

Report by the Comptroller and Auditor General

Ministry of Defence

Investigation into submarine defueling and dismantling

Key facts

20

19

out-of-service submarines stored by the Ministry of Defence (the Department) average number of years submarines out-of-service, against 26 years in-service £0.5bn

estimated total cost to the Department of maintaining retired submarines since 1980 (to 2017)¹

£96 million	estimated cost to the Department of fully disposing of a submarine ¹
£7.5 billion	Department's future liability for maintaining and disposing of its 20 stored and 10 in-service submarines, as at March 2018
Defueling submarines	
11	number of years' delay in re-establishing an ability to defuel submarines, moving from 2012 to a current planning estimate of 2023 ²
57% (£100 million)	budget increase for re-establishing a defueling capability from $\pounds175$ million (2007) to $\pounds275$ million (2018)
9	average number of years fuelled submarines have been stored
Dismantling submarines (removing radioactive parts)	
15	number of years delay rolling out a tested submarine dismantling approach, moving from 2011 to a current planning estimate of 2026 ²
50% (£0.8 billion)	increase in the cost of the project from $\pounds1.6$ billion (2002) to $\pounds2.4$ billion (2016)
£0.9 billion	estimated increase in the Department's longer-term financial liabilities related to submarine dismantling should it take:
	 six months longer to remove intermediate-level waste from boats dismantled in two stages than the expected 18 months; and

a similar delay dismantling the remaining submarines

Notes

1 Figures estimated based on the average annual cost over the last four years at 2017-18 prices.

2 'Current planning estimate' reflects the Department's current working level assumption, which has not yet been approved by the Departmental Investment Board as it is subject to ongoing scrutiny.

What this investigation is about

1 The Ministry of Defence (the Department) uses nuclear-powered submarines, including those with and without nuclear weapons, to meet its operational requirements. Since 1980, it has removed 20 submarines from service and replaced them with newer ones. It has committed to handling the resultant nuclear liabilities responsibly and disposing of submarines "as soon as reasonably practicable". Disposal includes removing the irradiated nuclear fuel (defueling), safely storing submarines, taking out the radioactive parts (dismantling), and then recycling the boat (**Figure 1** on pages 6 and 7).

2 To date, the Department has not yet disposed of any of its 20 retired submarines, with nine of them still containing irradiated fuel. The Department plans to take a further three submarines out of service over the next decade. The Department stores out-of-service submarines at dockyards in Devonport (Devon) and Rosyth (Fife), which the nuclear regulators have assessed as safe.

3 After examining our May 2018 landscape review of the Defence Nuclear Enterprise, the Committee of Public Accounts commented on the lack of berthing space within the Devonport dockyard. It recommended that the Department end the delays to submarine disposals.¹ The Department told the Committee that although it had deferred dismantling submarines on affordability grounds in the past, this was no longer acceptable on safety and reputational grounds. It committed to fully dismantling its first submarine, Swiftsure, by 2023.

¹ Comptroller and Auditor General, The Defence Nuclear Enterprise: a landscape review, Session 2017–2019, HC 1003, National Audit Office, May 2018; HC Committee of Public Accounts, *Ministry of Defence nuclear projects*, Sixty-first Report of Session 2017–2019, HC 1028, September 2018.

Figure 1

Submarine disposal process

To dispose of a submarine, the Ministry of Defence needs to defuel, dismantle and then recycle the boat



Notes

- 1 The submarine disposal time varies depending on the available funding, staff and facilities.
- 2 Government catergorises its nuclear waste according to radioactivity and heat generation levels.
- 3 On behalf of UK government, the Nuclear Decommissioning Authority (NDA) will provide the Geological Disposal Facility, which will provide a safe and secure long-term solution for the disposal of higher activity radioactive waste. The NDA manages the fuel storage site at Sellafield.

Source: National Audit Office



4 This report builds on our 2018 work by detailing the disposal process and the Department's progress at different stages. It sets out:

- the disposal process, roles and responsibilities and the Department's progress in disposing of out-of-service submarines (Part One);
- the Department's progress in re-establishing its ability to defuel submarines (Part Two); and
- the Department's progress in removing radioactive parts from submarines (Part Three).

We conducted our fieldwork between December 2018 and January 2019 (Appendix One). We interviewed staff in the Defence Nuclear Organisation and the Submarine Delivery Agency, and reviewed project data and documents. This report does not consider the value for money of the Department's approach to disposing of submarines.

Summary

Key findings

1 Despite a government commitment over 20 years ago, the Ministry of Defence (the Department) has not yet disposed of any of the 20 submarines it has decommissioned since 1980. Because of this, the Department now stores twice as many submarines as it operates, with seven of them having been in storage for longer than they were in service. Following a government commitment in 1995, the Department has committed to disposing of its submarines "as soon as reasonably practicable". It started considering submarine disposal in 2000 and first aimed to have an operational process agreed by 2011. Having started dismantling its first submarine in 2016, the Department now estimates to roll out its approach across other submarines by 2026. The Department has spent an estimated £0.5 billion on maintaining and storing its retired submarines since 1980 (paragraphs 1.2, 1.8, 3.7 and Figure 4).

2 The Department includes a £7.5 billion liability in its 2017-18 accounts for maintaining and then disposing of its out-of-service submarines. Of this figure, £2.2 billion relates to maintaining the 20 submarines currently out-of-service and the costs of using the Devonport site. The Department also provided £1.5 billion to dispose of these boats and the remaining three Trafalgar-class and four Vanguard-class submarines currently in service. The Department does not need to provide for the liabilities associated with storing and disposing of submarines that are not yet operational. It increased its liability by an average £100 million for each of the Astute-class submarines recently brought into service. Potential changes to HM Treasury's discount rates, which contributed significantly to the 50% (£2.5 billion) increase in the provision from 2016-17 to 2017-18, affect the size of the Department's liability (paragraphs 1.10 to 1.12 and Figure 6).

3 To dispose of submarines, the Department must undertake a complex series of inter-related tasks. At each stage of the disposal process (Figure 2 on pages 10 and 11), the Department needs the necessary space, infrastructure, skills and regulatory approvals. It manages several interdependent projects to ensure these are in place. They include:

- defueling-related projects at Devonport, including the upgrade to defueling facilities (the defuel facility project) such as the crane to remove the fuel, and a wider project upgrading nuclear-licensed docks and infrastructure (Part Two); and
- the Submarine Dismantling Project (the dismantling project), covering Rosyth and Devonport, to remove the radioactive parts from the submarine (Part Three).

Figure 2

Interdependencies across the submarine disposal process

The Ministry of Defence needs to manage interdependencies across the processes and projects it has in place to dispose of a submarine



Notes

- 1 The Ministry of Defence's projects include upgrading defueling facilities, upgrading Devonport infrastructure and dismantling submarines.
- 2 Fuelled submarines are stored in Devonport, where defueling will be conducted.
- 3 The Nuclear Decommissioning Authority has responsibility for providing the Geological Disposal Facility, with the Department contributing 6% of total annual costs (equivalent to £2 million in 2017-18) based on the estimated storage space it requires.

Source: National Audit Office analysis of Ministry of Defence data



4 The Department's ability to dispose of its submarines depends largely on one contractor and also on government more widely. Babcock International Group plc (Babcock) is currently the Department's sole supplier capable of undertaking most of the Department's defueling and dismantling requirements. It owns the nuclear-licensed dockyards and facilities in both Devonport and Rosyth, and also provides aspects of the related projects. The Department also relies on Radioactive Waste Management, a wholly owned subsidiary of the Nuclear Decommissioning Authority, to provide the Geological Disposal Facility. This is expected to be available to receive submarine-related intermediate-level waste from the 2050s. The Department currently contributes 6% of the total annual cost, equivalent to £2 million in 2017-18 (paragraphs 1.14 and 1.15, and Figure 7).

The defueling facility project

5 The Department has not defueled any submarines since 2004 and does not have a fully funded plan to re-start defueling. Nine of the Department's 20 out-of-service submarines contain irradiated fuel, which needs to be removed using dock facilities that have been approved by the nuclear regulator. In 2004, the Office for Nuclear Regulation found that facilities did not meet the latest required standards and the Department stopped defueling submarines. The Department estimates that defueling may take two years per boat. It has not yet allocated a defueling budget as part of its long-term financial planning and will have to consider this alongside other priorities (paragraphs 2.2, 2.3 and 2.11).

6 The defueling facility project has been delayed 11 years, with a £100 million (57%) increase in costs. In 2007, the Department approved the facilities project aiming to re-start defueling in 2012. Then, in 2013, it delayed the start date to 2017 as, although this project remained the best option, it did not represent value for money given commercial and technical issues. This represents the latest departmental approved start date. There have been further delays meaning the Department's latest planning estimate, subject to ongoing scrutiny and departmental approval, is to start defueling in 2023. Delays arose from the Department deciding in 2014 on an unplanned refuel of HMS Vanguard, and then in 2016 deciding to pause for two years its Devonport infrastructure upgrades. This meant defueling could not re-start and the facilities project, which was an estimated 90% complete, was suspended. To control costs and delays, in 2018 the Department contracted with Babcock to sustain necessary skills during the suspension. The Department now expects to pay more to complete this project than in 2016. There remain uncertainties over the project timeframes and costs given the need for commercial negotiations, regulatory permissions and financial approval (paragraphs 2.5 to 2.7 and Figure 9).

7 Delays to the defueling facility project have wider cost, risk and dock space implications. The Department pays an estimated £12 million a year to maintain and store the nine fuelled submarines currently stored in Devonport. Maintaining fuelled, rather than unfuelled, submarines also presents additional technical uncertainties and affects dock availability. This has contributed to space pressures in Devonport, with the Department at risk of not meeting its commitment to inspect, clean and repaint stored submarines at least every 15 years, and not having space to prepare *Torbay*, which left service in 2017, for long-term storage. Until submarines are prepared, the Department must keep them partially crewed, potentially affecting the Department's ability to redeploy its personnel. In 2017, the Department started a £1.5 million project to design a storage preparation process that could be conducted in the water, rather than a dock (paragraph 2.8).

The Submarine Dismantling Project

8 The Department has started to dismantle two submarines and is now developing its designs into approved processes to complete the work. In December 2016, the Department started dismantling *Swiftsure* (which left service and was defueled in 1992) by removing its low-level waste, the less radioactive parts of the reactor compartment. It completed this in August 2018, on time and within the £13 million budget, and in December 2018 started a similar process for *Resolution*. Following its 2011 and 2014 public consultations on the dismantling approach, the Department committed to removing the intermediate-level waste, such as the Reactor Pressure Vessel (RPV), from the submarine intact and then transporting it to an interim store in Cheshire. To date, it has not yet approved the technical processes for removing and transporting this waste. It is paying an estimated £1.5 million a year to reserve storage at the Cheshire site which it currently expects to use from the mid-2020s (paragraphs 3.13, 3.16 to 3.17 and Figure 11).

9 The dismantling project has been delayed by 15 years, with the whole-life cost increasing by £0.8 billion (50%). The delay follows changes to the requirements and temporary suspension of the project. In May 2000, the Department started to consider a submarine dismantling subsequently aiming to have an operational process by 2011. Given the lack of progress, which included a four-year deferral to make savings and the need to consider evolving government nuclear waste policy, it re-scoped the project in 2009 and 2013, resulting in an aim to have a tried and tested approach by 2024. The Department had to re-start its waste transportation procurement after it did not receive any viable bids, which caused a further two-year delay. The Department now estimates that it will roll out its approach by 2026 (paragraphs 3.6 to 3.8, 3.10 and 3.17).

10 Delays create cost, capacity and reputational risks beyond the project, but have given the Department an opportunity to re-assess its submarine dismantling approach. Alongside annual maintenance, the Department has committed to removing submarines from the water at least every 15 years for more detailed maintenance in dock. It recognises a £2.2 billion liability for this within the overall £7.5 billion liability included in its 2017-18 accounts. If this work took 24 months, rather than the assumed 18, and there was a two-year delay in dismantling the submarines, this could increase liabilities by an estimated £0.9 billion. Delays also put pressure on dock space, with Devonport expected to run out of space for retired submarines in the mid-2020s, while making it harder for the Department to demonstrate it has disposed of submarines as soon as practicable. Given developments in the civil nuclear sector and, having gained a better understanding of how to remove and transport waste, the Department is now reconsidering its approach to intermediate-level waste (paragraphs 1.10, 2.12 and 3.19).

Looking ahead

11 In the past two years, the Department has revised its governance arrangements which it is continuing to develop. In 2018, the Defence Nuclear Organisation (DNO) established a dedicated nuclear liabilities project board and set project-wide objectives. It is also developing its first strategic overview of projects and their interdependencies, alongside encouraging more routine senior-level engagement. From April 2019, DNO is responsible for all disposal-related projects, including those previously within the Royal Navy's remit. It continues to recognise as a high risk the failure to manage its nuclear liabilities coherently and has assessed itself as not yet having fully developed plans in place to meet 67% of its submarine defueling and dismantling objectives (paragraph 1.16).

12 To meet its commitments to Parliament, the Department has set itself a series of milestones. In particular, in order to dismantle its first submarine by 2023, the Department assesses that by December 2019 it needs to have decided its approach to removing and transporting intermediate-level waste. It will then design the process, and demonstrate it can do this work, alongside contracting for the transport and ensuring it has the budget in place. Beyond this, the Department's current estimates include:

- completing the defueling-related projects in 2023 to start defueling submarines at that date, although there remain uncertainties around this timeframe (paragraph 2.5 and Figure 9);
- removing the intermediate-level waste from *Swiftsure* between 2023 and 2024 to test its chosen approach to dismantling (Figure 10); and
- rolling out a dismantling approach in 2026, after having tested this on one submarine.
 It expects to formalise this date by summer 2020 (paragraph 3.18 and Figure 10).

13 The Department has not fully considered its approach to disposing of all its operational and future submarines. At present, the Department does not have a fully developed plan to dispose of Vanguard, Astute and Dreadnought-class submarines, which have different types of nuclear reactor. For the Vanguard and Astute-class it has identified suitable dock space which, if used, will need to be maintained. Within the civil nuclear sector, organisations must consider nuclear waste disposal during the design stage of power stations and nuclear infrastructure. The Department does not have a similar obligation (paragraphs 1.11, 2.12 and 3.22).