Submarine Dismantling Project (SDP)

Consultation Document

28th October 2011

MINISTRY OF DEFENCE

de&S

SUBMARINES

Consultation Events

Consultation starts: Fri 28 Oct 2011

Local events:

Plymouth	**Plymouth Guildhall** **Sat 12 to Wed 16 Nov 2011** Public Exhibition from 11am to 7pm each day Workshops are on Sat, Sun & Mon starting: 11.30, 13.00, 15.00, 16.30, 18.00
Fife	**Carnegie Conference Centre, Dunfermline** **Sat 19 to Wed 23 Nov 2011** Public Exhibition from 11am to 7pm each day Workshops are on Sat, Sun & Mon starting: 11.30, 13.00, 15.00, 16.30, 18.00
Saltash	**St Mellion Hotel, St Mellion** **Sat 3 to Mon 5 Dec 2011** Public Exhibition from 11am to 7pm each day Workshops are on Sat & Sun starting: 11.30, 13.00, 15.00, 16.30, 18.00
Torpoint	**Torpoint Town Hall** **Tue 6 Dec and Wed 7 Dec 2011** Public Exhibition from 11am to 7pm each day Workshops are on Wed 7 Dec starting: 11.30, 13.00, 15.00, 16.30, 18.00
Edinburgh	**Surgeons' Hall** **Fri 9 to Mon 12 and Wed 14 Dec 2011 (no event Tue 13 Dec)** Public Exhibition from 11am to 7pm each day Workshops are on Sat, Sun & Mon starting: 11.30, 13.00, 15.00, 16.30, 18.00

National workshops (please register to attend):

Birmingham	International Conference Centre, Broad Street, Birmingham, B1 2EA Tue 31 Jan 2012, 11am to 4pm
Glasgow	Scottish Exhibition & Conference Centre, Exhibition Way, Glasgow, Lanarkshire G3 8YW Mon 6 Feb 2012 , 11am to 4pm

Closing date for responses: Fri 17 Feb 2012

GUIDANCE FOR CONSULTEES

Contact Details

For all consultation enquiries, registration for national and local workshops or to request in hard copy or alternative formats contact:

Submarine Dismantling Consultation
Ash 1b #3112
MOD Abbey Wood
Bristol
BS34 8JH

Email: DESSMIS-SDP@mod.uk
Phone: 030 679 83793

All of the documents produced for this consultation and further background information is available on our website at:
www.mod.uk/submarinedismantling

You can submit your response to the public consultation by email, online or by freepost:

FREEPOST RSKJ-KRAH-YZRJ
Submarine Dismantling Project
C/o Green Issues Communications Ltd
30-31 Friar Street
Reading
RG1 1DX

Please contact us if you have specific requirements for this document in alternative formats

Submarine Dismantling Project (SDP)

FOREWORD

Peter Luff MP
Minister for Defence Equipment Support and Technology

I was fortunate to visit Rosyth Royal Dockyard recently, where I was able to tour the former HMS Resolution, one of 17 nuclear submarines that have left service with the Royal Navy and are in afloat storage at Rosyth and at Devonport Royal Dockyard. Resolution was the UK's first submarine to be armed with nuclear weapons, and provided the foundation of our nuclear deterrent from 1969 until 1994, when she was taken out of service.

To see Resolution in the water at Rosyth, and to descend into her decks and compartments, was to visit a remnant of the Cold War era, but one that retains its relevance to the modern world. While we look towards the future, towards new generations of nuclear submarines, such as the Astute Class and the successor to the Vanguard Class, we must not forget the past and the present, and we must take action to dispose of our older nuclear submarines. This includes those submarines, such as Resolution, that carried nuclear weapons, and those, such as the Royal Navy's first nuclear submarine, HMS Dreadnought, that carried conventional weapons.

I have seen for myself the excellent condition in which these submarines are maintained, which is a testament to the commitment and the engineering skills of the workers that built and continue to maintain them. However it is neither sustainable nor practical to maintain them indefinitely. We should not leave the problem of disposal for future generations. The aim of the Submarine Dismantling Project (SDP) is to deliver a solution for the disposal of our nuclear submarines, up to and including the Vanguard class, when they leave service. It is imperative that this solution is safe, secure and environmentally responsible, and that it delivers value for taxpayers' money.

The purpose of this public consultation is to seek your views on what this solution might be. The MOD has carried out detailed analysis and investigated a wide range of options, and we have used this information to reach our view on what we think the solution might look like. But the solution has not yet been decided upon, and public consultation will play a vital role in helping us make that decision. One area that we have focused on in particular is the potential for harm to the environment, so we have also published our environmental assessment of submarine dismantling, to allow comment on this important area that many people will understandably be concerned about.

This Consultation Document is the cornerstone of the SDP public consultation, and is intended to provide you with information in as clear and open a manner as possible, to help you to understand the project and to reach a view on our proposals. If you are interested in reading more about the project, there is a wealth of additional material available in a variety of formats, from straightforward background information to detailed technical information. We are also holding various events where you will have the opportunity to ask questions and to talk to people from the MOD about your views or concerns.

> "We should not leave the problem of disposal for future generations"

We are keen to hear your views, so I encourage you to take some time to read this document, to attend an SDP event if you can, and to submit your comments using one of the mechanisms listed later in this document. It is by getting the views of as wide a range of people as possible that we will reach the right decisions for communities, for defence and for the future.

PREFACE

This Document

The Submarine Dismantling Consultation seeks your views on the Ministry of Defence's (MOD's) proposals for dismantling the UK's redundant defuelled nuclear-powered submarines and its assessment of any environmental effects it will have.

This Consultation Document is at the heart of this process. When read in its entirety, it is intended to provide the information you need to form your views and to respond to the consultation questions. There is a feedback form at the back of this document for you to use to respond to the questions and to give us your views about the project. After the consultation has been completed we will publish a report that summarises the feedback we have received.

This document describes our proposals for taking forward the Submarine Dismantling Project (SDP), the rationale behind those proposals and our assessment of the environmental effects that will result. No decisions will be taken on these proposals until we have considered all the feedback we receive. Only then will the MOD reach its final conclusions. As a result, the decisions we make about submarine dismantling may be different to the proposals set out in this document.

Other Sources of Information

The Non-Technical Summary of the Environmental Report, which has been published alongside this document, summarises the findings of our Strategic Environmental Assessment (SEA). It includes further questions that invite your views on the approach it has taken and on its findings.

If you would like further information about the SDP, this is available on our website and at our consultation events. There are also signposts throughout this document to further information on particular subjects.

There are different levels of information available depending on your interests: from Factsheets for those who want to find out more about the key topics, through to the detailed studies that have helped us to analyse the options. The diagram opposite outlines the documents that are available.

Public Consultation Documentation Hierarchy

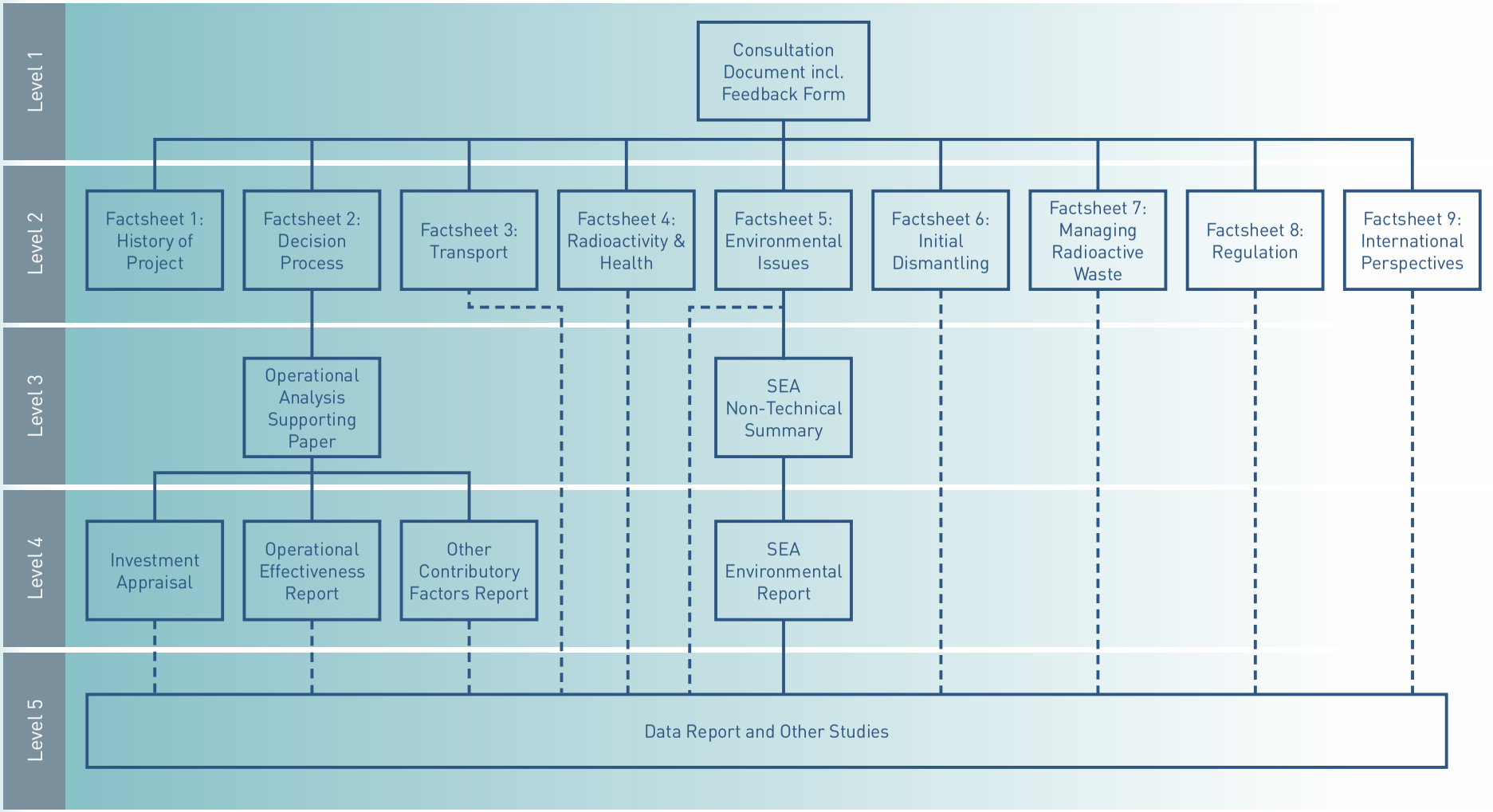


Diagram illustrating the information available according to the level of technical detail covered - from Level 1 (this document) to Level 5 (technical studies).

CONTENTS

1 INTRODUCTION

Introduction

This chapter describes the context of this Consultation process.

1.1. What is this consultation about?

1.1.1. This public consultation seeks your views on the Ministry of Defence's (MOD's) proposals for dismantling defuelled nuclear-powered submarines and for safely managing the radioactive waste that this generates.

1.1.2. The Royal Navy's submarines have a service life of around 25 years. Currently, when a submarine leaves service it is stored afloat and regularly maintained to preserve it in a safe condition. There are a total of 17 submarines currently being stored in this way in the UK, the oldest of which, the former HMS Dreadnought, left service 30 years ago.

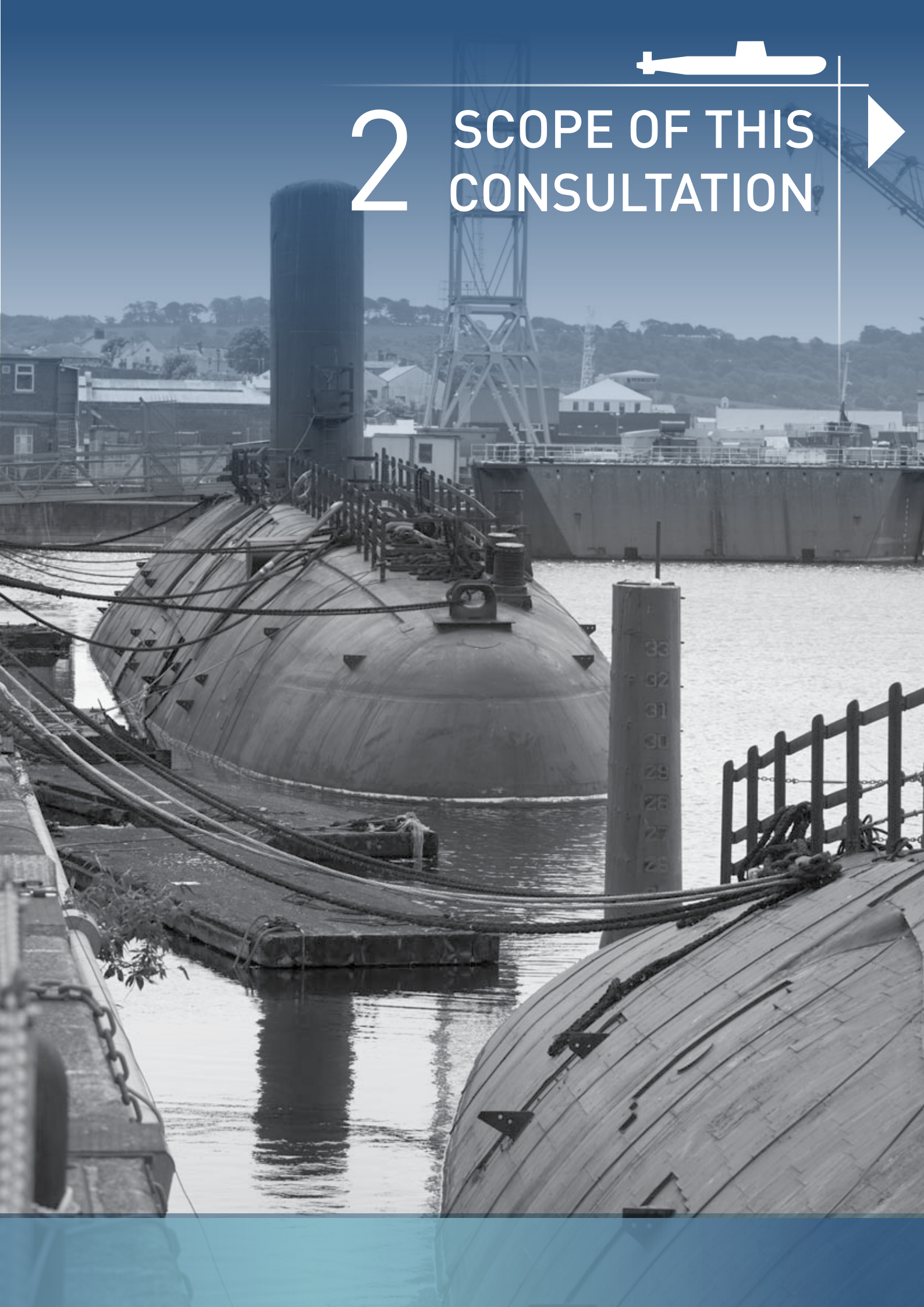
1.1.3. All the Royal Navy's submarines are powered by nuclear energy because it allows them to carry out military operations over thousands of miles while remaining submerged, helping them to stay undetected.

1.1.4. As a responsible nuclear operator, the MOD takes its duty seriously to manage the submarines, both during and after their service lives. Identifying a safe, environmentally responsible, secure and cost effective solution to dismantle these submarines, after they have left service and been defuelled, is the aim of the Submarine Dismantling Project (SDP).

1.1.5. We will use the feedback we receive during the consultation period to help inform our analysis of the various options that are available. This consultation has been timed to ensure it takes place when there is the opportunity for your views to influence the MOD's future decisions.

1.1.6. Submarine dismantling, like any work involving radioactive material, will be closely regulated by a number of independent bodies, including the Office for Nuclear Regulation and the Environment Agency (EA) / Scottish Environment Protection Agency (SEPA), to ensure it is conducted in a safe and environmentally responsible way. We must also obtain approval from local planning authorities for the dismantling facilities that will be needed before any dismantling can start.
Applications for planning and regulatory approval can only be made after the MOD has made decisions about what facilities will be needed and where they will be located.

1.1.7. This Consultation Document and the associated set of Factsheets aim to help you to understand more about submarine dismantling, to give you the information you need to form your views. Questions are posed throughout this document, the answers to which will help us to understand your thoughts on particular subjects. These are repeated at the end.



2 SCOPE OF THIS CONSULTATION

SCOPE OF THIS CONSULTATION

Introduction

This chapter describes the questions on which we are consulting, the ways in which you can get involved in the consultation and the information that is available.

2.1 Why are we consulting?

2.1.1. We recognise that there is keen public interest in how and where we dismantle our nuclear submarines and that the public should have confidence in the solution that is chosen. This is why we are seeking your views on our proposals through this public consultation. Consultation on our assessment of the environmental effects of submarine dismantling is also an important part of the formal process of Strategic Environmental Assessment (SEA) that we are carrying out. This is the third round of public consultation that has been conducted on dismantling submarines (more information about the previous consultations is available in the document SDP - Our Approach to Public and Stakeholder Engagement), which can be found on our website.

2.2. What are we asking you?

2.2.1. This consultation seeks your views on the three key decisions that need to be made about submarine dismantling:

- **How** the radioactive material is removed from the submarines;
- **Where** we carry out the removal of the radioactive material from the submarines; and
- **Which type** of site is used to store the radioactive waste that is awaiting disposal.

2.2.2. There are a number of potential answers to each of these questions. **No decisions will be taken until after we have considered the responses to this public consultation.**

2.2.3. We are also seeking your views on our assessment of the environmental effects of submarine dismantling as set out in the Environmental Report.

2.3. What we are *not* consulting on

2.3.1. Much of the work involved in submarine dismantling is similar to work that is already carried out routinely during submarine maintenance activities, and there are established practices for managing much of the waste that will be produced.

2.3.2. The MOD has established processes for disposing of ex-Royal Navy ships using existing ship recycling facilities. Once the radioactive material has been removed from a submarine, it is our intention to dispose of the hull at an existing ship recycling facility in the UK that has the necessary environmental licence.

2.3.3. We are not, therefore, consulting on these routine activities, although their environmental impacts are considered within the SEA. In some cases these activities may be subject to consultation at a later stage as part of applications for planning or regulatory approvals.

2.4. How are we consulting?

2.4.1. The formal consultation period began on 28 October 2011 and will close on 17 February 2012. There are a number of ways for you to get involved:

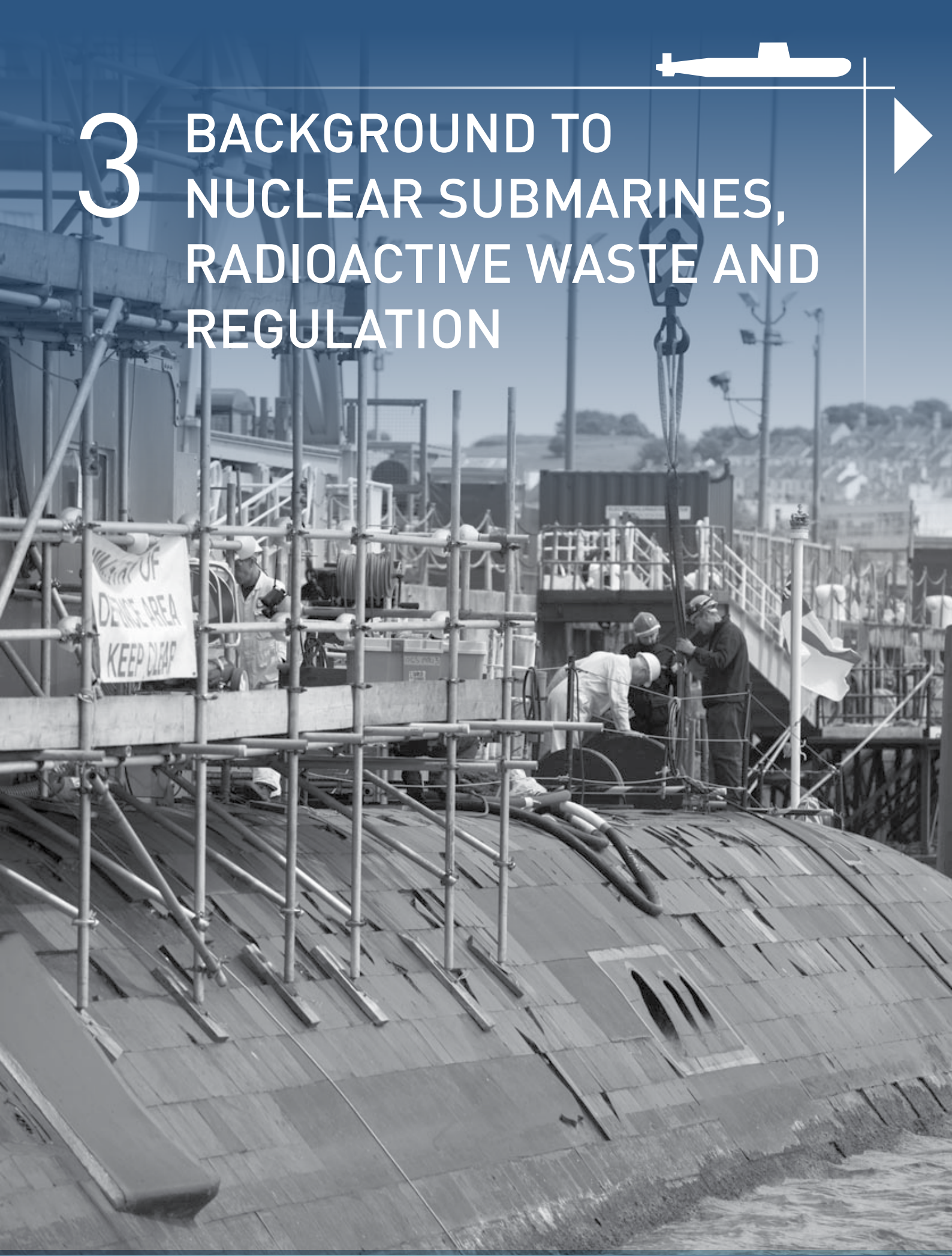
Online: All the information that has been published as part of this consultation is available online at **www.mod.uk/submarinedismantling** where you can also submit your feedback.

By post: If you wish to request paper copies of the documents, or submit your feedback by FREEPOST, contact details are on the inside front cover.

Local events: Events are being held in and around Devonport and Rosyth, where the candidate sites for initial dismantling are located. Members of the MOD project team will be available to answer questions and discuss any concerns you may have. Workshops will also be held during these events at which you can talk in a group with others and discuss issues in detail. Details of these events are on the inside front cover.

National workshops: Two larger workshops, where issues can be discussed in detail, are being held one in Birmingham and one in Glasgow. While they are open to everyone, these workshops are designed for those who have a strategic or specialist interest in the project, for example representatives of special interest groups, local authorities, industry, statutory bodies and other government departments. Details of these events, and contact details to register, are on the inside front cover.

3 BACKGROUND TO NUCLEAR SUBMARINES, RADIOACTIVE WASTE AND REGULATION



BACKGROUND TO NUCLEAR SUBMARINES, RADIOACTIVE WASTE AND REGULATION

Introduction

This chapter briefly describes how submarines work and explains where radioactive materials come from in a submarine. It explains different types of radioactive waste and how they are managed. It also introduces the role of the independent regulatory bodies in providing assurance that activities involving radiation are conducted safely.

A nuclear submarine is one that is powered by nuclear energy; not all nuclear submarines carry nuclear weapons.

3.1. About nuclear submarines

3.1.1. In the past, the UK's submarines were powered by diesel fuel which charged their batteries. This required them to surface regularly for air. Today, all Royal Navy submarines are powered by energy from nuclear reactors. Nuclear reactors produce their power without air and do not need to surface frequently, meaning they can operate underwater for thousands of miles. This is a huge advantage to a submarine, whose primary purpose is to operate undetected beneath the surface of the sea.

3.1.2. There are two types of nuclear-powered submarine; one carries nuclear weapons and one does not.

- "Fleet" submarines are designed to counter enemy submarines and surface ships, conduct surveillance and intelligence-gathering tasks and other covert operations. They do not carry nuclear weapons.
- "Ballistic missile" submarines carry long-range missiles with nuclear warheads that provide the UK's strategic nuclear deterrent.

3.1.3. The nuclear energy that powers the submarine is created by a nuclear reactor (using a type of reactor called a Pressurised Water Reactor). The nuclear fuel is contained in a robust metal chamber called a Reactor Pressure Vessel (RPV). The RPV is housed within a Reactor Compartment (RC), which is a robust metal enclosure that is designed to prevent radiation from escaping, protecting the crew inside the submarine and the environment outside. The RC is, in effect, the central section of the submarine (as illustrated in Figure 1 (below)).

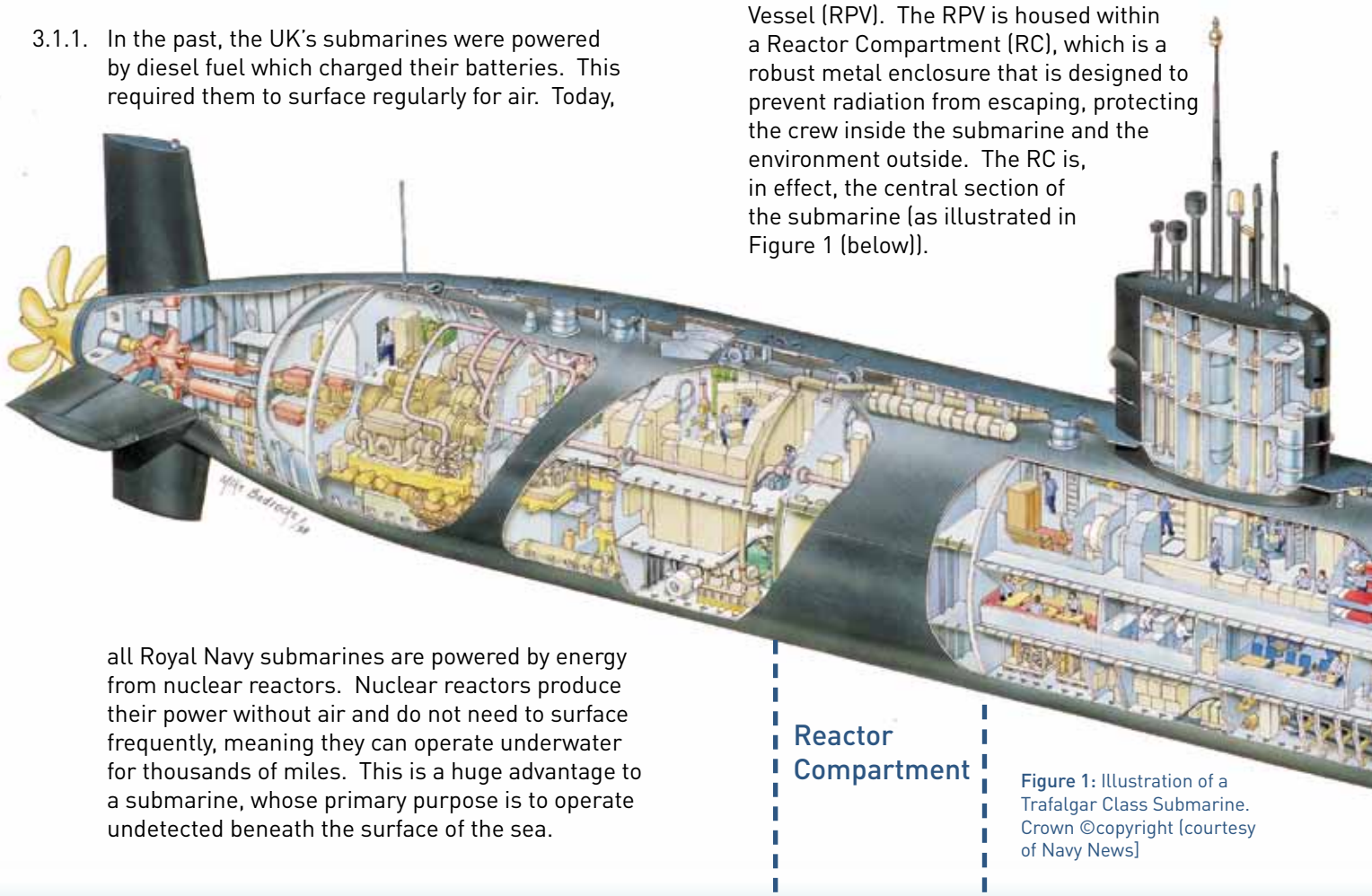


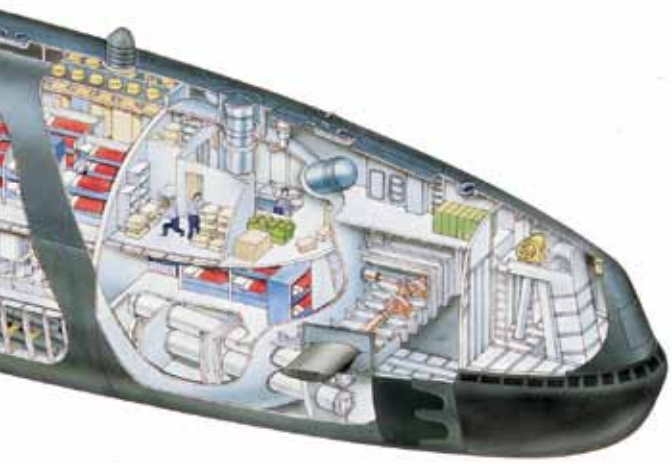
Figure 1: Illustration of a Trafalgar Class Submarine. Crown ©copyright (courtesy of Navy News)

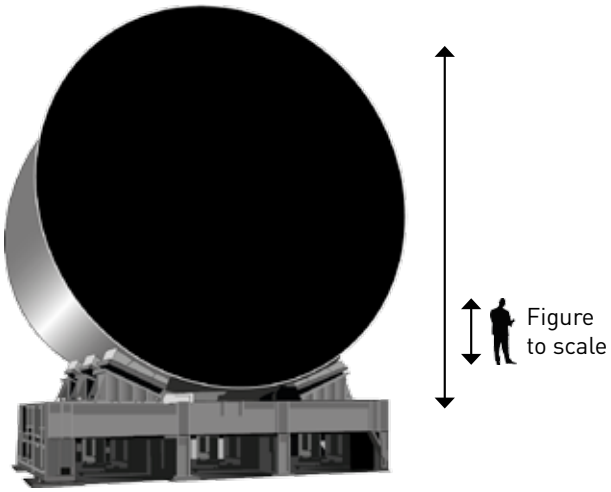
Royal Navy Submarines displace between 5,000 tonnes (of water) for the Trafalgar Class and 16,000 tonnes for the Vanguard Class.

An RPV is typically 2.5 – 3 metres in diameter, 4 metres high and weighs between 50 and 80 tonnes.

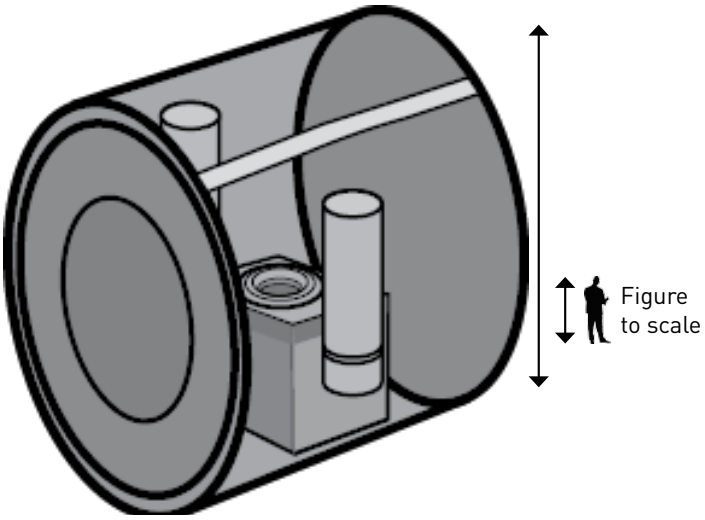
An RC is typically 10 metres in diameter, 9 metres long and weighs around 700 tonnes.

When a submarine leaves service all weapons are removed before they are stored afloat.

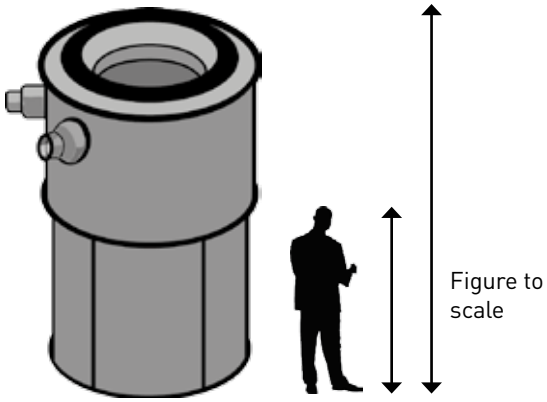




A Reactor Compartment during the building of a submarine.



RPV inside RC



A Reactor Pressure Vessel

Figure 2: Scaled illustrations of Reactor Compartment and Reactor Pressure Vessel

3.2. What is radioactive waste?

3.2.1. Radioactive materials must be carefully managed to minimise the hazard they pose to people and the environment. The radioactive materials in a nuclear-powered submarine include the nuclear fuel itself and some components that have become radioactive through the operation of the reactor.

3.2.2. After submarines leave service the nuclear fuel is removed and taken for storage at the national facility in Sellafield, Cumbria - this is not part of the SDP but is an existing activity that has taken place at Devonport Dockyard for many years and will continue in the future.

SDP will dismantle only defuelled nuclear submarines

3.2.3. Almost all the remaining radioactivity in the defuelled submarine is inside the steel of the RPV itself. The majority of this is within solid metal so there is very little potential for spreading radioactive contamination (as may be the case with gases or liquids).

3.2.4. Once dismantling begins, these components will be classed as radioactive waste. The radioactive waste that will result from submarine dismantling is categorised into two levels, depending on the amount of radioactivity it contains and each category is managed in different ways:

Low Level Waste (LLW)
LLW includes items such as ventilation ducting, drains, pipework, protective clothing and equipment that has come into contact with radioactive material. Facilities for the disposal of LLW already exist, such as the LLW Repository in Cumbria.

Factsheet://

To find out more, see the Factsheet: Radioactivity and Health

Intermediate Level Waste (ILW)
Typically, ILW comes mainly from nuclear power plants. It has radioactivity levels exceeding the upper boundaries for LLW. ILW on the defuelled submarines comes mainly from components that were close to the fuel. There is no disposal route currently available for ILW so it must be stored until it can be disposed of in the UK's proposed Geological Disposal Facility (GDF) (– see section 3.3).

3.2.5. In addition to the two types of radioactive waste that will be generated by submarine dismantling, there is an additional category of High Level Waste (HLW), which generates significant heat and has to be cooled continuously. The SDP will generate **no HLW.**

3.3. Geological disposal of ILW

3.3.1. The UK plans to develop a Geological Disposal Facility (GDF) for the disposal of ILW and HLW, by around 2040, but a site has not yet been identified. Geological disposal involves isolating the waste deep inside a suitable type of rock to ensure that no harmful quantities of radioactivity ever reach the surface environment.

3.3.2. The UK Government's policy[1] for geological disposal of these wastes was developed following a thorough review by the Committee on Radioactive Waste Management (CoRWM) and is set out in the Managing Radioactive Waste Safely (MRWS) White Paper[2]. The Nuclear Decommissioning Authority (NDA) is responsible for implementing geological disposal on behalf of the Department for Energy and Climate Change (DECC). The MOD, DECC and the NDA have been working together to ensure that the plans for the GDF take into account the need to include radioactive waste from submarines.

3.3.3. Until the proposed GDF becomes available, all ILW must be stored in purpose-built interim stores that ensure it is managed safely. It is this interim storage solution which the SDP must establish for the storage of the ILW from dismantled submarines.

3.4. How are nuclear activities regulated?

3.4.1. All nuclear and radiological work in the UK is closely regulated and is undertaken by licensed or authorised operators, whether it is carried out in the public or private sector. The independent bodies that regulate nuclear activities ensure that safety remains a top priority, and safety is paramount in all the MOD's nuclear activities.

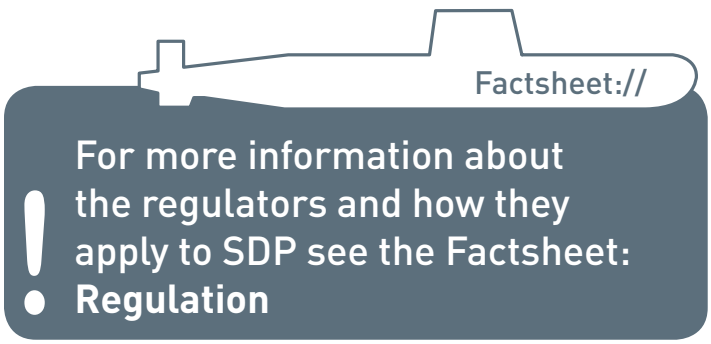
3.4.2. Government Departments, regulators and site operators all work together to ensure that stringent standards of safety are set and then achieved. Radiation doses are strictly controlled for both workers and members of the public, and the risk of accidents occurring is carefully assessed and reduced to an absolute minimum.

3.4.3. The MOD is responsible for the safe management of all its nuclear activities but it does not operate in isolation. Equivalent standards of regulation apply to both MOD and industry.

3.4.4. The regulators which authorise and monitor nuclear activities to ensure they comply with these standards and principles include:

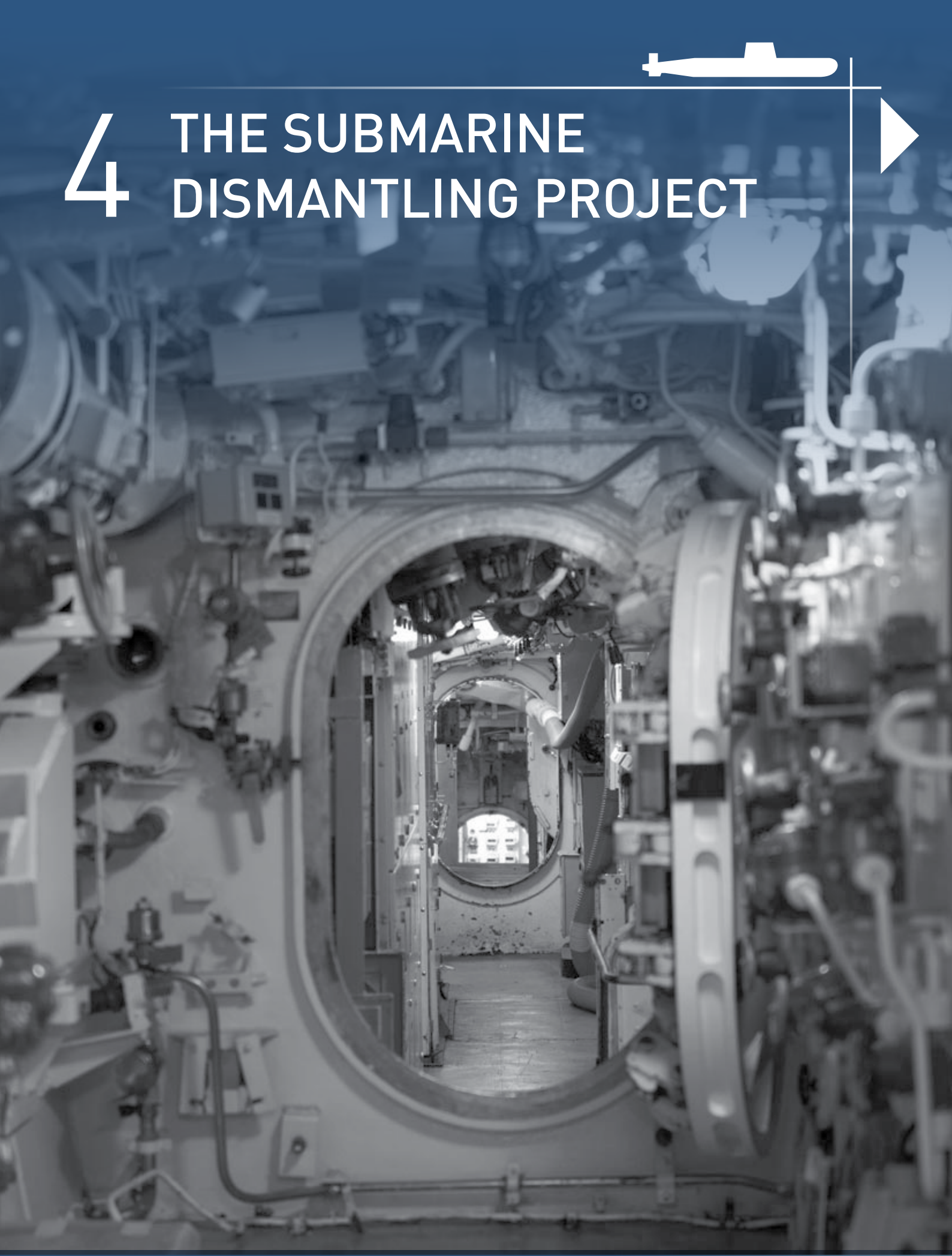
- Office for Nuclear Regulation (ONR) – an agency of the Health and Safety Executive
- Environment Agency (EA) / Scottish Environment Protection Agency (SEPA)
- Department of Transport (DfT) (for the transport of radioactive materials)[3]
- Defence Nuclear Safety Regulator (DNSR)

3.4.5. Submarine dismantling plans will be assessed for safety and fully controlled at every step of the process. The plans will be fully examined and endorsed by these bodies before any work begins; the implementation will then be monitored to ensure that it is carried out safely and effectively.



[1]Scottish Government policy for ILW differs from the policy in England and Wales and is for long-term management in near-surface, near-site facilities. It is not, however, applicable to waste arising from decommissioning of out-of-service nuclear submarines.
[2]http://mrws.decc.gov.uk
[3]DfT's Radioactive Materials Transport Team is currently in the process of being merged into ONR.

4 THE SUBMARINE DISMANTLING PROJECT



Introduction

This chapter introduces: **why** we need to dismantle submarines; **what** materials and waste will result and **where** they will go; the requirements and the scope of the SDP; and the benefits and impacts of the project.

4.1. Why do we need to dismantle the submarines?

4.1.1. The MOD takes its duty to manage the legacy of out-of-service submarines seriously. We believe that developing a solution now, rather than leaving future generations to do so, is the responsible course of action.

4.1.2. After they have left service, submarines are currently stored afloat at Devonport and Rosyth Dockyards where they undergo regular maintenance to keep them in a safe condition. While this has proved to be an acceptable arrangement for over 30 years, the cost to the tax-payer of maintaining them safely is rising significantly as they age and as more submarines leave service.

4.1.3. A total of 17 submarines are currently stored in this way, which is steadily increasing over time. We expect to reach our capacity to store further submarines by 2020, by which time a dismantling solution needs to be in place or the MOD will have to invest in creating more berthing space[4].

Factsheet://

For more information on submarine dismantling in other countries see the Factsheet: International Perspectives

4.1.4. Submarine dismantling is an established activity in other countries, including France, the USA and Russia. These countries have proven that safely dismantling submarines is practicable, paving the way for the UK to uphold its policy commitment to "undertake decommissioning and disposal activities as soon as reasonably practicable"[5].

4.2. What materials and waste will result from dismantling and where will it go?

4.2.1. A variety of materials and waste result from submarine dismantling; these include steels and other metals, hazardous waste (such as asbestos), a wide variety of non-hazardous waste and radioactive waste. The radioactive waste includes Low Level Waste (LLW) (such as contaminated pipework) and Intermediate Level Waste (ILW) which is in the form of steel that has become radioactive in the Reactor Pressure Vessel (RPV). Figure 3, left, shows the approximate amount of each material or waste resulting from dismantling a Trafalgar Class submarine.

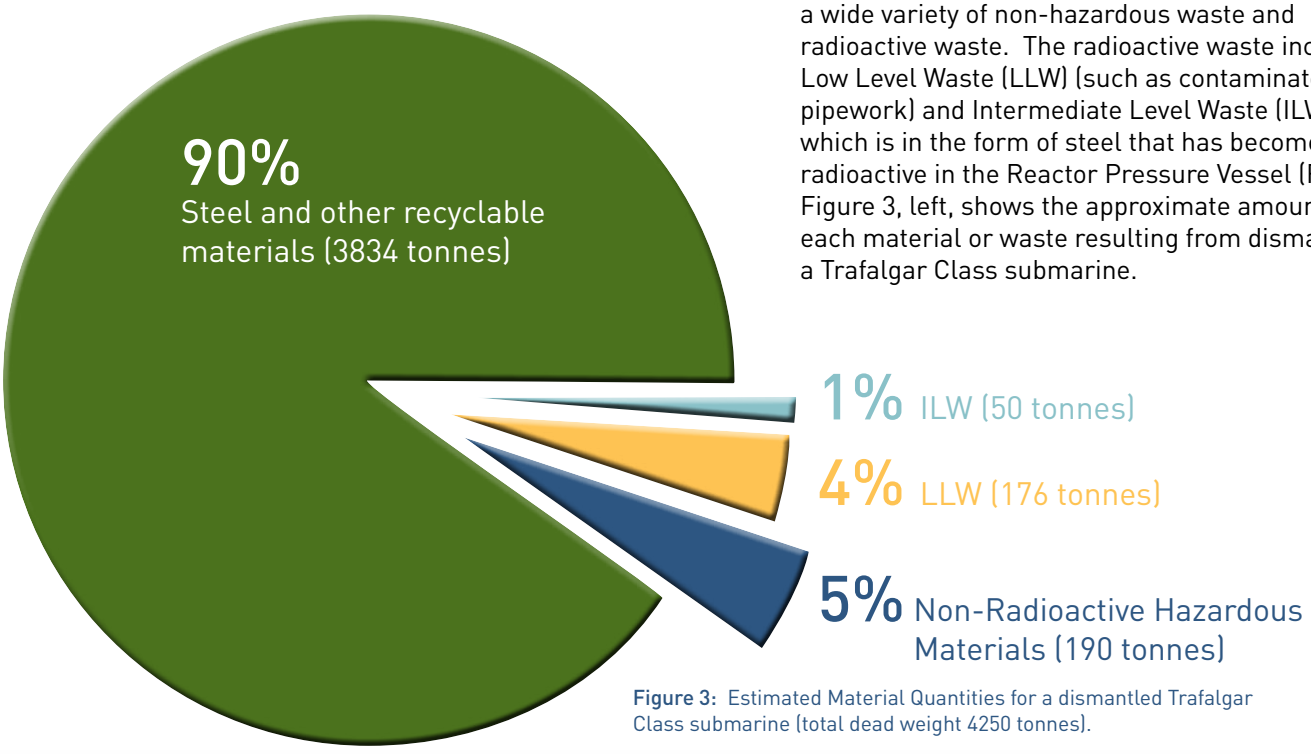


Figure 3: Estimated Material Quantities for a dismantled Trafalgar Class submarine (total dead weight 4250 tonnes).

[4]Seven out-of-service submarines are stored at Rosyth Dockyard and 10 are at Devonport Dockyard. All submarines leaving service in future will be stored at Devonport awaiting dismantling; no further submarines will be stored at Rosyth.
[5]The Decommissioning of the UK Nuclear Industry's Facilities – Amendment to Command 2919, DTI Paper, September 2004.

4.2.2. In approaching the dismantling of submarines, the MOD will apply the principles of the waste management hierarchy shown in Figure 4 below.

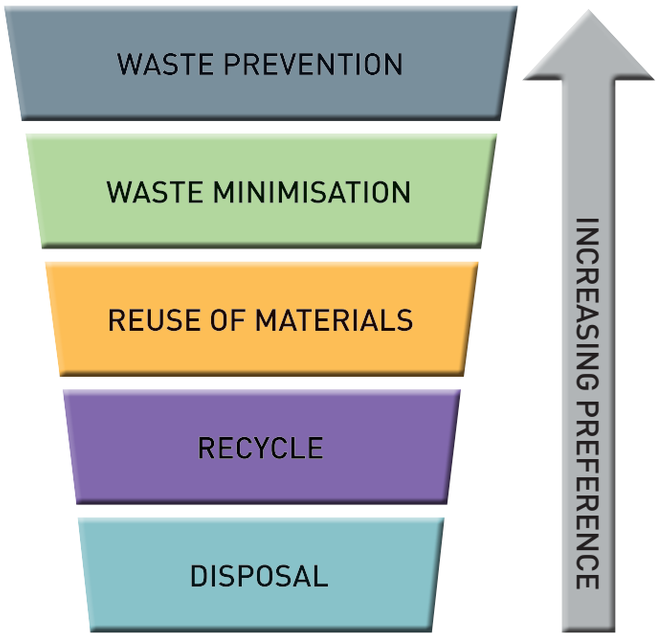


Figure 4: Waste Management Hierarchy

4.2.3. Components and materials that are re-useable on other submarines are removed in preparing the submarines for afloat storage. Up to 90% (by weight) of the materials from the dismantled submarine will be recyclable, notably the high quality structural steel that makes up the hull. Established and approved disposal routes already exist for hazardous and non-hazardous wastes that are not recyclable. Similarly, we will use established disposal routes for LLW in accordance with the UK's LLW Strategy[6].

4.2.4. Crucially, it is only ILW that does not have an established disposal route and therefore must be stored until the proposed Geological Disposal Facility (GDF) is available.

The estimated amount of ILW from all 27 submarines is less than 0.2% by volume of the UK's total inventory of ILW.

4.3. Project objectives

4.3.1. The MOD established the SDP to dismantle 27 defuelled submarines, including all the 17 currently stored afloat and a further 10 yet to leave service (up to and including the Vanguard Class). Dismantling of the new Astute Class, currently being brought into service, and the next planned class of submarine (known as 'Successor') will be subject to future decisions and are not within the scope of the SDP. Nevertheless, the proposed solution is required where possible, to retain the flexibility to extend facilities in the future should a decision be taken to accommodate further classes.

4.3.2. The project was established in 2000[7] following a study by the MOD, which concluded that the ILW from the submarines should be stored on land. It is a long-term project, extending for 60 years, from the development of a solution to the eventual decommissioning and disposing of facilities built for submarine dismantling when they are no longer required. Figure 5 illustrates the timeline of the project and highlights past and future milestones.

4.3.3. The project contributes to the delivery of the MOD's wider Nuclear Liabilities Management Strategy[8]. Its objectives have been set out formally by the MOD, in a way that can be monitored and measured to ensure they are met as effectively as possible. In summary, the SDP is required to dismantle 27 nuclear submarines:

- In a safe, secure and sustainable manner;
- Cost effectively;
- By 2050;
- Without exceeding the current submarine storage capacity;
- Upholding MOD's reputation as a responsible nuclear operator;
- Storing ILW until a disposal route is available;
- Disposing of all other radioactive, hazardous and non-hazardous waste in accordance with legislation; and
- Minimising impact upon military capability.

[6]UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry available at: www.nda.gov.uk/
[7]The project was formerly called Interim Storage of Laid Up Submarines (ISOLUS).
It was renamed the Submarine Dismantling Project in 2009 to better reflect its objectives.
[8]MOD Nuclear Liabilities Management Strategy 2011, available at www.mod.uk/

4.3.4. In the long-term, the major benefit of dismantling submarines is to remove a legacy that would otherwise be a burden to future generations and a growing financial liability to the taxpayer. The decision-making process that we are following is intended to maximise these benefits.

4.3.5. We accept, however, that there will be environmental impacts associated with submarine dismantling. Some of these will be temporary in nature (such as the nuisance or disruption caused by construction work for new facilities) while others may endure for the life of the project (such as the use of land for storage facilities or routine permitted discharges from dismantling activities). The objective for the MOD is to minimise these impacts as best we can.

4.3.6. For the purpose of developing the requirements and criteria of the project, the MOD has categorised the higher level benefits and impacts in terms of:

- Environmental and safety – achieving long term environmental benefits, such as dealing with the stored submarines, while minimising the environmental and safety impacts.
- Public confidence – the public view of submarine dismantling activities and outcomes and the MOD's reputation as a responsible nuclear operator.
- Socio-economic – benefits for and impacts on local communities, such as sustaining jobs in the long-term but potentially causing disturbance through construction in the short-term.
- Operations – benefits for and impacts on defence capability and operations, such as availability of berthing space or docks for submarine maintenance.
- Legislation and policy – compliance with legislation and implementation of government policy.

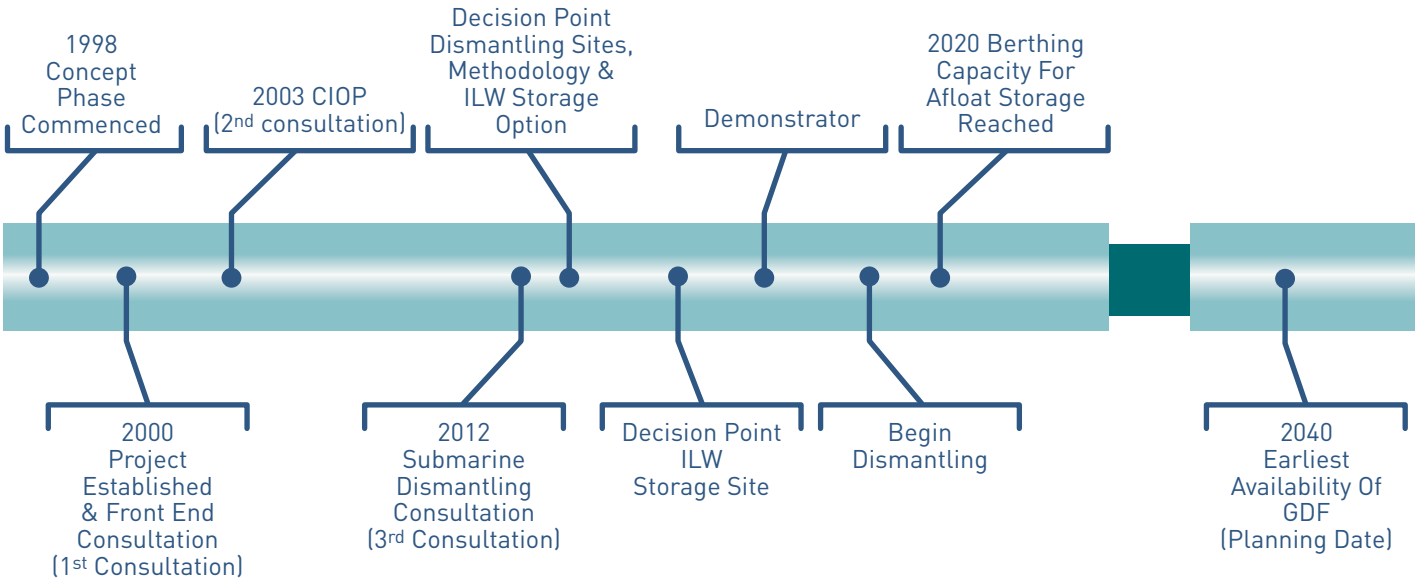
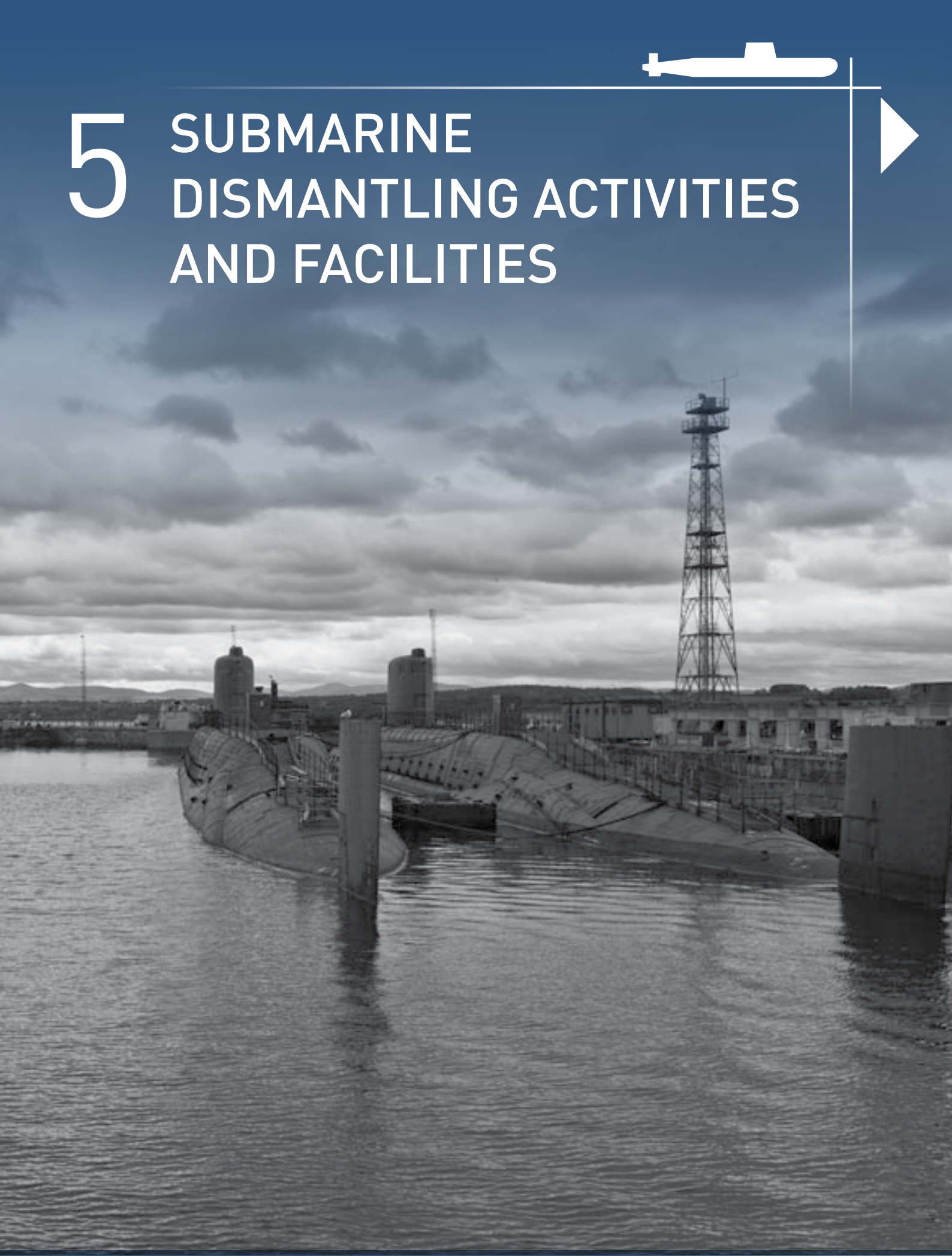


Figure 5: Key past and future milestones of the Submarine Dismantling Project. (Not to scale)

5 SUBMARINE DISMANTLING ACTIVITIES AND FACILITIES



Introduction

This chapter introduces the different activities and facilities that will be required to dismantle submarines and any implications they may have for people, or for the environment, in normal operation. It also gives examples of the safety measures that will be used to safeguard against an accident or other harmful event during dismantling.

The activities involved in dismantling a submarine are illustrated in Figure 6 (overleaf).

5.1. Removing the radioactive materials from the submarines (Initial Dismantling)

5.1.1. The first activity known as 'initial dismantling', is to remove the radioactive materials from the submarine. While almost all these materials are confined to the Reactor Compartment (RC), the whole submarine will be checked and any contaminated materials will be removed. There are three options for removal of radioactive materials. These are explained in the next chapter but, in each option, the intended result is that the submarine is cleared of radioactivity (to below regulatory limits) so that the hull can be sent for ship recycling (see 5.7). The resulting Low Level Waste (LLW) will be disposed of to an existing licensed facility (see 5.4) and the Intermediate Level Waste (ILW) will need to be suitably packaged ready for interim storage.

5.1.2. Most of the facilities needed for initial dismantling can already be found at a nuclear licensed dockyard. These include docks, cranes, lifting equipment and buildings that will support the submarine while it is out of the water during work to remove and contain the radioactive materials inside. We estimate that it will take about 12 months to dismantle a submarine but there may be opportunities to do it more quickly if this were shown to be feasible and cost effective.

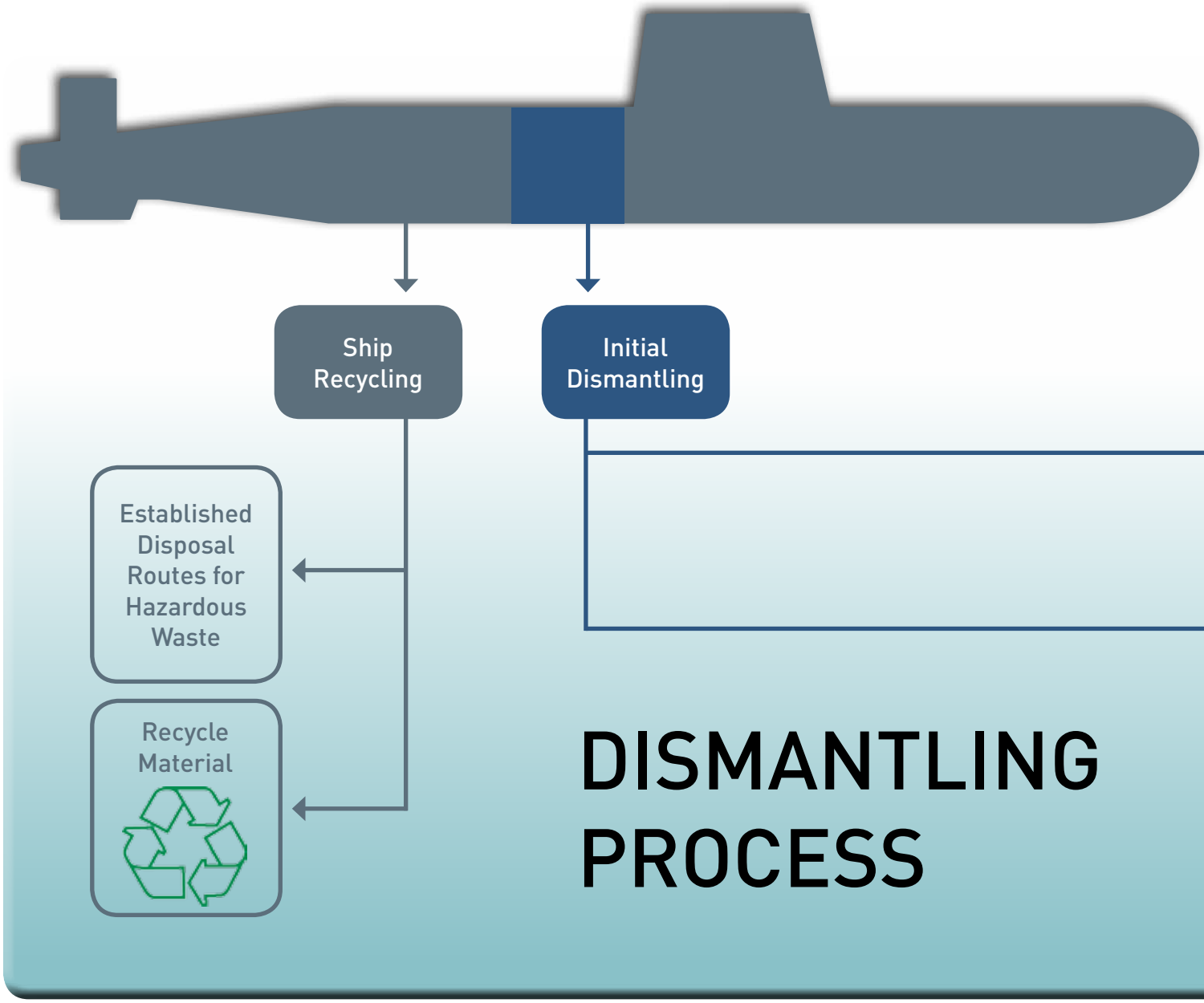
5.1.3. Any negative environmental effects arising from SDP work will be identified and limited. Dismantling work is unlikely to increase radioactive or non-radioactive discharges into the environment above the current permitted levels; any proposal to do so would require new permissions to be granted by the Environment Agency or Scottish Environment Protection Agency. Cutting the submarine hulls is not expected to raise the overall noise levels at the dockyards significantly. Positive effects include sustaining existing skilled jobs in the dockyard or dockyards and resolution of a legacy issue which MOD has been exploring for some time.

5.1.4. Any effects on the environment will largely be a result of the construction that is required to extend existing facilities or build new ones. As with any industrial development, these may include noise and vibration from building works, waste from construction or demolition, dust and fumes, and an increase in lorry movements. Since most of the facilities are already in place, the need for construction will be limited and therefore so will the environmental effects.

5.2. Size-reduction of the Reactor Pressure Vessel

5.2.1. Size-reduction is the process of cutting radioactive waste up into smaller pieces so that it can be packaged into boxes for disposal. Size-reduction is an established process in the civil nuclear industry. It is routinely used in the decommissioning of nuclear power plants including Reactor Pressure Vessel (RPV) components.

5.2.2. The ILW contained in the RPV will eventually be disposed of in the proposed Geological Disposal Facility (GDF). Current plans for this facility suggest that the RPV is too big to be disposed of whole and will have to be size-reduced and packaged in approved containers. This could be done before it is put into interim storage or afterwards (just before it is sent for disposal). Importantly, the design of the proposed GDF is not yet finalised and, if plans change, it may be possible to dispose of the RPV whole, without size-reduction.



5.2.3. The facilities required for size-reduction would include a building in which the RPV could be cut safely into smaller pieces and packaged for storage. Cutting the RPV exposes the more radioactive material inside, so this building would require remote handling (where the worker does not come into contact with the materials) and shielded areas where cutting work could be done while protecting workers from exposure. This building would also require decontamination facilities to remove radioactivity from the surfaces of items that had become contaminated by the cutting process. There will also be some LLW created during the size-reduction of RPVs and this will be safely disposed of (see section 5.4).

5.2.4. Any environmental effects will mainly be associated with construction, so the range of environmental effects will be similar to those for initial dismantling, described above. Unlike initial dismantling though, the facilities needed for size-reduction do not currently exist at the dockyards, so new facilities would need to be built.

5.3. Storing ILW that is awaiting disposal

5.3.1. The ILW resulting from initial dismantling must be stored until the proposed GDF is ready to accept it for disposal. The current planning date for the proposed GDF to begin receiving waste is 2040 but, as it will receive waste from a number of other sources, it may be many more years before it is ready to receive ILW from SDP. Storage facilities will therefore be designed to safely and securely hold waste for up to 100 years, to protect against any changes to the GDF timescales, in line with CoRWM's recommendations (see section 3.3).

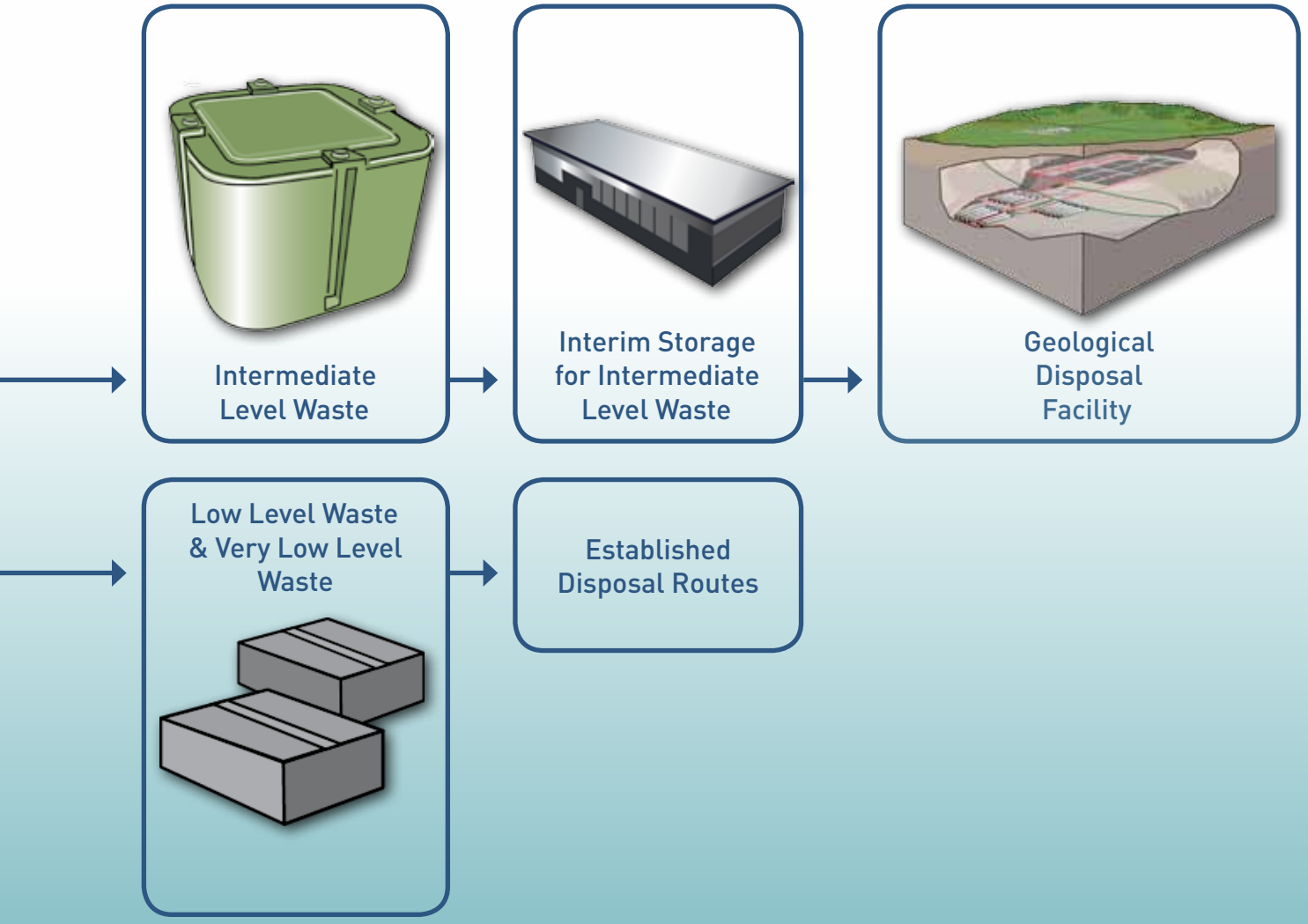


Figure 6: Dismantling Process

5.3.2. One or more buildings would be needed to store ILW and these would have to provide the required level of shielding, containment, security and protection. The design of the facilities will depend on the container in which the ILW is being stored. There are a number of existing and planned ILW storage facilities in the UK that may be suitable, but it may be necessary or preferable to develop new ILW storage facilities for SDP (see section 6.5).

5.3.3. The environmental effects of storing ILW are directly associated with the construction of the facility, as described in section 5.1.4, and the amount of land lost to the building itself. The scale of the effects depends on the size of the facility, which in turn is dictated by the size of the ILW container. Once the ILW is safely stored, it will be 'passively safe,' meaning that the operators of the store can keep a watchful eye to ensure that the radiation is contained. The only additional waste created will be domestic refuse (from guarding the site) and from routine building maintenance.

Factsheet://

For further information about ILW storage, see the Factsheet: Managing Radioactive Waste

5.4. Disposing of Low Level Waste

5.4.1. The LLW resulting from dismantling must be disposed of at a licensed facility such as the Low Level Waste Repository in Cumbria. Disposal of LLW is already carried out routinely by the nuclear industry in the UK in accordance with the UK LLW Strategy. Prior to disposal, following the principles of the waste management hierarchy (Figure 4), LLW may be treated to enable materials that have been decontaminated to be recycled, therefore minimising the volume of waste that must be disposed of. Established, licensed commercial services are available for the treatment of LLW prior to disposal; these are already used in the management of LLW generated during the maintenance of submarines while they are in service.

5.4.2. The facilities required for disposing of LLW would include one or more buildings in which LLW could be packaged in approved containers. From here it would be dispatched for treatment (where appropriate) and disposal. Such facilities would incorporate the required shielding, containment, security and protection. They can already be found in nuclear licensed dockyards, although some further development may be needed for the SDP.

5.4.3. The environmental effects of operating licensed LLW disposal facilities are outside the scope of the SDP, but these are well understood and are effectively minimised through the licensing conditions imposed by the regulators. There are no significant environmental effects from dispatching LLW from the dockyards for disposal; this is routine business and is closely regulated to prevent any damaging effects.

5.5. Transporting submarines

5.5.1. The submarines will be transported by sea if they need to be moved from where they are stored afloat to the initial dismantling site. This will not be necessary if both Devonport Dockyard and Rosyth Dockyard sites are used for initial dismantling. Out-of-service submarines can be moved using a number of methods including towing the submarine, towing a barge with the submarine on it or using a heavy lift ship. Submarines will be docked for additional maintenance prior to transport to ensure they are seaworthy. Following the removal of the radioactive materials, it will also be necessary to move submarines from the initial dismantling site(s) to the ship recycling facility. Although the modes of transport are similar, transporting submarines before the radioactive materials have been removed would involve additional safety measures and regulation.

5.5.2. The facilities required for transporting submarines include the docks, cranes, lifting equipment and buildings needed to maintain them and ensure they are seaworthy.

5.5.3. A suitable dock, port or harbour is needed to load submarines on to a barge or heavy lift ship, or to tow them and similarly to offload and / or moor them at their destination. Most of these facilities can be found at a nuclear licensed dockyard.

5.5.4. Transporting intact submarines between existing licensed sites has very few environmental effects, beyond those of the exhaust emissions of the transport and escort ships. If, however, the RC has been separated from the submarine leaving the separated front and rear sections, these cannot be towed and they will have to be transported by barge or heavy lift ship for which deep water is required. Depending on the site, this may require additional dredging of the sea bed which could impact the marine environment.

5.6. Transporting radioactive waste

5.6.1. Radioactive waste removed from the submarine needs to be transported in approved containers for disposal or for storage awaiting disposal. Depending on the size and type of container used, this could be by sea, road or rail.

5.6.2. The facilities and infrastructure required to transport waste may include docks, ports or harbours, rail-heads or access roads, depending on the methods chosen, as well as buildings to prepare waste for dispatch or to receive waste for storage. The facilities needed to dispatch LLW can already be found in a nuclear licensed dockyard. Development of new facilities may be needed to dispatch ILW but this will depend on the size and type of container and the mode of transport.

5.6.3. Radioactive waste is already transported regularly in the UK by road, rail and sea. It is closely regulated by a number of bodies including the Department for Transport and the Defence Nuclear Safety Regulator. UK legislation sets strict requirements for the safe transport of radioactive waste including; the types of transport package allowed; how much radioactivity they can contain; and how they must perform in specified tests to prove their integrity in the unlikely event of a transport accident.

5.6.4. The mode and frequency of transport needed to move ILW that has been removed from the submarines will depend on a number of factors, including the method of initial dismantling adopted and the location of the storage site.

5.6.5. The transport of radioactive material is closely regulated to minimise any foreseeable safety and environmental risks and has very few environmental effects beyond those of the exhaust emissions from transport. If the packages are large, moving them by road may cause some local disruption to traffic, as would be expected for any oversized load.

5.6.6. Transporting the ILW from the storage facility to the proposed GDF when it is available also falls under the scope of the SDP.

Factsheet://

To find out more about all aspects of transport, see the Factsheet: Transport

5.7. Ship recycling

5.7.1. Following the removal of radioactive material (the initial dismantling activity) the submarine can be transported to a commercial ship recycling facility within the UK. Here the hull will be broken up and dealt with in accordance with the waste management hierarchy (Figure 4, section 4.2). The recycling facility will require the relevant environmental permits and all materials, including hazardous and non-hazardous materials, will be managed through established and approved routes. Ship recycling will be conducted in accordance with the UK Ship Recycling Strategy (2007)[9].

5.7.2. There are a number of existing ship recycling facilities in the UK that would be suitable for dismantling submarines, once the submarine is cleared of radioactivity to below regulatory limits. It is not our intention to develop a new ship recycling facility for the SDP.

5.7.3. The facilities required for ship recycling include the docks, cranes and the space needed to support the submarine out of the water, separate and sort the materials and then dispatch the various non-radioactive materials for recycling or disposal.

5.7.4. The recycling of submarines will be very similar to the recycling of surface ships because the non-radioactive materials involved are very similar. This includes large quantities of valuable metals like copper, lead and steel. Like surface ships, submarines also contain some hazardous materials such as oils and lubricants, asbestos and heavy metals. These will be carefully managed by the ship recycling facility through approved routes and will be recycled wherever possible.

5.7.5. The MOD's Disposal Services Authority (DSA), which is responsible for the sale or disposal of all military equipment that is surplus to requirements, will manage the process of contracting a ship recycling facility on behalf of the SDP. The DSA has proven experience in managing the recycling of Royal Navy surface ships and a proven record of minimising waste sent to landfill, consistently recycling more than 95% of the material in the surface ships that are broken up.

Online Information://

More information about the DSA and its experience of managing ship recycling projects is available at www.edisposals.com

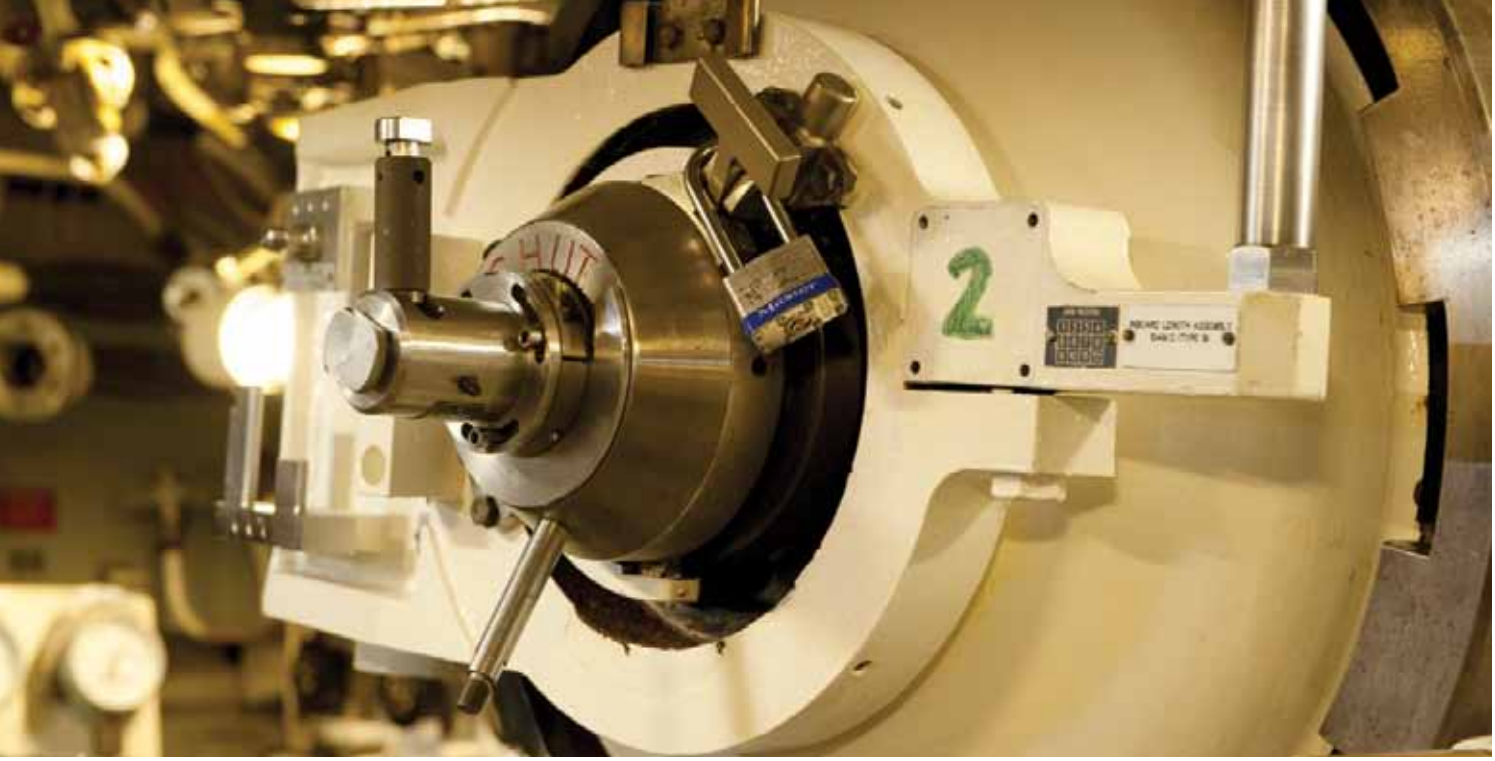
5.8. Assessing the environmental effects

5.8.1. One of the key objectives of the SDP is to ensure that submarine dismantling is carried out in a responsible way that minimises environmental impacts and takes advantage of opportunities to improve the environment.

5.8.2. In order to understand the environmental effects of each stage of submarine dismantling, some of which are described above, the MOD has commissioned a Strategic Environmental Assessment (SEA). An SEA is a formal and legally-defined process[10] that looks at what the significant environmental effects of a programme might be, so that these can be taken into account as the options are developed and before major decisions are made.

5.8.3. The potential environmental impacts that could occur at all the stages of the project, including possible impacts on communities and health have been assessed as part of the SDP's SEA. The results of the SEA, including recommendations for ways to avoid or minimise them, have been fed into the wider assessment of the options which is summarised in Chapter 7.

[9]UK Ship Recycling Strategy, February 2007 – available at www.defra.gov.uk/environment/waste/business/ship-recycling
[10]Assessment of Plans and Programmes Regulations 2004



5.8.4. An important part of the SEA is to give the public the opportunity to understand and comment on the effects that the SDP may have on them or their community, and to suggest any improvements. We are seeking your views on the SEA as part of this public consultation. The Non-Technical Summary and the Environmental Report itself pose a series of questions for your feedback. (These questions are reproduced at the back of this document.)

5.8.5. Following public consultation, the responses received on the SEA will be used, alongside all the consultation responses, to inform the MOD's recommendations about the way forward. If necessary, the SEA will be updated and further assessments undertaken. Once the initial dismantling site(s) have been selected, detailed site-specific environmental assessments will be carried out as required for planning and regulatory applications.

5.9. What are the possible accidents that could happen?

5.9.1. There is no risk of a nuclear reactor accident as a result of submarine dismantling because there is no nuclear fuel (fissile material) involved. Almost all of the radioactivity in the defuelled submarine is fixed within solid metal inside the RPV so the risk of accidental release of radioactivity is extremely small.

5.9.2. Before any activities can begin, a safety case must be prepared to prove to the regulators that every conceivable accident scenario has been assessed and that all reasonable measures have been put in place to prevent accidents from occurring to minimise their impact if they do occur. This work will take place after the key decisions which are the focus of this Consultation have been made. This is because it requires detailed assessment of designs for specific sites. These details will form part of planning and regulatory applications which have their own statutory requirements for public consultation. It is, however, possible to give some examples of potential accident scenarios at this stage. These are set out in Figure 7 right, together with examples of the kinds of safety measures that must be in place to prevent them from occurring, or to prevent them from causing harm to people or the environment if they do occur.

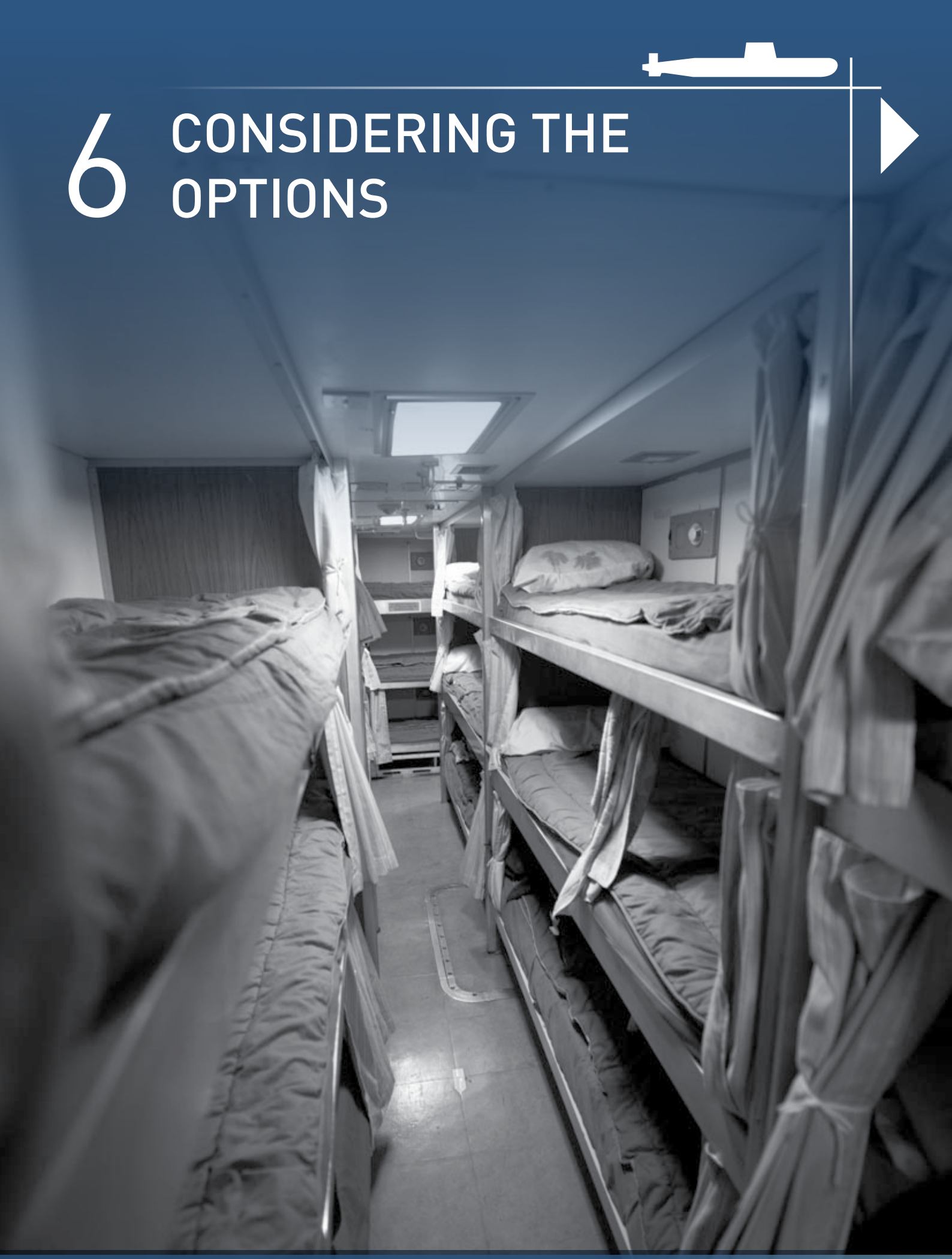
Factsheet://

To find out more about the SEA and the results of the assessments, see the Factsheet: **Environmental Issues** or read the Non-Technical Summary of the Environmental Report and the full report itself

Examples of potential accident scenarios	Examples of typical safety measures
Road accident during the transport of ILW	Waste may be set in concrete - absorbs radiation and keeps it together Package or shielded container tested and approved to strict transport standards Use of transport 'over-pack' - tested and approved to strict transport standards
Leak of small quantity of residual radioactive liquids during removal of radioactive material from the RC	Liquid systems drained as part of preparing submarine for afloat storage Containment around the RC to ensure that no liquids are lost
Fire in submarine while removing radioactive materials from RC	Flammable materials removed from submarine when preparing for afloat storage Ignition sources (e.g. electrical supplies and cutting equipment) strictly monitored and controlled Fire detection and protection equipment installed and fire drills rehearsed Use submarine compartments to prevent spread of fire and smoke
Excessive radiation dose received by workers during size reduction of the RPV	Remote operation of equipment to keep workers at distance from radioactivity Shielding (radiation absorbing walls and windows to protect staff) Strict controls on access to areas containing radioactive materials to limit workers' exposure to radiation
Terrorist attack on ILW store	Site security fences and barriers Controlled access to site and security patrols Design criteria for store and storage containers
Container drop during movement within the ILW Store	Design and test containers to prove that they can withstand drops and impacts Demonstrate procedures to recover a dropped container as part of store design and commissioning
Aircraft or large vehicle crashes into ILW store	Waste set in concrete Restricted airspace around site Crash barriers and road traffic controls around site
Corrosion of ILW container during storage	Designed and approved for 100 years storage Condition monitoring, ventilation control

Figure 7: Examples of possible accident scenarios and typical safety measures

6 CONSIDERING THE OPTIONS



Introduction

This chapter describes the key decisions that we need to make to guide our approach to submarine dismantling. It introduces the decision making-process that we are following, the factors and options we have considered and the methods of analysis we have used.

6.1. The decisions we need to reach

6.1.1. Of the activities explained in the previous chapter, the MOD has already established, proven and commercially available solutions for all except initial dismantling of submarines and the storage of Intermediate Level Waste (ILW) arising from it. The key decisions that need to be reached, are focused on the following activities:

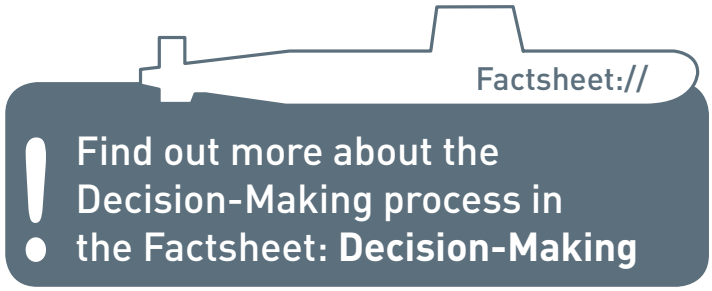
- **How** we remove the radioactive material from the submarines;
- **Where** we remove the radioactive material from the submarines;
- **Which type** of storage site is used for storing the ILW until it can be disposed of in the proposed Geological Disposal Facility (GDF).

6.2. The decision-making process we are following

6.2.1. The decision-making process we are following is explained in more detail in the document 'SDP – Our Approach to Decision Making' available on our website. To date, it has involved the following basic steps:

- Identifying the requirements for the project, the benefits we are seeking to deliver and the impacts we are seeking to avoid (these are outlined in Chapter 4);
- Identifying the options and screening out those that are impractical, uneconomic or fail to meet the project's requirements (described in sections 6.3 to 6.5);
- Identifying the factors that will enable us to assess how well the options meet the project requirements (described in section 6.7); and
- Assessing the options against these factors in order to form our proposals for consultation (the methods we have used to assess the options are described in section 6.9 and our current assessment of the options is described in Chapter 7).

6.2.2. The proposals we are making at this stage are described in Chapter 8. The process that will follow this public consultation is described in Chapter 9.



6.3. Options for how we remove the radioactive waste from the submarines

6.3.1. There are three possible options for removing radioactive waste from the submarines. Low Level Waste (LLW) is routinely removed and disposed of from submarines during service. These options focus on the removal of ILW:

Separate and store the whole Reactor Compartment 'RC Separation'

- The whole RC would be separated from the front and rear sections of the submarine and stored whole, leaving the hull of the submarine in two sections.
- The RC would be stored on land (the structure of the RC itself would provide the shielding needed while it is being stored).
- The RC is around 700 tonnes (of which up to 50 tonnes is ILW). Due to its size it would be difficult and very expensive to move the RC, so it is assumed in this option that it would be stored where it is removed (at the initial dismantling site).
- The RC would have to be cut up into smaller pieces and the ILW packaged at some point in the future before it can be disposed of in the proposed GDF.

Remove and store the Reactor Pressure Vessel 'RPV Removal'

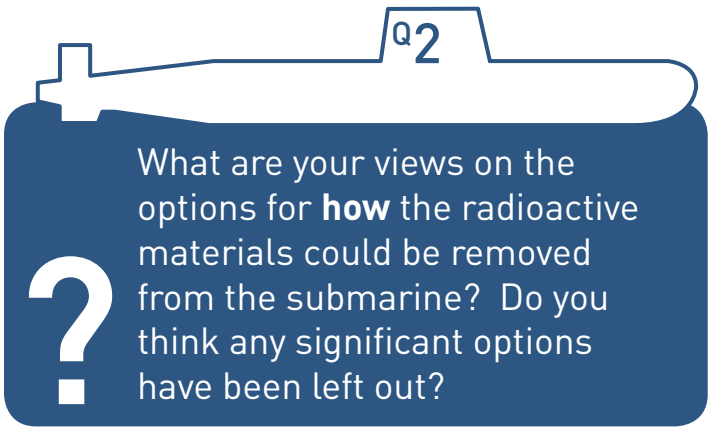
- The RPV, which sits within the Reactor Compartment and other radioactive materials would be removed through a hole in the hull of the submarine, leaving the RC and the rest of the submarine otherwise intact. The hole would be closed afterwards to make the submarine watertight again.
- The RPV which weighs between 50 – 80 tonnes and any remaining ILW (in pipework connected to the RPV for example) would then be packaged in a shielded container that is suitable for transport and storage.
- At some point in the future the RPV would need to be cut up into smaller pieces and packaged before it can be disposed of.

Remove and size-reduce the RPV for storage as Packaged Waste 'Packaged Waste'

- The RPV and other radioactive waste would be removed in the same way as above but then immediately size-reduced and packaged into boxes for storage. Once again the submarine would be left otherwise intact.
- No further cutting-up or packaging would be required in future before the boxes are disposed of.

6.3.2. In each case, we have accounted for the waste to be size-reduced and packaged into boxes at some point before it can be disposed of. However, we are exploring the possibility that the proposed GDF could accept larger packages which would mean the RPV could be disposed of without being cut up (as explained in section 5.2).

6.3.3. The main difference between the options therefore is the order and timing in which the size-reduction and storage activities are carried out, and the form in which the waste is removed from the submarine and stored while awaiting a disposal solution.



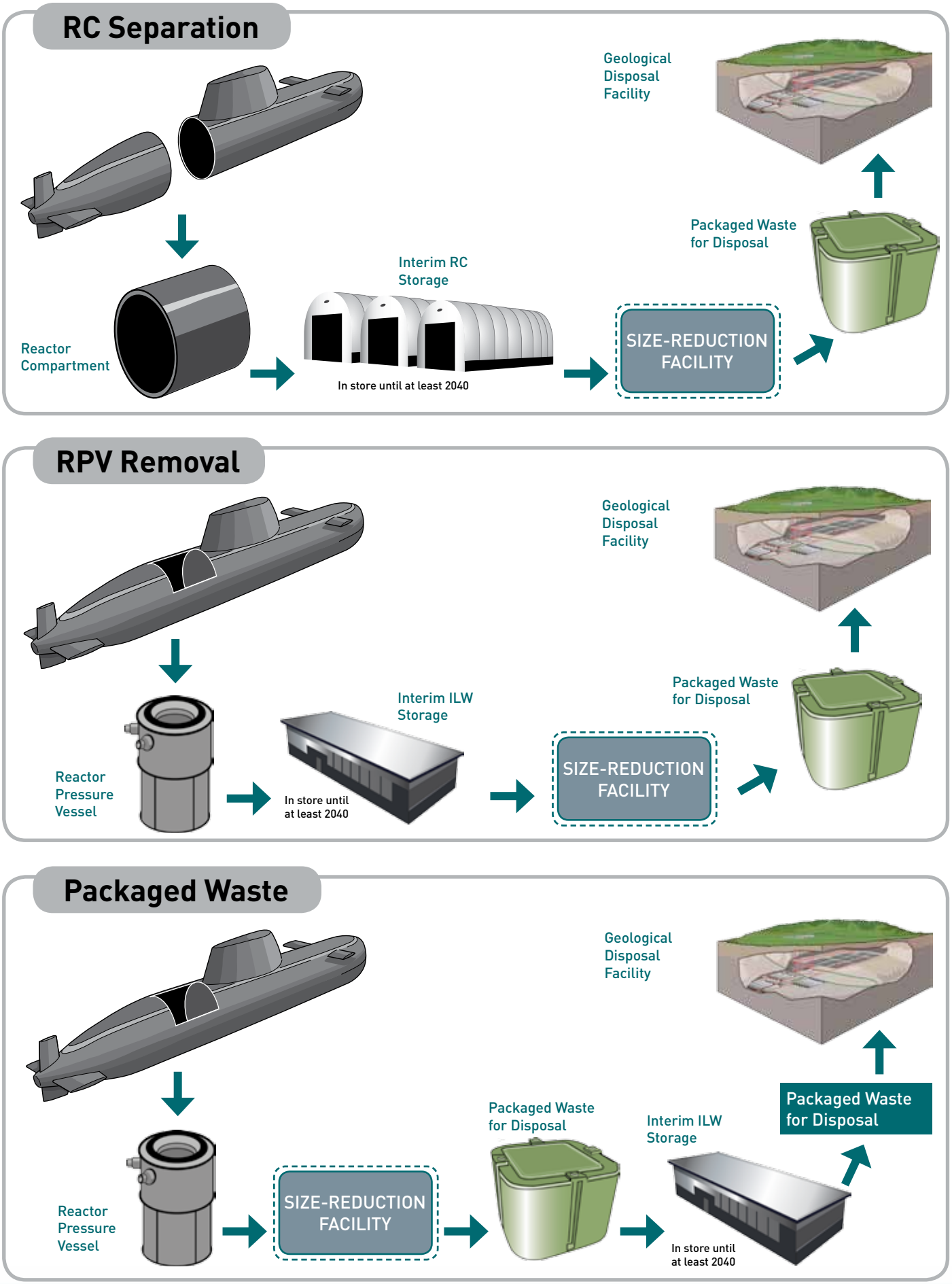


Figure 8: Options for how we remove the radioactive waste from the submarines

6.4. Options for where we remove the radioactive waste from the submarines

6.4.1. For security reasons surrounding the design of the submarine and reactor, initial dismantling must be carried out in the UK. It must also take place at a site that holds a nuclear licence for this work which means the site's activities will be closely regulated by the Office for Nuclear Regulation, to ensure the highest safety standards are maintained.

6.4.2. We considered all sites in the UK that currently carry out nuclear activities against a range of screening criteria such as accessibility by sea, available space and existing ship-handling facilities.

6.4.3. Devonport Dockyard and Rosyth Dockyard, where out-of-service submarines are currently stored and where in-service submarines are, or have been, maintained and refitted, met the screening criteria. The dockyards are owned by Babcock, the UK's experts in submarine maintenance.

6.4.4. Both sites have past or current experience of submarine maintenance and of nuclear decommissioning and therefore a workforce with existing skills and experience in these areas.

6.4.5. The submarines could be dismantled at either of these sites or at both (the 'dual site' option). Under the dual site option, each dockyard would undertake the initial dismantling of the submarines it currently stores afloat; submarines would not be moved between sites prior to initial dismantling. Further submarines yet to leave service would be dismantled at Devonport Dockyard. No further dismantling would take place at Rosyth once the seven submarines currently stored there have been dismantled.

Screening Paper://

For more information about the candidate site selection process see the SDP Site Criteria and Screening Paper available at www.mod.uk/submarinedismantling

Q3

What are your views on the candidate sites for **where** the radioactive waste is removed from the submarines? Do you think any significant options have been left out?

6.5. Options for which type of site is used to store ILW

6.5.1. We have identified sites that already undertake nuclear activities and therefore hold a license or authorisation as potential storage options for the ILW from dismantled submarines. These sites are owned either by the MOD, industry or the NDA.

6.5.2. We have considered these options according to their ownership and by location relative to the initial dismantling site(s). This would dictate whether or not the waste needs to be transported.

6.5.3. The NDA is in the process of exploring opportunities to share its current and planned storage facilities to improve value-for-money and reduce environmental impact of new store build. Such a development in the NDA's strategy would be an important consideration in any site screening exercise. To date it has not been appropriate to conduct a screening exercise to identify individual candidate storage sites. This is because of different contexts and developing strategies affecting different types of site. Commercial sites, meanwhile, would need to be screened through a commercial process inviting expressions of interest from site owners. At this stage, therefore, we are assessing the **types** of site that may be used and not the specific sites themselves.

6.5.4. Four types of sites have therefore been identified and assessed as options for ILW storage:

- **Storage at the point of waste generation** - this could include Devonport or Rosyth Dockyards or Her Majesty's Naval Base Devonport if initial dismantling were done at Devonport Dockyard;
- **Storage at sites owned by industry, remote from the point of waste generation;**
- **Storage at sites owned by the MOD, remote from the point of waste generation; and**
- **Storage at sites owned by the NDA - remote from the point of waste generation.**

6.5.5. All options, except the NDA option, assume that a new build storage facility will be required. As building more than one new storage facility for SDP would be uneconomic we have assumed, with the exception of the NDA option, that ILW storage would be at one site only.

6.5.6. The MOD is working jointly with NDA to assess the costs and benefits of using NDA storage facilities and whether or not this would be best value for money, compared to developing a new build facility on a MOD or commercially owned site.

No submarines will be dismantled until a storage solution has been agreed. Regulations are in place to enforce this commitment.

Factsheet://

For more information see the Factsheet:
Managing Radioactive Waste

Q4

What are your views on the options for **which** type of site is used to store the intermediate level waste from submarine dismantling?
Do you think any significant options have been left out?

6.6. The 'Do Minimum' option

6.6.1. Chapter 4 explained why we need to dismantle submarines, however, it is important that we compare the options for dismantling submarines with the alternative of not doing so. We call this alternative the 'do minimum' option which involves continuing to store and maintain out-of-service submarines afloat, indefinitely into the future, and building additional berthing space as it becomes necessary. It should be stressed that this is not being considered as a credible option but as a comparator for the options that do involve dismantling submarines.

6.7. Factors we have considered

6.7.1. Making these decisions involves many complex considerations and it must be based firmly on evidence, taking account of all the relevant factors. Figure 9 (overleaf) describes all the factors we have considered to date in assessing the options. These factors are derived from the objectives for the project (see section 4.3) and, where appropriate, are aligned to the Strategic Environmental Assessment (SEA).

Cost factors	**Whole Life Cost:** The total cost of an option throughout the life of the project.
Policy factors	**Flexibility and Robustness to Opportunities and Risk:** Opportunities and risks are things that may happen in the future that have a positive or negative impact, respectively. How far does an option maximise opportunities and minimise risk?
	Compliance with UK Policy and Strategy on Radioactive Waste Management: How well does an option satisfy UK Government policy?
	Scope and Extent of Transport of Submarines and Radioactive Waste: How far does an option minimise the amount of transport that will be required?
	Unauthorised Access to Classified Materials during Dismantling, Storage and Transport: How secure is an option in preventing unauthorised access to classified materials throughout the life of the project?
	Compliance with UK Decommissioning Policy: How well does an option satisfy UK policy objectives on nuclear decommissioning?
Operational factors	**Impact on the Maritime Enterprise:** What impact, positive or negative, will the option have on military operations, support to military operations and long-term military capability?
	Flexibility of Dismantling Approach to Managing Future Classes: To what extent will the option allow the MOD, in the future, to adapt or extend the life of facilities to undertake dismantling of future classes of submarines?
	Threat to Skill and Experience Set: To what extent will the option take advantage of existing skills and experience? What impact, positive or negative, will an option have on the availability of skills and experience in the future?
	Transferable Dismantling Knowledge: To what extent does an option allow us to learn from others or share learning with others, both in the UK and overseas?
Health and Safety factors	**Worker Dose: Dismantling, Storage and Transport:** What cumulative radiation dose will workers be exposed to for an option?
	Non-Radiological Impact on Workers: What are the other health and safety hazards to workers, involved with an option?
	Potential for an Unplanned Radiological Release during Dismantling: What is the potential of an option resulting in workers being exposed to an unplanned release of radiation during dismantling?
	Potential for an Unplanned Radiological Release during Transport: What is the potential of an option resulting in workers being exposed to an unplanned release of radiation during transport?
	Potential for an Unplanned Radiological Release during Storage: What is the potential of an option resulting in workers being exposed to an unplanned release of radiation during storage?
Environmental factors	**Radiological Discharges to the Public:** To what extent does an option minimise the impact of radiological discharges (planned and unplanned) to the public?
	Radiological Discharges to the Environment: To what extent does an option minimise the impact of radiological discharges (planned and unplanned) to the environment?
	Non-Radiological Impact on the Public: What are the non-radiological impacts of an option to the public? For example, how might an option affect the public through noise, light pollution, vibration or dust?
	Non-radiological Impact on the Environment: What are the non-radiological impacts of an option to the environment? For example, how might an option affect water quality, air quality and biodiversity?
	Impact on the Built Environment: What could be the impacts of an option on the built environment? For example, how might an option affect heritage, landscape or townscape?
	Impact from the Natural Environment: What could be the impact on an option from the Natural Environment? For example, how might an option be affected by flooding, extreme weather or the effects of climate change?

Figure 9: Cost and Effectiveness Factors

6.7.2. The factors listed in Figure 9 can all be assessed quantitatively through cost estimating, calculation or expert judgement. In addition, we have also identified a number of factors, called Other Contributory Factors (OCFs), which will be important considerations but which cannot be assessed quantitatively and require further evidence. Some of this evidence will be gathered through public consultation or further stakeholder engagement before a qualitative assessment can be made. The OCFs that we have identified to date are shown in Figure 10.

6.7.3. We have an understanding of some of these OCFs from earlier consultations; for example, based on the information available at the time, the Consultation on ISOLUS Outline Proposals (CIOP)[11] indicated a higher level of public confidence in the option of separating and storing the RC. However, there is a need to update and expand our understanding because more recent work and our current assessment of the cost, effectiveness and environmental effects of the options may have changed the picture.

6.7.4. Consultation responses relating to OCFs will be collated and summarised in the Post Consultation Report. The OCFs will then be reviewed. Where insights can be quantified they will be incorporated in the cost analysis, assessment of operational effectiveness or the risk analysis as appropriate and these analyses will be updated.
Any remaining factors will remain as OCFs to inform the final decision.

Other Contributory Factors
Public Confidence: What concerns do the public have about the MOD's proposals and the decision-making process that is being followed? What bearing do these concerns have on an option or the process by which it is being considered?
Socio-economic Impacts: What might be the socio-economic impacts (both positive and negative) of an option?
Political and Policy Frameworks: How might established political and policy frameworks affect an option?
Implications of or for other Local Projects: How might an option affect or be affected by other local development projects? What might be the combined effects?
Impact of or on other UK Radioactive Waste Management Initiatives: How might an option affect or be affected by UK radioactive waste management initiatives? Examples of such initiatives might be the UK's Strategy on Low Level Waste or the UK's programme for geological disposal.
Commercial Considerations: What commercial considerations might affect an option? Examples of commercial considerations might be the potential for competition or the right of suppliers to decline to tender.

Figure 10: Other Contributory Factors

[11]For more information see the Document Archive on the SDP website.

6.8. Integrated options

6.8.1. In order to take factors such as transport into account, we have assessed integrated options made up of the sensible combinations of the options for each of the three key decisions that we need to reach.

6.8.2. We have assessed a total of 24 integrated options (plus the 'do minimum' option) such as 'RC separation at Rosyth with storage at the point of waste generation' or 'RPV removal at Devonport with storage on a remote MOD site'.

6.8.3. Storage of RCs at a site remote from the initial dismantling site has not been assessed as an integrated option. This is because our cost studies found that the additional costs associated with sea transport and dockside handling of RCs would make moving them to a different site for storage uneconomic. This integrated option will, however, remain as a future opportunity to be reviewed as further detailed work helps to refine our estimates.

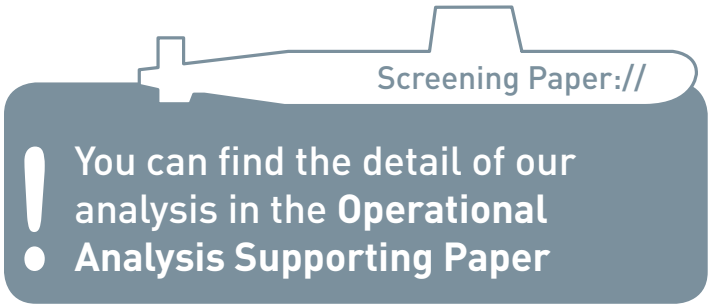
6.8.4. Storage of RPVs using NDA facilities has not been assessed as an integrated option either. This is because the feasibility of this combination has yet to be developed through joint studies with the NDA. It remains under review, however, as an opportunity that will be developed further should its feasibility be proven.

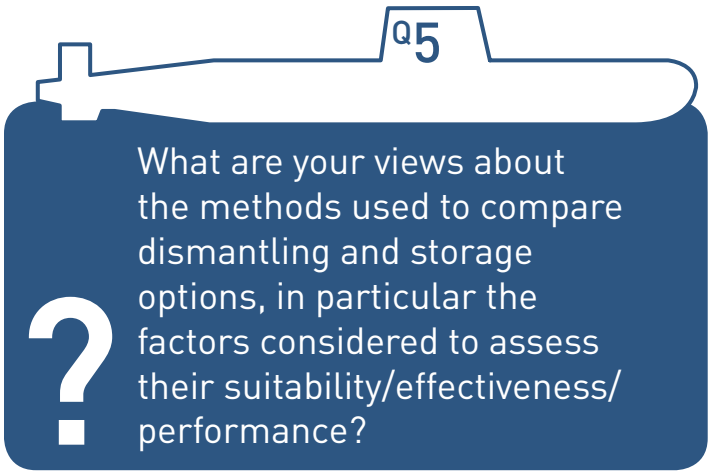
6.9. Analysis methods

6.9.1. A whole-life cost model was developed to provide estimates of the costs of each of the integrated options throughout the life of the project. These were then assessed in an investment appraisal which brings together the results of the cost model and applies a consistent set of accounting principles to provide a comprehensive assessment of the financial performance of each.

6.9.2. For those factors that could not be assessed in terms of cost, we assessed the 'effectiveness' of the options (i.e. how well they met the project's requirements) using Multi Criteria Decision Analysis (MCDA). The MCDA method involved three workshops where experts across a range of relevant subjects were asked to agree the factors, weight the importance of each factor and then score each integrated option against each factor.

6.9.3. The findings of the investment appraisal and the MCDA are brought together in the Operational Analysis Supporting Paper (OASP) which is our current assessment of the cost effectiveness (or value for money) of the integrated options. The OASP provides the basis for our proposals which are set out in Chapter 8.





7 OUR CURRENT ASSESSMENT

Introduction

This chapter summarises the findings of our current assessment of the options. It details the advantages, disadvantages and costs of the options for the key decisions we need to reach.

Work still remains to be done, and there are factors that cannot be assessed until the results of this consultation are available. However, we can draw some indications from the analysis to date. At this stage, no options have been discounted from further consideration (except the 'do minimum').

7.1. Our assessment of the 'Do Minimum' option

7.1.1. To provide a comparison with the options for dismantling submarines, we have also assessed the option of 'Doing Minimum' - continuing to store submarines afloat indefinitely and building more berthing space when required.

7.1.2. This option potentially restricts Dockyard and Naval Base operations due to a lack of berthing space. It leaves decommissioning issues to future generations and, in the long-term, will not comply with UK policy on decommissioning. This is also the most expensive of all the options in the long-term due to the cost of creating extra berthing space and the rising cost of maintenance.

7.2. Our assessment of the options for how we remove the radioactive waste from the submarines

7.2.1. As explained in Chapter 6, the three options for how we remove the radioactive waste from the submarines 'initial dismantling' are:

- Separate and store the whole RC **'RC Separation';**
- Remove and store the RPV **'RPV Removal';** or
- Remove the RPV and size reduce to store as packaged waste **'Packaged Waste'.**

7.2.2. Operational factors were the most significant in distinguishing between these options; such as the effect on berthing arrangements or competition with other dockyard activities. Policy factors were also significant in separating the options in terms of how well they balance different policy objectives. For example, dismantling as soon as "reasonably practicable", while taking advantage of the benefits of radioactive decay (whereby the amount of radiation reduces over time).

7.2.3. The RC Separation option would potentially have significant environmental effects due to the very large size of the store that would be required (more than 10 times bigger than the other options). This would have a significant visual impact and the amount of land 'lost' to the building could have knock on effects on drainage, habitats and other aspects of the environment. In Devonport, the RC Separation option would also be more likely to require dredging as submarines that have had their RC removed would need to be transported by barge or heavy lift ship (which requires deep water in order to load the submarine by sinking and then floating beneath it). Nevertheless, the environmental factors did not discriminate significantly between the effectiveness of the options because, in our assessment, all options could be designed to achieve the legally required environmental standards.

7.2.4. Both the RPV Removal and Packaged Waste options perform reasonably well on effectiveness and cost grounds; the RPV Removal option appeared to be the best, although Packaged Waste appears equally good if it can take advantage of NDA storage facilities.

7.2.5. The RPV Removal option takes advantage of the benefits of radioactive decay so that the size reduction activity at the end of the storage period might be made simpler and less costly. It also offers the greatest potential to take advantage of changes in GDF entry conditions for disposal of ILW (such as size, weight or radioactive inventory) which might, in the future, allow for whole RPVs to be disposed of without the need for size-reduction. This would offer significant savings in the cost of developing, operating and decommissioning a size-reduction facility and potential improvements in effectiveness.

7.2.6. The RC Separation options also take advantage of the same benefits of radioactive decay but appear to be less effective and more expensive than the others. This is because RCs are both large and heavy and the infrastructure required to handle and store 27 of them would be costly and have negative effects on the environment (as

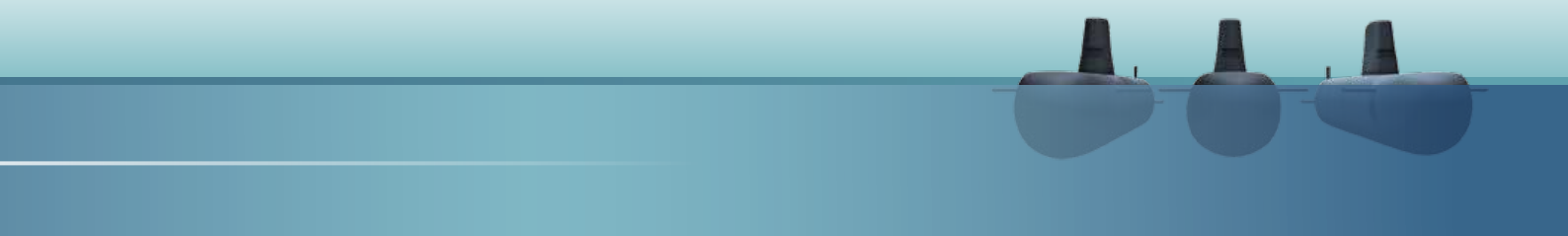
described above) and operations at the dockyard(s). Although this option would be broadly compliant with decommissioning policy it would, in our assessment, progress decommissioning activities more slowly than is reasonably practicable.

7.2.7. Health and safety factors, whilst of absolute importance, did not distinguish significantly between the options because, in our assessment, all three options could be designed to achieve the legally required safety standards. There were some differences between estimates of radiation exposure to workers (with RC Separation being lower than the RPV Removal and Packaged Waste options) but as all estimates were very low (relative to statutory limits and typical employer dose constraints) they did not distinguish significantly between the options.

7.2.8. Figure 11 summarises our assessment of how the advantages, disadvantages and costs compare for each of the options.

Option	Advantages	Disadvantages	Cost
RC Separation and storage	Allows for radioactive decay before RPV is removed and size-reduced Flexible to changes in entry conditions to the proposed GDF Experience of this approach in other countries	Additional operations and facilities to store and handle RCs Seaworthiness of submarine hull is compromised (for transport to ship recycling) RCs can only be transported by sea Very large store footprint (over 10 times larger than other options) causing largest overall environmental impact of storage facility	Generally most expensive due to RC handling and storage costs Potential cost savings if RPV size-reduction proves unnecessary or simpler due to decay Costly size-reduction facilities and operations deferred until later
RPV Removal and storage	Allows for radioactive decay before RPV is size-reduced Flexible to changes in entry conditions to the proposed GDF RPV transportable by land or sea RPV is self-shielding therefore less shielding required than for packaged waste	Transport, handling and storage less standardised than for packaged waste	Generally comparable to packaged waste Potential cost savings if RPV size reduction proves unnecessary or simpler due to decay Costly size reduction facilities and operations deferred until later
RPV Removal and size-reduction for storage as packaged waste	Stores ILW in disposable form with no further processing required Consistent with civil transport, handling and storage arrangements Packaged waste transportable by land or sea	Less flexible to changes in entry conditions to the proposed GDF Less radioactive decay prior to size reduction	Generally comparable to RPV Removal and storage Potential savings through use of NDA storage facilities Unnecessary initial expenditure if size-reduction not required

Figure 11: Summary comparison of technical options



7.3. Our assessment of the options for where we remove the radioactive waste from the submarines

7.3.1. As explained in the previous chapter, the options for the location of initial dismantling activities are:

- Devonport Dockyard;
- Rosyth Dockyard; or
- a combination of both of the above - 'dual-site'.

7.3.2. Both sites already have many of the facilities required to undertake initial dismantling including the berths, docks, handling facilities and Low Level Waste (LLW) processing facilities that would be required. As a result, the scale of development that would be needed is limited and no significant environmental effects of initial dismantling were identified at either site. As Devonport Dockyard is closer to a built up area than Rosyth Dockyard there would be a greater chance of construction activities causing disturbance to local communities but within the definitions of the SEA this was not identified as a significant effect.

7.3.3. Initial dismantling at Rosyth only, requires more submarines to be transported than initial dismantling at Devonport only. For storage of packaged waste or RPVs the Rosyth only options are less effective and cost more than the equivalent options for initial dismantling at Devonport, or at both sites. For the RC Separation options, however, Devonport would rank as the best option, followed by Rosyth and then dual-site.

7.3.4. The differences in effectiveness and cost between the Devonport and dual-site options are small. The costs of duplicating some facilities and operations at both sites are offset by the costs saved by avoiding the need to transport submarines prior to initial dismantling.

7.3.5. Figure 12 summarises our current assessment of how the advantages, disadvantages and costs compare for each of these options.

Option	Advantages	Disadvantages	Cost
Devonport Dockyard	Fewer submarines (7) to be transported prior to initial dismantling compared to Rosyth only option	Competition with other operations for space, resources and facilities Depth of water in Plymouth Sound may restrict some methods of submarine transport	Less expensive than Rosyth only option and comparable to the dual-site option
Rosyth Dockyard	In a less built up area reduced risk of disturbance to local community Currently more free space than Devonport	More submarines (20) to be transported prior to initial dismantling compared to Devonport only option Potential conflict with re-development plans	Most expensive due to costs of transporting more submarines and lack of other similar work with which to share overheads and site running costs
Both Devonport and Rosyth Dockyards 'dual-site'	No submarines to be transported prior to initial dismantling Rate and order of dismantling can be optimised to best manage liabilities at both Rosyth and Devonport	Some duplication of facilities and environmental effects	Less expensive than Rosyth only option and comparable to Devonport only option Cost savings on transport of submarines estimated to be greater than site duplication costs Potential to make further savings by optimising rate and order of submarine dismantling to minimise liabilities at both sites

Figure 12: Summary comparison of initial dismantling site options

7.4. Our assessment of the options for which type of site we use to store ILW

7.4.1. As explained in the previous chapter, the options for which type of site we use for storage of ILW are as follows:

- ILW storage at point of waste generation
- ILW storage at remote commercial site
- ILW storage at remote MOD site
- ILW storage at NDA site(s)

7.4.2. Our assessment found no net advantage to storage at point of waste generation over storage at remote sites. The advantages of less transport are cancelled out by the disadvantages of potential conflicts with operational and re-development priorities in the point of waste generation sites.

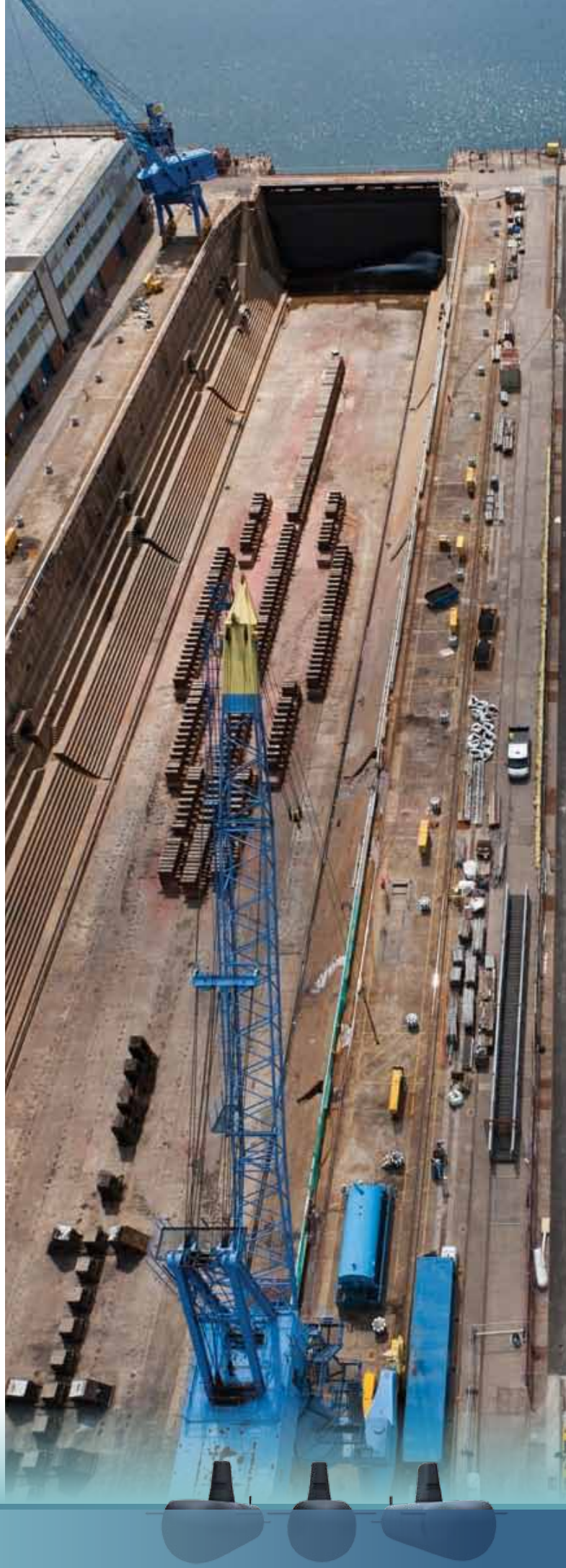
7.4.3. We also found no significant differences in the advantages, disadvantages and costs of storage at a remote commercial site compared to a remote MOD site. Clearly differences would emerge if, at a later stage, we were considering specific sites or commercial arrangements (see chapter 9 for an explanation of next steps).

Option	Advantages	Disadvantages	Cost
Storage at point of waste generation	Reduces transport of radioactive waste	Potential conflicts with other Dockyard or Naval Base activities or other re-development priorities A new storage facility would need to be built	Similar cost to commercial and MOD options as all require the build of a new store, operation/ maintenance of store and final decommissioning of the store
Storage at a remote commercial site	Avoids potential conflicts with other Dockyard or Naval Base activities or other re-development priorities	More transport of radioactive waste required A new storage facility would need to be built	As above
Storage at a remote MOD site	Similar to storage at a remote commercial site	Similar to storage at a remote commercial site	As above
Storage on NDA site(s)	Avoids potential conflicts with other Dockyard or Naval Base activities or other re-development priorities Potentially avoids the need to build a new storage facility Takes advantage of NDA / civil nuclear sector practice and expertise in storage and management of radioactive waste	Potential operational conflicts with other NDA activities on storage site More transport of radioactive waste required	Potential for significant cost savings through sharing costs of build, operation and final decommissioning of a storage facility

Figure13: Summary comparison of ILW storage options

7.4.4. Our assessment identified potential advantages in using NDA facilities as this avoids the environmental impacts of constructing new stores and draws on good practice and expertise in the civil nuclear sector. This option also potentially saves on the cost of developing, operating and decommissioning a storage facility. A shared assessment of this option, including the feasibility of storing RPVs in addition to packaged waste, is currently ongoing with the NDA.

7.4.5. Figure 13 summarises our assessment of how the advantages, disadvantages and costs compare for each of these options.



Q6

? Do you think we have captured all the potential advantages and disadvantages of the options and if not which others would you propose?

Q7

? Are there any other significant issues or factors you think we have overlooked?

8 OUR PROPOSALS FOR CONSULTATION

OUR PROPOSALS FOR CONSULTATION

Introduction

This chapter reviews the key findings from our current assessment and then sets out our proposals for consultation. It explains the rationale behind the proposals and how they might change following further work and consultation responses.

8.1. Key findings of our current assessment

8.1.1. Our current assessment found that the main factors distinguishing between the options were cost, operations and policy. Health and safety and environmental factors, while being of absolute importance, did not distinguish between the options significantly because the legally-required standards could be achieved by all options and were already accounted for in our cost estimates.

8.1.2. Overall, our assessment has not distinguished between the options conclusively in terms of cost or effectiveness but it has indicated that:

- Separation and storage of Reactor Compartments (RCs) is less effective because of the size of the store that would be required;
- Removal and storage of Reactor Pressure Vessels (RPVs) is more effective because it takes advantage of radioactive decay and is flexible enough to take advantage of any changes in entry conditions for disposal in the proposed Geological Disposal Facility (GDF);
- Initial dismantling at Rosyth only is more expensive because of the absence of other similar work to share overheads;
- Storage using Nuclear Decommissioning Authority (NDA) facilities is potentially less expensive (because of savings in the whole-life cost of storage facilities) and more effective (because of reduced impact to the environment and dockyard / naval base operations).

8.1.3. Submarine dismantling is a long-term project and our current assessment is based on plans or assumptions which may change. Another important consideration, therefore, is the flexibility of the options to take advantage of new opportunities or changes to these plans. In particular, our assessment is based on current plans for the GDF that suggest that size-reduction of the RPV will be required prior to disposal. We are currently exploring, however, the potential for RPVs to be disposed of whole in the GDF, which would avoid the cost and environmental impacts of size-reduction. Similarly, our current assessment assumes a rate of dismantling of one submarine per year but there is an opportunity, if both sites are used, to optimise this rate and also the order of submarine dismantling to best manage our liabilities at Rosyth and Devonport.

8.2. Forming proposals

8.2.1. Based on our current assessment of the available options, we have proposed the options which we believe best meet the criteria outlined above (see Chapter 6). While none of the options for dismantling submarines are discounted at this stage, our assessment was clear that the 'do minimum' option of continuing afloat storage, indefinitely into the future, is not viable.

8.2.2. Our assessment may change as a result of the responses from this consultation and further work that needs to be done, meaning the eventual decisions may be different to these proposals. Our proposals are described, below, followed by an explanation as to how and why that proposal might change for each of the decisions.

8.3. How we remove the radioactive waste from the submarines

8.3.1. Our proposed option for removing the radioactive waste from the submarines is **RPV removal and storage.**

8.3.2. This proposed option preserves the potential opportunity to dispose of whole RPVs without the need for size-reduction (cutting them up into smaller pieces to form packaged waste) in the future. This would make significant cost savings if size-reduction proves to be unnecessary for disposal, unlike the Packaged Waste option which commits to size-reduction sooner. Even if this opportunity were not to come about, savings could still be made on the cost of a size-reduction facility since the amount of radioactivity in the RPV will have diminished considerably over many years of storage. This would make the size-reduction process less hazardous and less technically challenging meaning that simpler, less expensive facilities would be needed.

8.3.3. Our assessment found that RC separation, while similar in cost to the other options, is less effective in meeting the requirements of the project.

8.4. What might change our proposal?

8.4.1. We will review our assessment of all three options in the light of the responses to the public consultation. We are also undertaking a joint assessment, with the NDA, of the costs and benefits of using their facilities to store packaged waste and also to investigate whether it is feasible to store RPVs in an NDA facility. This joint assessment could make the Packaged Waste or the RPV removal options more attractive. We will also be assessing whether it is possible to dispose of whole RPVs without the need for size-reduction, which has the potential to reduce costs significantly. These further assessments will enable us to distinguish between the technical options more conclusively before identifying our recommended option.

8.5. Where we remove the radioactive waste from the submarines

8.5.1. Our proposed option is to undertake initial dismantling at both **Devonport** and **Rosyth Dockyards.**

8.5.2. Using Devonport **and** Rosyth offers opportunities to better manage our liabilities at both sites by optimising the rate and order of dismantling. This would support our aim to avoid running out of existing berthing space at Devonport, while removing our liabilities at Rosyth Dockyard more quickly by dismantling the submarines where they are stored. Although this option leads to some limited duplication of facility costs and environmental impacts, it avoids the costs and risks of transporting submarines between dockyards before we have removed the radioactive material remaining onboard.

8.5.3. Our current assessment has found that the option to use Rosyth Dockyard only is the least attractive in terms of cost because it would require 20 submarines to be moved north and, in the longer term, there would be no similar work with which to share overheads. Dismantling at Devonport only, on the other hand, remains a more reasonable proposition.

8.6. What might change our proposal?

8.6.1. We will revisit our assessment of all three initial dismantling site options in the light of public consultation responses. We will also undertake conceptual design work to make a more detailed assessment of the extent to which we can optimise the rate of dismantling and submarine berthing arrangements by using both Dockyards. These further assessments will enable us to differentiate between the initial dismantling site options more conclusively before identifying our recommended option.

8.7. Which type of site we use to store the Intermediate Level Waste (ILW) from the submarines

8.7.1. Our assessment considered generic types of site by ownership: those existing nuclear sites owned by the MOD, by industry and by the NDA. In order to take transport of waste into account, these were also assessed in relation to the initial dismantling site as to whether they were 'remote' or at the point of waste generation.

8.7.2. At this stage, our proposed way forward is to continue working closely with NDA and wider government to assess whether it would be more cost effective and beneficial to use NDA storage facilities or to develop a new one for SDP.

8.7.3. If this assessment found in favour of an NDA option, we would then ask the NDA to develop a suitable storage solution for SDP. To do this, the NDA would need to follow its own processes and governance arrangements to identify which of its storage facilities and sites would be used (see chapter 9, 'Next Steps').

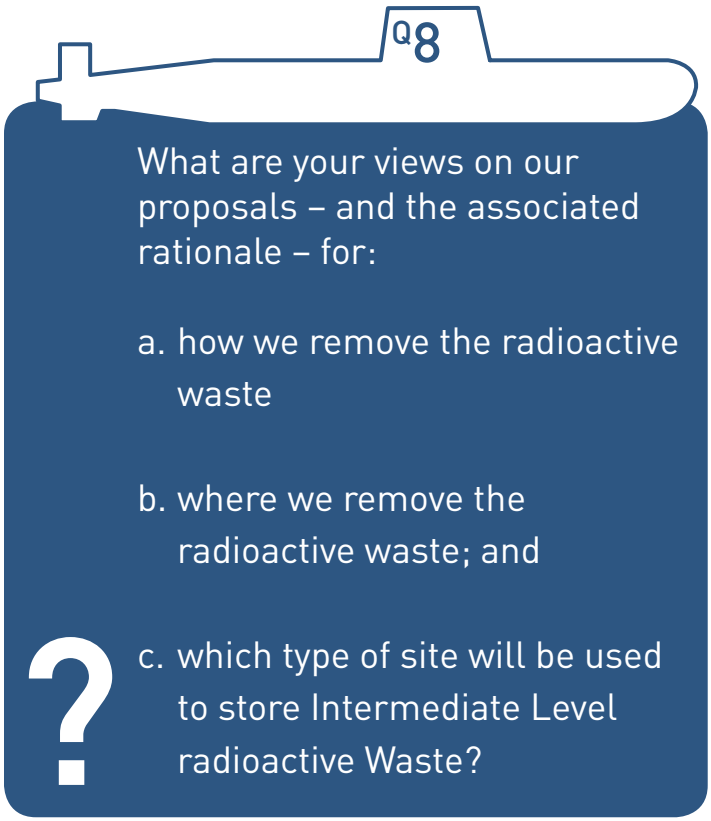
8.7.4. Alternatively, if this assessment finds in favour of a new-build store for SDP, or if the use of NDA storage facilities proves impractical, then NDA facilities will be discounted from further consideration and we would carry out a process to consider the use of existing licensed or authorised sites owned by the MOD or industry (see Chapter 9).

8.7.5. Our assessment has assumed that only packaged waste could be stored in NDA storage facilities, however, we will be working with the NDA to assess whether it would be feasible and beneficial to store RPVs which, for reasons explained above, is our proposed technical option.

8.7.6. Our assessment of the storage site options found that there was little separation between the options to store ILW either at the point of generation or remotely, except in the case of RC separation where the costs and risks of transporting RCs to a remote site would make this option uneconomic. Also, without proceeding to a more commercial evaluation, our current assessment has found little to distinguish MOD sites from commercial sites in terms of cost and effectiveness.

8.8. What might change our proposed way forwards?

8.8.1. We will review our assessment of all the ILW storage options in the light of public consultation responses. Our proposed way forward will be informed by these responses and by the outcome of joint working with NDA to assess the economic case for use of NDA stores and the feasibility of storing RPVs (in addition to packaged waste) on an NDA site.



9 NEXT STEPS

Introduction

This section describes the way in which your views and comments will help to shape future decisions. It also sets out our plans to feed back the outcomes of this public consultation and our commitments to being transparent about the process. Finally, it sets out the next steps which need to happen before submarine dismantling begins.

9.1. Your views matter

9.1.1. We are committed to taking all the views received during this public consultation into account in our future decisions.

9.1.2. We will publish comments on the website, subject to the respondent's approval to do so, during the consultation. Following the consultation period, we will publish a Post Consultation Report which will summarise the outcome of the public consultation. These documents will be made available through our website.

9.1.3. The responses received during the consultation process will be fed into a further period of analysis before we form our recommendations about the way forward which will be submitted to MOD Ministers who will make the final decisions.

9.1.4. Once these decisions have been made, we will publish a report summarising how the consultation responses have been taken into account. A Post Adoption Statement will also be published, describing how environmental considerations and responses to the SEA specifically have been integrated into the final SDP decisions.

9.2. The solution for storage of ILW

9.2.1. As discussed in Chapters 6 & 7, the MOD is working with the NDA to determine whether using NDA's storage facilities would provide the best value for taxpayers' money or whether building a new facility for the MOD would be a better option.

9.2.2. The option of sharing NDA facilities will not be considered further if its facilities are not available at the right time or if a MOD-only storage solution is shown to be the best option. Should this be the case, the MOD will carry out a selection process from suitable nuclear sites.

9.2.3. If, following this consultation, the MOD decides to develop a new-build storage facility for ILW from submarines (on sites owned by MOD or industry), a further public consultation will follow to support the selection of a site. Alternatively, if it is decided that the storage solution will be provided by the NDA then, in developing that solution, the NDA will engage the public and stakeholders in accordance with its established arrangements[12].

No dismantling of submarines will take place until a storage solution has been agreed. Regulations are in place to enforce this commitment.

9.3. When will the MOD make its decisions?

9.3.1. The recommendations for submarine dismantling must be put forward in a business case for approval by the relevant authorities in the MOD and by the independent regulators before any activities can start. We are not able to confirm detailed schedules and timescales until approval has been sought, but information about the future stages of the project will be published on our website as soon as it is available.

9.3.2. No date to start to dismantle submarines has been set. The capacity for storing further submarines afloat, however, is expected to be reached by 2020 and the MOD must either find extra capacity or be in a position to begin dismantling the submarines by then.

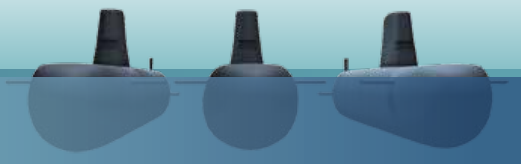
9.4. What happens then?

9.4.1. Planning permission from the appropriate local authorities and approval from the regulators will have to be granted before any dismantling of submarines can begin. The process of applying for planning permission includes further site-specific environmental and safety assessments, plus a period of further consultation with local communities.

9.4.2. If the business case is approved and planning and regulatory permissions granted, we will dismantle at least one complete submarine to refine our understanding of the industrial, regulatory and commercial processes. Lessons learned can then be applied in our development of further, detailed plans.

9.4.3. When the MOD is satisfied that the appropriate processes for dismantling and ILW storage are proven, it will seek approval for the release of funds to dismantle the remaining submarines.

[12]For further information about NDA's stakeholder engagement arrangements see NDA's 'PSE Statement of Principles' available at www.nda.gov.uk/



10 SUMMARY

SUMMARY

10.1. The aim of the Submarine Dismantling Project (SDP) is to deliver a safe, secure, environmentally-responsible and cost-effective solution for dismantling 27 of the UK's defuelled nuclear powered submarines including past and current classes.

10.2. We need to dismantle submarines because existing berthing space will be reached in 2020 and the cost of safely maintaining them afloat is rising as they age and as more submarines leave service. Dealing with this legacy now, rather than leaving it to future generations, is the responsible course of action.

10.3. We estimate that, for example, the amount of radioactive waste generated from a Trafalgar Class submarine will be around 175 tonnes of Low Level Waste (LLW) and up to 50 tonnes of Intermediate Level Waste (ILW). Of the radioactive waste resulting from submarine dismantling, LLW will be disposed of through existing routes but ILW must be stored while awaiting disposal in the UK's proposed Geological Disposal Facility (GDF). The majority (up to 90%) of the materials in the submarine can be recycled, such as the steel that makes up the hull and other metals.

10.4. The main activities of the project are:

- Initial dismantling to remove the radioactive materials from the submarine;
- Size-reduction of the Reactor Pressure Vessel (RPV) (which is too big for disposal in the GDF against current plans);
- Ship recycling to break up the submarine hull and manage all other materials after the radioactive materials have been removed;
- Interim storage of ILW until it can be disposed of in the proposed GDF; and
- Transport of the submarines and radioactive waste.

10.5. All activities will be closely regulated by independent bodies including the Office for Nuclear Regulation (ONR) and the Environment Agency (EA) or Scottish Environment Protection Agency (SEPA), to ensure they are conducted in a safe and environmentally-responsible way.

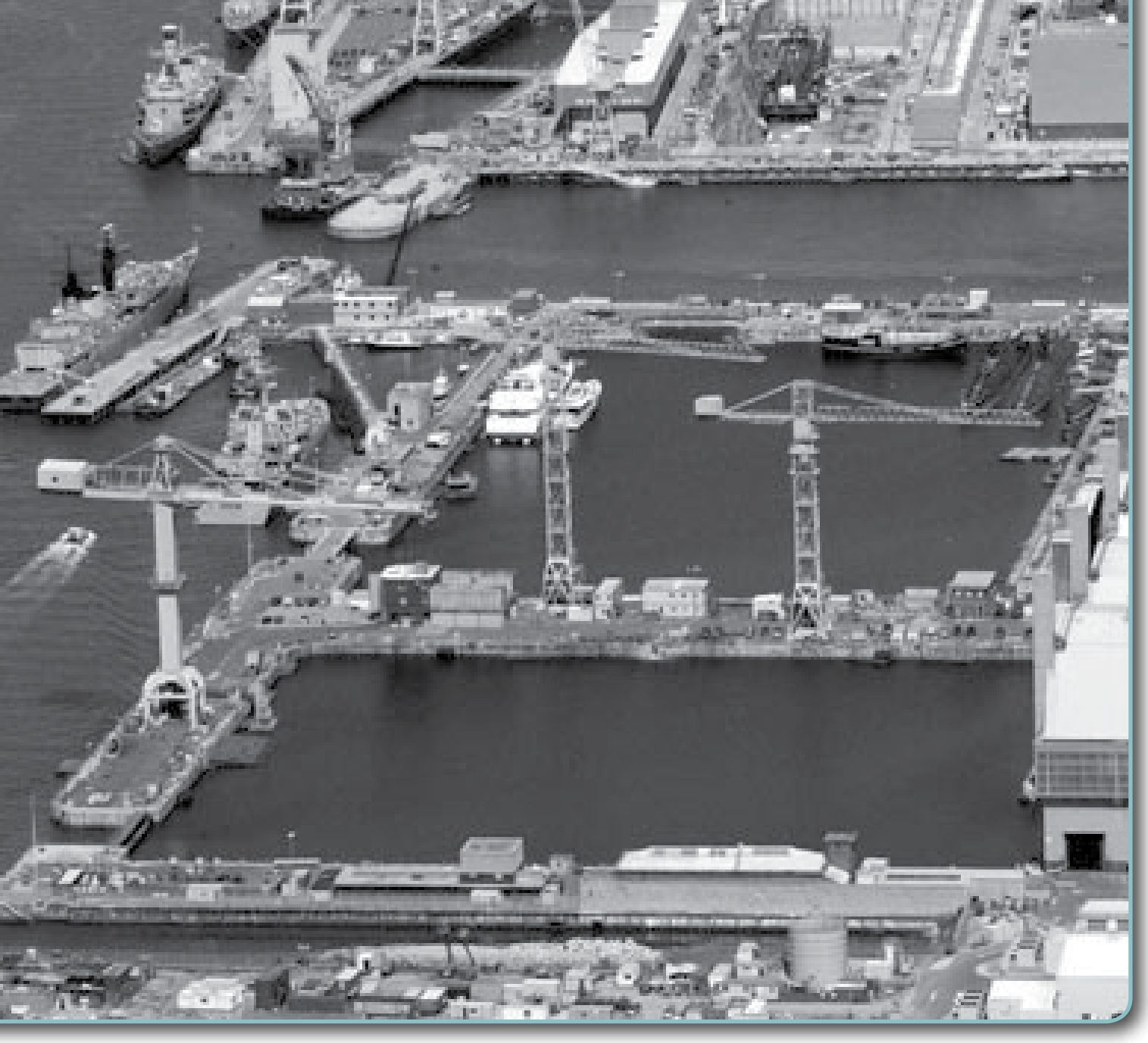
10.6. The key decisions we need to reach in order to guide our approach to submarine dismantling are:

- **How** the radioactive material is removed from the submarines;
- **Where** we carry out the removal of the radioactive waste from the submarines; and
- **Which type** of site is used to store the radioactive waste that is awaiting a disposal solution.

10.7. The Strategic Environment Assessment (SEA) found only two potentially significant negative environmental effects which both relate to the option of storing intact Reactor Compartments (RCs). The first is the visual effect at Devonport or Rosyth of the large building required to store 27 intact RCs and the second is the possible effects on protected wildlife habitats at Devonport because this option may require dredging of the seabed off Plymouth.

10.8. No other significant negative environmental effects of any of the other options were identified. Dismantling submarines was found to have a potentially significant positive effect on waste management, as it removes the legacy of laid-up submarines.

10.9. Our current assessment found that the main factors distinguishing between the options were cost, operations and policy. Health and safety and environmental factors, while being of absolute importance, did not distinguish between the options significantly because the legally required standards could be achieved by all options and were already accounted for in our cost estimates.



10.10. Overall, our current assessment has not distinguished between the options conclusively in terms of cost or effectiveness but it has indicated that:

- Separation and storage of RCs is less effective because of the size of the store that would be required;
- Removal and storage of RPVs is more effective because it takes advantage of radioactive decay and remains flexible to changes in entry conditions for disposal in the proposed GDF (e.g. enabling disposal of whole RPVs);
- Initial dismantling at Rosyth only is more expensive because of increased submarine transport and the absence of other similar work to share overheads;
- Options involving storage using NDA facilities have potential to be less expensive because of savings in the whole-life cost of storage facilities and to be more effective because of reduced impact on the environment and dockyard / naval base operations.

10.11. On the basis of our current assessment, our proposals for consultation for each of the key decisions we need to reach are:

- To remove the RPVs whole and store them prior to disposal;
- To remove the radioactive materials from the submarines at both Rosyth and Devonport Dockyards; and
- To continue joint working with the NDA to produce a shared assessment of the storage options for ILW i.e. building a new store on a MOD or commercial site versus using current or planned facilities on NDA site(s).

10.12. These proposals will be reviewed in the light of the responses to public consultation and further analysis before any decisions are taken. In particular, a decision on what type of site is used to store ILW will be dependent on the outcome of the joint assessment that we are undertaking with NDA. Beyond this, the eventual selection of specific storage site(s) will require further assessment and stakeholder engagement. Importantly, no submarine dismantling will commence until a solution is established for storage of ILW.

10.13. All decisions will remain subject to the planning and regulatory applications that will be required, at a later stage, on a site specific basis.

GLOSSARY

Authorisation / Authorised site	Authorisations allow specific defence-related nuclear activity to take place. Such 'Authorised' sites or activities are not subject to the Nuclear Installations Act (unlike civil nuclear sites) and so activities are not formally 'Licensed'. Instead, Authorisations are granted by the Defence Nuclear Safety Regulator. Where appropriate to the activity, Authorisation Conditions are equivalent to Licensing Conditions applied to civil nuclear work.
CoRWM	**Committee on Radioactive Waste Management:** This independent committee provides scrutiny and advice to Government on the long-term management of radioactive waste, including storage and disposal. See **http://corwm.decc.gov.uk/** for more details.
CIOP	**Consultation on ISOLUS Outline Proposals:** The second consultation on the project (then called ISOLUS) conducted in 2003.
Defuel	The removal of spent (used) nuclear fuel from the submarine's reactor after it has left service. Submarines will have been defuelled before they become part of SDP and are dismantled.
FEC	**Front End Consultation:** The first consultation on the project (then called ISOLUS) conducted in 2001.
GDF	**Geological Disposal Facility:** the UK government's proposed long-term, below-ground facility for disposing of Higher Activity Nuclear Waste (HLW and ILW). No site has yet been identified. **See http://mrws.decc.gov.uk/en/mrws/cms/home/What_is_geolog/What_is_geolog.aspx** for more details.
ILW	**Intermediate Level Waste:** radioactive waste with a radiological activity above 4 GigaBecquerels (GBq) per tonne of alpha, or 12 GBq/tonne of beta-gamma decay, but which does not generate enough heat to require it to be cooled during storage. By contrast, nuclear fuels are generally much more active, and have to be kept cool. The majority of ILW from submarines is metal within the RPV.
Interim ILW Storage	ILW is stored for an 'interim' period until a disposal route is available. Interim stores are designed for 100 years to provide safe and secure protection for waste packages. There are currently more than twenty such sites in the UK.
Initial Dismantling	The process whereby radioactive waste is removed from the laid-up submarines. This work has to take place on a site with an appropriate nuclear site Licence, issued by the Office for Nuclear Regulation. There are three options for initial dismantling in the SDP - namely RC separation and storage, RPV removal and storage, and RPV removal and size reduction for storage as packaged waste (explanations of each of these options are provided in this glossary).
ISOLUS	**Interim Storage of Laid-Up Submarines:** the former name of the Submarine Dismantling Project changed in 2009 to better reflect the outcome of the project.
Licence / Licensed site	A Nuclear Licence allows specific nuclear activities to take place at a specific site. Such 'Licensed' sites are subject to the Nuclear Installations Act (1965), with licences being granted by the Office for Nuclear Regulation. Nuclear power stations and other civil activities are licensed in this way.
LLW	**Low Level Waste:** This is defined as radioactive waste that has below 4 GBq per tonne of alpha activity and below 12 GBq per tonne of beta-gamma activity. It covers a variety of materials which arise principally as lightly contaminated miscellaneous scrap and redundant equipment. LLW is managed in accordance with the UK's LLW Strategy and with disposal to licensed facilities such as the LLW Repository in Cumbria.

MRWS	**Managing Radioactive Waste Safely:** the UK Government's approach to managing the nation's radioactive wastes, irrespective of where they come from and their level of activity. The SDP will adhere to this approach.
NDA	**Nuclear Decommissioning Authority:** The Nuclear Decommissioning Authority (NDA) is a non-departmental public body created through the Energy Act 2004. Its purpose is to deliver the decommissioning and clean-up of the UK's civil nuclear legacy in a safe and cost-effective manner.
Packaged Waste	RPV Removal and Size Reduction for Storage as Packaged Waste is the option for removing the radioactive materials from the submarine whereby the RPV is removed, cut-up and packaged in appropriate containers for transport, interim storage and disposal in the proposed GDF.
RC	**Reactor Compartment:** This is the central 'slice' of the submarine which contains the nuclear reactor, housing the RPV, and the primary circuit, which transfers heat to the boiler.
RC Separation	**RC Separation and Storage:** The option for removing the radioactive materials from the submarine whereby the complete RC is separated from the rest of the submarine and then stored intact. This is the current approach taken in the USA and Russia. RCs will be too large to fit into the proposed GDF intact. This means that each RC will eventually have to be 'cut up' to packaged waste before it can be disposed of.
RPV	**Reactor Pressure Vessel:** the self-contained metal chamber inside the RC which contained the nuclear fuel.
RPV Removal	**RPV Removal and Storage:** The option for removing the radioactive materials from the submarine whereby the whole RPV is removed from the submarine and stored intact. According to current plans, RPVs may be too large to fit into the proposed GDF intact but we are exploring the opportunities to dispose of whole RPVs. If this is not possible each RPV will eventually have to be 'cut up' (size-reduction) to packaged waste before it is disposed of.
SDP	**Submarine Dismantling Project**
Ship Recycling	This is the process whereby the hull of the submarine (which forms the bulk of the vessel) is dismantled. It is very similar to the way in which surface ships are disposed of.
Size-reduction	The term used by the nuclear industry to refer to the process of cutting-up radioactive waste into smaller pieces so that it can be packaged into containers. Size-reduction is an established process in the civil nuclear industry.
SEA	**Strategic Environmental Assessment:** A type of assessment undertaken on certain public plans and programmes, to assess the potential environmental effects that they may have, and to identify ways to avoid or minimise damaging impacts and to enhance positive ones. SEA gives the public the opportunity to see what those impacts might mean for them and comment on them before decisions are made, so that they can help shape the approach taken.

OTHER SOURCES OF INFORMATION

B

Regulation

- **Office of Nuclear Regulation** is an agency of the Health & Safety Executive with responsibility for nuclear sector regulation across the UK. **www.hse.gov.uk/nuclear**
- **Environment Agency (EA) / Scottish Environment Protection Agency (SEPA)** are executive non-departmental public bodies whose principal aims are to protect and improve the environment, and to promote sustainable development. **www.environment-agency.gov.uk** / **www.sepa.org.uk**
- **Department for Transport** is responsible for regulating the transport of radioactive waste. **www.dft.gov.uk/**

Policy

- **Committee on Radioactive Waste Management** is a group of independent experts appointed by Government to scrutinise plans for managing UK higher activity radioactive waste now and into the future. www.corwm.org.uk
- **Department for Energy and Climate Change** is the UK Government department responsible for UK policy on radioactive waste management including the proposed GDF. **http://mrws.decc.gov.uk**
- **The Scottish Government** is the devolved administration responsible for policy on radioactive waste management in Scotland. **www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/16293**
- **Department for Environment Food and Rural Affairs** is the Government department responsible for UK policy on ship recycling. **www.defra.gov.uk/environment/waste/business/ship-recycling**

Submarines

- **Ministry of Defence** is the Government department responsible for the Submarine Dismantling Project. **www.mod.uk/submarinedismantling**
- **Royal Navy** is the armed service that operates the UK's nuclear submarines. **www.royalnavy.mod.uk**

Other Government Bodies

- **Health Protection Agency** is a UK-wide Non Departmental Public Body that advises on the health and wellbeing of the population. The Radiation Protection Division, which is part of the Centre for Radiation, Chemical and Environmental Hazards, carries out the HPA's work on radiation. **www.hpa.org.uk**
- **Nuclear Decommissioning Authority** is a non-departmental public body reporting to the Department of Energy and Climate Change (DECC) and, for some aspects of its functions in Scotland, to Scottish Government Ministers. Its purpose is to deliver the decommissioning and clean-up of the UK's civil nuclear legacy in a safe and cost-effective manner. **www.nda.gov.uk**

Local Government

- **Nuclear Legacy Advisory Forum (NuLeaf)** seeks to identify and represent local government views on nuclear legacy management issues. NuLeaf is a Special Interest Group of the Local Government Association. **www.nuleaf.org.uk**
- **Nuclear Free Local Authorities (NFLA)** is a local government voice on nuclear issues and tackles in practical ways, and within its powers, the problems posed by civil and military nuclear hazards **http://nfznsc.gn.apc.org**

THE SEVEN CONSULTATION CRITERIA

This consultation has been designed in line with the Government Code of Practice on Consultation[13] and aims to adhere to all seven consultation criteria as outlined below:

1. **When to consult**
   No major decisions will be made until after the consultation. This consultation is taking place at a stage when there is scope to influence the decisions to be made. Initial assessment work has been done to inform this exercise but more planning work will be done once responses have been received and considered.

2. **Duration of consultation exercises**
   Consultation periods should normally run for 12 weeks - this consultation will run for 16 weeks in view of its importance and to enable as many people as possible to take part.

3. **Clarity of scope and impact**
   This document aims to be clear about the consultation process, what is being proposed, the scope to influence the decisions to be made and the expected costs and benefits of the proposals.

4. **Accessibility of consultation exercises**
   This consultation exercise is designed to be accessible to, and clearly targeted at, those people who have an interest in the project.

5. **The burden of consultation**
   We aim to keep the burden of consultation to a minimum to ensure consultation is effective and we obtain and maintain consultees' buy-in to the process. This is the third consultation on this issue.

6. **Responsiveness of consultation exercises**
   Consultation responses will be analysed carefully and clear feedback will be provided to participants following the consultation in the form of Post Consultation report and Post Adoption Statement. This will be available via the project website.

7. **Capacity to consult**
   We have sought guidance from experts and those with experience in running an effective consultation exercise and this has included a group of independent experts and advisors, the Advisory Group. We will also share what we have learned from our experience.

[13] www.bis.gov.uk/policies/better-regulation/consultation-guidance

D

You can respond to the Consultation questions using the tear-out sheet opposite.

Alternatively you can use the questionaire available at **www.mod.uk/submarinedismantling** and email your response to: **DESSMIS-SDP@mod.uk**
or
submit your response using the FREEPOST address:

FREEPOST RSKJ-KRAH-YZRJ
Submarine Dismantling Project
C/o Green Issues Communications Ltd
30-31 Friar Street
Reading
RG1 1DX

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the access to information regimes (these are primarily the Freedom of Information Act 2000 (FOIA), the Data Protection Act 1998 (DPA) and the Environmental Information Regulations 2004).

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances.
An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department.

The Department will process your personal data in accordance with the DPA and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

QUESTIONS

Please answer as many of the questions you wish to – you do not have to answer them all. If you require more space please attach additional sheets.

Consultation Document Questions

Q1. What are your views on the overall objectives for dismantling submarines that have left service? [chapter 4]

Q2. What are your views on the options for **how** the radioactive materials could be removed from the submarine? Do you think any significant options have been left out? [chapter 6]

Q3. What are your views on the candidate sites for **where** the radioactive waste is removed from the submarines? Do you think any significant options have been left out? [chapter 6]

Q4. What are your views on the options for **which** type of site is used to store the intermediate level waste from submarine dismantling? Do you think any significant options have been left out? [chapter 6]

Q5. What are your views about the methods used to compare dismantling and storage options, in particular the factors considered to assess their suitability/effectiveness/performance? [chapter 6]

Q6. Do you think we have captured all the potential advantages and disadvantages of the options and if not which others would you propose? [chapter 7]

Q7. Are there any other significant issues or factors you think we have overlooked? [chapter 7]

Q8. What are your views on our proposals, and associated rationale, for:

a. how we remove the radioactive waste; [chapter 8]

b. where we remove the radioactive waste; [chapter 8] and

c. which type of site will be used to store Intermediate Level radioactive Waste? [chapter 8]

Q9. Do you have any comments on the next stages of the decision-making process that will follow this consultation? [chapter 9]

Q10. Do you have any comments about how this consultation has been conducted? Did the consultation provide enough information for you to reach views on the key decisions? Did it meet the seven consultation criteria of the Government Code of Practice (outlined at Annex D)?

Environmental Questions

Please refer to the Environmental Report and Non-Technical Summary for the information you need to answer the Strategic Environmental Assessment questions.

Q11. Do you think that the Environmental Report has captured the significant environmental effects of the SDP options? If not, what effects do you think we have missed, and why?

Q12. Is there any other baseline environmental information, relevant to the SEA, that we have not included? If so, please provide details.

Q13. Do you agree with the proposed arrangements for monitoring significant effects of the SDP options, detailed in the Environmental Report? If not, what measures do you propose?

Q14. Do you agree with the conclusions of the Environmental Report and the recommendations for avoiding, reducing or off-setting significant effects of the SDP options? If not, what do you think should be the key recommendations and why?

Q15. Are there any other comments you would like to make?

About you...

- Are you happy for your comments to be published on our website?

Y		N	

- If so, do you want to be named alongside your comments when the responses are published on the website?

Y		N	

- If you wish to be kept informed about the SDP in future, please include your name, organisation (if applicable) and contact details, even if you wish to remain anonymous on our website.

NAME:	
ADDRESS:	
POSTCODE:	
EMAIL:	
PHONE:	

Are you (please tick):

Representing an Organisation ☐

If so, please state which one:

A Local Resident to Devonport or Rosyth Dockyards ☐

Other ☐ **Please state:**

Submarine Dismantling Project (SDP)

Submarine Dismantling Consultation

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All of the documents produced for this Consultation and further background information is available on our website at:

www.mod.uk/submarinedismantling

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