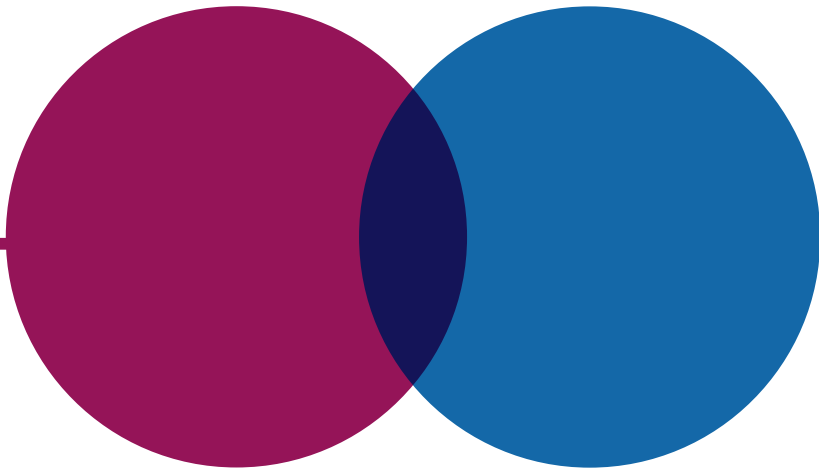




National Audit Office




The decommissioning of the AGR nuclear power stations

Department for Business, Energy & Industrial Strategy

REPORT

**by the Comptroller
and Auditor General**

**SESSION 2021-22
28 JANUARY 2022
HC 1017**



We are the UK's independent public spending watchdog.

We support Parliament in holding government to account and we help improve public services through our high-quality audits.

The National Audit Office (NAO) scrutinises public spending for Parliament and is independent of government and the civil service. We help Parliament hold government to account and we use our insights to help people who manage and govern public bodies improve public services.

The Comptroller and Auditor General (C&AG), Gareth Davies, is an Officer of the House of Commons and leads the NAO. We audit the financial accounts of departments and other public bodies. We also examine and report on the value for money of how public money has been spent.

In 2020, the NAO's work led to a positive financial impact through reduced costs, improved service delivery, or other benefits to citizens, of £926 million.



National Audit Office

The decommissioning of the AGR nuclear power stations

Department for Business, Energy & Industrial Strategy

Report by the Comptroller and Auditor General

Ordered by the House of Commons
to be printed on 26 January 2022

This report has been prepared under Section 6 of the
National Audit Act 1983 for presentation to the House of
Commons in accordance with Section 9 of the Act

Gareth Davies
Comptroller and Auditor General
National Audit Office

24 January 2022

Value for money reports

Our value for money reports examine government expenditure in order to form a judgement on whether value for money has been achieved. We also make recommendations to public bodies on how to improve public services.

The material featured in this document is subject to National Audit Office (NAO) copyright. The material may be copied or reproduced for non-commercial purposes only, namely reproduction for research, private study or for limited internal circulation within an organisation for the purpose of review.

Copying for non-commercial purposes is subject to the material being accompanied by a sufficient acknowledgement, reproduced accurately, and not being used in a misleading context. To reproduce NAO copyright material for any other use, you must contact copyright@nao.org.uk. Please tell us who you are, the organisation you represent (if any) and how and why you wish to use our material. Please include your full contact details: name, address, telephone number and email.

Please note that the material featured in this document may not be reproduced for commercial gain without the NAO's express and direct permission and that the NAO reserves its right to pursue copyright infringement proceedings against individuals or companies who reproduce material for commercial gain without our permission.

Links to external websites were valid at the time of publication of this report. The National Audit Office is not responsible for the future validity of the links.



Contents

Key facts 4

Summary 5

Part One

Background to decommissioning of the AGR stations 14

Part Two

Renegotiation of the decommissioning arrangements 28

Part Three

Plans for defueling the AGR fleet 39

Part Four

The transfer and decommissioning of the AGR stations 49

Appendix One

Our audit approach 56

Appendix Two

Our evidence base 58

Appendix Three

Glossary of key terms and phrases 60

This report can be found on the National Audit Office website at www.nao.org.uk


If you need a version of this report in an alternative format for accessibility reasons, or any of the figures in a different format, contact the NAO at enquiries@nao.org.uk


The National Audit Office study team consisted of:


Hedley Ayres, Alex Burfitt
Anthony Pitt, Riaz Rahman, and
Josie Short, under the direction
of Peter Gray.

For further information about the National Audit Office please contact:

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

 020 7798 7400

 www.nao.org.uk

 @NAOorguk

Key facts

7

number of Advanced Gas-cooled Reactor (AGR) stations in the UK

2028

closure date of the last AGR station when electricity generation ceases and decommissioning begins

£23.5bn

EDF Energy's (EDFE's) 2021 estimate of the total undiscounted decommissioning liabilities of the seven AGR stations plus the Pressurised Water Reactor (PWR) at Sizewell B¹

- £14.8 billion** value of assets at March 2021 held by the Nuclear Liabilities Fund (the Fund) to help meet the decommissioning costs of the seven AGR stations and the PWR at Sizewell B. In July 2020, government injected £5.1 billion into the Fund. Assessment of the Fund's sufficiency is complex: the aim is that target returns from investments over decades will meet the liabilities.
- £3.1 billion – £8.0 billion** EDFE's total estimated range of costs for defueling the AGR stations – the first stage of the decommissioning process – under different scenarios. The costs of defueling form part of the decommissioning liability.
- £1 billion** the Department for Business, Energy & Industrial Strategy's estimate of the savings that could be achieved during the defueling of the AGR stations following its negotiations with EDFE.
- £100 million** potential upside and downside incentivisation (gain/loss) available to EDFE for defueling and transfer of AGR stations to Magnox Ltd.

Note

¹ All financial data in this report is in real terms at 2020-21 prices unless otherwise stated. On this page the estimates for defueling costs and the value of the potential incentives available to EDFE were made in 2021-22 and have not been converted into 2020-21 prices.

Summary

Introduction

1 The UK has eight second generation nuclear power stations accounting for around 16% of total UK electricity generation in 2020. Seven of the eight stations are Advanced Gas-cooled Reactor (AGR) stations, the design of which built on that of the first generation of now closed Magnox reactors.¹ Under current plans, all of the AGR stations will have stopped generating electricity by 2028. EDF Energy (EDFE) bought the stations in 2009 following the sale of British Energy, which had operated the stations since its privatisation in 1996. At the time of the sale, the taxpayer held an interest in 36% of the shares in British Energy.

2 In 1996, the government established the Nuclear Liabilities Fund (the Fund) to meet the costs of decommissioning the AGR and Pressurised Water Reactor (PWR) stations. The UK government has provided a guarantee to underwrite the Fund in the event that its assets are insufficient to meet the total costs of decommissioning. EDFE's latest estimate of the cost of decommissioning the AGR and PWR stations, at March 2021, was £23.5 billion.² At that time, the Fund's assets were valued at £14.8 billion. Assessment of the Fund's sufficiency is complex: the aim is that target returns from investments will over decades meet the liabilities. In 2020, government made a contribution of £5.1 billion in recognition of the impact on the Fund of an increase of over £2 billion in the estimated cost of decommissioning combined with continued low returns from investments in the National Loans Fund.

3 The arrangements for decommissioning the stations have been governed by a series of agreements between, variously, the Fund, the Department for Business, Energy & Industrial Strategy (the Department) and the station owners, which were originally drawn up in 2005 when British Energy was restructured. The agreements cover, for example, the government guarantee of decommissioning costs, the arrangements for reimbursing costs, and a reserve option for the Secretary of State to take these stations back into the public sector.

¹ The UK's only other active nuclear power station is a Pressurised Water Reactor (PWR) at Sizewell B, which is not a focus of this report.

² Costs quoted in this report are presented at March 2021 values unless stated otherwise. The estimated cost of decommissioning the stations is presented in undiscounted terms in this report in order to aid comparability with previously published estimates.

4 A review of the arrangements in 2015 by government's Shareholder Executive identified opportunities for improvement, including introducing commercial incentives for EDFE to decommission the stations efficiently. In late 2017, the Department entered into negotiations with EDFE to revise the agreements for the AGR stations, which it finalised in June 2021. Under the revised agreements EDFE will continue, upon closure of the stations, to defuel each of the stations as previously planned. The Department has, however, agreed financial incentives to encourage EDFE to accelerate defueling and transfer of the stations, with the opportunity to gain or lose up to £100 million in nominal terms depending upon its performance. Once defueling is completed, the Department will take the stations back into public ownership. Ownership of the stations will be transferred one by one to the Nuclear Decommissioning Authority (NDA), for its subsidiary Magnox Ltd to complete the decommissioning process by dismantling the reactors and taking down buildings. The Department estimates the new agreements could save the taxpayer up to £1 billion compared with the previous agreements as a result of accelerated defueling and that there will be further benefits from the NDA taking over these stations.

5 This report examines whether the outcome of the Department's negotiations with EDFE, and subsequent preparations for defueling and deconstruction, are likely to lead to better value for money when decommissioning the AGR fleet. The report covers the:

- background to decommissioning the AGR stations, how decommissioning is funded and the prospects for further calls on taxpayers' money to cover the long-term costs (Part One);
- commercial agreements which underpin how decommissioning will be delivered including the Department's rationale for renegotiating the agreements and whether it met its negotiating objectives (Part Two);
- arrangements to remove fuel from the AGR stations (Part Three); and
- progress with planning for the eventual transfer and decommissioning of the AGR stations to NDA and Magnox Ltd (Part Four).

Key findings

Meeting the cost of decommissioning

6 Meeting the costs of decommissioning may over time require more support from the taxpayer. At the end of March 2021, the Fund held assets of £14.8 billion, compared with forecast liabilities of £23.5 billion. The Fund trustees expect the investments to grow over the long term and to eventually cover the costs of decommissioning. This view is based on the long timescales over which the liabilities are expected to be incurred, for example the expectation that assets will grow when the stations are in a period of extended care and maintenance at which point the level of drawdowns from the Fund are expected to be low. Following the £5.1 billion injection in 2020, however, the Fund's recently published accounts for 2020-21 highlighted a new request to the Department for an injection of a further £5.6 billion due primarily to an increase in corporation tax rates to be paid by the Fund. The liabilities have almost doubled in real terms since 2004-05. If recent returns from the Fund's investments, which are mainly held in the National Loans Fund, and the historic upward trend of nuclear liability estimates are sustained, there remains a risk that the taxpayer will have to make further contributions in the future (paragraphs 1.7 to 1.16).

The renegotiated agreements

7 In 2015, the Shareholder Executive highlighted concerns about the ability of the existing funding arrangements to incentivise efficient decommissioning of the AGR fleet. Prompted by concerns within government about the likelihood of the Fund being able to cover the rising costs of decommissioning, the Department commissioned the then Shareholder Executive to carry out a strategic review of the governance, commercial and delivery arrangements for decommissioning. Under the original funding agreement, EDFE would be paid for all the decommissioning costs incurred that fell under the terms of the funding agreement. The review found that there was no financial incentive for EDFE to carry out decommissioning work efficiently. There were limited powers for the government to reject plans on the grounds of cost-effectiveness. There was also a lack of clarity on how EDFE should allocate costs between ongoing operations and decommissioning, such as the purchase of equipment that could be used for both station operations and defueling, or the costs of using its own specialists to work on decommissioning tasks (paragraphs 2.5 to 2.8).

8 The revised agreements provide EDFE with improved clarity about its role and a commercial incentive to improve defueling performance, although the approach to implementing the incentive will need to be kept under review. The Department's main objectives were to provide EDFE with financial incentives to minimise the cost of decommissioning, focused on the defueling stage, and to provide clarity on EDFE's role and the recovery of qualifying costs in decommissioning to enable it to plan ahead. The new agreements are clear that the stations will transfer to the NDA once the fuel has been safely removed and have introduced financial incentives for EDFE to earn up to £100 million, or incur penalties up to £100 million; £86 million of this incentive is intended to encourage safe, accelerated defueling.³ EDFE agreed that a proportion of the incentive should be targeted at improving site-by-site performance. This action could improve the impact of the incentive across the sites. The success of the financial incentive regime will depend on the ability of the Department to set sufficiently stretching but realistic target costs against which the EDFE incentive will be measured and applied (paragraphs 2.9 to 2.14, 2.22 and 2.23).

9 The Department considers that exercising the option to transfer the entire fleet of stations enabled it to achieve its negotiating objectives, but the NDA will not fully know the condition of assets it is taking over until they are transferred. The Department believes that a transfer to the NDA will deliver greater efficiencies by making use of the specialist expertise already gained during work on the Magnox fleet, since three of the seven AGR stations are co-located with Magnox stations. The original agreements allowed the Secretary of State to exercise the transfer option station by station. In the statement of negotiating principles agreed with EDFE in July 2019, however, the Department indicated its intention to exercise its option to transfer the entire fleet of AGR stations. The decision removed an important uncertainty for EDFE and allowed negotiations to proceed. While the Department analysed the relative benefits of exercising the option over all the stations now, rather than doing so on a station-by-station basis, it did so after the statement of negotiating principles had been agreed with EDFE. The Department has taken an irrevocable decision to transfer the stations, but the NDA will not know the exact details of what will transfer nor have a full understanding of the associated costs and liabilities until closer to the expected transfer (paragraphs 2.15 to 2.20 and 4.6).

³ Values in this paragraph are presented in nominal terms.

Risks from the defueling of the AGR stations

10 The cost of defueling the AGR fleet is likely to be highly dependent on the rate at which the stations can be safely defueled. EDFE estimated in 2021-22 that the cost of defueling the AGR fleet could be between £3.1 billion and £8.0 billion depending on the scenario.⁴ As soon as EDFE declares a station closed to electricity production all the costs of the station are borne by the Fund. EDFE estimated that the fixed costs to manage and maintain a station that is not generating electricity but still holds fuel are around £140 million per station per year, compared with around £25 million to £35 million per station per year once the fuel has been removed. The costs to be borne by the Fund are therefore very dependent on how soon defueling begins once a station ceases electricity generation, and how quickly fuel can be removed. Accelerated defueling will test the capacity of EDFE to remove the fuel, and then the NDA to transport and store the fuel safely at Sellafield. A bottleneck at any point in this process could have repercussions across the defueling programme. Early, unexpected closure of a station, meanwhile, could mean that fuel remains on site, with defueling plans not ready, safety cases yet to be approved by the Office for Nuclear Regulation and therefore the parties not ready to begin accelerated defueling. For example, the recent unexpected early closure of Dungeness B, because of a fault in the reactor core, may lead to additional calls on the Fund of an estimated £0.5 billion to £1.0 billion (paragraphs 3.2 to 3.4 and 3.13 to 3.17).

11 The Department, EDFE and the NDA have established joint arrangements to plan and oversee the accelerated defueling phase, but the scale of the task poses a big challenge. In 2015, the Department, EDFE and the NDA established the AGR Operating Programme (AGROP) and Defueling Steering Panel to provide management and oversight of the defueling of the AGR fleet. These have enabled the parties over the past six years to come together to develop plans for accelerated defueling. A mid-programme health review of AGROP representatives from the Fund, EDFE and the NDA concluded in December 2020 that the management arrangements were appropriate and mature enough to deliver the preparation phase with good evidence of cross-industry experience being used. The joint arrangements, in our view, look to be a sensible development but will be significantly tested once defueling accelerates and the parties operate under the revised agreements, with new financial incentives for EDFE (paragraphs 3.5 to 3.12).

⁴ Values in this paragraph are presented in nominal terms.

Risks from the transfer of the AGR stations to NDA

12 The new agreements set out the principles for what will be transferred to NDA and Magnox Ltd to support decommissioning, but some important details of precisely what will be transferred, when, and how are still to be agreed. The revised Option Agreement sets out that EDFE will transfer all land, assets and contracts required by Magnox Ltd to commence deconstruction on the sites. The way in which EDFE, NDA and Magnox Ltd will work together to plan for transfer of the stations is set out in a Memorandum of Understanding. The Department had originally intended this to be a legally binding agreement but it was not possible to agree terms between EDFE and NDA. Unlike the preparations for defueling, which started soon after the 2015 review by the Shareholder Executive, the preparations for transfer did not start in earnest until June 2021 when the new agreements were signed by the Secretary of State. Under current plans the first station could transfer as early as 2026. The Department, NDA and EDFE consider this provides sufficient time to prepare, but there is a history of such plans and preparations taking longer than expected. Our 2017 report on the NDA's Magnox contract outlined delays that arose when management and operations of those stations were transferred to a private contractor. The parties to the AGR transfer will need to manage similar risks when developing and executing their plans.⁵ Some issues are likely to become pressing long before transfer, for example:

- the workforce on AGR stations will very soon want to know what the transfer to Magnox Ltd will mean for them. On-site EDFE teams have deep knowledge of their stations and are likely to have expertise important for the post-transfer decommissioning;
- Magnox Ltd will need to build its own capacity to take on management of the stations. By the mid-2030s, when it is currently planned that the AGR stations will be fully transferred, the number of sites being decommissioned by Magnox Ltd will have expanded from 12 to 19;
- NDA had little information about the stations until the agreements were signed. With improved access to information Magnox Ltd will need to draw up plans for becoming the site licensee at each individual station and get approval from the Office for Nuclear Regulation. It can take up to two years to develop management arrangements and secure approval;
- EDFE and Magnox Ltd will need to reach agreement on how contracts with the suppliers for each station should be handled in the period leading up to transfer; and
- there is currently a lack of certainty about the exact land boundary and facilities the NDA and Magnox Ltd will receive to support decommissioning. The details need to be decided early in order to support planning and avoid protracted negotiations arising between the parties, particularly where sites may have value for other uses (paragraphs 2.19 to 2.20 and 4.2 to 4.5).

⁵ Comptroller and Auditor General, *The Nuclear Decommissioning Authority's Magnox Contract*, Session 2017-2019, HC 408, National Audit Office, October 2017.

13 The long-term benefits of taking the AGR stations back into public ownership will depend on the ability of Magnox Ltd to deliver efficiencies from combining the AGR stations with its existing portfolio of nuclear stations. There is potential for Magnox Ltd to realise some of these efficiencies from deconstruction work in the years immediately after transfer of the stations. NDA's ability to deliver efficiencies from the combined Magnox and AGR stations will depend on cooperative working between EDFE and Magnox Ltd and the quality of the plans developed in the years prior to transfer. Looking further ahead to the 2030s and beyond, the current decommissioning strategy drawn up by EDFE envisages putting the reactor buildings into a period of care and maintenance lasting some decades to allow radioactivity levels to decay before deconstruction of the main reactor buildings. However, since 2021 the NDA has adopted what it terms a rolling decommissioning strategy for its Magnox stations. This approach, it believes, could allow reactors to be decommissioned sooner. Stakeholders we spoke to with technical expertise and knowledge of the AGR stations expressed differing views on the applicability of a rolling strategy to the AGR fleet (paragraphs 4.6 to 4.11).

Overseeing the future performance of the decommissioning programme

14 The Department has an important role to play in overseeing the programme but as yet there are no arrangements in place to provide assurance on how well it discharges its responsibilities. The dispersed responsibility for different elements of the programme creates risks for the taxpayer as value for money will depend on how the system performs as a whole, not just the performance of the individual parties. The new agreements include arrangements for EDFE and the NDA to resolve disputes, with input from the Department where necessary. EDFE has established a set of milestones and key performance indicators. The Department is, however, having to fulfil a variety of roles: it is a signatory to the agreements; it has an important role in ensuring the agreements work in the interests of the taxpayer; it is the sponsoring department of the NDA; it is involved in the Fund's corporate governance; and it has existing relationships with EDFE in relation to new nuclear projects. The Department's success in discharging these responsibilities will have an important influence on the success of the decommissioning programme. The centre of government has yet to put in place arrangements by which it can assure itself that the Department is fulfilling these roles and the decommissioning programme is performing effectively. There are no plans yet, for example, to include the programme in the Government Major Projects Portfolio (GMPP) (paragraphs 2.26 to 2.28 and Figure 7).

Conclusion on value for money

15 The renegotiated commercial and delivery agreements, signed in June 2021, provide improved clarity about the future of the AGR stations. By providing EDFE with a financial incentive to complete defueling of the stations efficiently, the revised funding agreement offers the prospect of securing better value for money. But the defueling programme carries substantial risks which, if poorly managed, could result in costs increasing significantly. Success will depend on how effectively EDFE and the NDA Group work together. In terms of preparing to transfer the stations, the Department is reliant on there being continuing goodwill between EDFE and the NDA to resolve potential differences. If it is to achieve value for money from the new agreements, the Department will need a clear view of how the programme is performing as a whole and will need to act quickly and decisively should problems emerge, given the large sums of taxpayers' money still at stake.

16 Initial ambitions that the existence of the Fund would help eliminate taxpayers' exposure are being tested, with rapid increases in the estimates of decommissioning costs outstripping investment returns. The history of the AGR fleet provides lessons for other long-term programmes carrying significant end-of-life liabilities, including new nuclear energy programmes.

Recommendations

17 The value for money to be delivered from the new decommissioning agreements will depend on the ability of EDFE and the NDA Group to work together effectively, alongside the other stakeholders including the Fund and the nuclear regulator. Our recommendations are made with this purpose in mind.

- a** EDFE has developed key performance indicators and milestones against which it will report progress with decommissioning. **The Department should also develop measures against which it can monitor broader aspects of the performance of the programme for decommissioning the AGR stations.** Measures should include, for example the:
- adequacy of estimates to defuel and decommission the AGR stations and the implications for the likely demands upon the Fund;
 - extent to which the actions of the various parties align in the interest of delivering safe and cost-effective decommissioning; and
 - extent to which the savings envisaged in the business case are indeed being delivered.

- b** Given the impact that early closure of a station can have on the costs incurred by the Fund, **the Department should, with EDFE, review the risks of early closure at each of the AGR stations to ensure appropriate contingency planning is in place.**
 - c** **The Department should ensure that the NDA and Magnox Ltd have a clear plan for delivering value for money in the period post-transfer,** taking advantage of any efficiencies to be realised from the combined AGR and Magnox fleets. The Department should agree performance metrics based on the plans and hold NDA and Magnox Ltd to account for delivery.
 - d** **The Department should consider what changes to the oversight and funding arrangements will be needed as the NDA begins to take responsibility for stations.** For example, whether it will remain sensible for decommissioning of the AGR and Magnox stations to be funded via different mechanisms. At present, AGR decommissioning is funded from the Fund, and the decommissioning of Magnox Ltd's stations is funded from the NDA's grant from the Department.
 - e** **The Department, working with HM Treasury, should put in place appropriate arrangements to assure the taxpayer that it is discharging its oversight role effectively and that the decommissioning programme is performing well.** It should consider, for example, in consultation with HM Treasury, whether the decommissioning programme should be added to the Government Major Projects Portfolio (GMPP), and thereby receive additional challenge and scrutiny within government. It should report publicly on the performance of the programme.
- 18** The complex history of the AGR stations demonstrates the challenge of making adequate provision for end-of-life liabilities during the operating life of these facilities.
- f** **The Department and HM Treasury should draw upon the lessons from the AGR arrangements when informing strategies for funding the decommissioning of new nuclear stations.** This should include consideration of how the taxpayer's position can be protected for the longer term, bearing in mind that estimates of decommissioning liabilities have had a tendency to increase the closer they get to maturing.

Part One

Background to decommissioning of the AGR stations

1.1 This part covers:

- the background to the UK fleet of Advanced Gas-cooled Reactor (AGR) stations;
- the decommissioning process and the operation of the Nuclear Liabilities Fund (the Fund); and
- the roles and responsibilities for taking forward decommissioning.

The Advanced Gas-cooled Reactors

1.2 The AGR stations are the UK's second generation of nuclear power station; the first being the 11 Magnox stations. The AGR stations – along with the Pressurised Water Reactor (PWR) station at Sizewell B – are the only UK nuclear power stations currently generating electricity, contributing around 16% of the UK's electricity in 2020.

1.3 The AGR stations were designed to be more efficient than the Magnox stations. While there are many similarities between the two types of reactors, the AGR design had a number of adaptations which were enabled, in part, by the fact that the AGR stations were designed for the sole purpose of generating electricity; the Magnox reactors, in some cases, had also been used to produce plutonium. The seven AGR stations were designed and built between the 1960s and 1980s, with the first stations becoming operational and supplying the National Grid in 1976. Three of the seven AGR stations are co-located with Magnox stations (**Figure 1** on pages 15 and 16). Following the closure of Dungeness B and Hunterston B stations in June 2021 and January 2022 respectively, five of the seven AGR stations continue to generate electricity.

1.4 Between 1996 and 2009, following the privatisation of the UK's nuclear energy generation, British Energy owned and operated the AGR and PWR stations. Under the terms of the privatisation, British Energy would be responsible for meeting the costs of decommissioning the stations. However, in 2002 British Energy experienced financial difficulty and the government stepped in to provide financial assistance. The taxpayer took a 64% stake in British Energy through the Fund and the government agreed to underwrite the cost of decommissioning.

Figure 1

Commercial nuclear facilities in Great Britain, in January 2022

EDF Energy (EDFE) owns and operates eight second generation nuclear power stations, including the seven Advanced Gas-cooled Reactor (AGR) stations

EDFE estate

- Advanced Gas-cooled Reactor stations
- Pressurised Water Reactor station

Nuclear Decommissioning Authority estate

- △ Magnox Ltd stations
- △ Sellafield
- △ Other sites

EDFE estate

- 1 Torness
- 2 Hartlepool
- 3 Sizewell B
- 4 Dungeness B
- 5 Hinkley Point B
- 6 Heysham 1
- 7 Heysham 2
- 8 Hunterston B

Nuclear Decommissioning Authority estate

- A Dounreay
- B Sizewell A
- C Bradwell
- D Dungeness A
- E Harwell
- F Winfrith
- G Hinkley Point A
- H Oldbury
- I Berkeley
- J Trawsfynydd
- K Wylfa
- L Capenhurst
- M Springfields
- N LLW Repository
- O Sellafield
- P Chapelcross
- Q Hunterston A

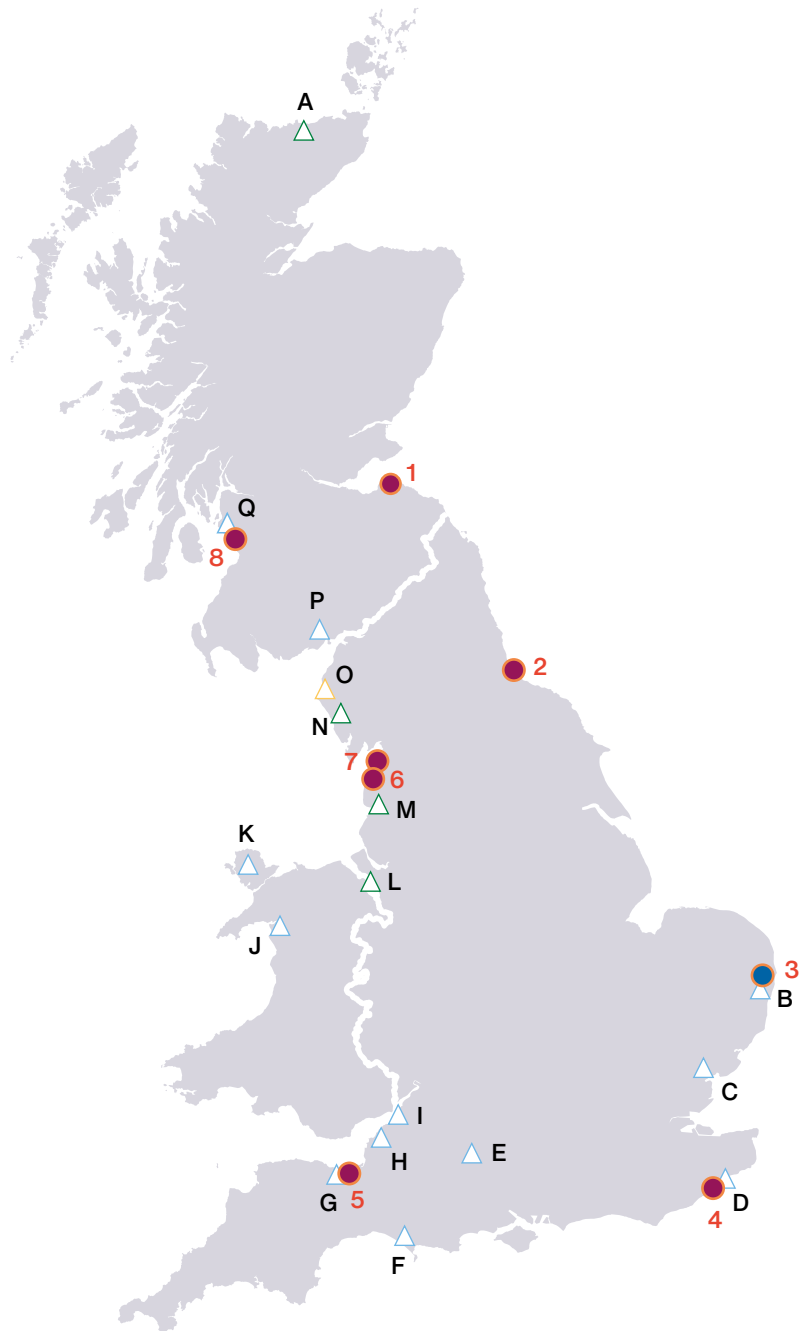


Figure 1 *continued*

Commercial nuclear facilities in Great Britain, in January 2022

Notes

- 1 EDFE also owns a Pressurised Water Reactor, Sizewell B, which is technically different from the AGR stations, and will apply a different decommissioning approach. It was not part of the negotiations between EDFE and the Department for Business, Energy & Industrial Strategy (the Department).
- 2 The Nuclear Decommissioning Authority (NDA) owns and is decommissioning the Magnox stations, which are the first generation of nuclear power stations, all of which have been defueled. All UK Magnox stations are being decommissioned by Magnox Ltd, aside from Calder Hall, the first Magnox reactor station, which is part of the Sellafield estate and is being decommissioned by Sellafield Ltd.
- 3 Sellafield provides important services to the UK nuclear industry such as dismantling spent fuel from nuclear facilities in operation, and storage facilities.
- 4 The other sites include the LLW Repository, which treats and disposes of low-level radioactive waste; Dounreay is a nuclear site that is being decommissioned; Springfields produces nuclear fuel, and Capenhurst manages and stores nuclear materials.
- 5 The Figure excludes the new nuclear station in development, Hinkley Point C.

Source: Office for National Statistics licensed under the Open Government Licence v3.0. Contains OS data
© Crown copyright and database right 2022

1.5 In 2009, EDF Energy (referred to as EDFE in this report) purchased British Energy for around £12.5 billion, with the Fund receiving around £4.4 billion for its stake in the company.^{6,7} EDFE currently owns and operates the AGR stations. As part of the purchase of the AGR stations, EDFE became responsible for their decommissioning, but, under the terms of the sale, the government guarantee for funding decommissioning remained. **Figure 2** shows a timeline of events surrounding changes in ownership of the AGR stations.

The decommissioning process

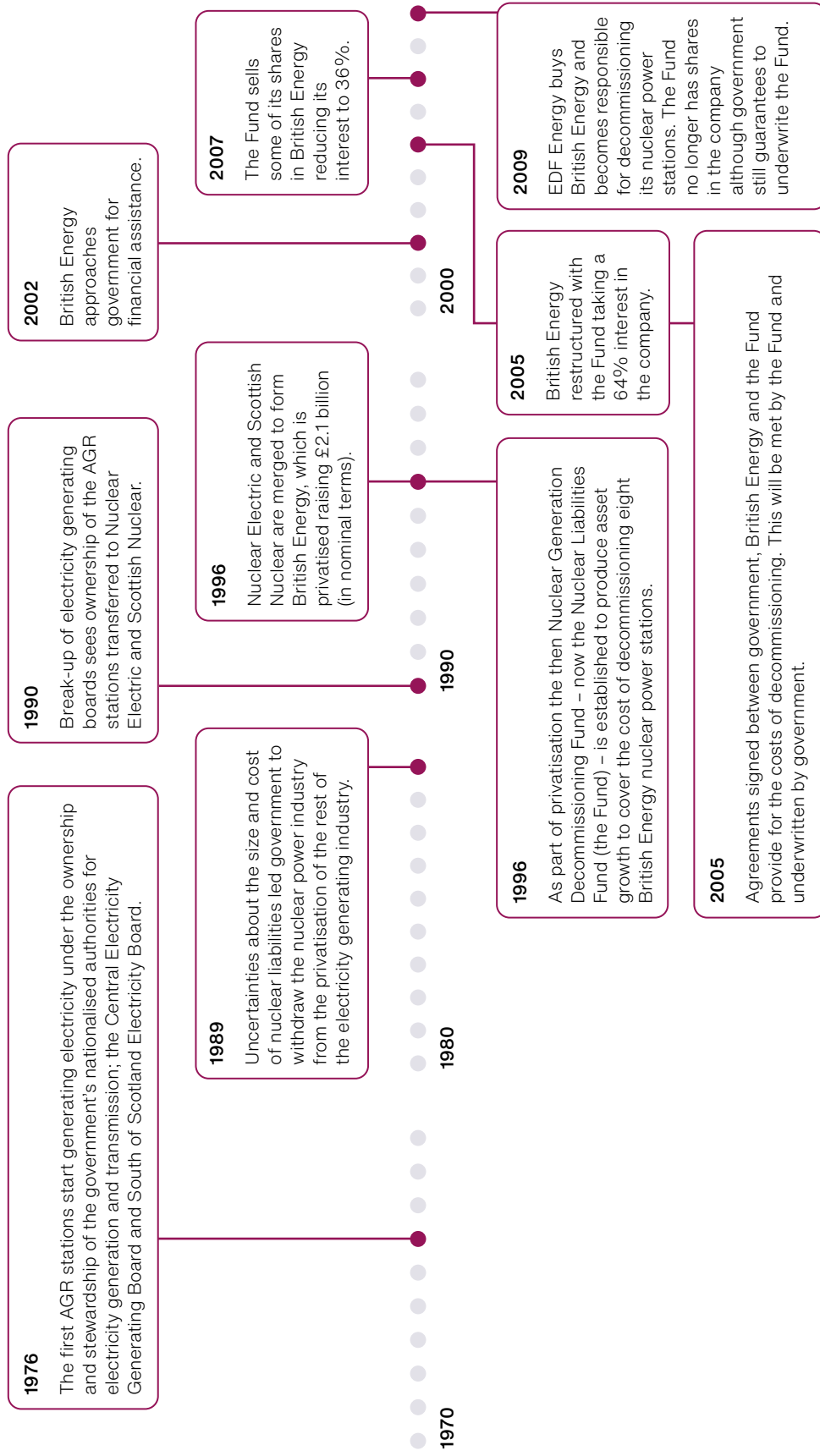
1.6 Decommissioning is the process by which a nuclear station that has reached the end of its useful operating life is made safe and ultimately returned to a state in which the land can be reused. The main stages of the decommissioning process are shown in **Figure 3** on page 18.

6 At the time of sale to EDFE, British Energy was a publicly listed company with the taxpayer holding an interest of 36% through the Fund. Other shareholders also sold their shares at this point.

7 Costs quoted in this paragraph have not been adjusted for inflation.

Figure 2
History and ownership of Advanced Gas-cooled Reactor (AGR) stations up to 2009

Ownership and therefore liabilities for decommissioning these stations has moved between public and private ownership



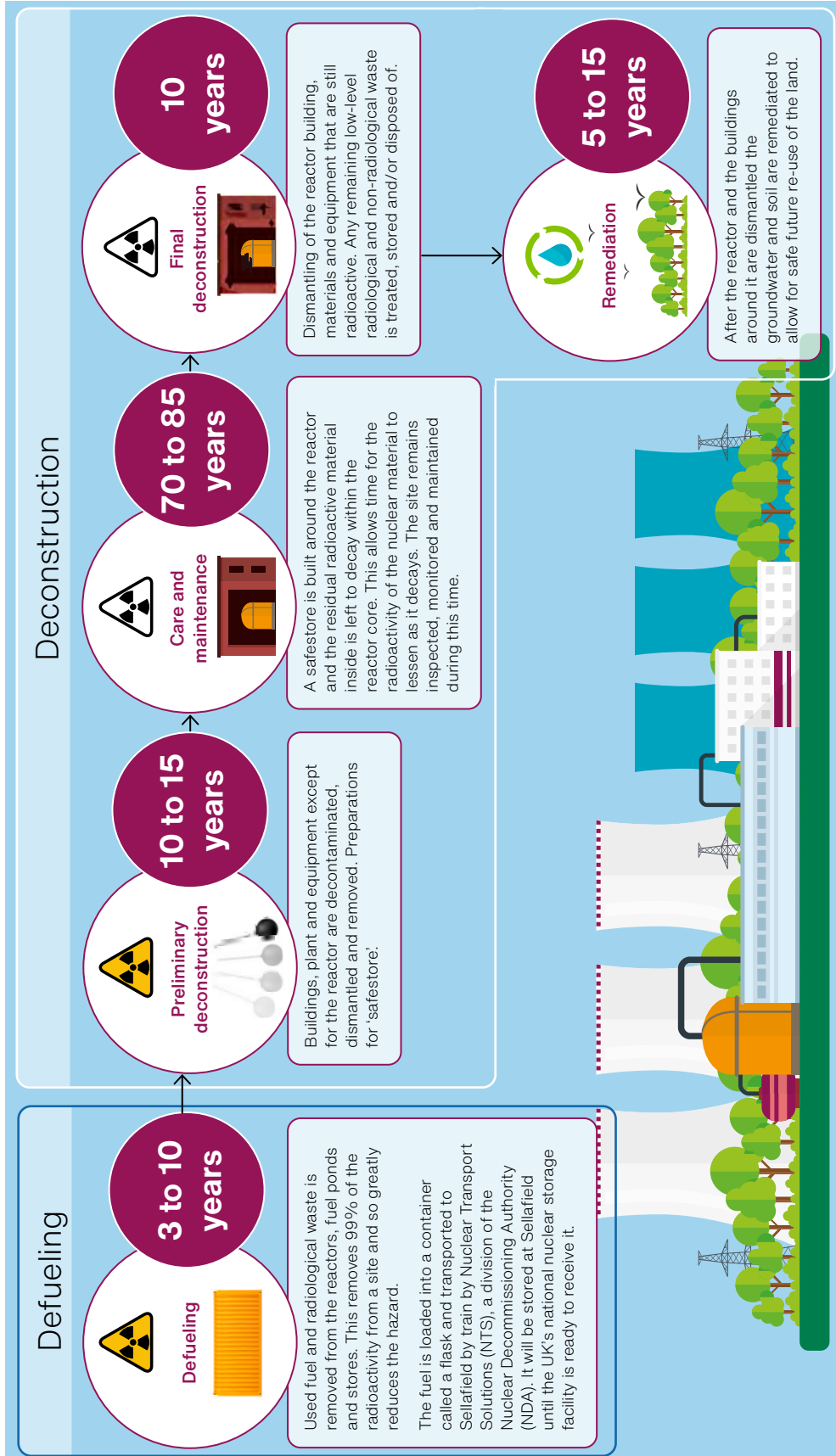
Note

1 Costs quoted in this figure have not been adjusted for inflation.

Source: National Audit Office analysis of our previous work and parliamentary information relating to the Advanced Gas-cooled Reactor stations

Figure 3 EDF Energy's indicative process and timeline for decommissioning the Advanced Gas-cooled Reactor stations

Decommissioning is the process by which a nuclear station that has reached the end of its useful operating life is returned to a state in which the land can be reused



Notes

- 1 The figure shows a care and maintenance (deferred) decommissioning approach. This involves a prolonged storage stage prior to final deconstruction. An alternative decommissioning process forgoes the care and maintenance stage to deconstruct and dismantle the reactor over a shorter period, which is discussed in Part Four.
- 2 Under the revised agreements EDF Energy will undertake defueling and transfer the stations to NDA for deconstruction.

The Nuclear Liabilities Fund

1.7 The Fund was established in 1996, following the privatisation of British Energy, to meet the eventual cost of decommissioning the AGR stations and the PWR station at Sizewell B.⁸ The aim at the time was to help eliminate taxpayers' exposure by accumulating assets that were at least sufficient to meet the anticipated decommissioning liabilities of British Energy's existing nuclear stations. The Fund was to be built up from contributions from the owners of the AGR and PWR stations (British Energy and then EDFE) following initial government endowment of £232 million in 1996.⁹

1.8 The Nuclear Trust oversees the Fund, which is a limited company registered in Scotland. The Nuclear Trust is overseen by five trustees, three of whom are appointed by the Secretary of State, including the chair, and two by EDFE. Trustees design and oversee an investment strategy that targets a rate of return sufficient to meet the estimated future liabilities of decommissioning the eight nuclear power stations. Investment managers are appointed by the Fund in accordance with the investment strategy, principles and risk appetite set by the trustees.

Assets

1.9 At the end of March 2021, the Fund held assets worth around £14.8 billion. The assets have been built from the contributions made by the station operators, income from investments, capital injection from government and proceeds from the sale of the Fund's shares in British Energy (**Figure 4** overleaf). By March 2021, the contributions from operators totalled £1.4 billion, of which EDFE paid £274 million.¹⁰ To date the Fund has received a total of £11.8 billion in the form of capital injections, including a £5.1 billion contribution from government in 2020 (paragraph 1.15) and receipts from the sale of shares in British Energy. The Fund has paid out £395 million to meet decommissioning costs already incurred, of which £391 million has been paid to EDFE since it took ownership in 2009.

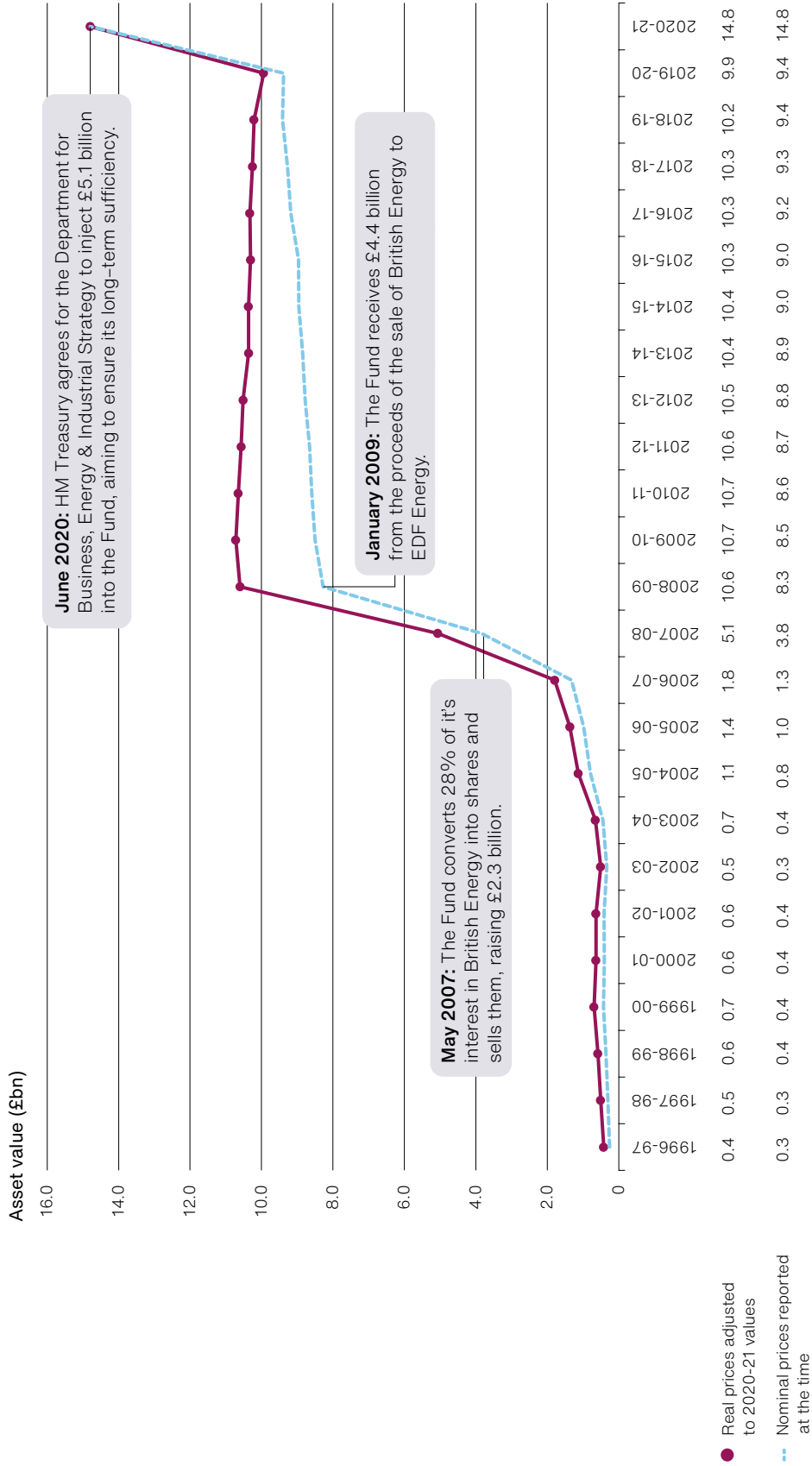
1.10 The majority of the Fund's assets (around 80%) are held in the UK government's National Loans Fund, which is considered low-risk but produces a low return on investment. The remaining assets in the Fund are held in a mixed portfolio of mainly illiquid, private sector investments.

8 Between 1996 and the completion of the restructuring of British Energy in 2005, the Nuclear Liabilities Fund was known as the Nuclear Generation Decommissioning Fund.

9 A fixed schedule of tapered payments for each AGR station set according to original closure dates and a contribution in respect of Sizewell B in respect of the actual fuel loaded. All were adjusted in line with the retail price index. The £232 million government endowment is presented in nominal terms.

10 £1.4 billion contributions from operators includes initial contributions from British Energy while under state ownership. Contributions and drawdown values to and from the Fund outlined in this paragraph have not been adjusted for inflation.

Figure 4
 The value of assets in the Nuclear Liabilities Fund (the Fund) between 1996-97 and 2020-21
 Injections of capital from government and sale of shares have supplemented the growth of the Fund



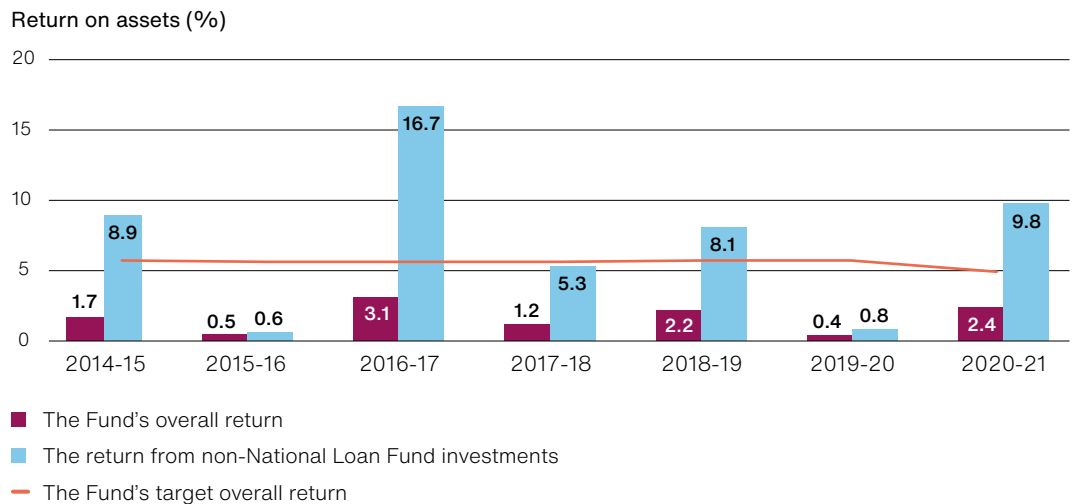
Notes

- 1 Nominal prices are asset values as at March each year as reported in the annual accounts of the Fund.
- 2 Real prices take account of inflation using December 2021 GDP deflator indices to show prices at March 2021 values.
- 3 Under terms of the 2005 restructuring the Fund received a cash sweep payment contribution approximately equal to 64% of British Energy's adjusted net cash flow. The Fund had the right to convert the cash sweep payment into a number of shares. In 2007-08, the Secretary of State directed the Fund to sell part of its cash sweep from approximately 64% to 36% and in 2008-09 to reduce its interest to nil following the sale to EDF Energy.
- 4 Text boxes included in the chart above quote values in nominal terms.

1.11 Over most of the past seven years, the rate of return on the Fund’s investments in the National Loans Fund has been significantly lower (equivalent to 0.1% return) than the return achieved from the portfolio of private sector investments. This is because of a long period of low interest rates. **Figure 5** shows that the Fund’s private sector investment has outperformed the performance of the Fund overall. The low level of returns from its National Loans Fund investment have been a significant factor in the Fund’s failure to meet the target asset return the Fund’s trustees consider necessary, in the absence of further government support (see paragraph 1.14), to meet estimated liabilities.

Figure 5
Return on assets of the Nuclear Liabilities Fund (the Fund),
2014-15 to 2020-21

The Fund has failed to meet its target for returns from its portfolio in each of the last seven years



Notes

- 1 Around 80% of the assets of the Fund are invested in the National Loans Fund with the remaining 20% in a mixed portfolio of mainly illiquid private sector investments.
- 2 The Fund's target return is the required return from all investments to meet the estimated decommissioning liabilities in full. Between 2014-15 and 2019-20, the target return was either 5.6% or 5.7%, in 2020-21 it was 4.9%.

Source: National Audit Office analysis of the Nuclear Liabilities Fund’s annual reports and accounts

Liabilities

1.12 The Fund's projected liabilities have increased beyond inflation most years since 2005 due to increases in the estimated cost of decommissioning (**Figure 6**). Under the terms of the Nuclear Liabilities Funding Agreement, EDFE is required to produce an estimate of likely liabilities from decommissioning plans. This estimate must be substantially revalued broadly every five years, with minor annual updates in the interim. The estimates are scrutinised by the Non-NDA Liabilities Assurance team (NLA), a segregated team within the Nuclear Decommissioning Authority (NDA) acting as the Department for Business, Energy & Industrial Strategy's (the Department's) agent for reviewing and approving EDFE's plans and budgets and the estimated costs of defueling and deconstruction. The total estimated cost to decommission the AGR stations and the PWR station at Sizewell B nearly doubled, adjusting for inflation, between 2004-05 and 2020-21 to £23.5 billion.¹¹

1.13 We have reported on increases in the likely cost of decommissioning other sites in the UK's nuclear portfolio including the Magnox stations and the facilities at Sellafield.¹² Increases have reflected the difficulty of estimating costs that will be incurred decades into the future; the comparatively little experience internationally of decommissioning and hence the limited body of knowledge to draw upon; and because understanding of the sites and the required work improves as decommissioning plans become clearer and as works progress.

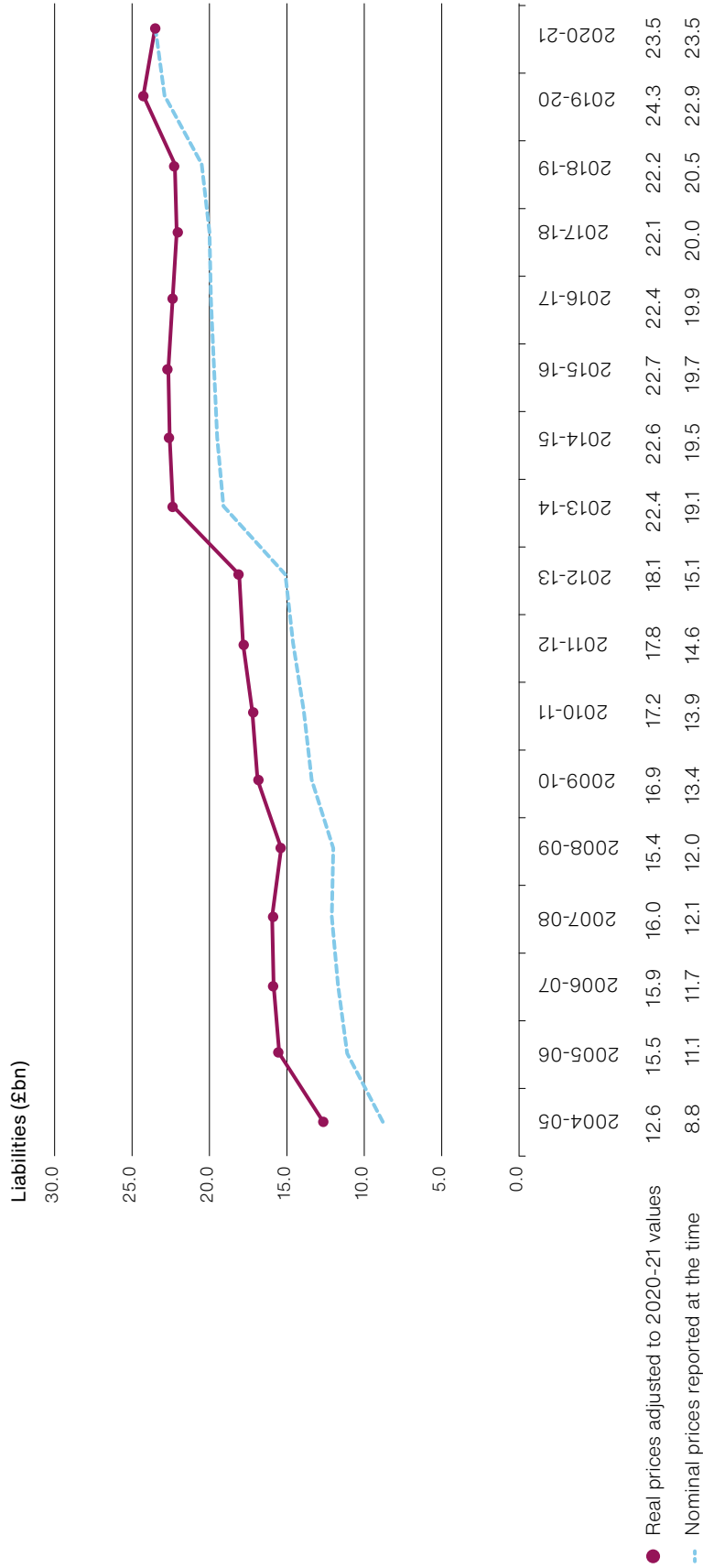
Funding sufficiency

1.14 Assessment of the Fund's sufficiency is more complex than just subtracting the value of liabilities from the Fund's assets; the aim is that target returns from investments over decades will meet the liabilities. The Fund's trustees informed us that they expect that returns on the Fund's assets will be greater than the increase in liabilities when the stations are in a period of extended 'care and maintenance' (Figure 3), during which the level of drawdowns from the Fund will be low. In 2020, the Fund entered into an agreement with the UK government that if the annual sufficiency review forecasts a shortfall of more than £300 million between the Fund's forecast assets and liabilities, government will provide a top-up to the Fund or allow the Fund to withdraw an amount from the National Loans Fund for investment in higher-returning assets.

¹¹ The estimated cost of decommissioning the stations is presented in undiscounted terms in this report in order to aid comparability with previous published estimates.

¹² See for example: Comptroller and Auditor General, *Progress Report: Terminating the Magnox Contract*, Session 2019–2021, HC 727, National Audit Office, October 2020, and Comptroller and Auditor General, *The Nuclear Decommissioning Authority: progress with reducing risk at Sellafield*, Session 2017–2019, HC 1126, National Audit Office, June 2018.

Figure 6
 Estimates of decommissioning liabilities of EDF Energy's stations, 2004-05 to 2020-21
 Estimates have almost doubled in real terms between 2004-05 and 2020-21



Notes

- 1 Estimates of decommissioning liabilities are shown from 2004-05 when the Nuclear Liabilities Fund (the Fund) was expanded following the restructuring of British Energy to include additional costs including those related to the processing and storage of certain radioactive waste and spent fuel.
- 2 Estimates include costs of defueling and deconstructing seven Advanced Gas-cooled Reactor stations and the Pressurised Water Reactor station, Sizewell B, as well as spent fuel and radioactive waste liabilities.
- 3 Nominal prices are liability values as at March each year as reported in the annual report and accounts of the Fund.
- 4 Real prices take account of inflation to show prices at 2021 values. We use GDP deflator indices to effect this, which includes the impact of the higher rate of inflation between 2019-20 and 2020-21. Although this figure shows a real terms decrease in the value of the liability between 2019-20 and 2020-21, the nominal value increased during this time.

Source: National Audit Office analysis of Nuclear Liabilities Fund and EDF Energy information

1.15 In recent years, the Fund's trustees have raised concerns about the sufficiency of the assets to cover the costs of decommissioning the stations. In each of the past two years, this has prompted the trustees to request either agreement from government to a change in its investment policy or for the provision of additional funding:

- In 2019-20, following an increase of over £2 billion in the estimated cost of decommissioning coupled with continued low returns from the National Loans Fund, the trustees commissioned a review of the Fund's sufficiency. The review concluded that all the Fund's investments in the National Loans Fund should be taken out and invested elsewhere to improve returns. This followed the trustees' warning the Department in 2017 that the Fund's assets would likely be insufficient to cover the estimated liabilities without a substantial change in investment policy.
- This led to agreement with HM Treasury in 2020 that the Department would make a £5.1 billion cash injection to ensure sufficiency of the Fund over the long term. This was granted on the basis that the injection would be invested in the National Loans Fund. This injection of funds avoided an immediate negative fiscal impact for government as removal of the Fund's deposits from the National Loans Fund would have increased public sector net debt. As part of this agreement, the Fund now undertakes an annual review of its sufficiency.
- The trustees confirmed to the Department in 2021 that, as at March that year, the Fund was sufficient, on the basis that in the case of a shortfall of over £300 million, either it could be topped-up by the Department or the trustees could withdraw an amount from the National Loans Fund for investment in higher returning assets.
- Following the 2020-21 annual sufficiency review, the Fund's 2020-21 accounts (published December 2021) outlined its request to the Department for an injection of £5.6 billion predominantly as a consequence of the impact of an increase in corporation tax rates to be paid by the Fund. Again, this was on the assumption that the funding would be injected into the National Loans Fund.

1.16 Estimates of nuclear decommissioning are subject to inherent uncertainty and risk (paragraphs 4.12 to 4.15) and they have a tendency to increase over time. The AGR and PWR liabilities have almost doubled in real terms since 2004-05 (Figure 6) and we have reported previously on significant increases in the NDA's liabilities. If recent returns from the Fund's investments (Figure 5) and the historic upward trend of nuclear liability estimates are sustained, there remains a risk that the taxpayer will have to make further contributions in the future.

Roles and responsibilities

1.17 EDFE is currently the owner and licensed operator of all the AGR stations. It has complete responsibility for the safety of all operations. To date the companies in the NDA Group have played no substantial role in the operation of the AGR stations and have had no involvement with them except as contractors to EDFE transporting spent fuel to Sellafield for reprocessing and storage.

1.18 The commercial and delivery arrangements that will govern the decommissioning of the AGR stations are underpinned by a series of agreements between EDFE and the government. These define the roles, responsibilities and rights of the various parties as to decommissioning and how it is funded. These agreements were first drawn up in 1996, revised in 2005 after the government's provision of financial support to British Energy, and in 2009 after the sale of the government stake in British Energy to EDFE. The core agreements comprise:

- a funding agreement – which defines how the Fund will operate, how it will be funded and how costs will be reimbursed; and
- an option agreement – in 2009 EDFE became responsible for the safe operation and subsequent defueling and deconstruction of the AGR stations. However, the Secretary of State retained an option to take ownership of each station for the purposes of either operating the station in order to generate electricity or decommissioning. Transfer is subject to certain conditions including that the station recipient has obtained a site licence from the regulator.

1.19 In 2021, following extensive renegotiation of the agreements with EDFE, the Secretary of State decided to exercise the option to bring the stations back into public control once they have been defueled by EDFE. The stations will be transferred, one by one, to the NDA for it to complete the process of decommissioning alongside its existing portfolio of nuclear sites, which include the older Magnox stations. **Figure 7** on pages 26 and 27 shows the roles and responsibilities of the various parties as ownership of the stations begins to transfer.

Figure 7
Advanced Gas-cooled Reactor (AGR) stations – roles and responsibilities

Multiple stakeholders need to perform to ensure that the AGR stations can be defueled and transferred effectively

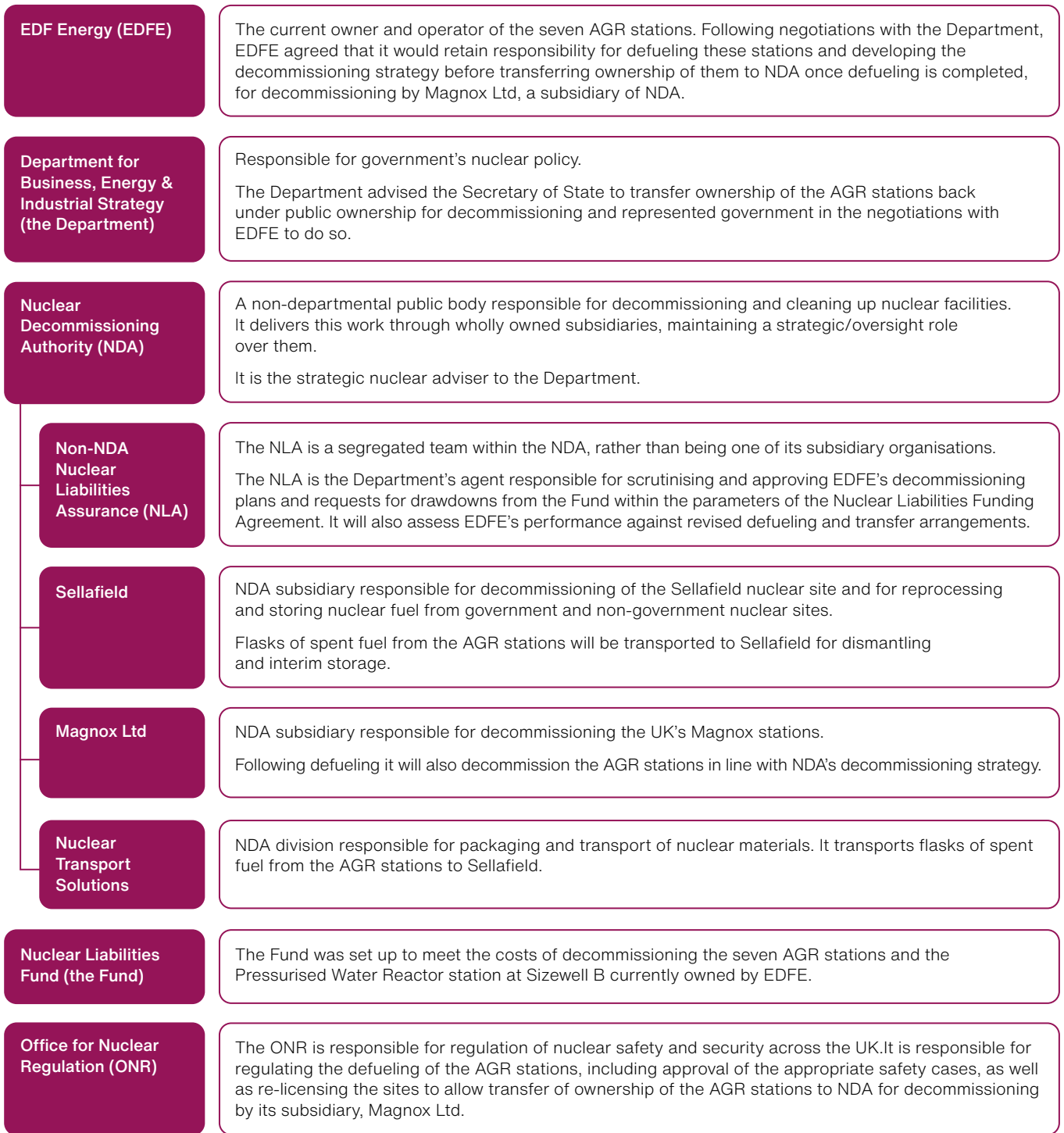


Figure 7 *continued*

Advanced Gas-cooled Reactors (AGR) stations – roles and responsibilities

Notes

- 1 Magnox Ltd only becomes responsible for decommissioning plans after transfer and when it becomes the site licensee. Before that point EDFE as the site licensee has regulatory responsibility for developing plans.
- 2 The Department plans to review the role of the NLA prior to the transfer of AGR stations to the NDA and Magnox Ltd.
- 3 There are ongoing discussions within government whether deconstruction activity by NDA will be funded through its overall public spending settlement or reimbursed through the Fund.

Source: National Audit Office analysis of information provided by the Department for Business, Energy & Industrial Strategy, the Nuclear Decommissioning Authority and EDF Energy

Part Two

Renegotiation of the decommissioning arrangements

2.1 This part examines:

- the rationale for renegotiating the agreements with EDF Energy (EDFE);
- whether the Department for Business, Energy & Industrial Strategy (the Department) achieved its negotiating objectives; and
- the arrangements for reviewing the performance of the decommissioning programme.

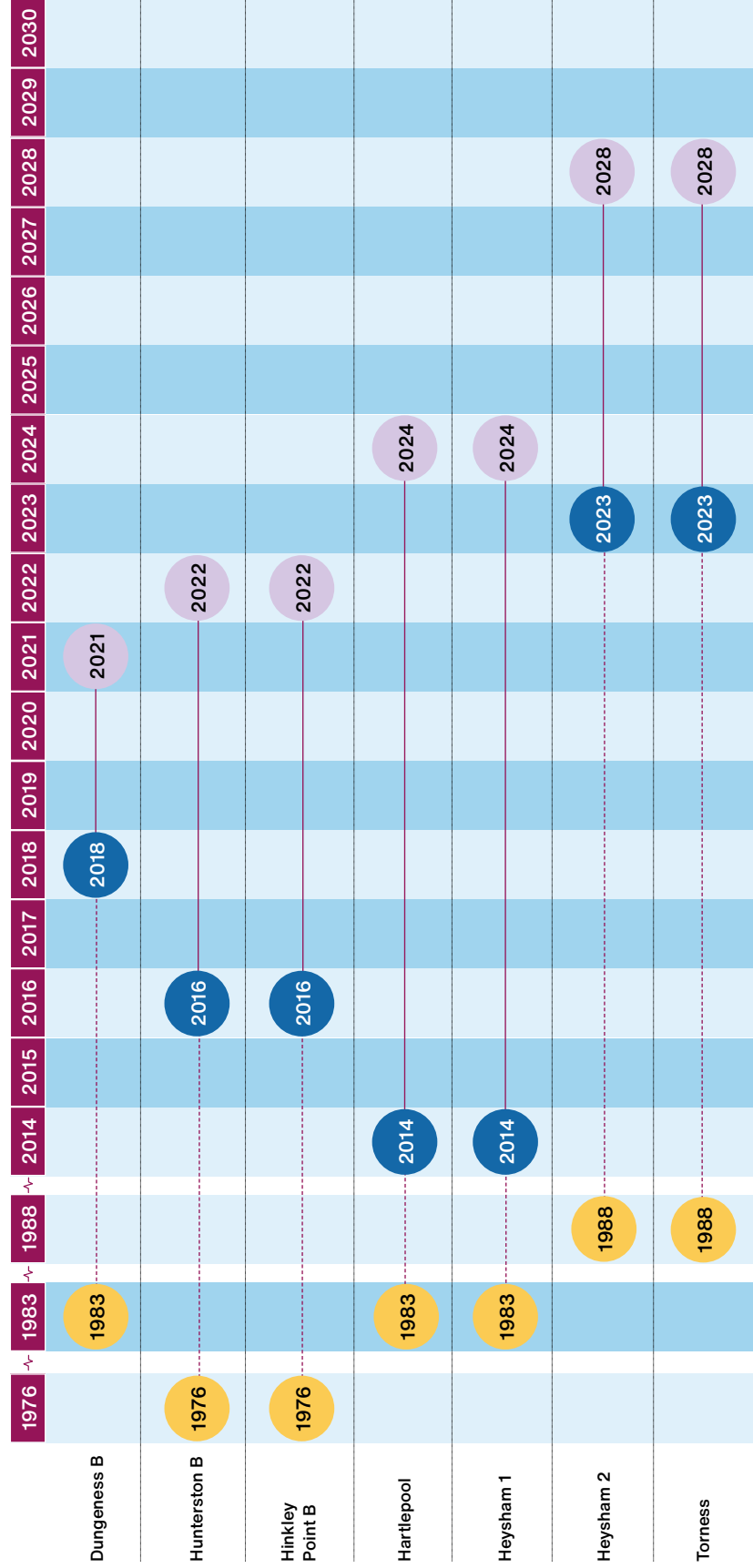
The rationale for renegotiating the decommissioning agreements with EDFE

2.2 The decommissioning agreements were not a major focus during the 2009 sale of British Energy to EDFE. The government's principal objective for selling its stake in the company had been to ensure that there would be nuclear operators in the UK able to build and operate any new nuclear power stations. The government did not consider British Energy financially strong enough to make such investments itself. An additional objective was to maintain the viability and continued operation of the Advanced Gas-cooled Reactor (AGR) fleet.

2.3 Government did not seek and EDFE did not offer any binding commitment to build new nuclear power stations as a condition of sale. EDFE's parent group EDF has, however, since become the lead partner in the construction of a new nuclear power station at Hinkley Point C, due for completion in 2026. It is also the lead partner in a consortium putting together the proposal for a new nuclear power station at Sizewell. Since 2009, EDFE has also maintained the viability and continued operation of the AGR fleet. Compared with expectations in 2009, **Figure 8** shows that it has successfully extended the operating life of all seven stations in the AGR fleet.

Figure 8
Original and revised closure dates of the Advanced Gas-cooled Reactor (AGR) stations

All seven AGR stations will have generated electricity for longer than was originally planned



- Opening date
- Scheduled closure date when EDF Energy took over
- Current scheduled closure date

Source: National Audit Office analysis of information provided by EDF Energy and the Department for Business, Energy & Industrial Strategy

2.4 At the time of the sale, government did not carry out a formal assessment of the possible impact of the sale on the risk of taxpayers having to bear nuclear liabilities. Following the sale, the Nuclear Liabilities Fund's (the Fund's) 2008-09 accounts reported assets of £10.6 billion and a liability for cleaning up the stations of £15.4 billion. We noted in 2010 that these liabilities would be incurred over many decades and were highly sensitive to assumptions about the likely expenditure profile and costs.¹³

The 2015 review of the decommissioning agreements

2.5 In 2015, the then Shareholder Executive, on behalf of the Department, undertook a review of the arrangements with EDFE for decommissioning the AGR stations.^{14,15} The review was carried out in the context of concerns about increases in the estimated cost of decommissioning and the fact that continuing low returns on investments were limiting the ability of the Fund to grow its investments. By 2015-16 the estimated cost of decommissioning had risen to £22.7 billion from £15.4 billion in 2008-09. There was an increasing risk that the assets in the Fund would be insufficient to cover the liabilities, and that a call on the government's guarantee would be needed.

2.6 The focus of the review was on assessing the extent to which management of the AGR stations could be optimised in order to achieve value for money and reduce the risk of government's commitment to underwrite the Fund being called upon. The Shareholder Executive led with input from EDFE, the Department, the Fund and the Nuclear Decommissioning Authority (NDA).

2.7 The review, completed in October 2015, identified that the existing agreements did not incentivise EDFE to look at more innovative or cost-efficient ways to minimise decommissioning costs. Costs were to be reimbursed under a cost pass-through model. The review also noted that officials assessing claims made on the Fund could only assess whether the costs qualified for reimbursement and could not consider the efficacy of plans. It was unclear what costs incurred by EDFE could be reimbursed and so there was a risk of works being delayed should disputes arise. Time was running short ahead of the expected closure of the first AGR stations (which was then expected to start in 2023) and the review found that the existing arrangements governing defueling and decommissioning could be enhanced. The report favoured EDFE retaining responsibility for the initial stages of defueling and early deconstruction, given EDFE's knowledge and experience of the stations as the incumbent operator.

¹³ Comptroller and Auditor General, *The sale of the government's interest in British Energy*, Session 2009-10, HC 215, National Audit Office, January 2010.

¹⁴ The Shareholder Executive is now UK Government Investments (UKGI).

¹⁵ While the review considered all EDFE stations – seven AGR stations and the Pressurised Water Reactor (PWR) – its focus and recommendations were directed at the AGR stations as they were closing much earlier than the PWR.

2.8 The review made a series of recommendations, most of which were focused on planning for defueling and decommissioning. These included the creation of a joint defueling steering group to oversee and govern the development of an integrated plan for defueling AGR stations, which would include the parties working more closely together to improve their understanding of the challenge. The review also identified a need for further discussion on issues such as incentivisation and risk-sharing to drive efficiency. It suggested further work be done to assess if government ownership would deliver better value, with 2019 considered at the time an appropriate point to decide whether to exercise the transfer option.

Whether the Department achieved its negotiating objectives

The Department's approach to negotiations

2.9 UK Government Investments (UKGI), working with the Department, opened discussions with EDFE in late 2017.¹⁶ The initial task was for the parties to negotiate on the main features of a likely agreement to be followed by detailed work on the text of the agreements. It quickly became clear that the negotiations would raise broader policy questions that would normally lie outside the remit of the UKGI. As a result, the Department assumed full responsibility for the negotiations in April 2018.

2.10 In June 2018 the Department set itself the objective of negotiating optimal commercial arrangements with EDFE, focused on safe defueling that would minimise decommissioning costs. The Department set out to:

- introduce financial incentives for EDFE, which included EDFE bearing downside financial risk and upside opportunity; and
- achieve value for money for the taxpayer from the transfer and deconstruction of the stations.

2.11 Over the period leading up to and during the negotiations the Department:

- established in October 2017 a project steering group, including officials from HM Treasury and UKGI, to oversee and advise on the negotiations;
- appointed in 2017 an experienced chief negotiator and a lead negotiator who had been involved in the area since 2012. These individuals were involved throughout the key period 2017 to 2021. This consistency of staff, which is unusual in government, was beneficial especially during the prolonged and technical discussions with counter-parties;

¹⁶ The Shareholder Executive became UK Government Investments in 2016.

- worked constructively with the Fund trustees to take account of their views. As the Fund is a signatory to the funding agreement the Department needed its support for the changes. The Fund trustees did not negotiate with EDFE but had extensive discussions with the Department to safeguard the interests of the Fund. The trustees regarded the changes arising from the negotiations as structurally sound and a significant step forward;
- commissioned an external law firm with experience in the field to advise on how the terms of the agreements might be amended to improve clarity and protect value for money;
- received technical advice from a segregated team within the NDA, the non-NDA Liabilities Assurance team (NLA), on matters relating to how EDFE's recovery of costs could be monitored and controlled and oversight of EDFE's decommissioning plans improved; and
- sought advice in 2016 from the NDA about the optimal time for the stations to transfer to the NDA. The Department negotiated with EDFE and sought advice from the NDA around amendments to the Option Agreement and development of the Cooperation Memorandum of Understanding.

2.12 In July 2019, the Department and EDFE agreed a statement of principles that set out the main issues for more detailed discussion and agreement. The main elements included:

- the Department exercising its option to transfer all EDFE's AGR stations to the NDA on an irrevocable basis (subject to due diligence);
- ownership of the stations to transfer to the NDA after EDFE had completed defueling. The precise timing to be agreed but expected to be station by station up to a year after defueling is completed;
- an incentive arrangement to be established focused on defueling, which will involve £100 million of upside opportunity (that is to say, fee) and £100 million of downside risk for EDFE;¹⁷
- NDA and EDFE to enter into a cooperation agreement to help ensure an efficient transfer of the AGR stations;
- NDA to set the strategy for any deconstruction activity undertaken by EDFE prior to transfer; and
- clarificatory amendments to be made to ensure EDFE received full qualifying cost recovery in relation to defueling and decommissioning activity.

¹⁷ Values in this paragraph are presented in nominal terms.

2.13 In autumn 2019 the Department asked the chair of the 2015 review to undertake a ‘critical friend’ review to consider whether the direction of travel set out in the statement of principles was reasonable from a commercial and strategic perspective, and to offer a view on the next phase of the negotiations including the design of the performance reward framework. The review noted that unless the Secretary of State exercised the option to transfer the stations, the existing agreement guaranteed EDFE a long-term cost pass-through contract with very limited risk to EDFE, little incentive for EDFE to decommission stations more efficiently and only minimum performance standards. The reviewer concluded that the existing agreements provided the Department with few negotiating levers, and that those it had, if exercised, might hurt the Department more. Given the weakness of the Department’s position, the review suggested that a collaborative rather than adversarial negotiating position would have a greater chance of success. It advised the Department to be prepared to hold its ground in the detailed negotiations where time pressure might be an important weapon.

The outcome of negotiations

2.14 The negotiations were concluded in June 2021. We examine further below the extent to which the revised agreements have helped the Department deliver on its negotiating objectives. We consider the following elements in turn:

- i** The Department’s decision to exercise the option to transfer all of the stations back into public ownership.
- ii** Confirmation that EDFE would continue to be responsible for the complete defueling of the AGR fleet.
- iii** The introduction of an incentive regime to motivate EDFE to undertake defueling and station transfer in a cost-efficient way.
- iv** Greater clarity on the type of costs allowed to be claimed under the Nuclear Liabilities Funding Agreement.

i) The decision to exercise the transfer option

2.15 The transfer of the stations to Magnox Ltd once defueling is complete provides clarity to EDFE, the NDA and Magnox Ltd. The option was exercised at the point the new decommissioning agreements were signed in June 2021 and applies to all the AGR stations. The Secretary of State’s decision is irrevocable.

2.16 The financial benefits to be had from transfer are inevitably highly uncertain. It will be difficult to measure efficiencies against what might have happened if transfer had not occurred. The Department's business case prepared in late 2020 estimated that the net benefits to the Fund of transferring the AGR stations to Magnox Ltd could be of the order of £600 million in the years immediately post-transfer. However, the business case also noted that any such estimates were highly uncertain as there was considerable uncertainty and risk associated with station transfer. Estimates prepared by the NDA for the Department put the net benefit range between around £800 million and minus £900 million. The business case nevertheless argued that public ownership would allow greater control over how liabilities are discharged and therefore closer alignment with government objectives for minimising the cost of safe decommissioning, with potential benefits from realising corporate and technical synergies between Magnox Ltd and AGR estates.

2.17 The full range of risks for the NDA associated with taking on the new stations will not be known until much closer to transfer. In January 2020, the Department asked the NDA to undertake due diligence, the purpose of which was to identify: risks which should be considered by NDA and Magnox boards; material liabilities that could transfer to NDA and Magnox Ltd; the extent of transfer restrictions in connection with contracts, know-how, intellectual property and other assets; and the nature and scope of possible dependencies. As the review was conducted several years ahead of transfer there was no way of knowing what condition the stations would be in at the time of transfer. The NDA view was reliant on the information available or provided.

2.18 The original agreements allowed the Secretary of State to exercise the transfer option station by station. The statement of principles agreed in July 2019, however, opted for the Department exercising its option to transfer the entire fleet of AGR stations in one go. The decision removed an important uncertainty for EDFE and allowed negotiations to proceed. The Department considers that exercising the option in this way enabled it to achieve its negotiating objectives. In 2020, the Department undertook an analysis of the relative benefits of exercising the option in one go versus exercising the option on a station-by-station basis, but this analysis was carried out after the negotiating principles had been agreed with EDFE. The Department has taken an irrecoverable decision to transfer the stations, but the NDA will not know the results of due diligence until closer to the expected transfer.

2.19 Following agreement on the statement of principles, the Department sought a legally binding agreement between EDFE and NDA to define how the parties will work together to prepare for the transfer of the stations to NDA. It was unable to agree full terms between EDFE and NDA on this point. The Department also intended for the NDA, as the recipient of the stations, to have strategic authority over any deconstruction work carried out by EDFE ahead of transfer but this could not be achieved as regulatory responsibilities have to stay with EDFE, as the site licensee, until transfer takes place. In the event, a non-legally binding Memorandum of Understanding between EDFE and the NDA provides a framework for how the parties will work together on defueling, deconstruction and transfer. The memorandum contains provision for the NDA and the Department to inform EDFE's approach and sets out how disputes between the parties will be escalated and resolved. The Department informed us this would better support collaboration rather than a narrow, detailed agreement that may have required frequent review and led to disputes. The revised option agreement outlines what categories of assets and resources will be transferred to Magnox Ltd, such as the land, buildings, equipment, people and contracts required to carry out deconstruction work once the fuel has been removed from the reactors. As we set out in Part Four, however, there remains some important detail to be tied down before the stations can transfer.

2.20 On completion of the negotiations between the Department and EDFE, the NDA requested and received a direction from the Department to take over the AGR stations once they have had fuel removed. This reflects the fact that the Department, not the boards of the NDA and Magnox Ltd, was responsible for the commercial terms agreed with EDFE. The NDA informed the Department that the arrangements were not ideally suited to delivering best value for money because it had not been possible to secure legal certainty about the people and assets transferring from EDFE to Magnox Ltd. The NDA was also of the view that it could not determine a pre-transfer decommissioning strategy for each station, and that this created risks to best value for money. The Department acknowledged that risks and uncertainties remain and will require significant effort from the NDA Group to achieve successful outcomes. The Department agreed that the NDA will not be held to the benefits in the business case and that it will be funded for any costs and liabilities incurred from the transfer.

ii) EDFE will defuel the stations

2.21 The Department properly considered whether the stations should be transferred prior to defueling. EDFE wanted to complete the defueling of the AGR fleet. The company had in-depth knowledge of the stations and its teams were already experienced in defueling as part of the routine operation of stations. The Department sought the views of the NDA at an early stage about transferring stations to any new operator prior to defueling. The NDA advised against early transfer and considered that EDFE, given its existing knowledge of the AGR stations and the sites, was best placed to take forward defueling. We saw no evidence to suggest that transferring the stations prior to defueling would have been a practical option, particularly given the short time available before defueling was due to start.

iii) The introduction of an incentive regime

2.22 EDFE stands to earn a fee of up to £100 million in the event that it meets its milestones for defueling and supporting transfer; similarly, it could lose up to £100 million for poor performance.¹⁸ These incentives are weighted towards the defueling stage; up to £86 million is available for good performance or EDFE can incur costs of up to £100 million. They reflect the greater certainty about the defueling requirements compared with the less developed plans for EDFE's work to support transfer, and the greater financial significance to the Fund of EDFE's performance in defueling the AGR fleet compared with its preparations for transferring the stations and its involvement in preliminary deconstruction work.

2.23 The new arrangements are an improvement on the previous agreement, which only allowed for costs to be reimbursed with no incentive to deliver defueling more efficiently. The Department estimates that the new agreements could deliver more than £1 billion of savings compared with previous agreements. The 'critical friend' review suggested that the £100 million potential fee might not be enough incentive for EDFE to place greater corporate focus on the AGR stations, given the potential value of its other UK interests and recommended that the incentive be focused more on performance at individual stations.¹⁹ The Department implemented this recommendation. EDFE is reviewing how performance incentives for senior staff at the individual stations can be linked to the new financial incentive. The baselines against which these incentives will be assessed will be agreed by the NLA once each station has ceased operations and a clearer picture of likely costs and risks has been established, following the methodology agreed in the revised funding agreement.

¹⁸ Values in this paragraph are presented in nominal terms.

¹⁹ The £100 million fee is presented in nominal terms.

iv) Clarification of allowable costs

2.24 The 2021 agreements have clarified the definition of what constitutes a qualifying cost, which is designed to reduce the potential for disagreements. The 2009 agreements were ambiguous about what constituted a decommissioning cost. This created the potential for delay and additional cost while EDFE and officials determined whether a particular cost was recoverable from the Fund.

2.25 The 2021 agreements clarified which EDFE costs can now be reimbursed. The agreements also give the NLA greater access to EDFE's cost information and the NLA can now challenge the efficiency of EDFE's plans. Under the 2009 agreements, the NLA had less access to EDFE's cost information and had fewer powers to undertake validation of EDFE's cost recovery claim. The new powers should help guard against the risk that the Fund reimburses costs more applicable to operating the stations and generating electricity than decommissioning activities.

The arrangements for reviewing the performance of the decommissioning programme

2.26 The AGR decommissioning programme is unusual compared with other major government projects and programmes as no single organisation has complete responsibility and authority for the performance of the overall programme. As the regulated site licensee, EDFE remains responsible for its own stations and for everything that happens on-site until they are transferred. The NDA has limited rights of access to the stations prior to transfer. On transfer the NDA assumes full responsibility for the stations and most of the liabilities associated with them, irrespective of what those might turn out to be. The dispersed nature of responsibility for different elements of the programme creates risks for the taxpayer as value for money will depend on how the system as a whole performs, not just the performance of individual entities.

2.27 The agreements include arrangements by which the parties – the Department, EDFE and the NDA, along with the Fund – will be able to resolve problems and differences. In line with a new requirement of the revised funding agreement, EDFE has produced a framework of key performance indicators and milestones against which progress will be measured. EDFE will report on its performance at quarterly and annual review meetings with the parties, including the Department. Given the substantial sums of taxpayers' money that has already been transferred to the Fund, the potential for further calls on taxpayers' money and the criticality of cooperative working between the parties, it will be important that the Department has its own measures to keep track of how effectively the overall programme is being managed and how well the various parties are working together.

2.28 The Department itself will be fulfilling a number of roles in relation to decommissioning the AGR stations. It is the sponsoring department of the NDA, a signatory of the agreements with EDFE, involved in the Fund's corporate governance, and has existing relationships with EDFE in relation to new nuclear projects. There may be merit in the Department being subject to scrutiny from the centre of government about how effectively it is fulfilling its various roles. High-risk or high-value government projects are often scrutinised by the Infrastructure and Projects Authority through the Government Major Projects Portfolio (GMPP). Despite the high value of the decommissioning work, HM Treasury told us that there were no plans to place AGR decommissioning on the GMPP, although it may reconsider this when the stations transfer to the NDA.

Part Three

Plans for defueling the AGR fleet

3.1 This part examines whether appropriate arrangements have been made to manage the risks to value for money during the defueling stage.

The defueling process

3.2 Once an AGR station formally ceases commercial electricity generation, the costs of maintaining the station and any decommissioning activities will be met from the Nuclear Liabilities Fund (the Fund). The first major decommissioning stage is to remove all the fuel from the reactor core, cooling ponds and stores on-site and transport it to Sellafield for dismantling and consolidating for safe long-term storage (**Figure 9** overleaf). Removal of fuel reduces around 99% of the radioactivity, which significantly reduces the hazard. Although defueling and refuelling takes place while a station is generating electricity, removal of fuel from a reactor following closure involves a much greater volume of material needing to be transported to and stored at Sellafield. This will place new demands on the ability of EDF Energy (EDFE) to increase its defueling capacity, and on Nuclear Transport Solutions and Sellafield Ltd to transport, dismantle and store the fuel.

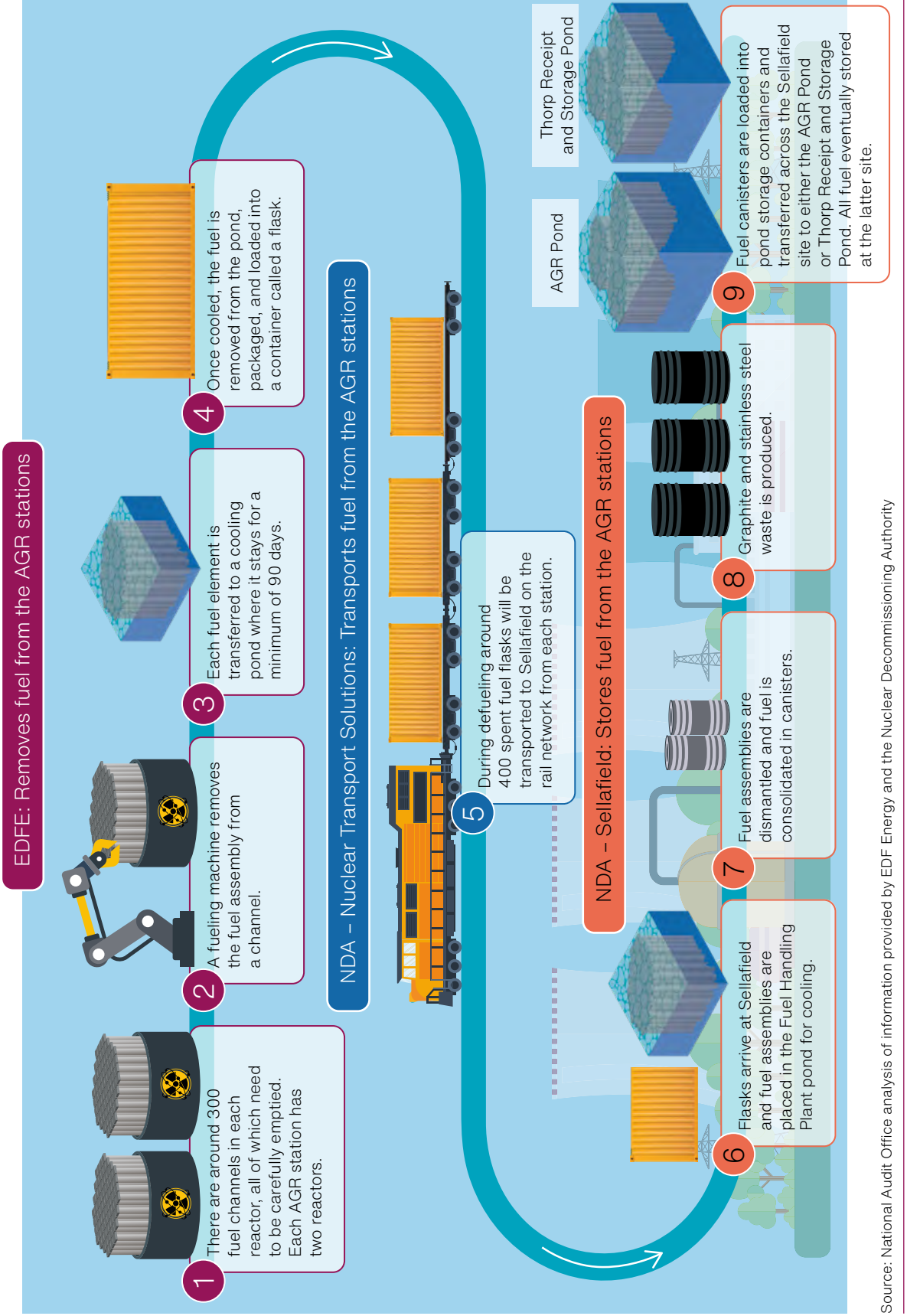
3.3 There are significant cost implications the longer fuel remains on site following closure. EDFE has estimated that the fixed costs to manage and maintain a station that is not generating electricity but still holds fuel could amount to around £140 million per station per year.²⁰ These estimates reflect the cost of having to maintain the station, with all the associated staffing and facilities required to keep the reactor in a safe state. These fixed costs are expected to fall significantly to around £25 million to £35 million per station per year once the fuel has been removed.

3.4 The estimated cost of defueling the AGR fleet is highly sensitive to assumptions about the rate at which individual stations can be defueled safely following closure. In November 2021, EDFE estimated that defueling the AGR stations would cost between £3.1 billion and £8.0 billion. EDFE measured this range against four assessed scenarios ranging from a best-case to a worst-case scenario. The criteria defining each scenario are set out in **Figure 10** on page 41.

²⁰ All costs referred to in Part Three are 2021-22 values presented in nominal terms.

Figure 9 Outline of the defueling process for Advanced Gas-cooled Reactor (AGR) stations

To avoid delays the defueling process will require EDF Energy (EDFE) and the Nuclear Decommissioning Authority (NDA) working in tandem to extract, transport, dismantle and store fuel



Source: National Audit Office analysis of information provided by EDF Energy and the Nuclear Decommissioning Authority

Figure 10

EDF Energy's scenario criteria for estimates of potential defueling costs

The estimated cost range for defueling is between £3.1 billion and £8.0 billion, with works estimated to take between 3.6 and 7.2 years on average per station

| Scenario | Performance | Estimated fleetwide cost (£bn) | Average duration each station Years |
|------------------------|--|-----------------------------------|--|
| Reasonable best case: | <ul style="list-style-type: none"> All remaining stations closed as planned. Strong planning preparations. Strong station defueling performance. Learning between stations successfully transferred. Uncertainty works to benefit the programme. Very few risks events emerge. | 3.1 | 3.6 |
| Reasonable good case: | <ul style="list-style-type: none"> Early closure of some stations. Good planning preparations. Good station defueling performance. Learning transferred to a few stations. Small negative impact from uncertainty. Typical risk occurrence but risks are mitigated. | 4.3 | 4.4 |
| Reasonable bad case: | <ul style="list-style-type: none"> Early closure of most stations. Limited planning preparations. Average station defueling performance. Limited learning between stations. Medium negative impact from uncertainty. Above average risk occurrence that is insufficiently mitigated. | 5.8 | 5.7 |
| Reasonable worst case: | <ul style="list-style-type: none"> Closure of most stations is substantially earlier than planned. Unplanned closure of most stations hinders planning preparations. Poor station defueling performance. No learning between stations. High negative impact from uncertainty. High-risk occurrence that is insufficiently mitigated. | 8.0 | 7.2 |

Notes

- Estimated costs and durations for each scenario include risk and uncertainty. The defueling duration is the average across the fleet.
- Estimated fleetwide costs are October 2021 values presented in nominal terms.

Source: National Audit Office analysis of information provided by EDF Energy

3.5 We examined the arrangements being put in place alongside the funding agreement to plan the safe and efficient defueling of the AGR fleet, in particular:

- i whether the Department for Business, Energy & Industrial Strategy (the Department), the Nuclear Decommissioning Authority (NDA) and EDFE are working together effectively to develop defueling plans; and
- ii whether there are appropriate arrangements in place to manage the risks to the prompt defueling of the fleet.

i) Whether the Department, the NDA and EDFE are working together effectively to develop defueling plans

3.6 As illustrated at Figure 9, the defueling of a nuclear station is a complex operation that will require the on-site EDFE team to scale up the capacity of its normal defueling activities and to do so safely. At the same time, the different parts of the NDA will need to be ready to transport, dismantle and store the greater volume of fuel leaving AGR stations. All of this will require careful planning of the capacity at each stage of the end-to-end chain. As more stations begin to close (**Figure 11**), the number of stations undergoing defueling at the same time will increase. This will test the robustness of any programme management arrangements put in place by EDFE and the NDA.

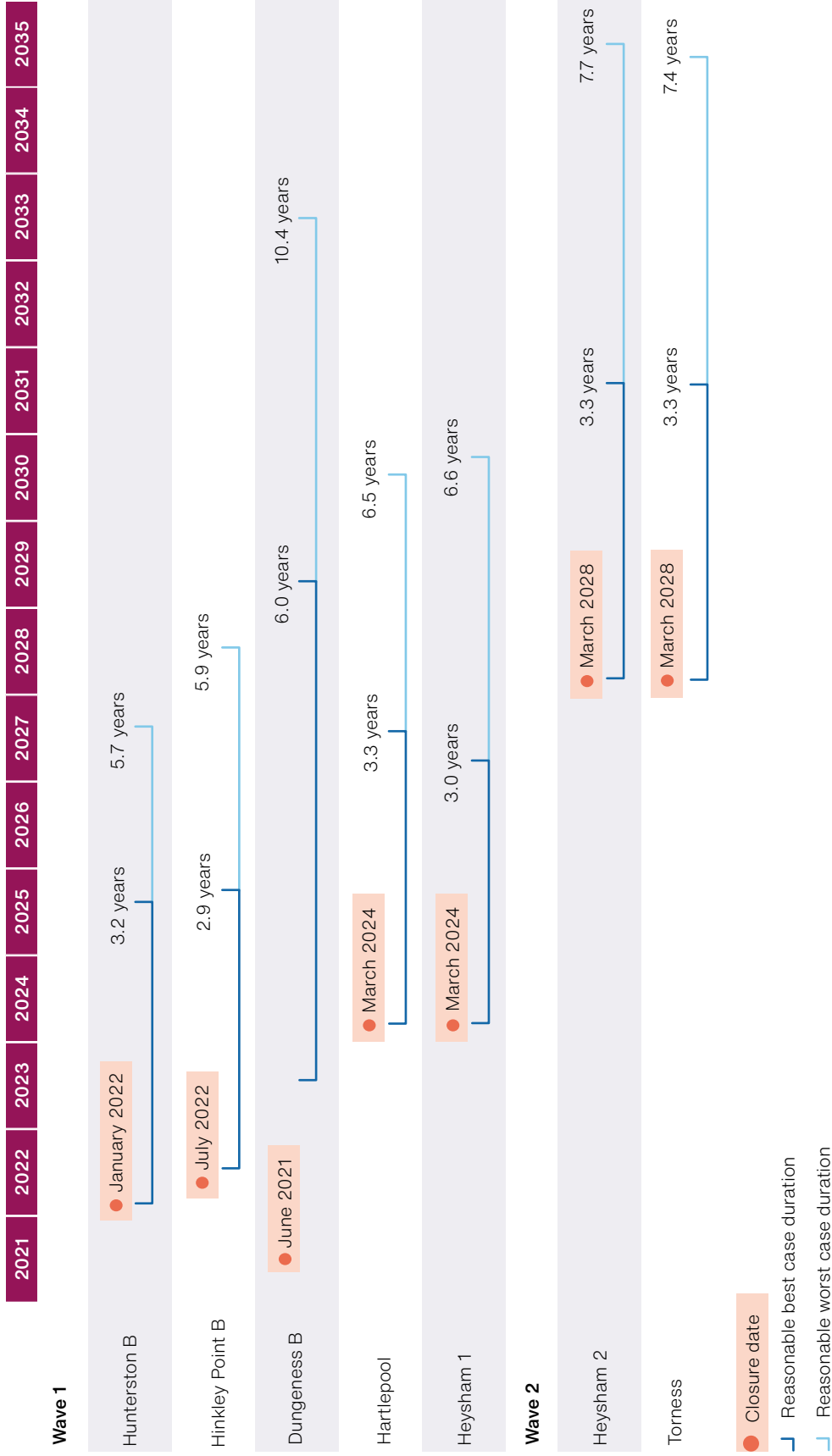
3.7 Our work suggests that the Department, EDFE and NDA recognised promptly the potential scale of the defueling challenge and began to set up joint arrangements to plan and oversee delivery of the programme. The 2015 review led by the Shareholder Executive had highlighted an urgent need to start planning for defueling in good time. It suggested that planning should commence five to six years prior to closure to allow time for the necessary plans to be drawn up and the appropriate arrangements put in place. As defueling would have to take place irrespective of the outcome of the renegotiation of the decommissioning agreements, the parties decided to press ahead with making plans. This decision has given the parties time to build their teams and consider how best to manage the Programme.

3.8 In 2015, EDFE and the NDA established the AGR Operating Programme (AGROP), which is overseen by the Defueling Steering Panel chaired by the Department, to provide management and oversight of AGR spent fuel activities.²¹ This has enabled the parties over the past six years to come together through these forums and sub-working groups to develop contacts at technical and senior levels and consider the scope for facilitating efficient accelerated defueling. A mid-programme health review of AGROP by the Fund and NDA, in December 2020, concluded that the management arrangements were appropriate and mature to deliver the preparation phase with good evidence of cross-industry experience being utilised.

²¹ Other attendees of the Defueling Steering Panel include the Fund and regulators.

Figure 11
Defueling timeline of the Advanced Gas-cooled Reactor stations

As stations begin to close the number simultaneously defueling will increase



Notes

- 1 The Figure is illustrative of defueling durations of stations under the reasonable best case and reasonable worst case scenarios. Closure dates above reflect planning assumptions under the reasonable best case scenario. Under the reasonable worst case scenario the closure date of some stations would be earlier than above.
- 2 Dungeness B closed in June 2021, previously it was scheduled to close in March 2028 as part of wave 2 closures.

3.9 Officials we spoke to across the NDA, EDFE and the Department were positive about the AGROP arrangements providing a mechanism to work collegiately and effectively. They will build on the existing EDFE/NDA arrangements for defueling but are intended to provide a stronger basis for joint working as the parties transition into the untested environment of accelerated defueling of the AGR fleet.

ii) Whether there are appropriate arrangements in place to manage the risks to defueling the AGR fleet

3.10 The safe defueling of the AGR fleet is subject to regulation and scrutiny by the Office for Nuclear Regulation (ONR). As the licensed operator of each AGR station EDFE is required to prepare a safety case station by station to accompany its plans for defueling and have the safety case approved by the ONR. The plans take time to develop and are subject to detailed scrutiny by the ONR, which can take some two to three years. Ideally, the safety case is prepared and submitted to the ONR while the station is still operating. Once a station is closed, defueling cannot begin until the safety case is approved.

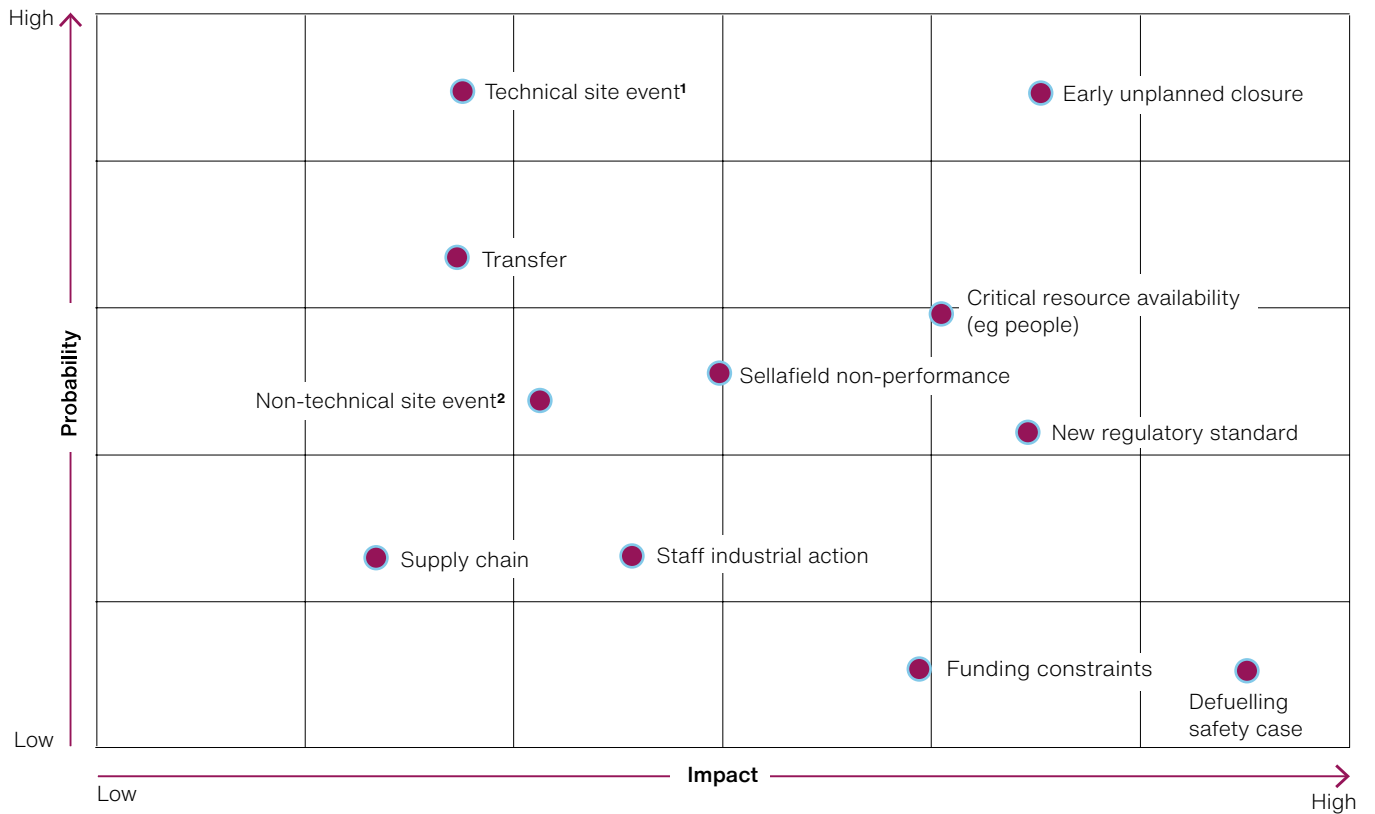
3.11 Subject to safety requirements being satisfied, the Department, EDFE and the NDA have focused on ways of accelerating the defueling programme and have drawn up plans. They estimate that this accelerated defueling programme could reduce the defueling period for each AGR station from eight years to three and a half years, which could significantly reduce the potential call on the Fund as already illustrated at Figure 10. The incentive regime along with clarifications to qualifying costs negotiated as part of the new decommissioning agreements are intended to support delivery of the accelerated programme on the EDFE stations (see paragraphs 2.22 to 2.25).

3.12 There are a number of risks and uncertainties that will need to be managed if the defueling programme is to operate as planned. EDFE and the NDA have been addressing the major risks to the accelerated defueling programme and how they might best be managed. **Figure 12** shows EDFE's depiction of principal risks and their potential impact.

Figure 12

EDF Energy's strategic risk factors to defueling the Advanced Gas-cooled Reactor stations

There are high levels of risk and uncertainty that could significantly impact the duration and cost of defueling



Notes

- 1 Technical site event relates to factors such as major plant equipment breakdown, stuck fuel in reactor, or a pond contamination event. For example, a damaged fuel issue could result in a six- to nine-month delay.
- 2 Non-technical site event examples include a significant fire or major health and safety event.
- 3 This figure has been replicated from a version included in EDF Energy's 2020 Decommissioning Plan Submission.

Source: National Audit Office analysis of information provided by EDF Energy

3.13 A major determinant of a positive value-for-money outcome will be the extent to which defueling takes place quickly following the closure of normal operations. This is more likely to happen if the closure programme takes place as scheduled (Figure 11) with defueling plans prepared, safety cases approved and all parties in a position to activate the plans. Since the agreements were signed five of the stations have had their scheduled closure date change. A key value-for-money risk occurs if there is a significant departure from the closure schedule. In 2018, for example, EDFE stopped electricity production at Dungeness B because of a reactor outage. In June 2021, following further work, EDFE took the decision to cease production for good, although the station had been planned to continue operation until 2028. As a result of the early closure, EDFE estimates that it will cost an additional £0.5 billion to £1.0 billion to defuel the station because it will be incurring fixed costs until defueling can fully start and will have a longer defueling period (see **Case study 1**).

Case study 1

Dungeness B and the impact of uncertainty

The Dungeness B station ceased generating electricity in 2021, seven years before its revised closure date of 2028

Dungeness B is situated on the South Kent coast and began electricity generation in 1983. It employs around 550 EDF Energy (EDFE) full-time employees and over 200 contractors. It is co-located and built alongside a Magnox A station, which is undergoing decommissioning.

When EDFE took over ownership, Dungeness B had a closure date of 2018. This date was subsequently extended and it was expected this station would be defueled as part of the second wave of AGR stations, with a closure date of 2028. Since 2018, the station has been in extended outage and was taken offline following problems with its reactors. In June 2021, EDFE announced it would not be able to restart Dungeness B and announced closure of the station with immediate effect.

As a result of this early and unplanned closure, EDFE estimates it will cost an additional £0.5 billion to £1.0 billion to defuel Dungeness B - as it will incur ongoing fixed costs before defueling can start, which is now planned to begin in 2023. It will also take longer to defuel, at between six and ten years, with a maximum of two flasks of fuel being transported to Sellafield a week, compared with three for the other stations. As Dungeness B had not begun defueling preparations (best practice is to start preparations 5-6 years prior to station closure) its early closure had a severe impact. Prior to the announcement of early closure, the working assumption for defueling Dungeness B was between four and six years.

In contrast, at Hunterston B and Hinkley Point B, which are now scheduled to close 12 and 6 months earlier than planned, defueling preparations were already underway. With less variance between planned and actual closure dates, the impact on the defueling programme is more manageable across delivery partners.

Source: National Audit Office analysis of information provided by EDF Energy

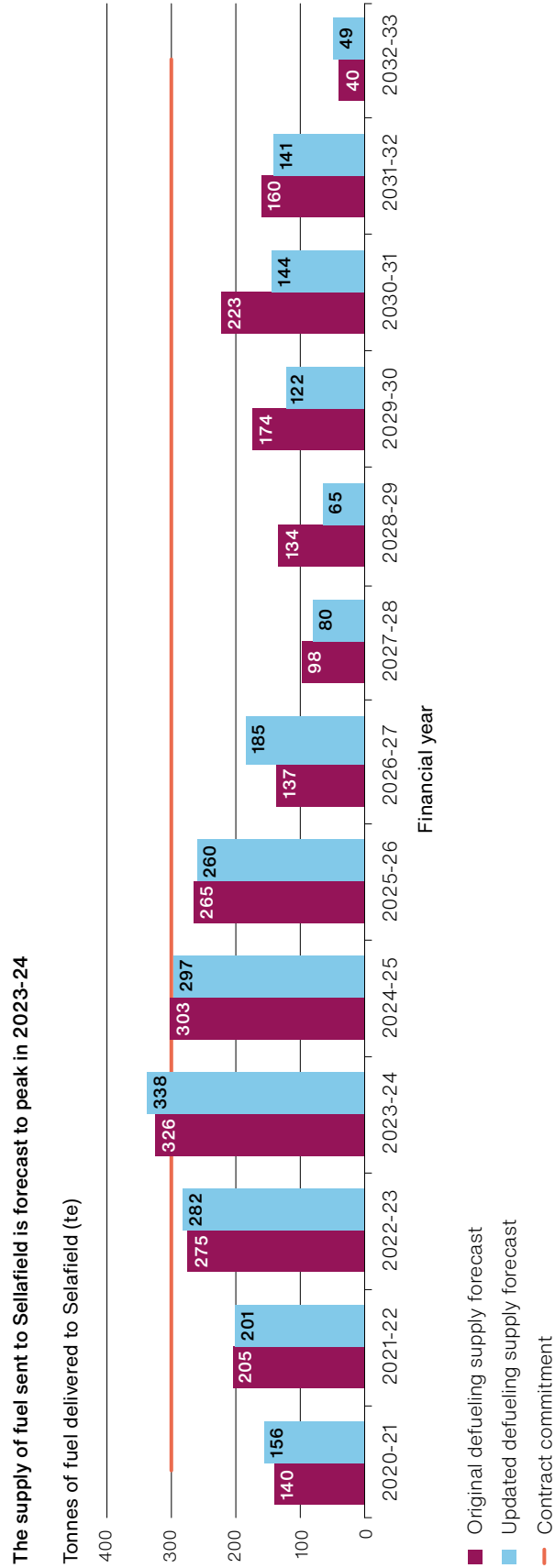
3.14 The accelerated defueling plan will require the average rate of transport of flasks of fuel to Sellafield to increase, for example from one flask per week at Hinkley Point B to three. For this to happen a whole series of actions need to be taken by EDFE and the NDA across the end-to-end defueling, transport and storage process, including plant modifications required to handle the increase in volume and rate of defueling, sourcing of critical spares, removal from across the AGR fleet of sufficiently cooled fuel to reduce overall pond fuel stocks, and the NDA ensuring that it has adequate capacity for the transporting and dismantling of fuel. Experience gained from defueling the NDA-owned Magnox stations suggests that despite significant effort it was difficult to increase the rate from one to three flasks per week and it took several years to achieve the required performance.

3.15 Successful accelerated defueling will also require Sellafield to receive, dismantle and store increased rates of fuel from the AGR stations. EDFE contracts with the NDA to receive and store AGR fuel. Sellafield will need to dismantle fuel and process waste (Figure 9) to place in interim storage at a rate that preserves space in the fuel storage ponds for future imports from EDFE. It currently receives around 200 tonnes of fuel annually, which is expected to increase to 300 tonnes for accelerated defueling. Sellafield is undertaking a series of project enhancements to build its resilience for dismantling fuel – for example, installing a secondary fuel lifting hoist to increase resilience of dismantling operations, and making more efficient use of storage capacity. Sellafield will ultimately have to store more than 4,500 tonnes of AGR fuel, of which more than 2,300 tonnes are forecast to arrive at Sellafield during the defueling period.

3.16 **Figure 13** overleaf shows that Sellafield will now receive a higher intake of fuel than previously expected during the defueling peak between 2022-23 and 2025-26, because of the closure of Dungeness B in 2021 instead of 2028 and the commencement of its defueling from 2023. If the annual supply of fuel exceeds 300 tonnes, Sellafield will manage the receipt of fuel on a reasonable endeavours basis only, which could increase the costs incurred by EDFE on the AGR stations and ultimately the claims made on the Fund.

3.17 The uncertainties involved in the decommissioning process cannot all be avoided, and effective management of the risks will depend critically on how well the AGROP arrangements (paragraph 3.8) enable the parties to work together. This will require: building openness and trust between the parties; incentivising performance at each point in the end-to-end defueling chain in pursuit of a common defueling goal; sharing realistic assessments of likely timetables and the preparedness of each link in the chain; and having effective arrangements in place to address emerging problems quickly and effectively.

Figure 13
Forecast maximum supply of fuel from Advanced Gas-cooled Reactor stations to Sellafield between 2020-21 and 2032-33



Notes

- 1 Dungeness B was originally scheduled to commence defueling in 2028. The red bars in this figure show forecast defueling levels under this scenario. Dungeness B is now set to commence defueling in 2023. The blue bars in this figure show forecast defueling levels following the station's early closure.
- 2 The profile of the projected supply of fuel is likely to change as station closure dates become more certain. Chart data assumes the closure of the last two stations, Heysham 2 and Torness, is in 2030. EDFE recently announced that these stations will now close in 2028.

Source: National Audit Office analysis of information provided by the Nuclear Decommissioning Authority

Part Four

The transfer and decommissioning of the AGR stations

4.1 This part examines the arrangements being put in place to transfer the Advanced Gas-cooled Reactor (AGR) stations to the Nuclear Decommissioning Authority (NDA).

4.2 Under the terms of the renegotiated agreements EDF Energy (EDFE) will transfer ownership of the AGR fleet to the NDA station by station. The revised option agreement outlines what categories of assets will be transferred, such as land, building, contracts and relevant EDFE employees. However, the Department for Business, Energy & Industrial Strategy (the Department), EDFE and the NDA are yet to work out precisely what will be transferred to Magnox Ltd.

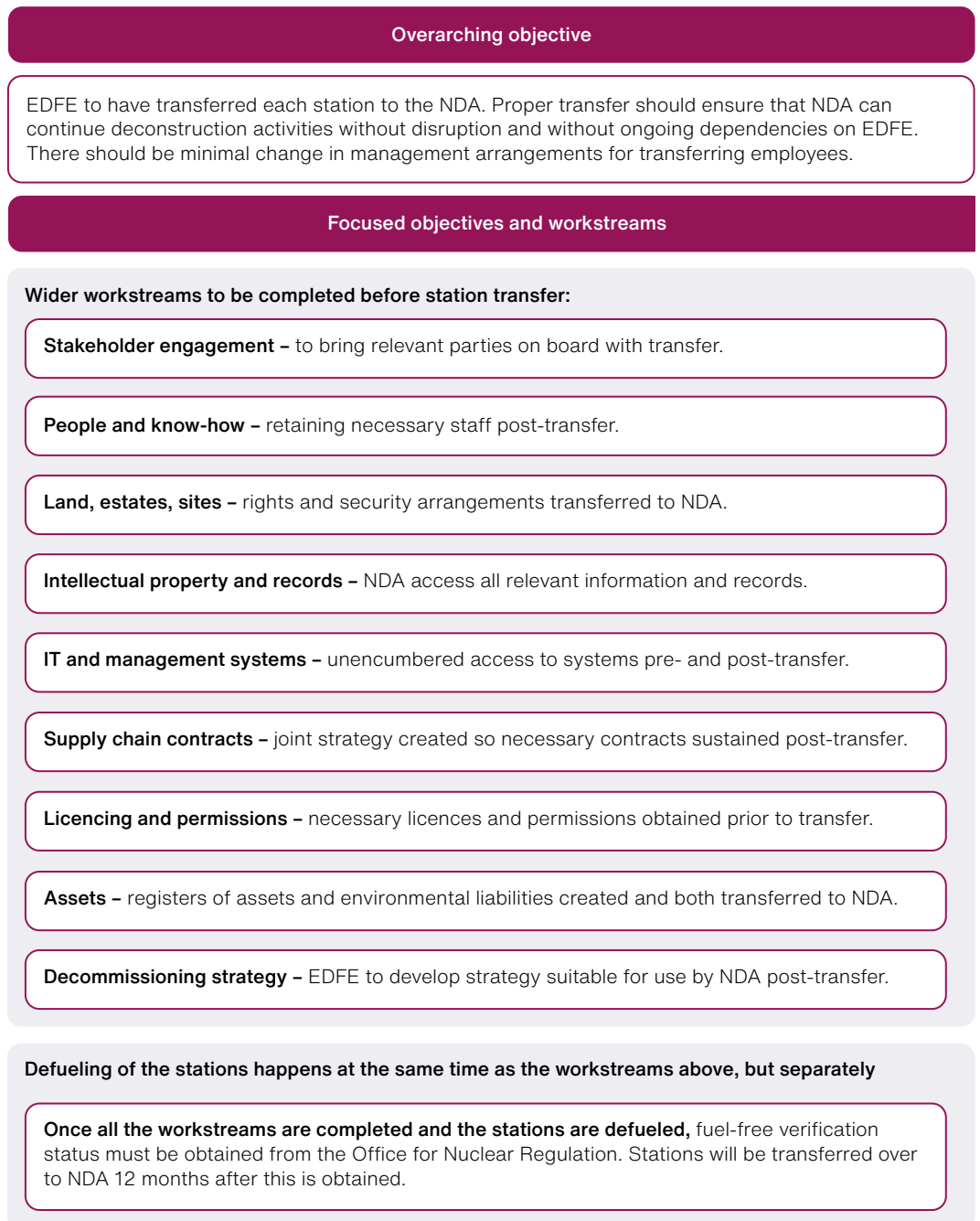
4.3 To support planning for transfer, EDFE and the NDA have identified nine workstreams seen as vital to achieving a smooth transfer of stations (**Figure 14** overleaf). Although they are in the very early stages of planning, these workstreams appear to cover the main areas that we would expect, including the transfer of expertise and workforce (described as people and know-how), land and assets and supply chain and contracts.

4.4 Station transfers and associated liabilities are subject to the option agreement terms. There is a risk that transfer timings do not allow NDA to fully understand and assess the transferring liabilities. It is important that the NDA does not rush the station transfer process, exposing it unduly to liabilities. That said, the experience of the Department's renegotiation of the agreements with EDFE has shown that agreeing the detailed arrangements can take longer than expected. The Department originally expected negotiations with EDFE to conclude in April 2020, but the agreements were not signed until June 2021.

Figure 14

Key milestones to achieve prior to transferring the Advanced Gas-cooled Reactor stations

EDF Energy (EDFE) and the Nuclear Decommissioning Authority (NDA) need to achieve a number of challenging defueling milestones before stations can be transferred, while also collaborating on nine separate workstreams



Source: National Audit Office analysis of information provided by the Department for Business, Energy & Industrial Strategy and EDF Energy

4.5 EDFE and the NDA have made progress in establishing objectives and defining their respective roles and responsibilities. The Department, EDFE and the NDA informed us that they are confident that there is sufficient time to plan and prepare to transfer the first station by around 2026. Some issues are likely to become pressing long before transfer and will need prompt attention, for example:

- the workforce at AGR stations entering the defueling phase will very soon want to know what the transfer of the stations to Magnox Ltd will mean for them. On-site EDFE teams have deep knowledge of their stations and are likely to have expertise important for the post-transfer deconstruction phase. EDFE informed us that they have begun to engage their workforce and trade unions on the plans;
- it is as yet unclear what happens to specialist EDFE staff who are based at its corporate centre but who hold important AGR expertise. The NDA and EDFE have begun to discuss what key expertise will be required by the NDA and Magnox Ltd;
- Magnox Ltd will need to build its capacity to take on management of the stations. Once the AGR stations are fully transferred the number of nuclear sites being decommissioned by Magnox Ltd will have expanded from 12 to 19.²² This represents a significant change programme for the NDA subsidiary;
- the NDA and Magnox Ltd have had little access to the stations or information about them and their condition to date. Using the additional access that it has under the revised agreements, the NDA will need to assure itself in advance of the likely condition of the assets transferring across, identify risks and draw up plans for managing them. Magnox Ltd will need to draw up plans for becoming the site licensee at each individual station and get approval from the Office for Nuclear Regulation for its plans. It can take up to two years to develop management arrangements and secure approval;
- EDFE and Magnox Ltd will need to reach agreement on how contracts with suppliers for each station should be handled in the period leading up to transfer; and
- there is currently a lack of certainty about the exact land boundary and facilities the NDA and Magnox Ltd will receive to support decommissioning. The details need to be decided early in order to support planning and avoid protracted negotiations arising between the parties, particularly where sites may have value for other uses.

²² Consultation is under way to also transfer NDA's Dounreay station to Magnox Ltd, meaning that the organisation may control 20 nuclear stations by the time all AGR stations have fully transferred. The level of work required to decommission each station varies.

4.6 The Department's business case in support of the renegotiated agreements estimated potential transfer costs and liabilities of around £300 million but identified a range up to £1.8 billion. The business case identified uncertainties surrounding some of the costs – including around a potential need to update IT systems, the condition and nature of assets, and the cost of employee pension contributions and redundancy payments. The estimated cost range illustrates the importance of efforts to get the transfer arrangements right in the interests of the Nuclear Liabilities Fund (the Fund) and ultimately the taxpayer.

Developing a clear long-term delivery strategy

4.7 The long-term benefits of taking the AGR stations back into public ownership, as envisaged in the Department's business plan, will depend on the ability of Magnox Ltd to make best use of its existing expertise and deliver synergies with the parallel decommissioning of the Magnox fleet. The Department did not attempt to estimate the value of these synergies. Given the uncertainties and long timescales we consider this to be reasonable.

4.8 There is potential for Magnox Ltd to realise some of these efficiencies from deconstruction work in the years immediately after transfer of the stations. Magnox Ltd is currently engaged in this initial deconstruction phase on the Magnox stations. Magnox Ltd will have the opportunity to apply lessons from the Magnox fleet to the AGR fleet, but there may also be the opportunity to deliver efficiencies from a joined-up approach to work on Magnox and AGR stations. Magnox Ltd, working with EDFE, has already taken positive steps in this direction. For example, the parties recently decided to use the existing waste storage facilities on the Hunterston and Hinkley Point sites for both the Magnox reactor and the AGR stations, rather than spending some £100 million in nominal terms on new facilities.

4.9 Although defueling and transport of the fuel to Sellafield removes most of the hazard, residual radioactivity levels within reactor cores will remain high for some decades. Decommissioning will only be complete once an end-state, agreed with regulators, has been achieved.

4.10 Delivering the benefits will require a clear long-term delivery strategy covering the AGR and Magnox fleets. The current decommissioning strategy drawn up by EDFE envisages putting the reactor buildings into a state of care and maintenance lasting some decades to allow radioactivity levels to decay before commencing deconstruction of the main reactor buildings. However, subject to technical and safety considerations, a rolling decommissioning strategy (**Case study 2**) may offer a different approach.

Case study 2

Comparison of the rolling and care and maintenance decommissioning strategies

A rolling decommissioning strategy may present additional opportunities for synergies between the Advance Gas-cooled Reactor (AGR) and Magnox stations

There are two potential strategies for decommissioning the AGR stations. Given the high level of cost, uncertainty and risk associated with decommissioning the AGR stations, ascertaining which strategy will deliver the greatest value for money should be prioritised.

Care and maintenance

The current decommissioning strategy for AGR stations is termed care and maintenance. The strategy requires the stations to be defueled before preliminary deconstruction work is completed to put the stations into a safe and dormant state in which they will remain for a period of 70-85 years. This approach is believed to allow radioactivity levels to decay, making subsequent works more straightforward. Following this, the buildings are deconstructed and the land they are on is remediated. The Nuclear Decommissioning Authority (NDA) moved away from using a care and maintenance strategy for its Magnox stations in 2021.

A care and maintenance strategy requires high levels of physical and staff resources during the initial and final deconstruction phases but demands on both are much lower during the 70-85 years when stations are in a safe and dormant state. Due to the extended duration of the care and maintenance phase, this may present risks of the loss of key suppliers and corporate knowledge of the stations when activity levels increase again during final deconstruction.

For the AGR stations, a high level of cost is expected to be incurred during the defueling and preliminary deconstruction phases, and again from around 2100 after the care and maintenance phase has been completed. However, costs are forecast to be very low during the period in which stations are kept in a safe and dormant state. The Nuclear Liabilities Fund's (the Fund's) investment strategy is predicated on a care and maintenance strategy, meaning it may require additional injections of capital if the decommissioning strategy is changed to one that incurs costs earlier – such as the rolling decommissioning strategy outlined below – even if the new strategy is cheaper overall.

Rolling decommissioning

A rolling decommissioning strategy takes a site-specific approach, where the 70-85 years where stations are kept in a safe and dormant state can be reduced to between 10 and 50 years or avoided entirely. The NDA adopted this strategy for its Magnox stations in 2021 as it believed that some of the benefits of radioactive decay that it envisaged its care and maintenance strategy having had eroded and that some stations needed to be decommissioned earlier on safety grounds.

Work is undertaken sequentially, with stations entering each phase at different points in time. Therefore, a rolling strategy is expected to better retain skills and corporate knowledge and protect supply chains – both of which are key when operating in such a specialist sector where availability of these resources requires careful management. It also means that some stations can be decommissioned more quickly, removing a long-term hazard and freeing up the land for reuse for other purposes. However, bringing work forward in this manner may place strains on existing infrastructure and storage facilities.

If such a strategy is adopted for the AGR stations, if feasible, it could present increased levels of synergies, with supplies, assets and resources being used sequentially between AGR and Magnox stations.

Stakeholders we spoke to with technical expertise and knowledge of the AGR stations expressed differing views on the applicability of a rolling strategy to the AGR fleet.

4.11 EDFE remains formally responsible for setting the overall decommissioning strategy until stations are transferred to NDA. Under the terms of the funding agreement, the Department can ask EDFE to change its deconstruction strategy and plans if the Department can demonstrate savings of more than £5 million in nominal terms to the Fund. The Cooperation Memorandum of Understanding (paragraph 2.19) will allow NDA to provide observations to EDFE and discuss how best to approach deconstruction.

The challenge of estimating the long-term liabilities

4.12 Any change from the current AGR strategy of care and maintenance, for example bringing forward the timing of activity, would have implications for the estimated liabilities of the Fund. Estimating the potential cost of decommissioning nuclear stations is very complex. Assumptions need to be made about future technologies, costs, changes to the long-term condition of nuclear stations, and the availability of skills and the supply chain decades into the future. EDFE's current plans for decommissioning the AGR stations have an end date of around 2130. The NDA's experience of estimating its own nuclear liabilities has highlighted the significant uncertainties to be attached to any such estimates. For example, the NDA's 2020-21 accounts highlight how its existing liabilities for nuclear decommissioning (£135 billion) could increase by £109 billion or decrease by £20 billion depending on a range of variables.

4.13 EDFE is required to maintain costed lifetime plans for each AGR station. The plans are required under the decommissioning agreements to be updated substantially every five years (paragraphs 1.12 and 1.13). The most recent estimate of the entire liability available was published in 2016 and comprised two elements: the costs of managing spent fuel and radioactive waste (known as the Uncontracted Liabilities Discharge Plan (UCLDP)); and the costs of defueling and deconstruction works (known as the Baseline Decommissioning Plan (BDP)), which forms the majority of the overall liability.

4.14 The plans and associated cost estimates were reviewed by the Non-NDA Liabilities Assurance team (NLA) under its responsibilities under the Nuclear Liabilities Funding Agreement. The NLA approved the plans but noted that significant work was necessary to ensure that works could be carried out in a cost-effective manner. In its review of the plans for deconstruction work (the BDP), the NLA noted several findings that indicate that the estimate was at risk of being incomplete or inaccurate and creating a risk that strategic decisions by multiple stakeholders were made on deficient information. For example, the NLA found that the deconstruction estimate (BDP):

- did not contain a detailed and executable plan. It did not outline the context under which works took place, meaning it would not have been possible to properly monitor performance against the plan or make timely updates to it;
- contained multiple outdated references to supporting evidence – many pre-dating 2005; and
- was not integrated with the estimate for the cost of managing spent fuel (the UCLDP), meaning that interdependencies between the two plans were not identified or explored.

4.15 EDFE produced updated plans and estimates for the costs of defueling in 2020 and 2021, and it will provide a substantially updated version covering the whole programme of works in 2022. The update will provide a complete and more consistent estimate for the entire decommissioning process and will include costed ranges for different scenarios. It is intended to address known inconsistencies in the assumptions used to compile the 2016 estimate.

Appendix One

Our audit approach

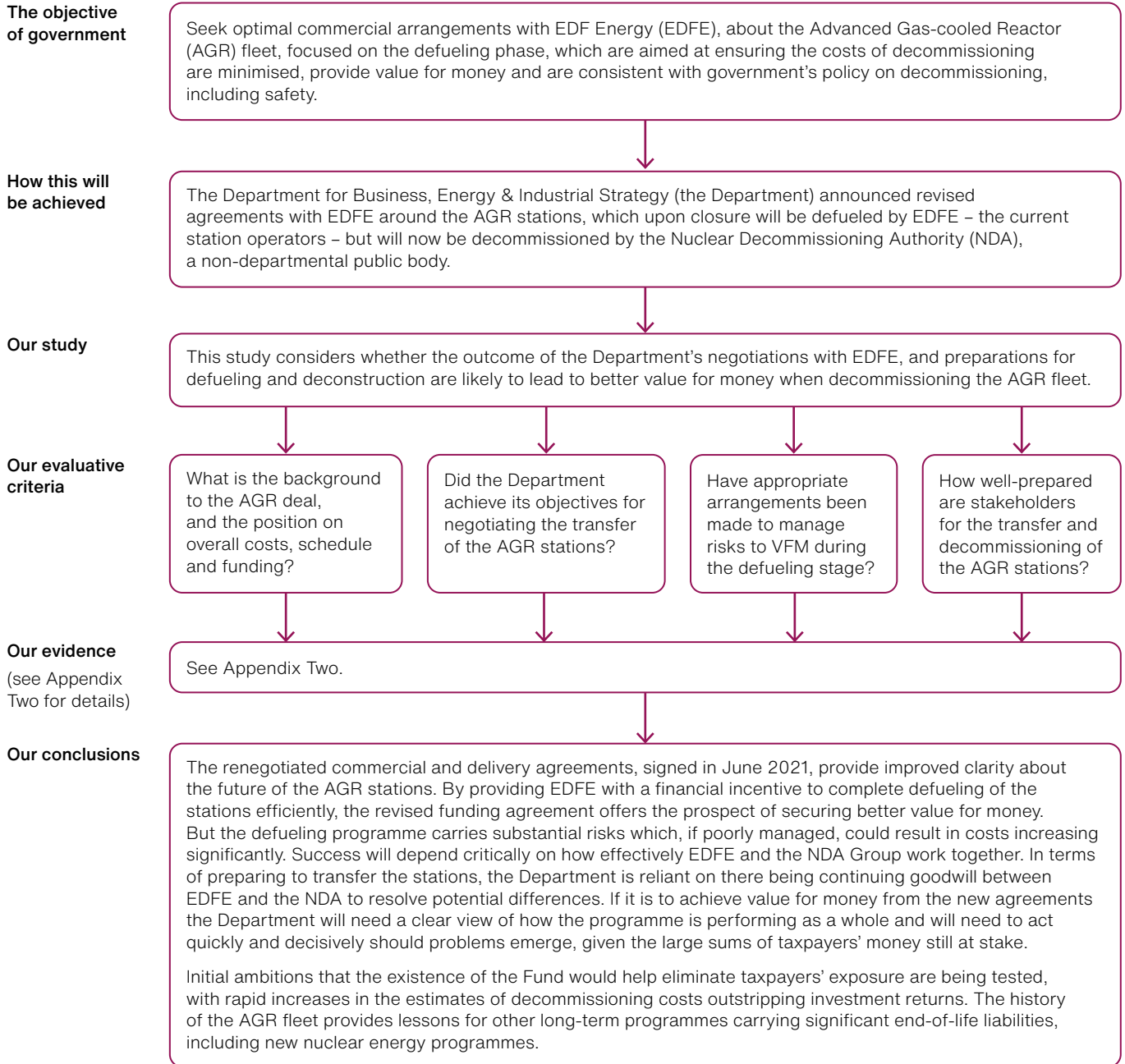
1 This report examines whether the outcome of negotiations between the Department for Business, Energy & Industrial Strategy (the Department) and EDF Energy (EDFE), and subsequent preparations for defueling and deconstruction are likely to lead to better value for money when decommissioning the Advanced Gas-cooled Reactor (AGR) fleet. The report, and our assessment of value for money, cover the:

- background to decommissioning the AGR stations, including how decommissioning is funded and the prospects for further calls on taxpayers' money to cover the long-term costs (Part One);
- commercial agreements which underpin how decommissioning will be delivered including the Department's rationale for renegotiating the agreements and whether it met its negotiating objectives (Part Two);
- arrangements to remove fuel from the AGR stations (Part Three); and
- progress with planning for the eventual transfer and decommissioning of the AGR stations to the Nuclear Decommissioning Authority (NDA) and Magnox Ltd (Part Four).

2 Our audit approach is summarised in **Figure 15**.

Figure 15

Our audit approach



Appendix Two

Our evidence base

1 We reached our independent conclusions on the Department for Business, Energy & Industrial Strategy's (the Department's) performance in negotiating with EDF Energy (EDFE) to improve the arrangements for decommissioning the Advanced Gas-cooled Reactor (AGR) nuclear stations, and the preparations being made for defueling and deconstructing the stations after analysing evidence collected between July 2021 and January 2022. Our audit approach is outlined in Appendix One.

2 In designing and carrying out our work, we took account of previous relevant National Audit Office (NAO) reports, including our 2020 report *Progress report: terminating the Magnox contract*; our 2018 report *The Nuclear Decommissioning Authority: progress with reducing risk at Sellafield* and our 2010 report *The sale of the government's interest in British Energy*.

3 We conducted interviews with officials from:

- the Department with responsibilities for the oversight of its interests in nuclear decommissioning, and those who were involved in the negotiations with EDFE to transfer the stations to government control;
- EDFE who are responsible for the AGR stations' operation and its future decommissioning, and those involved with negotiations with the Department;
- NDA, including representatives of its executive team. We also spoke with the following subsidiaries within the NDA Group:
 - Magnox Ltd – who will have oversight of future work to decommission the AGR stations; and
 - Sellafield Ltd – who have responsibility for work to manage and store AGR fuel;
- the Nuclear Liabilities Fund (the Fund);
- UK Government Investments;
- HM Treasury; and
- the Office for Nuclear Regulation.

4 We reviewed relevant documents, including:

- the Department's business case in support of its decisions, including to transfer the AGR stations to the NDA once EDFE had completed the defueling of them;
- the historic and current agreements in place between EDFE and government for the decommissioning of the AGR stations, including the Nuclear Liabilities Funding Agreement, the Option Agreement and the Cooperation Memorandum of Understanding;²³
- reports produced by EDFE that outline the strategic plans and cost estimates in place to decommission the AGR stations, and the reports summarising the review of these by the NDA's Non-NDA Liabilities Assurance team (NLA);
- minutes of meetings from the AGR Operating Programme (AGROP) group, the Defueling Steering Panel (DSP), the AGR Project Steering Group and the NDA's board;
- ministerial submissions provided by the Department to its Secretary of State on the revised AGR decommissioning arrangements; and
- internal audit reports.

5 We reviewed relevant data sets, including:

- estimates for the whole-life costs of future AGR decommissioning and annual figures for the single-point estimate of the costs of these works;
- estimates for defueling the AGR fleet under different scenarios; and
- the level of assets held by the Fund.

6 This report focuses on the seven AGR stations that will gradually be transferred to the NDA. EDFE also operates a Pressurised Water Reactor at Sizewell B. Although some cost estimates quoted in this report also include the estimated costs to decommission Sizewell B, this report does not consider the EDFE's and the Department's plans to decommission that station. Sizewell B is technically different from the AGR stations and will require a different decommissioning approach, so the station was not part of the negotiations between EDFE and the Department.

7 Costs quoted in this report are presented as at 31 March 2021 unless stated otherwise. We have used the December 2021 GDP deflator indices published by HM Treasury to inflate historic costs up to 31 March 2021 values.

²³ This also included some agreements between British Energy – the former operators of the AGR stations – and HM Government.

Appendix Three

Glossary of key terms and phrases

| | |
|---|---|
| AGR Operating Programme (AGROP) | A group established in 2015 and involving multiple stakeholders including representatives from EDF Energy (EDFE) and the Nuclear Decommissioning Authority (NDA), whose function is to provide management and oversight of AGR spent fuel activities. It is overseen by the Defueling Steering Panel. |
| Advanced Gas-cooled Reactor (AGR) stations | The UK's second generation of nuclear reactors. Designed and built between the 1960s and 1980s, with the first stations becoming operational in 1976. |
| Department for Business, Energy & Industrial Strategy (the Department) | Government department responsible for business; industrial strategy; science; research and innovation; energy and clean growth; and climate change. Sponsors and funds the NDA and led negotiations with EDFE on behalf of government. |
| British Energy | The operator of the AGR stations between 1996 and 2009. The company was sold to EDFE in 2009. |
| Care and maintenance | 'Care and maintenance' is a stage during the decommissioning process where reactors and waste stores are sealed and the station kept secure for a period of time to allow radiation levels to naturally decay. The term is also used to reflect an overall approach to decommissioning nuclear stations that utilises this stage. |
| Cooperation Memorandum of Understanding | A non-legally binding agreement in place to outline the intent of EDFE and the NDA to cooperate in key areas of taxpayer value relating to the AGR stations around defueling, transfer and deconstruction strategy. An agreement introduced in 2021. |
| Decommissioning | The process by which a nuclear station that has reached the end of its useful operating life is made safe and ultimately returned to a state in which the land can be reused. |
| Deconstruction | A term for decommissioning stages, where all site buildings, plant and equipment and eventually the reactors are decontaminated, dismantled and removed. |
| Defueling | The removal of used nuclear fuel from the AGR stations' reactors, fuel ponds and stores. |
| Defueling Steering Panel (DSP) | A cross-party group, chaired by the Department, put in place to oversee and govern the development of an integrated plan for defueling AGR stations, aiming to facilitate parties working more closely together to improve their shared understanding of the challenge. |

| | |
|---|---|
| EDF Energy (EDFE) | The company responsible for operating the AGR stations, for defueling them, and for leading work on the strategy to decommission them. |
| Flask | A container used to transport spent nuclear fuel to Sellafield. |
| Interim storage | Once fuel is treated at Sellafield, it is placed into interim storage at the site. It is stored there on an interim basis only because NDA plans to eventually transport it to its Geological Disposal Facility. This facility has not yet been constructed. |
| Magnox Ltd | Magnox Ltd is a nuclear decommissioning site licence company (SLC). It derives its licence to operate from the Office for Nuclear Regulation (ONR). Magnox Ltd became a subsidiary of the NDA in September 2019. |
| Magnox station | Magnox is a type of nuclear power/production reactor. There are 11 stations in the UK with Magnox reactors. The Calder Hall site is controlled by Sellafield Ltd and the remaining 10 sites are controlled by Magnox Ltd. |
| National Loans Fund | The National Loans Fund was established in 1968 by the National Loans Act 1968 to account for government borrowing and lending. It is administered by HM Treasury with the bank accounts maintained at the Bank of England. |
| Non-NDA Liabilities Assurance team (NLA) | A segregated, specialist team within the NDA responsible for reviewing and approving, on behalf of the Department and the Nuclear Liabilities Fund's trustees, EDFE's decommissioning plans and cost claims under the terms of the Nuclear Liabilities Funding Agreement. |
| Nuclear Decommissioning Authority (NDA) | The NDA is a non-departmental public body created through the Energy Act 2004. It owns 17 sites across England, Wales and Scotland and has a strategic role with establishing the overall approach, allocating budgets, setting targets and monitoring progress. It reports to the Department for Business, Energy & Industrial Strategy (the Department). The NDA has several subsidiaries; the term 'the NDA Group' is used in the report to refer to these collectively. |
| Nuclear Liabilities Fund | The fund in place to cover the costs of decommissioning the AGR and PWR stations. Established in 1996 and originally known as the Nuclear Generation Decommissioning Fund. |
| Nuclear Liabilities Funding Agreement | An agreement that outlines how the funding of the decommissioning and relevant spent fuel and radioactive waste liabilities of the AGR and Pressurised Water Reactor (PWR) stations will be met. It was revised in 2021. |
| Nuclear Transport Solutions | A division of the NDA responsible for transporting nuclear spent fuel around the UK and internationally, including from AGR stations to Sellafield. |
| Office for Nuclear Regulation (ONR) | The ONR is responsible for regulation of nuclear safety and security across the UK. |

| | |
|---|--|
| Option Agreement | An agreement outlining the conditions under which the Secretary of State's option to bring the AGR stations back under government control should be exercised, and the roles and responsibilities of each party when the option is exercised. The option agreement outlines what categories of assets will be transferred, such as land, building, contracts, and relevant EDFE employees. It was revised in 2021. |
| Pressurised Water Reactor (PWR) | In addition to the AGR stations, EDFE also owns a Pressurised Water Reactor, Sizewell B, which is technically different from the AGR stations and will apply a different decommissioning approach. |
| Rolling decommissioning | NDA's current strategy in place for decommissioning its Magnox stations, whereby the care and maintenance period is reduced or avoided, and stations are decommissioned sequentially in small batches. |
| Sellafield | The Sellafield site is home to more than 200 nuclear facilities and the largest inventory of untreated nuclear waste in the world. The Calder Hall and Windscale reactors were developed and built at Sellafield. Work at the site is now focused on retrieving nuclear waste, remediating nuclear and non-nuclear facilities, managing spent nuclear fuel and waste and storing special nuclear materials. |
| Sellafield Ltd | A subsidiary of the NDA, responsible for the safe and secure operation and clean-up of the Sellafield nuclear site. |
| Shareholder Executive | The Shareholder Executive managed the government's shareholder relations with businesses owned or part-owned by the government. In 2016 it was brought together with UK Financial Investments under a single holding company – UK Government Investments. |
| Statement of Principles | Agreed in 2019 by the Department and EDFE. Sets out the main issues for discussion and agreement during negotiations. |
| Transfer | The change in ownership of the AGR stations, from EDFE to the NDA. |
| UK Government Investments (UKGI) | UKGI is the government's centre of excellence in corporate finance and corporate governance. UKGI supports and has oversight of NDA performance and governance on the Department's behalf. |

This report has been printed on Pro Digital Silk and contains material sourced from responsibly managed and sustainable forests certified in accordance with the FSC (Forest Stewardship Council).

The wood pulp is totally recyclable and acid-free. Our printers also have full ISO 14001 environmental accreditation, which ensures that they have effective procedures in place to manage waste and practices that may affect the environment.



National Audit Office

Design and Production by NAO Communications Team
DP Ref: 009296-001

£10.00

ISBN 978-1-78604-411-2



9 781786 044112