel retrievals from the legacy ponds, and with its preparations for waste retrieval from the legacy silos.

6.6 Removal of radioactive waste sludge from the Pile Fuel Storage Pond (PFSP) and First-Generation Magnox Storage Pond (FGMSP) has continued, along with preparations for further retrievals of the more challenging waste and fuel-based inventories in the ponds. There have been some delays to near-term milestones due to the complexity of work, uncertainty associated with dealing with the legacy hazard and supply chain quality, and delivery issues – notably the availability of Self Shielded Boxes (SSB) needed for safe recovery and storage of some material from the ponds. We are, therefore, maintaining regulatory scrutiny of Sellafield Ltd's work in this area to ensure it resolves these issues and secures a reliable supply chain. There is recent evidence of improvement in the SSB quality and supply issues.

6.7 We are in the final stages of assessing Sellafield Ltd's request for our agreement to commence retrieval of miscellaneous beta gamma waste from MSSS. We expect to be able to decide on issuing agreement in early April 2022.[16] Retrieval operations are planned to start soon after agreement.

6.8 In 2020, we reported on leakage of contaminated water ('liquor') from MSSS. While we remain satisfied that this poses a very low risk to workers and the public, we asked Sellafield Ltd to ensure effective management and mitigation of the leak and to enhance its safety case in this area.

6.9 We consider that Sellafield Ltd's programme of work to address regulatory concerns is progressing well and have gained confidence from engagements and responses to date that Sellafield Ltd will be able to address regulatory concerns to our satisfaction. Throughout, we have worked collaboratively with the Environment Agency, sharing relevant intelligence, and forming common understandings of our respective regulatory concerns and means of addressing them. All responses to regulatory concerns are due to be delivered during 2022/23.

6.10 Sellafield Ltd continues to make progress in preparing for the operation of a new facility, known as the Box Encapsulation Plant Product Store/Direct Import Facility (BEPPS/DIF), for long-term storage of waste from MSSS and PFCS. Although challenges in constructing this storage facility have delayed its commissioning and operation, we are satisfied that Sellafield Ltd has adequately resolved these matters. We expect the facility to request commencement of active commissioning in October 2022.

6.11 Given the degraded condition of these facilities, containment safety functions that fall below the standards expected, and their significant radioactive inventory, these facilities will remain in 'significantly enhanced' attention for the foreseeable future.

Special Nuclear Material (SNM) facilities

6.12 Sellafield Ltd has continued to make good progress with improvements to, and remediation of, some of its ageing SNM facilities with the Finishing Line No. 3 containment wall and electrical distribution upgrade projects nearing completion, and retrieval of SNM containers having commenced from one of Sellafield Ltd's stores.

6.13 There is a continued need to develop facilities to treat SNM containers, in particular packages transported from Dounreay. We will maintain focus in this area to secure the timely availability of this capability.

6.14 Notwithstanding the overall progress made in this area, the addition of Dounreay material to Sellafield Ltd's own inventory has increased the overall risk and made the totality of the remediation work more onerous. We will therefore continue to attach a significantly enhanced level of regulatory attention to this area.

16 We have completed a rigorous assessment of Sellafield's safety case and we're satisfied that it is now safe for retrievals to commence from the Magnox Swarf Storage Silo (MSSS). We granted permission for this in April 2022, following on from the decision to permission retrievals from the Pile Fuel Cladding Silo. Originally constructed in the 1960s and subsequently extended, the MSSS is one of the oldest facilities at Sellafield. The silo poses one of the most significant hazards to safety on the Sellafield site and safely removing the waste from this ageing facility and placing it into modern storage facilities is both a national and an ONR priority. Commencing retrievals is a significant step forward in reducing the long-term risk at Sellafield, and represents a major regulatory milestone for ONR. Removing the full inventory of waste from MSSS is expected to take around 35 years. Once the waste is removed it will be placed into modern storage facilities on the site, pending long term disposal in a geological disposal facility.

Other Sellafield facilities

6.15 **Reprocessing:** The Magnox Reprocessing Facility (MRF) operated safely and continued to reprocess as much of the spent fuel as was reasonably practicable. The MRF has reprocessed almost 55,000 tonnes of spent nuclear fuel from the Magnox power stations across the country including all the spent nuclear fuel from the Dounreay Fast Reactor. The facility is scheduled to cease reprocessing in July 2022,[17] at which point it will move into post operational clean-out and decommissioning.

6.16 **High level waste plants:** The Waste Vitrification Plant continues to vitrify the site's highly active liquor (HAL) stocks, although performance has been impacted by the COVID-19 pandemic and plant reliability issues. As of the end of 2021, HAL stocks at Sellafield Ltd were at the lowest level, in terms of both volume and heat load, since 2000. We continue to retain oversight of the HAL stock levels and vitrification performance.

6.17 **Emergency preparedness and response:** Sellafield Ltd adequately demonstrated its safety and security arrangements with a Level 1 Emergency Exercise in October 2021. We continue to engage with Sellafield Ltd as it embeds the learning from this exercise.

6.18 **Analytical services:** The existing Analytical Services facility dates to original operations on the site and is degrading. The facility is, currently, fundamental to ensuring safe and secure operations on the site and provides essential support for hazard and risk reduction. Key drivers for the 'enhanced attention' level are the legacy asset condition, the key operational role that Analytical Services provides to the site, and the remaining importance associated with timely delivery of the new replacement facility to ensure continued hazard and risk reduction.

6.19 **Industrial safety:** Performance in this area has been variable this year and is a key driver for the 'enhanced attention' level. We have seen improvements in electrical safety, but formal enforcement was required across a range of other areas.

6.20 **Incidents on the site:** There has been one INES Level 1 (anomaly) event this year, relating to a lack of sensitivity of the Magnox Reprocessing Plant Criticality Incident Detection and Alarm System (CIDAS). Sellafield Ltd has made the relevant plant modifications in line with our enforcement letter requirements.

6.21 Notwithstanding legal obligations, we have observed an open and positive reporting culture of nuclear and radiological safety incidents and events at Sellafield Ltd, which we welcome and strongly encourage.

6.22 **Investigations and enforcement:** We have conducted four investigations in the year at Sellafield Ltd into:

- a fall from height in the Low Active Cell of Magnox Reprocessing Plant
- a case of hand and arm vibration syndrome
- injuries sustained during use of scaffolding stairs outside of a building
- an electrical incident at the Waste Vitrification Plant (WVP) Calciner

17 Magnox Reprocessing Plant safely reprocessed the final box of spent fuel from the UK's fast reactor programme being stored in the plant's ponds in June 2022: www.gov.uk/government/news/magnox-reprocessing-plant-achieves-final-milestone

6.23 Two of the investigations resulted in enforcement letters. Two investigations are ongoing at the time of writing this report. However, we have issued one improvement notice in relation to the ongoing investigation into the fall from height in the Low Active Cell of the Magnox Reprocessing Facility. We have also issued 19 enforcement letters this year, relating to incidents and inspection findings on the site.

6.24 **Dutyholder compliance:** We have undertaken planned compliance inspections against Licence Conditions, IRR17, and other relevant legislation. Over 90% of inspections were rated green, with no formal action required. Nine inspections were rated amber for which we sought improvement, and no inspections were rated red.

6.25 When appropriate during inspections, we have sought assurance of compliance with Sellafield Ltd's COVID-19 control measures. No matters were identified that required formal action by us.

Security and Safeguards performance

6.26 We pro-actively ensure our security regulatory activity supports high hazard and risk reduction (HHRR) activities. Taking an enabling approach and after careful assessment, we have approved innovative arrangements to allow more nuclear material stores to be opened concurrently, directly supporting HHRR, while ensuring the site can meet all required security outcomes.

6.27 Although Sellafield Ltd's performance in protective security has been generally adequate, a number of shortfalls requiring further attention have been identified relating to cyber security. Therefore, Sellafield continues to be subject to 'significantly enhanced' regulatory attention and we have issued targeted formal enforcement to ensure that shortfalls are addressed and to closely monitor progress. We have ensured this formal enforcement is complementary to HHRR.

6.28 During the reporting period, we have sought to integrate safeguarding activities with our other core purposes, supporting HHRR activities while ensuring compliance with nuclear safeguards regulations and continued facilitation of IAEA activities in an efficient and effective manner. Overall, Sellafield Ltd has continued to deliver satisfactory safeguards performance throughout the period and engaged constructively with us in addressing any gaps in compliance that have been identified. We have also worked closely with Sellafield Ltd to facilitate installation of IAEA safeguards equipment, which is essential for allowing the IAEA to implement their safeguards verification measures at Sellafield.

Case study 3

Pile Fuel Cladding Silo Remediation and ONR's Regulatory Approach

Background

The Pile Fuel Cladding Silo facility dates from 1950 and consists of a reinforced concrete structure configured as a series of 6 compartments containing approximately 3,200m^3 of intermediate level waste (ILW). The ILW consists of fuel cladding and experimental residues that were tipped into the compartments through access points in a roof tunnel (Figure 1), these were subsequently sealed. New access points were recently created in the silo walls, each sealed with a high integrity containment door to maintain an argon atmosphere and nuclear safety (Figure 2).

Our regulatory approach

The safe and effective removal of legacy radioactive waste from the PFCS, in a timely manner, is a priority risk reduction project. In addition, Sellafield Ltd designated the first box of waste delivered to store as a key decommissioning milestone.

The delivery of a retrievals capability has been extremely challenging as a waste retrievals infrastructure needed to be constructed against an ageing facility and an alternative approach to management of untreated radioactive waste was required.

We applied an enabling regulatory approach by engaging early with Sellafield Ltd to understand its proposals and the challenges associated with waste disturbance during retrievals and safe storage. We assessed Sellafield Ltd's alternative ILW approach at a strategic level and have worked closely with Sellafield Ltd to ensure that the deployment of this approach does not create a future legacy.

Sellafield Ltd has applied a staged approach in delivering its retrievals capability and we have assessed certain stages to ensure that risks are being reduced so far as is reasonably practicable and provide regulatory advice and guidance where appropriate.

Preparing for first waste retrieval

To retrieve the waste, an argon-inerted retrievals module is positioned next to a compartment and the sealing door opened (Figure 3). The retrievals module will then, temporarily, become an extension to the silo, allowing the waste to be retrieved while maintaining the inert atmosphere. The waste will be placed in purpose-built 3 m^3 waste containers (Figure 4) before being transported to a storage facility on the Sellafield site.

The waste retrieval process and infrastructure has been designed to achieve a low oxygen environment; however, it is recognised that the waste retrieval process will increase the risk of a waste fire which could potentially result in a release of radioactivity. This is because the waste will necessarily be disturbed as the mechanical retrieval process is undertaken, which has the potential to create conditions for waste ignition.

Consequently, we have engaged with Sellafield on this project for several years and have assessed the reliability of current safety systems and the enhancements to the structural integrity of the silo. We have also undertaken assessment of the waste retrievals process to ensure it is fit for purpose to enable timely delivery of the decommissioning programme, while minimising the risks in so far as is reasonably practicable while this work is undertaken.

In addition to the robust argon inerting system and constant monitoring of the interior of the silo, Sellafield Ltd has implemented additional firefighting capability ahead of retrievals from the silo. This provides a further independent safety measure against a fire (involving PFCS waste) propagating. As part of the permissioning activities, we also observed a facility exercise that demonstrated the adequacy of Sellafield Ltd's emergency response capability when dealing with an event at PFCS.

We granted permission to conduct active commissioning and commence waste retrievals from compartment 5 in February 2022. This first phase of waste retrievals will allow Sellafield Ltd to increase its understanding of the characteristics of the waste and to refine the retrieval method into a sustainable and efficient longer-term solution to support retrievals from the other compartments.

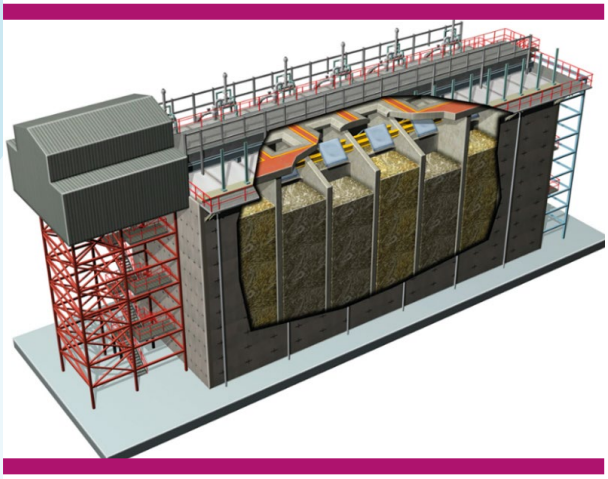


Figure 1: Pile Fuel Cladding Silo (PFCS)

Figure 2: PFCS doors ready for retrievals

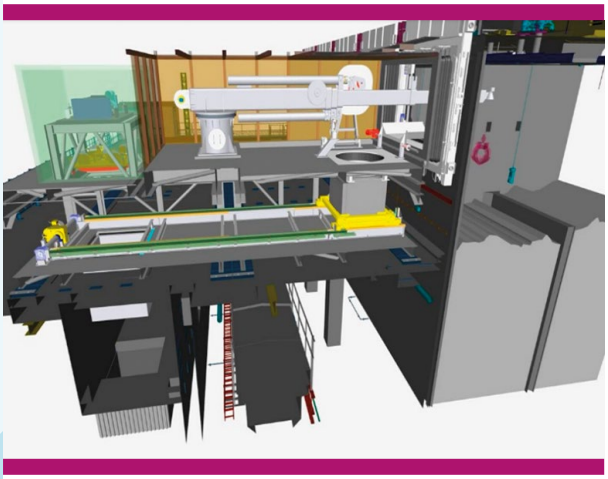


Figure 3: Retrievals mechanism

Figure 4: Waste container

Decommissioning, fuel and waste sites

Dounreay

6.29 Dounreay Site Restoration Ltd (DSRL), has continued to make steady progress with its decommissioning programmes. In 2021, the NDA announced plans to transfer management of the Dounreay site to Magnox Ltd in March 2023. We have now received the application to re-licence the site to Magnox Ltd and have begun our consideration and analysis of the application.

6.30 DSRL continues to make good progress in removing and shipping breeder fuel from the Dounreay Fast Reactor to Sellafield Ltd. By March 2021, approximately 75% of the fuel had been safely removed from the reactor core. In the Prototype Fast Reactor (PFR), DSRL successfully removed the final pool of residual bulk liquid metal coolant from a part of the reactor pressure vessel that is very difficult to access. This represents an important milestone for decommissioning at PFR.

6.31 During this period, we released a regulatory hold-point to allow DSRL to commence concrete pouring as the initial stage in constructing the facilities necessary to retrieve and package the legacy material disposed to the shaft and silo many decades ago. This is an important hazard and risk reduction project for the site, after many years of work to develop a safe and reliable means of waste removal and packaging.

6.32 We continue to focus on the licensee's ability to maintain adequate organisational capability to safely deliver its workstreams and judge DSRL's safety performance to be adequate.

6.33 We also judge DSRL's security performance to be adequate. We have worked closely with DSRL, in an enabling manner, to support development of innovative plans for the offsite transport of nuclear material.

6.34 Broadly, DSRL has continued to deliver sufficient safeguards performance throughout the period and has engaged constructively with us in addressing any identified shortfalls in compliance.

Magnox Limited sites

6.35 Decommissioning work has continued safely on the 12 Magnox Ltd (ML) licensed sites. The principal hazard reduction activity on most sites is the retrieval and packaging of Intermediate Level Waste into modern storage facilities, pending disposal routes becoming available. Our inspections and assessments have confirmed that ML continues to meet the required safety standards.

6.36 The preferred approach for decommissioning continues to be a rolling programme based on site specific strategies, beginning with Trawsfynydd, the lead site for early dismantling.

6.37 At Winfrith our site inspections have confirmed that safe progress continues to be made with decommissioning both the Steam Generating Heavy Water Reactor (SGHWR) and the Dragon facility. At SGHWR, ML and its sub-contractors are progressing with their preparations to cut-up and remove the reactor core remotely. We continue to assess the safety case and have released a regulatory hold-point to allow civil construction work to commence.

6.38 Good progress has also been made at Dragon where active commissioning is planned to commence in the second half of 2022 and work on core dismantling in 2023.

6.39 The regulatory attention level for security for Magnox corporate has reduced from an enhanced to routine level of regulatory attention. Both Harwell and Berkeley are in enhanced regulatory attention for security. This reflects the increased work required by us to assess revisions in the site's security plans resulting from hazard and waste reduction work on the site.

6.40 Magnox Ltd's licensed sites have significantly revised their security plans and have agreed a revised timetable to submit these for approval in the next reporting period.

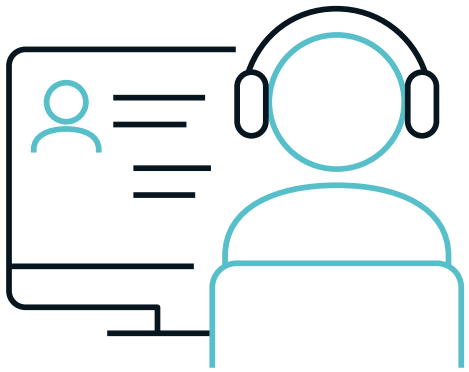
6.41 Overall, Magnox Ltd sites have continued to deliver adequate safeguards performance with some minor gaps in compliance, which are being addressed.

6.42 Magnox Ltd continues to make steady progress with the relicensing of Dounreay site into Magnox Ltd with the timeframe of April 2023.

Fuel manufacturing sites

6.43 Regulatory attention for safeguards in relation to Urenco Capenhurst has been focused on ensuring that the Urenco ACP is fit for purpose and that the nuclear material accountancy reports are timely and accurate, as well as meeting legal requirements. Overall, we judge Urenco safeguards performance to be adequate and the dutyholder has worked constructively with us to address a small number of compliance gaps in some areas.

6.44 Parts of the Urenco Capenhurst site have been selected by the IAEA under the UK/IAEA safeguards agreement. This means that IAEA inspectors undertake monthly planned and unannounced short notice inspections at the site.



6.45 Urenco, together with the NDA, has developed a strategy to deal with the backlog of legacy cylinders on the Capenhurst site. These cylinders contain residual radioactive material (hex tails) that requires safe management. We support the strategy to deal with ageing cylinders through removing and converting the material into a more stable form for long-term storage.

6.46 Active commissioning of the new Tails Management Facility (TMF) continued throughout the period with Urenco experiencing some technical challenges, which it has systematically addressed to bring the plant to the point where it is about to enter routine operations.

6.47 Springfields Fuels Ltd produces AGR fuel, but the requirement for this will reduce towards the end of AGR power generation. Springfields has kept us informed of the future opportunities it is considering for diversifying its business, and we have provided early advice on how these might be regulated, as well as maintaining regulatory oversight of current operations and any requirements for change.

Low-level waste sites

6.48 In January 2022 the Low-level Waste Repository (LLWR) became part of the NDA's Nuclear Waste Services group, which also now incorporates Radioactive Waste Management (RWM). We assessed the change proposal and were satisfied that LLWR can retain the necessary organisational capability to fulfil the requirements of its licence.

6.49 We have successfully facilitated the IAEA inspection activities at the site during the period, despite the challenges posed by the COVID-19 pandemic. In addition, the IAEA performed a complementary access visit at the Urenco Capenhurst site under the UK/IAEA Additional Protocol (AP) in November 2021 to seek further information on the AP declaration made by the UK. The IAEA has confirmed that all safeguards objectives at the site were satisfactorily met during the period.

Delicensing sites

6.50 The Imperial College Research Reactor site near Ascot reached the end of its decommissioning stage in 2021 and Imperial College applied to have its nuclear site licence revoked. We assessed the submission, determined it met the 'no danger' criteria, and subsequently signed the licence revocation in March 2022, releasing the site for re-use.

6.51 We have continued to advise BEIS on the legislative framework for nuclear sites that are in the final stages of decommissioning and clean-up. BEIS has finalised proposals to amend the Nuclear Installations Act 1965 (NIA65) to bring the UK into line with international agreements on ending nuclear third-party liability and to provide licensees with an alternative means to using the 'no danger' criteria when seeking to have their site licence revoked. The necessary amendments to NIA65 are anticipated to proceed through parliamentary processes during 2022/23.

Geological disposal facility

6.52 The government has decided that any future Geological Disposal Facility (GDF) will be subject to the nuclear licensing regime. To facilitate the necessary legal changes, we undertook a public consultation and subsequently revised our position statement for interpreting the term 'Bulk Quantities' (from NIA65) of radioactive material for storage and its extension for disposal purposes. This was published on our website in November 2021[18] and is intended to facilitate the prescription (and, therefore, need to hold a nuclear site licence) of a GDF in a future amendment to regulations.

18 Consultation – Bulk quantities for disposal: www.onr.org.uk/consultations/2020/bulk-quantities/index.htm

7 Regulation across our integrated functions

Summary of performance

7.1 This section reports our assessment of dutyholder performance covering radioactive materials transport, Emergency Preparedness and Response (EP&R) and Conventional Health and Safety (CH&S). It also summarises the key supply chain interventions we have performed on our licensees' vendors.

7.2 Following COVID-19 disruptions, we subsequently increased our inspections of consignors and carriers of UN Class 7 (radioactive materials) goods, generally finding adequate levels of compliance with The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CGD09). This has included providing advice and, where necessary, proportionate enforcement, for example to improve arrangements for responding to transport emergencies.

7.3 Our focus for EP&R has been on inspecting all Local Authority (LA) Off-Site Emergency Plans (OSEP), which we completed at the end of 2021. We are satisfied that all plans meet the requirements of REPPIR19. Using provisions within this legislation, we have also agreed to revised testing timescales with LAs, in recognition of COVID-19 constraints. Some LAs have commenced testing of their OSEP, and we have encouraged them to also implement modular testing under REPPIR19.

7.4 Testing has revealed similar gaps across all LAs, particularly associated with absence of testing of Radiation Monitoring Units (RMUs). BEIS, working with the UK Health Security Agency (UKHSA), is considering how to further improve the provision of the national RMU capability. We will continue to engage with LAs and BEIS to understand how their plans are developing.

7.5 Increased efforts by industry are having a positive effect on CH&S performance. Continued focus is required to deliver strategic improvements in safety leadership and construction safety, particularly around sites undergoing major changes, and will therefore remain a priority – to ensure that industry initiatives continue to deliver sustainable improvements.

7.6 Our vendor inspections have targeted suppliers associated with new build and civil nuclear operations activities, who provide products or services that carry the highest nuclear safety consequences. We found several examples of good practice, but also areas requiring improvement; vendor management system arrangements, for example. These areas will be targeted in future licensee engagements and vendor inspections.

Radioactive materials transport performance

7.7 Our civil transport inspection strategy has evolved and adapted to accommodate the impact of the COVID-19 pandemic. We have successfully delivered a programme of face to face and remote inspections of consignors and carriers of radioactive material, including hospitals. The analysis of the inspection findings has given us the necessary confidence that dutyholders are generally compliant with the required safety and security standards.

Influencing improvements

7.8 We have developed guidance to support our transport inspection activities carried out at dutyholder premises and other relevant places. This will aid our inspectors in judging dutyholder compliance with the requirement to demonstrate that lower hazard category (Type A) transport package design meets all the applicable standards.

7.9 This guidance provides inspectors with relevant good practice to help them make informed regulatory judgments that are consistent with compliance inspection of The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG). The guidance may also be useful to dutyholders in determining legal requirements and our expectations.

Transport package approvals in the nuclear and non-nuclear sector

7.10 We issued 18 transport package approvals to support a broad range of transport activities. These approvals have supported the safe transport of:

- nuclear fuel, for example enriched uranium oxide nuclear fuel and uranium hexafluoride
- the return of irradiated fuel from nuclear power plants in the UK to Sellafield
- radioactive material used to support cancer treatments and industrial radiography

Significant incidents

7.11 A package containing radioactive material fell from a vehicle while in transit, the package of radiopharmaceuticals was not secured correctly in the vehicle and became loose while being transported. As a result, we served Siemens Healthcare Ltd with an improvement notice for an inadequate radiation risk assessment, which was the underlying cause of the failure to respond to the incident in a suitable way. There was no harm to the public or the environment and the consignment was subsequently retrieved, and all materials accounted for.

7.12 Following our investigation, we took enforcement action against Siemens Healthcare Ltd to secure future compliance. Siemens Healthcare Ltd fully complied with the improvement notice served after the loss of the package, in January 2022.[19]

Emergency preparedness and response performance

7.13 Following the revision of the LA OSEPs in line with requirements of REPPIR19, we have focused on reviewing the content of all OSEPs to ensure their content, including the determination of the detailed emergency planning zones (DEPZs), was compliant. This review was completed for all LAs by the end of 2021. We are satisfied that all LA OSEPs meet the requirements of REPPIR19.

7.14 There have been some delays to the usual test interval (of three years for nuclear emergency plans) because of the constraints imposed by COVID-19. However, provisions within REPPIR19 allowed local authorities to agree revised timescales with us. REPPIR19 introduced the concept of modular testing of off-site nuclear emergency plans.

7.15 COVID-19 required LAs to implement some (non-nuclear) elements of their local emergency plans. These elements would be no different to some of the equivalent modules within the off-site nuclear emergency plan. In view of this, where appropriate to do so, we encouraged LAs to consider the extent of any outstanding testing of the off-site nuclear emergency that would still be required, if justification could be provided for certain elements already demonstrated as part of their response to COVID-19.

19 https://news.onr.org.uk/2022/01/siemens-healthcare-ltd-complies-with-improvement-notice/

7.16 LAs undertook a gap analysis to identify the outstanding elements of the off-site nuclear emergency plan in addition to those implemented as part of their COVID-19 response. Broadly, our review revealed similar gaps in the testing arrangements across all LA off-site nuclear emergency plans.

7.17 The main issues identified were a lack of testing of Radiation Monitoring Units (RMUs) and a lack of demonstration of the Scientific, Technical and Advisory Cell.

7.18 We are aware of the uncertainty associated with the capability to establish RMUs, and the impact this is having on dutyholders' ability to plan for the testing of this aspect of the OSEPs. BEIS has been working with UKHSA to identify potential solutions to improve the consistency of approach, while delivering efficiencies for deployment.

7.19 We will continue to engage with both BEIS and LAs to understand how their plans to test the RMUs are developing. We took the opportunity to visit an RMU that had been set up near Glasgow as part of the wider COP26 emergency response arrangements. We shared our learning points and observations with the Local Authority Nuclear Working Group (LANWG) to ensure that some progress can be made at local level while the national arrangements continue to be developed.

Regulation of conventional health and safety

Dutyholder conventional health and safety performance

7.20 COVID-19 has continued to have a major impact on industry working patterns and practices. Following the relaxation of government restrictions, there have been higher levels of staff on nuclear sites and an associated increase in site activities. As the pandemic continues, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) reports associated with COVID-19 transmission are still being received but remain low in number.

7.21 This year's statistics generally indicate a positive trend of increased work activity but decreased rates of injuries and ill health. However, the incidence of dangerous occurrences has risen, which indicates that overall control of CH&S must remain an area of focus for both industry and regulator alike.

7.22 Additionally, although the industry-wide trend remains positive, there are some noticeable variations between sites. Although Sellafield Ltd has continued to work on improving its arrangements for CH&S, we are concerned that reportable injuries at the site have shown a marked increase this year. We are developing an intervention to assess leadership and management of CH&S risks at the site and will seek to ensure underlying contributors to events are identified and addressed.

7.23 Last year we reported on our intention to generate better CH&S data to ensure that trending and comparisons can be improved and engaged with the HSE 'discovering safety' project. Following a review, we decided to continue to enhance integration of CH&S regulatory data with that of our nuclear safety, transport safety, safeguards and security purposes.

7.24 We carried out a pilot, whereby we successfully integrated our management of RIDDOR incidents into our WIReD information management system. We have implemented this approach for management of all RIDDOR incidents, thereby allowing us to analyse them for themes and trends. Our inspectors can now use this intelligence to inform their intervention plans. Recent analysis work has focused on identifying opportunities for improving our management of enforcement. The expected outcome of this work is improved efficiency and consistency across our purposes.

7.25 We have continued to ensure that all dutyholders have implemented proportionate health protection measures in line with the government's 'COVID-19 Secure' guidelines. To this end, we circulated internal guidance to our inspectors, to ensure necessary controls were in place. As scientific/government advice developed during the pandemic, we reviewed and updated the guidance accordingly.

7.26 Given the continued focus on management of CH&S risks, we have prioritised consideration of industry initiatives to drive further improvements. Last year, we identified adverse trends and near misses in electrical incidents reported across the industry, and that trend has continued. As a result, in 2022/23 we will initiate a series of industry-wide interventions targeting electrical safety. These will be multi-disciplinary interventions spanning our core purposes and specialisms.

7.27 Performance regarding the safety of lifting operations across relevant statutory provisions and licence conditions has seen some improvement, although there is still a need for further improvements to be made, particularly in relation to construction activities. We will maintain focus on this topic to ensure compliance and consistency across the regulatory framework.

7.28 Although we continue to see evidence of the industry making improvements to integrate CH&S into wider safety management systems and associated arrangements, there are three areas where specific attention and embedding of improvements is still required: safety leadership, construction activities, and control of contractors.

7.29 We continue to take steps to assist the continuous improvement of CH&S standards across the industry, focussing on those sites with hazards representing the greatest CH&S risks or where there are significant compliance gaps.

Fire safety

7.30 Our programme of fire safety inspections on licensed sites during the reporting year aimed to ensure that the industry's existing fire safety arrangements and management procedures are both effective and resilient. Although there was a drop in performance in fire safety associated with some construction activities, the industry continued to take a proactive approach in maintaining the effectiveness of fire safety of its buildings, while introducing measures to control COVID-19 virus transmission.

7.31 We continued to monitor the progress of the public inquiry into the Grenfell Tower fire, although there appear to be no fire safety implications directly applicable to the nuclear industry at this time. We also continued to monitor the government's responses to recommendations to the Hackitt Report, including the Fire Safety Bill and Building Safety Bill.

7.32 Through our full membership of the Western European Nuclear Regulators Association (WENRA) and as observers in the European Nuclear Safety Regulators Group (ENSREG), we pro-actively contributed to the development of the terms of reference and technical specification that will guide the ENSREG's Topical Peer Review (TPR) 2 exercise that will cover Fire Protection from a nuclear safety perspective,[20] which the UK will participate in during 2022/23. This ensured the adoption of a targeted, sampling approach to the peer review exercise which focuses attention on installations with significant radiological risks from fire.[21]

Control of Major Accident Hazards (COMAH)

7.33 Once again, we have maintained focus on industry performance around compliance with COMAH Regulations. This year, industry compliance with COMAH continues to be good and improving, and we are continuing to target resources at those sites where shortfalls in performance have been identified. Dutyholders have responded positively to implementing improvement actions where are these are necessary, and regulatory oversight continues to ensure measures are validated and completed as planned.

7.34 Joint technical inspections have enabled inspectors across our statutory purposes to gain confidence and a greater understanding of how COMAH regulations can be applied utilising equivalent nuclear arrangements. This integrated and unified approach to emergency planning and combined site interventions continues to benefit licensed COMAH sites as it minimises duplication of regulation and maximises synergies.

7.35 Our inspectors continue to ensure that CH&S and COMAH aspects are appropriately reflected during the development of licensees' business transformation activities, corporate decommissioning strategies, and subsequent plans. We continue to scrutinise the depth and extent of relevant management of change assessments to ensure effective risk identification and control has been demonstrated.

20 www.ensreg.eu/tpr-2-background

21 Through self-assessment from 2022 and expert peer review in 2023/24, the UK alongside other participant countries will identify areas of good practice, areas of good performance, areas for improvement and/or challenges in this important topic. It is expected that, following the TPR 2 exercise, there will be development and implementation of Action Plans to address areas for improvement and/or challenges in nuclear fire protection across Europe.

7.36 In addition to co-ordinating interactions with local authority resilience teams in cases where REPPIR and COMAH off-site emergency planning and modular emergency exercise development overlap, we have also updated our hazardous substance consent processes to improve effectiveness, efficiency, and resilience.

Vendor (supplier) inspections

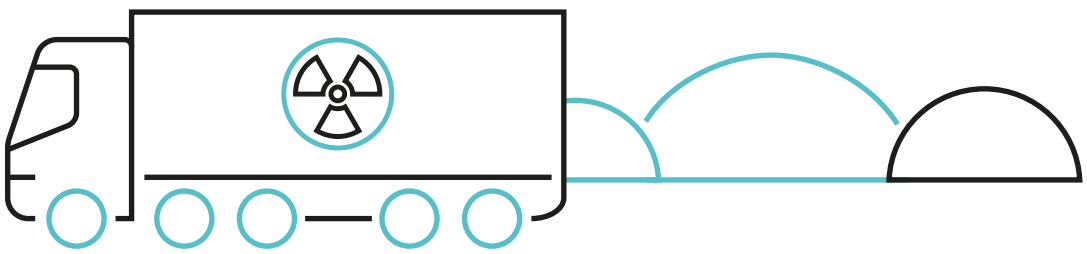
7.37 We undertook nine vendor inspections during the reporting period which focussed on suppliers associated with new build and civil nuclear operations activity. The inspections targeted suppliers who provide products or services that carry the highest nuclear safety consequences and those on whom multiple licensees are dependant.

7.38 We found examples of good practice in some licensee and vendor arrangements, but also noted areas requiring improvement. These areas will be targeted in future licensee engagements and vendor inspections.

7.39 The key area that we identified as requiring improvement related to licensee and vendor management system arrangements, specifically the generation and management of records, including the adequate completion of inspection and test plans. We also found examples where improvements are needed to ensure that licensees improve the effectiveness of the cascade of their requirements throughout their supply chains.

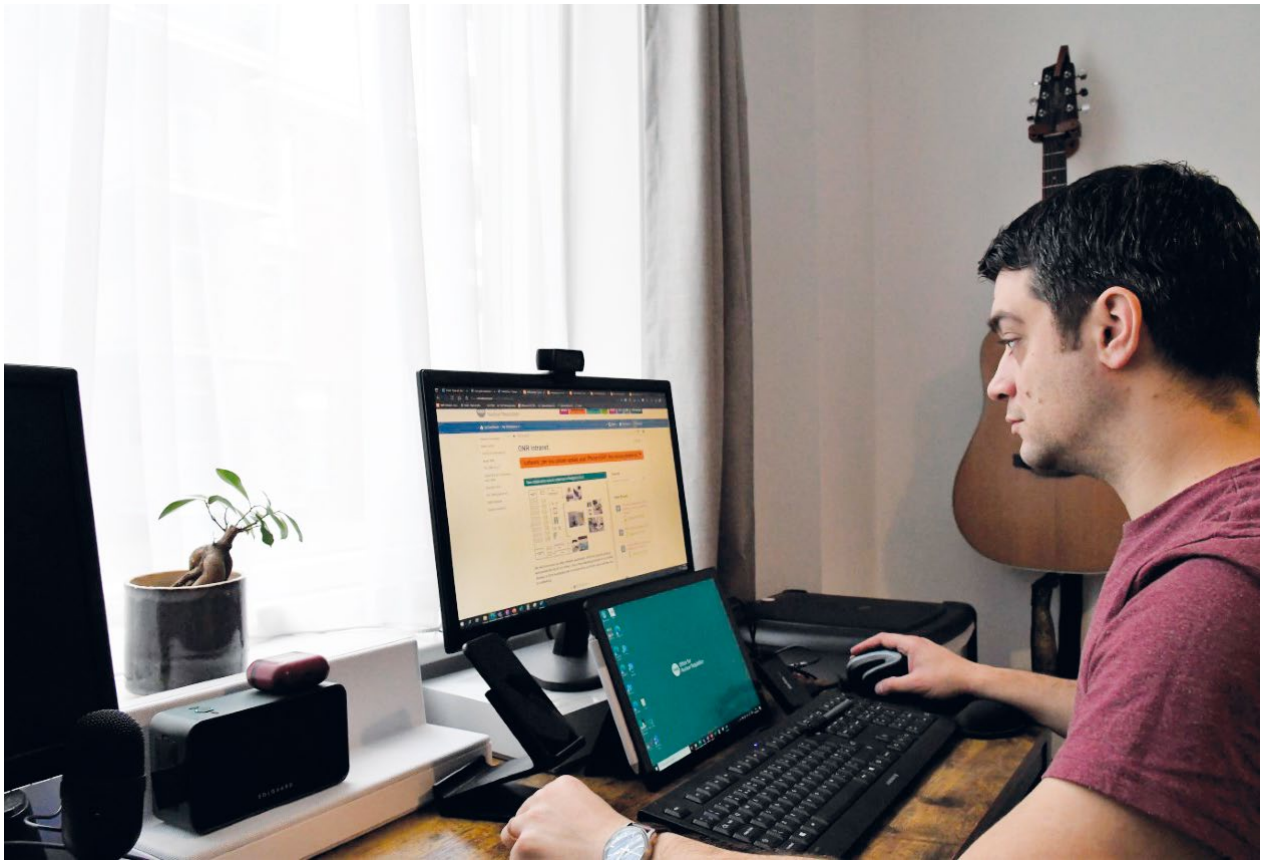
7.40 Our vendor inspections continued to examine mitigation to prevent the supply of counterfeit, fraudulent, and suspect items (CFSI) in the nuclear industry supply chain. While the inspections found good awareness of risk mitigation approaches, our regulatory intelligence continues to identify CFSI as a potential risk within licensee supply chain management arrangements. This will be an area of continued dutyholder and regulatory vigilance. We will continue to establish proportionate approaches for the regulatory oversight of CFSI mitigation arrangements in licensee and vendor supply chain management systems.

7.41 Where shortfalls were identified, we took proportionate action to ensure appropriate improvements were put in place. In addition, we have provided feedback to licensees as a group via the safety directors' forum's supply chain quality working group (SDF SCQWG), to ensure cross-sector learning.

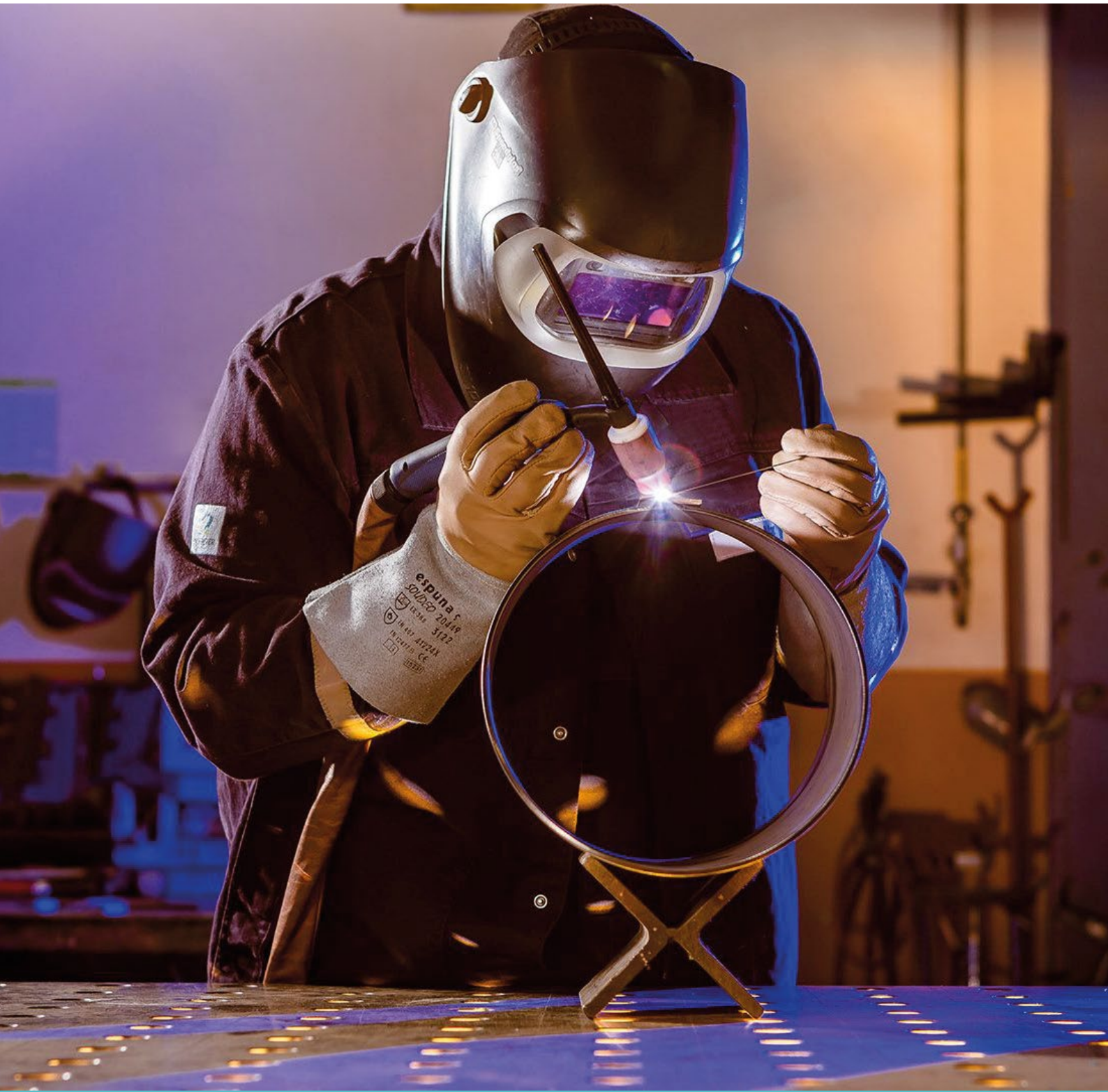


7.42 Examples of good practice observed and sampled during the 2021/22 vendor inspections included:

- management of quality plans, lifetime quality records and collaborative working for the vendor associated with the supply of the PFCS and MSSS boxes
- operational experience and CFSI arrangements for the vendor associated with the supply of reactor protection equipment
- development of improved training material to prevent CFSI by the SDF SCQWG. Future plans include sharing the training material within the respective SDF SCQWG organisations to enhance their training on the topic of CFSI



8 Research



8.1 Section 88 of the Energy Act 2013 enables us to carry out or commission research in connection with our purposes and to publish the results if we consider it appropriate to do so.[22]

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 as well as helping us base our decisions on the most current, objective, scientific and well-founded technical understanding of the safety, security and safeguards risks posed by nuclear operations.

8.3 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. We seek to gain maximum value from our research activities by partnering, where possible, with other key national and international research institutions and projects, and by avoiding duplication. This is another reason why we continue to engage proactively with industry, and at a wider national and international level.

8.4 Our research portfolio includes approximately 50 projects. Of these, about half are developed into work specifications and delivered by technical support organisations funded directly by us, with a typical annual budget of £2.5 million. The remaining projects are funded and delivered directly by the nuclear industry while we monitor progress and provide oversight.

Effectiveness of commissioned research

8.5 The Regulators' Code requires us to share information about compliance and risk to help those we regulate meet their responsibilities to comply with their statutory obligations, and to ensure that our approach to regulatory activities is transparent.

8.6 In accordance with the code, we have recently launched a comprehensive research effectiveness process. Using the consistency of the framework, we now invite the views of the relevant dutyholder(s) regarding the effectiveness of our research and use it as part of our evaluation.

8.7 During this reporting period we also commissioned an independent external review of the effectiveness of our research. The overall outcome of this review is positive, while making recommendations to further improve some specific aspects of our performance. In response we are improving the visibility and management of the 'knowledge gap' before and after research is performed, and whether the research conducted was effective in totally or partially delivering the information that we required.

8.8 Additionally, we propose to collaborate with relevant organisations to develop horizon scanning, to ensure that our inspectors have access to the best available information to maintain our regulator readiness and support regulatory decision-making, particularly given the increasing levels of innovation being considered and adopted by the industry.

22 Our research strategy, including research objectives are available at www.onr.org.uk/research/ and www.onr.org.uk/documents/2019/onr-research-strategy.pdf

Research study 1

Graphite weight loss

Challenge

The core of Advanced Gas-cooled Reactors (AGRs) is made of several thousand graphite bricks (Figure 5). These bricks provide essential functions within an AGR such as neutron moderation, structural strength and neutron reflection.

During operation, the graphite material is subjected to intense neutron and gamma irradiation. A known reaction between the gamma rays and the gas coolant produces ionising species which can react with graphite. This degradation mechanism is known as radiolytic oxidation, or graphite weight loss (Figure 6).

Changes to the mass of graphite within an AGR can affect the ability to shut down and hold down the nuclear reaction. Graphite weight loss is an expected but irreversible process and is one of the life limiting aspects of AGR operation. Robust monitoring and prediction of graphite weight loss is of importance to nuclear safety and must be kept within strict safety case limits.

Measurement of graphite weight loss is determined by routine maintenance activities by which small samples of graphite are removed from the reactor core for physical analysis, including weight loss. By its nature, however, this is a lagging indicator and is limited to the locations sampled (Figure 7). The licensee, therefore, relies on diverse weight loss computer modelling techniques to extrapolate from measured data to ensure operation within limits and conditions. This is achieved by application of diverse mechanistic and statistical methods.

Research activity

ONR graphite weight loss experts from the Graphite Technical Advisory Committee (GTAC), the Brick Cracking Network (BCN) and University of Manchester (UoM) are internationally recognised experts in this area of materials science. They have provided independent expert advice to us on subjects including material behaviour, graphite weight loss, testing programmes, analysis techniques and inspection activities since 2003.

The prediction of graphite weight loss is complex and multi-disciplinary. It requires knowledge of the graphite behaviour, gamma radiation profile, gas flow within the reactor, of the characteristics of porous graphite bricks and radiation chemistry.

To predict graphite weight loss, the licensee has developed a dedicated, physically informed predictive tool, FEAT-DIFFUSE (FD). The latest version of FD, version 8, was a significant update of the code and incorporated the licensee's latest understanding of the physical processes responsible for graphite weight loss. Similarly, statistical methods were also improved to provide more representative forecasts of weight loss within interstitial channels.

Recently, we commissioned GTAC and BCN to independently review the assumptions that underpin the licensee's forecasting tools. We directed the GTAC review to focus upon the evolving physical and chemical understanding and the BCN review on the mathematical credibility of models. Reviews were managed on tight timescales to support safety case assessment and safe continued operation of the AGRs and have proved to be effective in doing so as described below.

Intelligence gained

Thorough technical reviews from the GTAC and the BCN have informed our regulatory judgements and assessment strategy, highlighting several areas which we utilised to test and assess the adequacy of the licensee's safety case to ensure safe operation. In turn, this allowed early engagement with the licensee and led to improvements in the clarity of the licensee's safety justifications.

Expert reviews from the GTAC and BCN have provided us with significant confidence in the graphite weight loss forecasts used in the safety assessment of the reactors. Specifically, they have improved our understanding and enabled us to remove undue conservatisms and over-optimisms in forecasts. They have enabled us to permission increased reactor burn-up limits and continued operation of Heysham 2 and Torness, with confidence that it was safe to do so. It is anticipated this will also inform our decisions associated with similar safety case submissions for Hartlepool and Heysham 1.

Figure 5: Graphite core structure

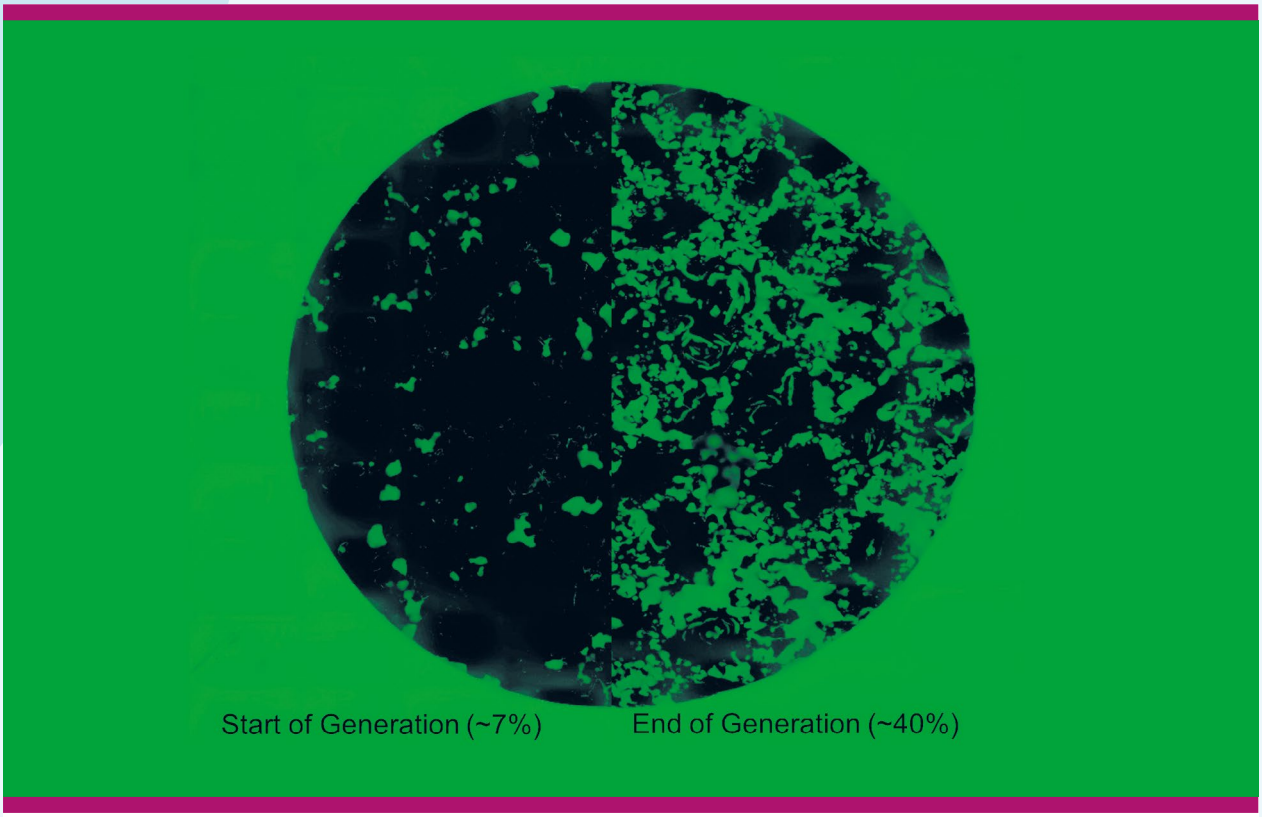


Figure 6: Microscopy of graphite weight loss

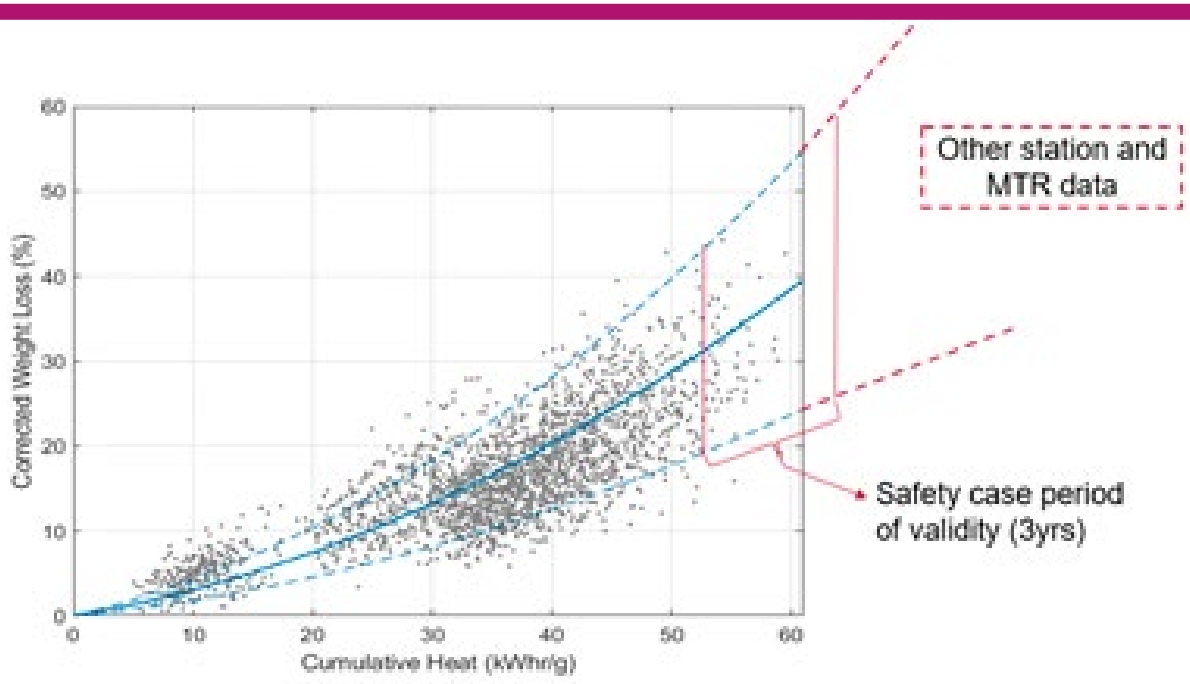


Figure 7: Graphite weight loss vs cumulative heat

Research study 2

Dual Purpose Casks for Combined Storage and Transport of Radioactive Material

Challenge

Radioactive waste materials, derived from the use of nuclear technologies for power generation, defence, medicine and other industrial applications, are stored at various locations around the country.

Typically, these materials are stored at interim surface facilities but may, in the near-term, require a consolidated solution to ensure their long-term safe storage and containment. Most low-level wastes (LLW) can be stored at the Low-Level Waste Repository (LLWR) in Cumbria. However, the higher-activity wastes (HAW) require an alternative longer-term solution.

A geological disposal policy document from BEIS outlines the strategy for managing HAW through the development of a GDF.

With the design and operation of a future GDF in the conceptual stage (hence subject to modification), the consideration for new types of containers to store radioactive waste or transfer packages, is regularly under review.

The dispersed locations of the UK's nuclear sites will require the transport of many thousands of waste packages located around the country, to the GDF. Currently, many of the waste packages identified in the Inventory for Geological Disposal (IGD) must be transported inside designated transport containers, increasing the complexity and amount of handling operations. One solution to simplify the transport arrangement is the use of a dual-purpose cask (DPC) for both interim storage and transport.

This research project considers the relevant guidance, case studies and inventory data to investigate the storage, transportation and as low as reasonably practicable (ALARP) arguments for the implementation of a DPC system, and integration with the GDF.

Research activity

We sought independent advice from subject matter experts (SMEs) to provide guidance and the independent technical support required to produce a report into the feasibility of a DPC transport system.

The research used the IGD data, which includes both UK Radioactive Waste Inventory (UKRWI) data and materials not yet classified as waste (such as spent fuel and stocks of uranium).

DPC systems have been implemented in several countries, and the IAEA has published guidance regarding the methodology required to present a safety case for the storage and transportation of spent fuel in DPCs.

International guidance, along with a range of research from other relevant organisations, is summarised to demonstrate the range of sources available to guide our inspectors on potential future safety cases for DPCs to store and transport radioactive materials, including spent nuclear fuel, in the UK.

Intelligence gained

The independent research established the benefits and limitations of a DPC system, such as transport challenges, and how a DPC will interface with a future GDF.

Transportation of DPCs is only considered viable for road or rail, as sea transport is currently not deemed cost, or nuclear-safety effective. Limitations for transport by rail include the number of sites with functioning railheads and the route/gauge availability.

A section of the research is dedicated to reviewing the ALARP considerations regarding the justification for implementing a DPC system, which include:

- handling systems and re-packaging
- containment barriers
- fuel assembly capacity of a DPC
- benefits of DPCs for failed fuel assemblies
- importance of ageing management
- monitoring of DPCs during interim storage
- the vulnerability of ALARP justifications to future changes to both regulation and the GDF design

This independent research has provided us with knowledge upon which we can base our regulatory assessments of future DPC safety cases.[23]

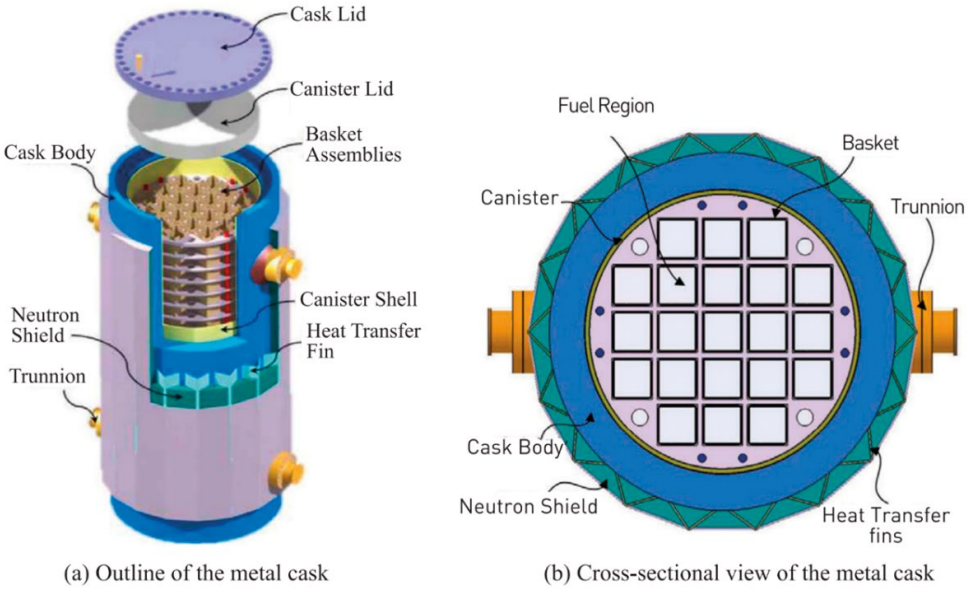


Figure 8: Fuel assembly – dual-purpose cask design
Source: Ko, Jae-Hun, et al. (2014). Shielding Analysis of Dual-Purpose Casks for Spent Nuclear Fuel Under Normal Storage Conditions. Nuclear Engineering and Technology. 46. 547-556. 10.5516/NET.08.2013.039.

23 The research report is available at ONR-RRR-086 (Contract ONR375) – Dual Purpose Casks – https://www.onr.org.uk/documents/2019/onr-rrr-086.pdf

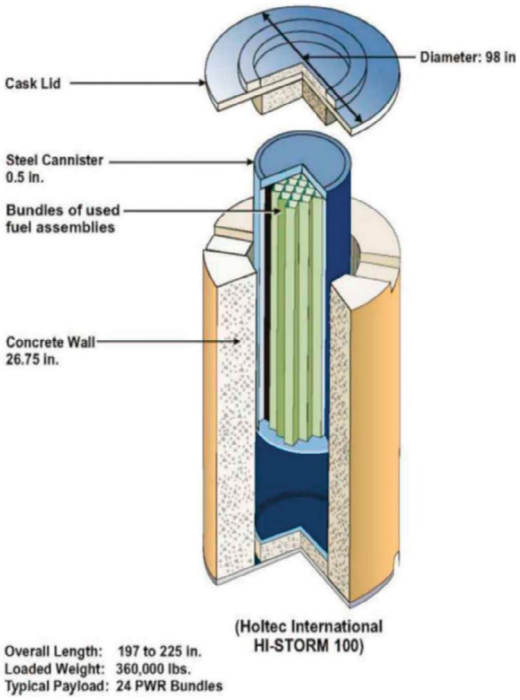


Figure 9: Holtec International HI-STORM 100 DPC design
Source: U.S. NRC 'Developing a Regulatory Framework for Extended Storage and Transportation' May 2011
Developing a Regulatory Framework for Extended Storage and Transportation (energy.gov)
www.energy.gov/sites/prod/files/em/Easton_NTSF_2011.pdf

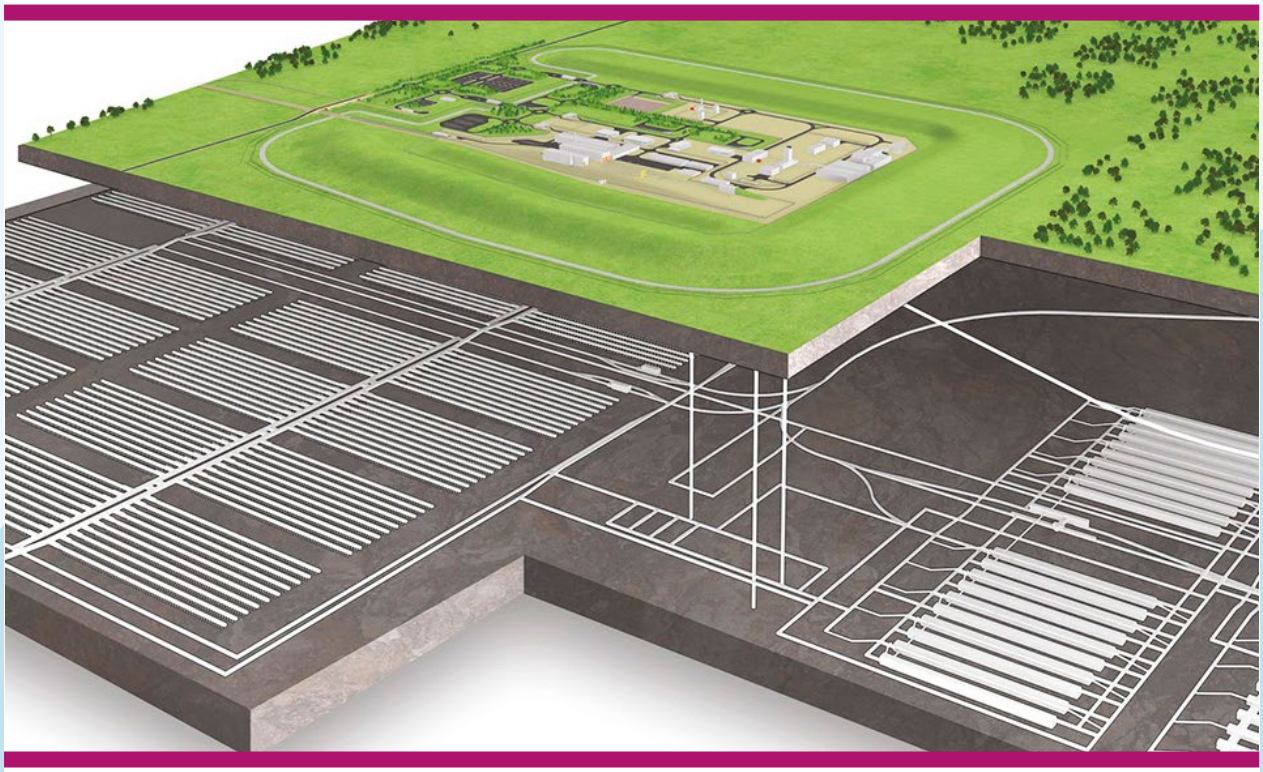


Figure 10: Illustrative example of a Geological Disposal Facility
Source: Nuclear Waste Services – Guidance: GDF (Geological Disposal Facility), GDF (Geological Disposal Facility) – GOV.UK (www.gov.uk)
www.gov.uk/guidance/gdf-geological-disposal-facility, January 2022

Research study 3

UK Design Basis Threat

Challenge

The UK Design Basis Threat (DBT) assessment identifies a range of credible malevolent security threats. The DBT document is fundamental to the effective design and evaluation of physical protection systems (PPS) and is the benchmark for us to assess the adequacy of dutyholders' security arrangements. The UK DBT reflects UK government's risk appetite and the need for future-proofed physical security.

It is the role of the dutyholder to determine how the UK DBT threats may manifest themselves within their site-specific environment; establish the potential effects of an attack, and design and implement security arrangements to meet our Security Assessment Principles (SyAPs) PPS outcomes.

Inspectors across all our purposes work together to ensure a holistic understanding of the range and scale of the risks, and to make balanced regulatory judgements as to whether nuclear assets are adequately protected. Our sabotage target analysis and review (STAR) team demonstrates this cross-purpose working by assessing dutyholder arrangements for identifying and protecting areas deemed vital to nuclear safety and security.

To achieve this, UK civil nuclear facilities are theoretically targeted by the UK DBT capabilities to determine the unmitigated worst-case outcome from malicious acts to identify the areas at each site requiring enhanced physical protection. While our STAR team is suitably qualified and experienced to make judgements within this field, it is necessary to enhance our understanding of threat consequences in the spirit of continual improvement and to ensure consistency and proportionality.

Research to understand explosive blast phenomena is well established and is applied on a conservative basis within our work. However, STAR has engaged with independent researchers with relevant expertise to better understand this field and to explore considerations unique to civil nuclear facilities and material inventories, systems, structures and components. The research will commence later in 2022.

Research activity

The purpose of the research is to increase our understanding of the effects of certain threats on nuclear facilities and materials. Findings will be derived from computer-based modelling, whereby the most suitable software options are critically evaluated. The researchers will then validate the data through scaled physical testing. An example of this is represented graphically by Figures 11 and 12, which provide an example of a computer modelled simulation and a scaled physical test. The graph shown in Figure 13 provides a rudimentary example of how the two tests validate one another, with the results informing our regulatory expectations.

There are notable logistical and financial challenges associated with carrying out full-scale, physical testing of explosive material against nuclear infrastructure. Physical tests alone cannot provide the robust confidence necessary to inform our analysis, and we cannot utilise real nuclear material or facilities in pursuit of understanding the impact of blasts.

Other challenges include considering factors such as degradation associated with ageing concrete structures, which may be influenced by environmental conditions of a given site. For these reasons, computer-based modelling, which can overcome some of these restrictions, is a key component of the research. Modelling has the added advantage of allowing for results to be obtained in relatively short order while considering a broad range of relevant threat permutations.

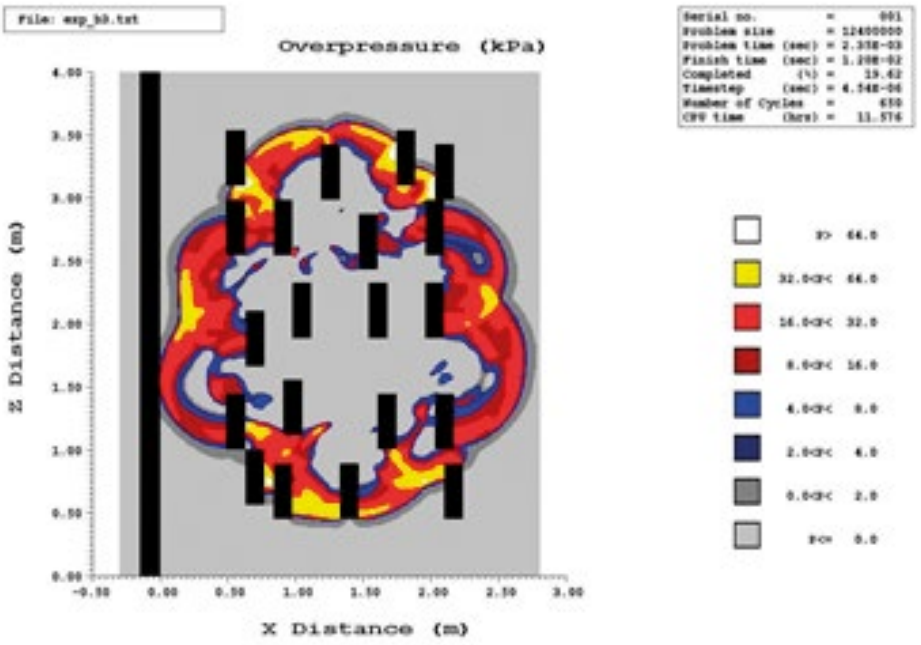


Figure 11: Scenario run using computerised modelling software

Figure 12: Scaled physical tests using scaled explosives and blast sensors

Given the various strengths and weaknesses associated with certain computer modelling software packages, each with their own unique purposes, part of the research will include an independent review to determine the most appropriate package for the industry's purposes. Our evaluation of this aspect of the research will be in accordance with the Safety Assessment Principles (SAPs) AV series assurance of validity of data and models to ensure theoretical models are appropriately representative.

Initially, the UK DBT capabilities will be modelled against a generic relevant nuclear storage facility to further our understanding of the potential threat impact. While the research findings will directly enhance our current understanding to inform our regulatory judgements, the research will also facilitate the sustainable development of our internal capability. The research will inform future software procurement decisions, and through the provision of training, provide us with additional tools to enhance organisational learning to better inform assessment across the nuclear estate.

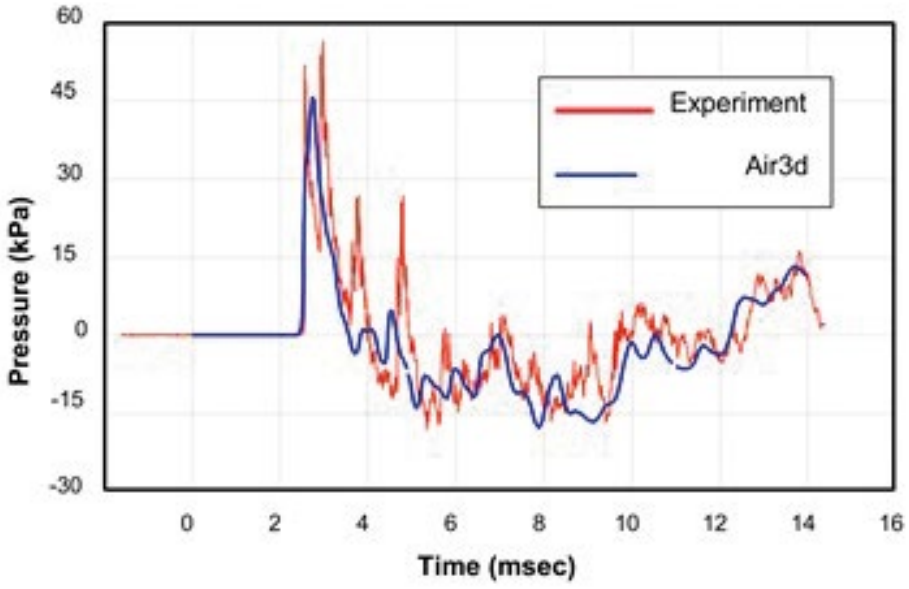


Figure 13: Validation analysis comparing both computer modelling data and physical test data

Intelligence gained

An independent review of the most suitable computer-based modelling software to support the accuracy, consistency and proportionality of our regulatory judgements. The research will provide robust data from computer-based modelling validated through scaled physical tests to further inform our understanding of the impact of UK DBT capabilities against nuclear material and facilities.

We will receive training in the use of relevant computer-based modelling software to sustainably develop the team and broaden the application of our learning. This, in combination with data from scaled physical tests, will further inform our professional judgements by enhancing our understanding of blast in the wider nuclear environment.

9 Annex 1 – Incidents reported to ONR

9.1 This annex provides an overview of the incidents that dutyholders have reported to us in this reporting period. It presents analysis of incidents across our purposes and trends over successive years. It includes a summary of our regulatory judgements for the incidents and the intelligence we have drawn from them. It concludes with a brief description of most significant incidents in the reporting period.

Dutyholder requirements

9.2 The Energy Act 2003 identifies ONR as the relevant authority for our dutyholders to report incidents where reporting is specified in relevant regulations. Regulations that have specific requirements for dutyholders to report incidents to ONR include:

- the Nuclear Installations Act 1965 and Licence Conditions made under it
- the Nuclear Industries (Dangerous Occurrences) Regulations 1965
- the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009
- civil nuclear security events or matters in accordance with duties under the Nuclear Industry Security Regulations 2003
- safeguards incidents to ONR in accordance with the Nuclear Safeguards (EU Exit) Regulations 2019
- conventional health and safety incidents under the Reporting of Injuries, Diseases, and Dangerous Occurrences Regulations 2013

9.3 This year, we have introduced WIReD (Well Informed Regulatory Decisions), our IT platform for our regulatory processes that provides our incidents information management system. We are preparing to implement a WIReD dutyholder portal and to issue new notification guidance in the next reporting period. These changes will make it easier for dutyholders to notify us of incidents and improve consistency across the incident topic areas.

9.4 Our incident notification guidance allows dutyholder judgment when deciding the threshold for reporting lower significance incidents. Our analysis has shown that some dutyholders have adopted more conservative notification practices. For example, they notify us of incidents for very low actual or potential impact incidents. It is important that dutyholders capture, trend and learn from incidents. However, we recognise that formally notifying us in all instances, regardless of scale, may be an unnecessary regulatory burden. As a result, we have engaged with industry groups to improve the clarity of our expectations for incident notification. We plan to publish this new guidance in the next financial year.

9.5 The change in approach has impacted the overall numbers of incidents reported to ONR during the reported period and the upward trend has the potential to continue in future years. We are satisfied it does not represent a reduction in safety, security or safeguards performance but is evidence of the industry capturing all incidents, no matter how minor.

9.6 The WIReD system has an established mechanism for dutyholders to categorise the incidents into following topic areas:

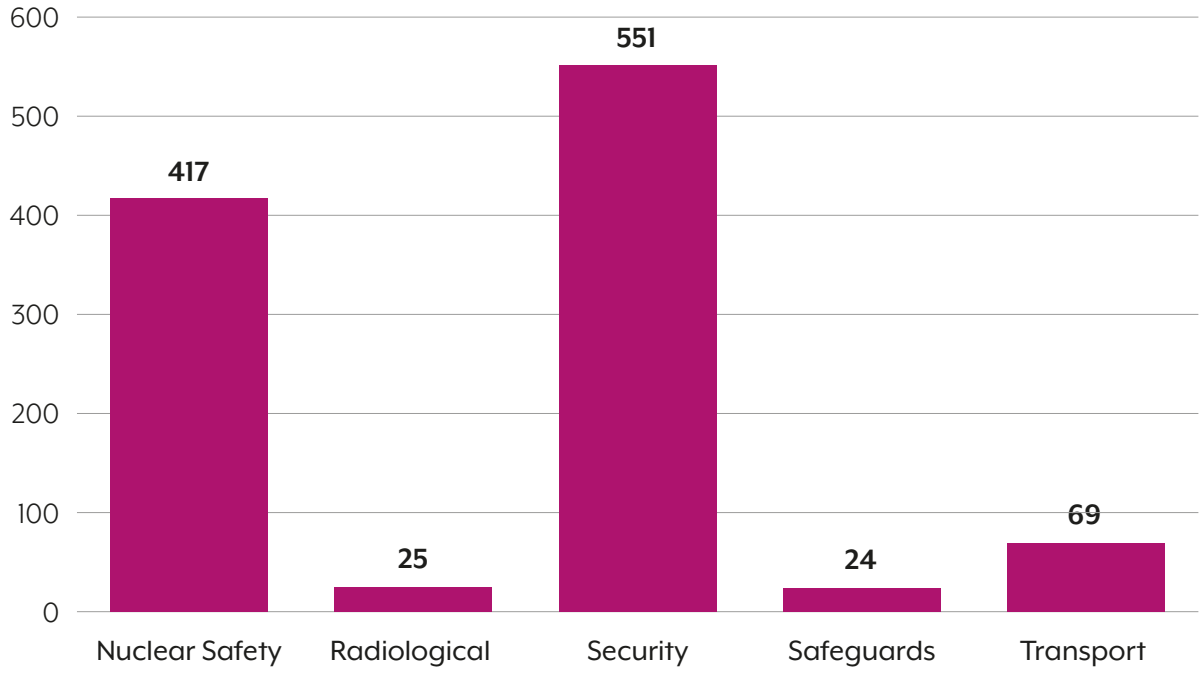
- **nuclear safety** – covering incidents involving plant and equipment issues, typically at nuclear sites, that have a potential impact on nuclear safety
- **radiological safety** – covering incidents where personnel have been involved or could have been potentially exposed to radiation exceeding normal working levels
- **transport safety** – covering incidents relating to the movement of radioactive material
- **safeguards** – covers incidents where there are issues relating to the accountancy and/or control of relevant radioactive material
- **security** – covers security-related incidents

Incident reporting in 2021/22 across our purposes

9.7 Figure 14 presents an overview of the incidents reported to us against each of these five topic areas during the reporting period 1 April 2021 to 31 March 2022.

9.8 The distribution of incident reports across the topic areas is broadly consistent with previous financial years. We have classified most of these reported incidents as minor or no significance.[24]

Figure 14: Incident reports during the Financial Year 2021/22



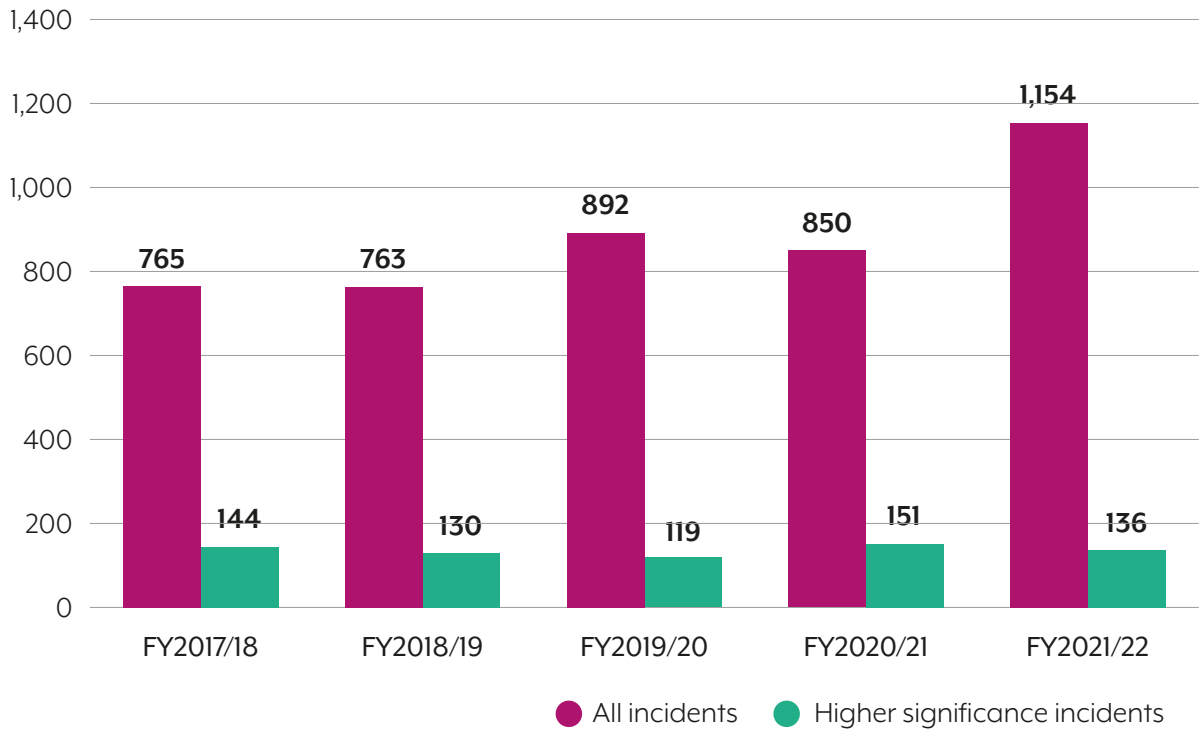
24 Governance categories 3 or 4, Guidance for INF1 Governance and event Oversight (ONR-OPEX-GD-004)

Trends of significance of incidents

9.9 In support of integrating our regulatory purposes, we are using four variables to consistently trend higher significance incidents. This includes INES ratings[25] reported in previous years, as well as our expected timescales for incident notification, our inspectors' judgements on incident significance, and the dutyholders' judgement of incident significance.[26] Our analysis has shown that dutyholder reporting practices do not impact this subset of incidents as much as overall incident numbers. This is because the higher significance incident categories have tighter criteria that allow for less dutyholder judgement. For example, a non-compliance with an operating rule or safety shutdown. Therefore, the trends of more significant incidents give a better indication of dutyholder safety and security performance.

9.10 This consistent trending method shows that there was a total of 136 more significant incidents across all our purposes in the reporting period. Figure 15 presents the five yearly trend of total incidents and more significant incidents reported to us.

Figure 15: Five year trend of all incidents and significant incidents



9.11 Dutyholders notified us of an increased number of incidents this reporting period, compared with previous years. The increase was mainly due to greater numbers of reports of minor non-compliances with standards, procedures, or arrangements described in the dutyholders' security plans. Our inspectors assessed these incidents and judged that they did not significantly impact the sites' security resilience.

25 INES: The International Nuclear and Radiological Event Scale User's Manual, 2008 Edition
26 ONR-PROC-RIO-003: Processing Incident Notifications

9.12 Our analysis has shown that the increase in security incidents is mainly a result of changes to the dutyholders' notification practices reflecting greater maturity in security culture. Dutyholders are increasingly aware of the expectation for notifying these incidents. This means that similar numbers of incidents may have occurred in previous periods, but were insufficient to trigger the dutyholders reporting arrangements.

9.13 We encourage nuclear sites to have a healthy reporting culture and learn from incidents. The vast majority of the reported incidents are minor events or near misses that could happen at any large industrial site. Nuclear facilities are designed and operated to deal with unexpected incidents that occur and there are multiple barriers to stop those incidents becoming more serious.

Regulatory response to incidents

9.14 Our inspectors evaluate and decide a proportionate regulatory response to all incidents reported to us. Most incidents have minimal significance. We use the regulatory intelligence from incidents to identify additional actions that dutyholders can take to improve their overall performance and to target future regulatory interventions.

9.15 During this reporting period, we conducted preliminary enquires[27] in response to 37 incidents. These enquires were to gather information for a decision on formally investigating the incident or otherwise. In addition, five incidents met our investigation criteria on immediate notification. The outcome of these preliminary enquires or investigations was formal enforcement for 18 incidents.

9.16 Most of our formal enforcement action following incidents took the form of enforcement letters or informal advice. Two of the incidents resulted in an improvement notice or a Nuclear Site Licence Condition direction. Our inspectors are satisfied that these dutyholders are taking appropriate actions in response to each of these enforcement actions.

9.17 Using the Ministerial Reporting Criteria (MRC)[28], we report the most significant incidents to BEIS on a quarterly basis and publish details of the incidents on the ONR website. In the reporting period, we reported four incidents to BEIS. Table 4 provides information on these incidents and our regulatory response.

Regulatory intelligence

9.18 Each of our divisions and technical specialisms has an appointed regulatory intelligence lead inspector, who screens incidents and then facilitates further analysis and follow-up where appropriate to their regulatory area. Typically, the regulatory intelligence leads produce regulatory intelligence reviews, which outline the results from this work.

9.19 Our regulatory intelligence reviews have used incident data to:

- inform divisional intervention strategies
- search for, and identify, common themes in industry performance
- improve our regulatory approaches

27 ONR-PROC-RIO-003: Processing Incident Notifications
28 Appendices 2 and 3 of ONR-OPEX-GD-001: Notifying and Reporting Incidents and Events to ONR

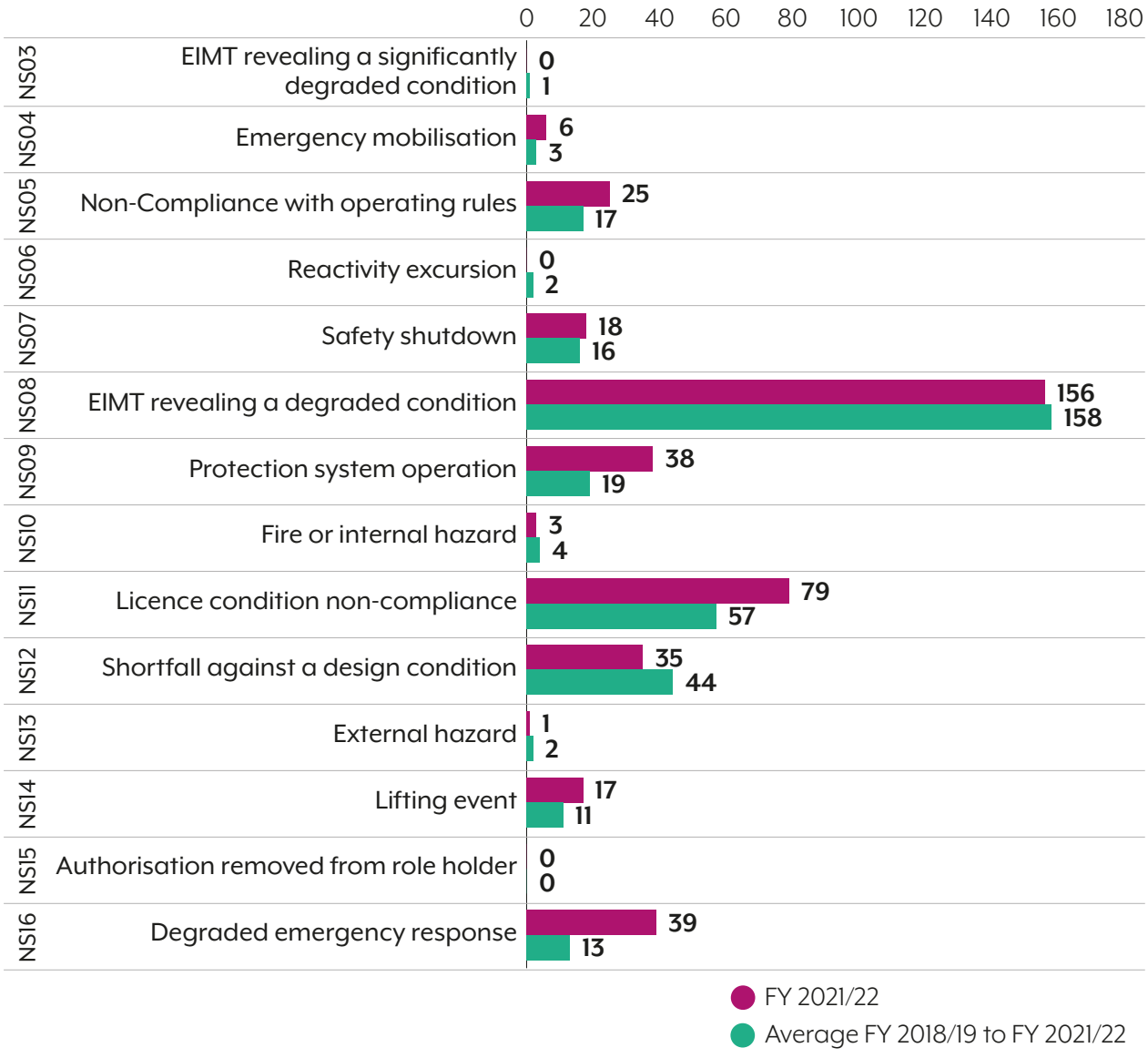
9.20 Examples of effective use of these regulatory intelligence reviews include a cross divisional and multidisciplinary intervention following an adverse trend of electrical safety incidents, and enhancements to the management of safeguards regulatory issues and interventions.

9.21 During the reporting period, some of the incident intelligence reviews have led to us producing advice notes for inspectors. These provide information and guidance to maximise organisation learning.

Topic area analysis – nuclear safety incidents

9.22 Incidents are reported to us under categories according to criteria defined in our Incidents Notification guidance[29]. Figure 16 shows all incidents with a nuclear safety category. The comparison of FY 2021/22 data with the average of the previous three financial years shows consistency in all the categories of incidents.

Figure 16: Breakdown of incidents related to Nuclear Safety for the Financial Year 2021/22 based on ONR's incident categories



29 ONR-OPEX-GD-001: Notifying and Reporting Incidents and Events to ONR

9.23 Figure 16 shows that the largest nuclear safety incident category is 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'.

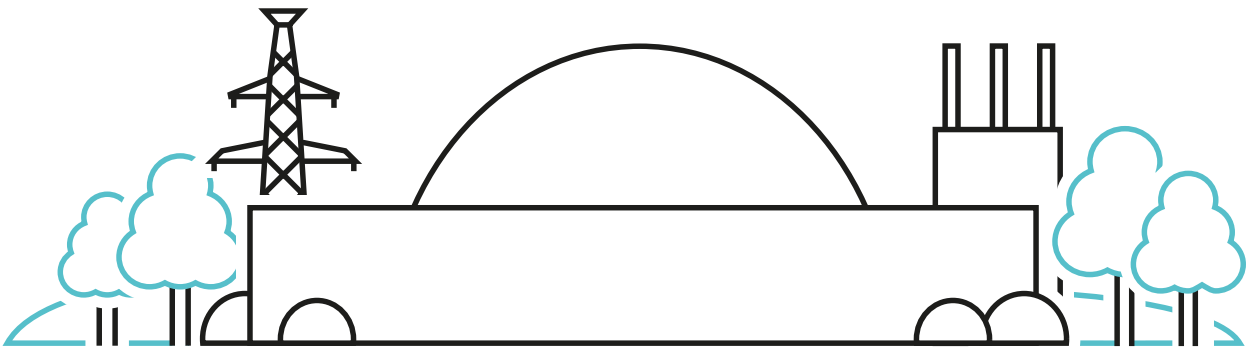
9.24 Our analysis of the incidents in the NS08 category has identified inconsistent reporting practices between dutyholders. This limits effective intelligence analysis. Following engagement with industry we have identified opportunities for us to improve the clarity of our expectations for this category. As a result, we are working with industry to improve the clarity of this guidance and hence the consistency of reporting.

9.25 The next largest incident categories 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'
- **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'
- **NS16:** 'Any event or occurrence that could significantly compromise the effectiveness of the arrangements for emergency preparedness and response on the site'

9.26 Most incident reports in each category align with long-term averages. This indicates that the safety performance of the industry has remained consistent. The NS04, NS09 and NS16 categories are notably above average. The causes of these differences are:

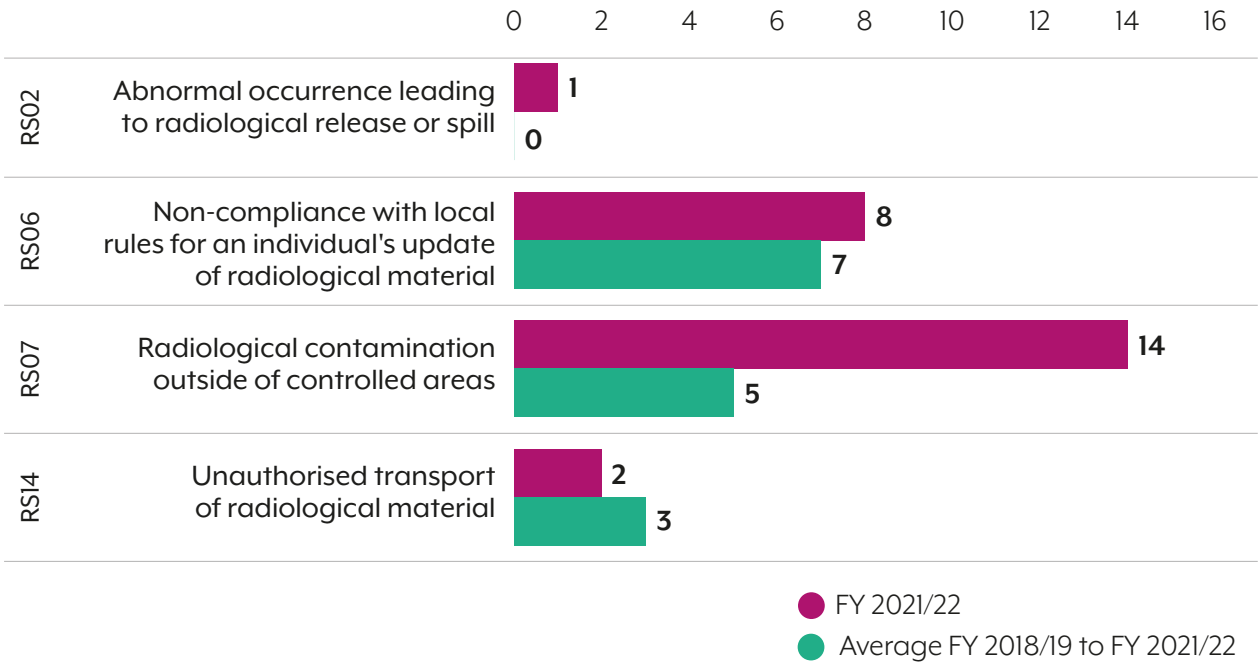
- **NS04:** A result of a greater number of site incidents for Operating Facilities Division sites
- **NS09:** More appropriate use of this category for incidents that would previously have been categorised NS08
- **NS16:** The impact of the COVID-19 pandemic on the availability of emergency scheme personnel because of self isolation



Topic area analysis – radiological safety incidents

9.27 Figure 17 shows all incidents with a radiological safety category. The comparison of FY 2021/22 data with the average of the previous three financial years shows consistency in most of the categories of incidents. The increase in RS07 incidents has resulted from improved categorisation of incidents and increased work on the sites following the release of COVID-19 restrictions.

Figure 17: Breakdown of incidents related to Radiological Safety for the Financial Year 2021/22 based on ONR's incident categories

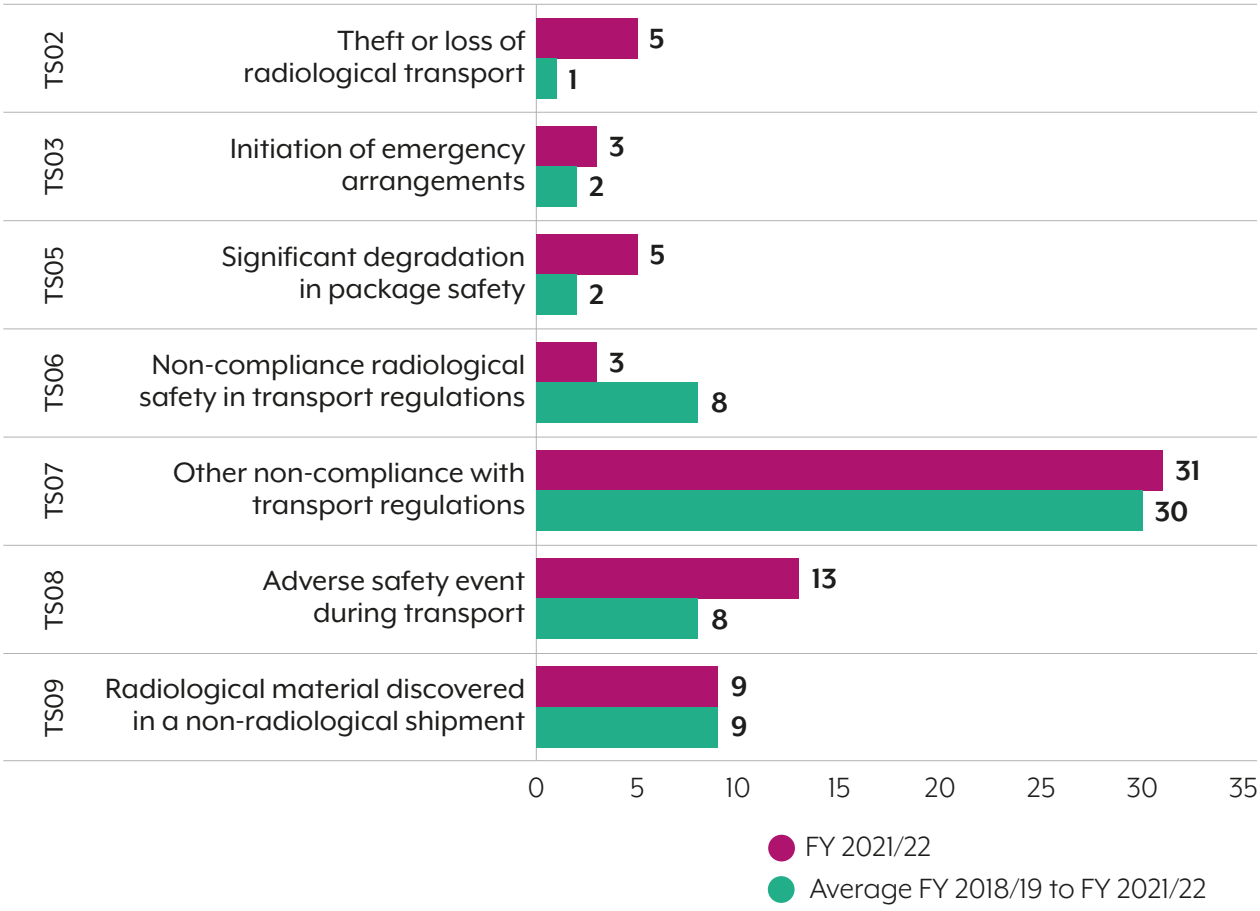


9.28 The numbers of radiological incidents are associated with the amount of work on a site. During the pandemic the work on the sites reduced. In this reporting period, the number of radiological safety incidents reported has returned to its pre-pandemic level. This indicates that despite an increase in incidents, the radiological safety performance of the industry has remained consistent.

Topic area analysis – transport safety incidents

9.29 Figure 18 provides a breakdown of transport safety incidents by category as reported to us during 2021/22.

Figure 18: Breakdown of incidents related to Transport Safety for the Financial Year 2021/22 based on ONR's incident categories



9.30 The following incident categories have apparent increases compared to historical trend:

- **TS02: five instances.** Three involved attempted thefts of vehicles with packages containing radioactive material onboard. These events were not related to the presence of radioactive packages within the vehicle. At all times the packages remained safe and secure. The other two incidents related to lost packages which were subsequently recovered. We have established that there was no harm to workers and the public as a consequence.
- **TS05: five instances.** Four of these related to damaged glass vials containing radiopharmaceuticals. We have established that there was no harm to workers or the public as a consequence. The fifth incident occurred outside the UK, but with a UK-based consignor. It has been recorded for monitoring purposes.
- **TS08: 13 instances.** The increase in this coding is primarily due to a number of minor road traffic incidents (packages undamaged).

9.31 The variation in transport incidents is within the expected levels for the numbers of radiological material transports. These incidents were of low significance with respect to public safety. However, for some instances, we have taken proportionate enforcement action in line with our enforcement policy statement to ensure ongoing compliance. One of the TS08 incidents resulted in formal enforcement action, which we reported to BEIS. This incident is summarised in Table 4.

Topic area 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 us during 2021/22 impacted on the UK's compliance.

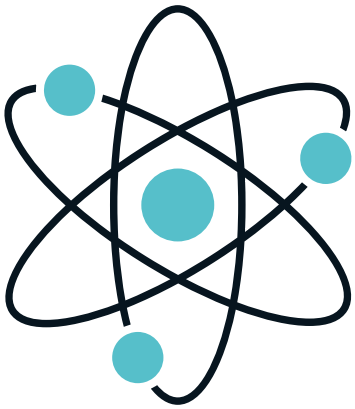


Figure 19: Breakdown of incidents related to Safeguards for the Financial Year 2021/22 based on ONR's incident categories

9.33 There has been an increase in the numbers of SG02 in the reporting period. Dutyholders use this category to notify us of incidents where they discover a potential apparent gain or loss of nuclear material during their operational activities.

9.34 The primary explanations for greater numbers of incidents in this category are:

- Apparent finds of nuclear material during accelerated decommissioning activities, clean up or reconciliation of legacy items
- Our engagements with nuclear material and qualifying nuclear facilities with limited operation have led to increased awareness of our safeguards expectations, and better reporting practices as the UK safeguards regime becomes established

9.35 We expect to see an increased number of incidents in the SG02 category into the next reporting period, reflecting continued improvements in dutyholder reporting practices and increased decommissioning activities. Our safeguards team will continue to monitor to this trend and may use the regulatory intelligence to target their regulatory activities.

Table 4 – Incidents ONR reported to BEIS

Heysham 1, INF 2021/563

Description	On 22 July 2021 at 14:57, following failure of a National Grid transformer located offsite, Heysham 1 experienced a complete loss of 400kV power supplies. Both reactors were operating at nominal full power prior to the incident, and both tripped automatically. Post trip cooling was successfully established by the automatic start of one of the station's four Emergency Boiler Feed Pumps (EBFP). There are four EBFPs, any one of which can maintain effective post trip cooling. One EBFP was out of service for planned maintenance and the two remaining EBFPs failed to initiate on demand because of an automatic control system issue. The two additional EBPFs were started manually after 45 minutes. Post trip cooling was effective, and the reactors were safely shut down. There were no radiological consequences.

Heysham 1, INF 2021/563

Dutyholder's response	EDF initiated its emergency arrangements and declared a site incident. Post trip cooling was established, and teams were despatched to start additional emergency boiler feed pumps and to ensure adequate stocks of boiler feed demineralised water were maintained. The site incident was stood down after approximately 16 hours. EDF's internal investigation was completed, the learning from which resulted in: • Improvements with demineralised water stock management including the permanent availability of a demineralised water production trailer to improve water treatment plant resilience and improved decision-making instructions and operator training. • Modification to the post trip logic to ensure post trip start signals are not challenged by a similar event.
ONR's actions	We completed a formal investigation into the circumstances surrounding the incident which concluded that although a complete loss of grid fault sequence is reasonably foreseeable, the incident revealed a shortfall in the operation of the post trip logic equipment which was not reasonably foreseeable. Our investigation did not reveal any significant shortfalls in compliance and confirmed that the dutyholder has taken appropriate measures to learn from the incident. We carried out a return to service readiness inspection which, following the adequate implementation of modifications, did not reveal any regulatory issues which would prevent EDF from restarting both reactors at Heysham 1. Fleet wide, Hartlepool is the only other station that is of similar design to Heysham 1 in terms of post-trip cooling. However, the post trip logic equipment at Hartlepool was confirmed to be resilient to this type of fault sequence. Therefore, we do not consider this a fleet issue. The event has been rated Level 2 (Incident) on the International Nuclear Event Scale (INES).

Sellafield, INF 2021/646

Description	On 9 August 2021 Sellafield Ltd reported to ONR that holes had been identified in one of the ventilation ducts in the Highly Active Liquor Evaporation and Storage facility. Similar holes have been identified and repaired in the past and the removal of a redundant nearby structure had allowed further inspection and the identification of the new holes. Although radioactive contamination has been detected external to the duct, there is no evidence of contamination beyond the immediate vicinity of the duct. There was no radiological impact to either workers or the public.
Dutyholder's response	Sellafield Ltd carried out further inspections and radiological monitoring around the area to confirm no further release from the duct. Sellafield Ltd is planning work to repair the duct work.
ONR's actions	We have worked alongside the Environment Agency to monitor the dutyholder's response. We consider the actual or potential harm to people or the environment to be low. We remain content that Sellafield Ltd has undertaken the appropriate immediate steps to respond to the event and will repair the duct. The International Nuclear Event Scale (INES) rating is 0 – Below Scale (no safety significance).

Sellafield, INF-1279

Description	On 22 October 2021 a fire was detected in a radiologically controlled area within the Sellafield Magnox Reprocessing Facility.
Dutyholder's response	The plant responded in accordance with the emergency instruction and evacuated the building. Sellafield Fire and Rescue Service arrived promptly and extinguished the fire. Sellafield Ltd reported that there were no nuclear safety issues, no injuries were sustained and there were no radiological consequences. A Fire Safety Assessor from Cumbria Fire Service was dispatched to site and determined the cause of the fire to be a faulty light fitting which ignited plastic scaffolding boards. Magnox reprocessing operations were shut down. Sellafield Ltd has now checked and replaced damaged equipment and cabling in the area. Sellafield Ltd has concluded that all equipment is working correctly in the area and has brought the Magnox reprocessing facility back into service.
ONR's actions	We judge that Sellafield Ltd responded appropriately and followed its emergency arrangements. The plant remained in a safe state and no immediate action was required by us. No investigation was required by us as there were no radiological or nuclear safety consequences from this incident. The International Nuclear Event Scale (INES) rating is 0 – Below Scale (no safety significance).

Siemens Healthcare Limited, INF-1178

Description	On 11 September 2021 a package being transported for Siemens Healthcare Limited* between Siemens' production facility at Mount Vernon Hospital in London and London Bridge Hospital fell from a vehicle while in transit. It appears the package of radiopharmaceuticals was not secured correctly in the vehicle and while in transit became loose. The loose package then pressed the internal door release button due to the movement of the vehicle and fell out. Radiopharmaceuticals are radioactive medicines commonly used for the diagnosis and treatment of diseases such as cancer which are routinely transported to medical facilities across the country. Transport arrangements must meet strict regulatory requirements to protect workers and the public. *Siemens Healthcare Limited is trading as Siemens Healthineers PETNET (Mt Vernon).
Dutyholder's response	The undamaged package was found by a member of the public who quickly contacted Siemens Healthcare Limited to collect it. There was no risk to the member of the public or the environment from the undamaged package. Since an improvement notice was issued by us, Siemens Healthcare Limited has provided a suitable radiation risk assessment and implementation schedule which meets the requirements of the regulations.

Siemens Healthcare Limited, INF-1178

ONR's actions	After the incident was reported to us, an investigation was carried out into Siemens Healthcare Limited's handling of the loss of the package of radiopharmaceuticals. Following the investigation, we served Siemens Healthcare Limited with an improvement notice, due to an inadequate radiation risk assessment which was the underlying cause of the failure to respond to the incident in a suitable way. The improvement notice was issued under the Health and Safety at Work Act 1974, Section 2(1) and 3(1) and Ionising Radiations Regulations 2017 Regulation 8 – Radiation Risk Assessment. The improvement notice was complied with in January 2022.[30] The International Nuclear Event Scale (INES) rating is 1 – Anomaly (no safety significance).

Conventional health and safety incidents

9.36 Specified injuries to workers, diseases and dangerous occurrences on GB nuclear sites are reported to us.

Reportable injuries

9.37 Table 5 provides information on the number of RIDDOR reportable injuries notified to us between 1 April 2021 to 31 March 2022. The data presented includes all RIDDOR injuries reported for the GB nuclear sites and therefore includes those reported by contractors, tenants, licensees, and authorisees.

9.38 It is important to note that such a small dataset does not allow for clear comparisons in health and safety performance either between sites or year on year. Variables such as size of the undertaking; ranges and types of activities being performed; and reporting culture affect the number of incidents reported. As such, no trend analyses are reported here.

30 Siemens Healthcare Limited complies with Improvement Notice: https://news.onr.org.uk/2022/01/siemens-healthcare-ltd-complies-with-improvement-notice/

Table 5: RIDDOR reportable injuries 1 April 2021 – 31 March 2022

Site	Total injuries r eported
Hinkley Point B	1
Dungeness B	1
Winfrith	1
Berkeley	1
Dounreay	1
Springfields	1
Burghfield	2
Barrow	2
Hartlepool	3
Heysham 2	3
Devonport	4
Aldermaston	7
Hinkley Point C	15
Sellafield	21
Total	**63**

9.39 There is limited intelligence value in comparing numbers of RIDDOR incidents between dutyholder sites. This is because the dutyholders have different reporting practices, work activities and numbers of individuals on their sites. For example, there are significantly larger numbers of individuals on the Hinkley Point C site than most other sites. Our analysis shows that the numbers of RIDDOR reports for the sites are consistent with sites for equivalent industries and numbers of workers. We are satisfied that the conventional safety performance of nuclear sites is consistent with the non-nuclear industry.

Diseases

9.40 Notifications of reportable diseases did increase during the reporting period, primarily due to occurrences whereby a person at work (a worker) was diagnosed with COVID-19 following an occupational exposure to coronavirus.

9.41 However, we continued to be satisfied that licensee's pandemic arrangements remained appropriate to protect the health of the workforce on their sites during the reporting period.

9.42 Cases where it is more likely than not that the person's work was the source of exposure to coronavirus are reportable under RIDDOR and 49 such cases were reported to us during the period:

- **Sizewell A –** one RIDDOR report in relation to five cases
- **Hunterston A –** one RIDDOR report in relation to five cases
- **Trawsfynydd –** one RIDDOR report in relation to 18 cases
- **Dungeness A –** one RIDDOR report in relation to three cases
- **Harwell –** two RIDDOR reports in relation to 14 cases
- **Winfrith –** one RIDDOR report in relation to four cases

9.43 There were two RIDDOR reported incidents for cases of hand vibration syndrome at Sellafield and Dounreay.

Dangerous occurrences

9.44 Table 6 lists the RIDDOR dangerous occurrences notified to us between 1 April 2021 to 31 March 2022.

Table 6: RIDDOR reportable dangerous occurrences 1 April 2021 – 31 March 2022

Site	Total injuries reported
Hinkley Point B	1
HMNB Clyde	1
Hinkley Point C	1
Heysham 1	1
Dounreay	1
Heysham 2	2
Torness	2
Devonport	3
Sellafield	4
Total	**16**

9.45 We carried out preliminary enquires or follow-up of a number of RIDDOR dangerous occurrences in the reporting period. These included:

- **Torness –** an electrical short circuit, July 2021
- **Hinkley Point B –** an electrical generator trip, August 2021
- **Hinkley Point C –** a fire on site, September 2021
- **Sellafield Site –** a fire on site, November 2021
- **Sellafield Site –** a contractors' cabin fire, January 2022
- **Torness –** a small-bore fitting failure of 50 barg oxygen line, March 2022.

9.46 We formally investigated one dangerous occurrences event that occurred at His Majesty's Naval Base (HMNB) Clyde Authorised site,[31] which took place onboard a VANGUARD Class submarine. We were satisfied that there were no injuries to personnel and no risk to the public, however there was the potential for a serious injury/s and or possible loss of life. The event happened during maintenance on the submarine's batteries, undertaken by Babcock Marine (Clyde) Limited. Shortfalls were identified in the risk assessment and the system of work adopted, which we formally raised with the duty holder. We will measure progress with the required improvements during a future planned visit to the site.

31 Her Majesty's Naval Base Clyde at the time of the event