MINISTRY OF DEFENCE

Ministry of Defence

Nuclear Liabilities
Management Strategy

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Foreword

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Secretary of State for Defence
September 2011

The United Kingdom's Defence Nuclear Programme has played a vital role in the nation's security for over 60 years. From the uncertain times after World War II through the tensions of the Cold War to a present day where threats are changing and evolving, nuclear weapons and nuclear propulsion have been critical technologies underpinning our military capability and safeguarding the United Kingdom's interests.

Nuclear technology is not without its costs and the Government recognises that foremost among these is the need to manage effectively the decommissioning and disposal of our nuclear assets as they reach the end of their useful life, including the management of the resultant nuclear materials and the disposal of radioactive waste. This covers buildings and facilities, as well as equipment such as nuclear reactors, submarines, and nuclear weapons.

The overriding imperative in all nuclear activities is to deliver them safely and securely, minimising the risk to the public, workers, and the environment. We are proud of the excellent safety record that has been maintained throughout the life of the Defence Nuclear Programme, but we are not complacent and are always striving to improve. We are robustly regulated, internally, by the Defence Nuclear Safety Regulator, and externally by bodies such as the Office for Nuclear Regulation (previously the Nuclear Installations Inspectorate), the Environment Agency, and the Scottish Environment Protection Agency. We also work closely with the Department of Energy and Climate Change and the Nuclear Decommissioning Authority, share good practice with our counterparts in the civil nuclear sector, and seek solutions that give the best value for money for the UK taxpayer. This is in recognition that the Ministry of Defence has only a small proportion of the UK's nuclear and radioactive materials.

We fully recognise the public interest in the Defence Nuclear Programme and, as a Department, we are committed to openness and transparency about our nuclear activities so far as we are able. I am pleased, therefore, to publish this initial version of the Ministry of Defence's Nuclear Liabilities Management Strategy, which is the first step towards implementing the policy (for Decommissioning and the Disposal of Radioactive Waste and Residual Nuclear Material Arising From the Nuclear Programme) that was published in 2007. The work described in this Strategy will take many years, and the Strategy itself is intended to evolve over that time. Therefore we intend to publish revised versions every five years to provide a coherent picture of the progress that is made.

The Strategy poses many challenges for the MOD but we accept those challenges and we are committed to dealing with them as a fundamental part of our role as a responsible nuclear operator and owner of nuclear liabilities.

Executive Summary

This Strategy sets out the high level approaches for managing the Ministry of Defence (MOD) nuclear liabilities; it provides the basis for a coherent approach to decommissioning and disposal across the Defence Nuclear Programme.

MOD nuclear liabilities have arisen from building and operating nuclear submarines and from the manufacture and management of nuclear weapons. The Strategy considers four liability categories, called themes: nuclear materials; irradiated fuel; sites, facilities and submarines that support the Defence Nuclear Programme; and, the resultant radioactive wastes. These are compatible with the Nuclear Decommissioning Authority (NDA)'s strategy themes.

The MOD is committed to being a responsible owner of its liabilities; safe and secure storage of its current and future nuclear liabilities continues to be of paramount importance. It is recognised, however, that storage does not provide a complete strategy but a robust interim position until the MOD's liabilities can be taken to an appropriate end point.

Although substantial, the MOD's liabilities are significantly smaller than the civil nuclear liabilities. The MOD's radioactive wastes account for less than 1.5% (by volume) and 0.1% (by radioactivity) of the UK total. The MOD has no high level waste but some of the options to deal with irradiated fuel may produce it.

Classification of all the MOD's nuclear liabilities as radioactive waste and permanently disposing of them is not always the preferred solution, as some of the liabilities include valuable materials or materials that may be regarded as valuable in the future. In the same way, the MOD will not condition liability materials into a form that would make the subsequent extraction of valuable components difficult or expensive unless there is a safety or security requirement to do so. The MOD irradiated fuel still contains a significant amount of U-235 that could be used in the manufacture of new fuel.

The MOD is committed to working with the NDA and waste producers to ensure that this Strategy delivers best value for money solutions for the UK. The MOD will explore the benefits of collaborative solutions.

At its current stage of development the Strategy requires some MOD nuclear liabilities to be disposed of to a geological facility, or managed in line with Scottish Government policy on higher activity waste where applicable. The MOD's approach accords with the Committee on Radioactive Waste Management recommendations for developing a robust programme of storage and long-term management options.

Some elements of the MOD's nuclear liabilities strategy need to be addressed in the short term. For example, the Submarine Dismantling Project (SDP) has been established to develop a solution for the dismantling of the UK's nuclear submarines that have left naval service and for the management of the materials and wastes arising.

In some cases, strategy development is a long term activity that will be influenced by a number of factors including developments in the management of civil nuclear materials and spent fuels, and the design, availability and timing of storage and disposal facilities. It is currently not possible to have a complete strategy for some of the MOD's nuclear liabilities as individual approaches continue to develop in line with UK policies and as options are further examined and analysed. The development of these options will support future liability management decisions.

1. Strategy overview

1.1 Why does the Ministry of Defence have nuclear liabilities?

P1 The MOD nuclear liabilities have arisen from building and operating nuclear submarines, and from the manufacture and management of nuclear weapons, collectively referred to as the Defence Nuclear Programme (DNP).

P2 The UK's nuclear weapon programme began in the 1940s and, since 1963, we have operated nuclear powered attack submarines that carry conventional but not nuclear weapons. The first Royal Navy nuclear powered submarine was HMS Dreadnought followed by the now out-of-service Valiant, Churchill, and Swiftsure classes; the current Trafalgar class; and the latest Astute class.

P3 From the late 1960s, four Resolution class submarines supported the strategic deterrent; these carried US-supplied Polaris missiles fitted with UK Chevaline nuclear warheads. The Resolution class submarines have now left service, and the Chevaline warheads have been dismantled. Other historical UK nuclear warheads have also been dismantled.

P4 Since 1994, four Vanguard class submarines have been introduced into service and these carry Trident nuclear weapons. Vanguard class submarines

are due to be replaced by a new class of submarines, currently known as 'Successor'.

P5 The UK plans to maintain and renew its strategic nuclear deterrent capability using nuclear powered submarines. The DNP is enduring insofar as we do not currently foresee an end to the provision of a strategic nuclear defence capability. This is reviewed in accordance with security policies and international treaty obligations; it does not obscure the ultimate vision of a world free from nuclear weapons. This Strategy is about management of the MOD's nuclear liabilities; it is not about the UK's policies on nuclear deterrence or the future of that deterrent.

P6 A number of sites and facilities support the DNP, and will require either updating or replacing as they age. Future liabilities will be produced from in-service operations and from the future requirements of the DNP. This Strategy addresses the management, decommissioning and disposal of current and future MOD nuclear liabilities.

The Defence Nuclear Programme

The DNP comprises:

- The nuclear submarine programme that manages nuclear submarines including the nuclear propulsion aspects, from initial design and manufacturing through support in service to decommissioning, dismantling, and disposal.
- The nuclear weapon programme that manages all aspects of nuclear weapons from initial design and manufacturing through support in service, to decommissioning, dismantling, and disposal.

1.2 What are the MOD's nuclear liabilities?

P7 The MOD's nuclear liabilities comprise the nuclear materiel used in the DNP for which the MOD is ultimately responsible.

These liabilities are divided into four categories, referred to as 'themes':

- Nuclear Materials. This theme is dominated by uranium and plutonium no longer required for Defence purposes.
- Irradiated Fuel. This is submarine reactor fuel that has fulfilled its purpose, and includes prototype and research assemblies.
- Sites, Facilities, and Submarines. The MOD uses a number of sites across the UK to support the DNP. These sites and the Defence nuclear facilities on them are covered in this theme. This theme includes submarines that have left naval service.
- Radioactive Waste. This theme covers the management of radioactive wastes that are produced from the other three themes. The MOD's radioactive waste is mostly Very Low Level Waste (VLLW) and Low Level Waste (LLW). The MOD has Intermediate Level Waste (ILW) but no High Level Waste (HLW). Options to deal with irradiated fuel have the potential to produce HLW in the future. The theme is focussed on safe management which includes secure packaging, storage and disposal.

A simplified schematic of the four themes and their interrelated nature is illustrated in Figure 1.

1.3 What is the size of the MOD's nuclear liabilities?

P8 The MOD's nuclear liabilities, although substantial, are significantly smaller than the civil nuclear liabilities owned and managed by the NDA. The MOD's radioactive wastes account for a very small percentage of the UK total: 1.5% by volume; 0.1% by radioactivity (reference 2). Table 1 shows the relative size of the MOD's nuclear liabilities for each theme compared with the NDA's civil liabilities. NDA liabilities do not include all UK civil nuclear liabilities.

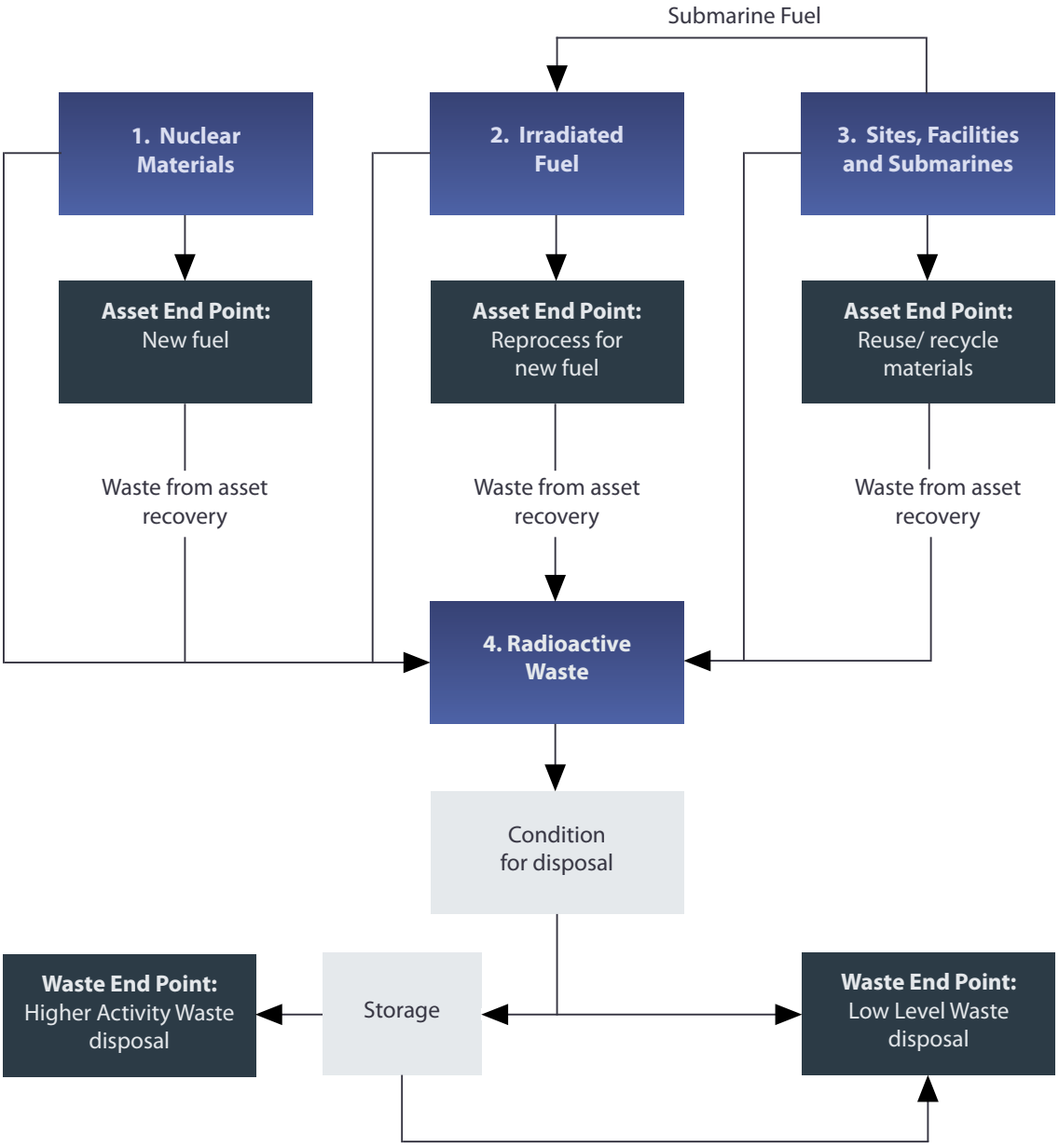


Figure 1: MOD's Four Key Themes

Table 1: Comparison between MOD and NDA Nuclear Liabilities

The MOD theme and the NDA equivalent	Relative size of the MOD nuclear liabilities	Similarities and differences between the MOD and the NDA themes
Nuclear Materials **NDA theme: Nuclear Materials**	MOD uranium liabilities are approximately 15% (by mass) of NDA uranium liabilities. MOD plutonium liabilities are approximately 2% (by mass) of NDA plutonium liabilities.	Both themes address plutonium and uranium. MOD and NDA uranium liabilities are in similar chemical forms (e.g. oxides and hexafluoride). There are differences in the isotopic content of MOD and NDA plutonium.
Irradiated Fuel **NDA theme: Spent Fuels including Exotic Fuels.**	There are no direct comparisons. NDA spent fuels have a lower U-235 enrichment and are clad in different materials to MOD irradiated fuel. The quantity of residual U-235 in MOD's irradiated fuel is of the same order of magnitude as the amount of residual U-235 recovered from spent Magnox fuel.	The NDA theme is dominated by spent oxide and Magnox fuels from the civil nuclear programme which have a reprocessing route. There are similarities between MOD irradiated fuel and some of the high enriched uranium fuel that the NDA describes as 'exotic fuels'
Sites, Facilities and Submarines **NDA theme: Site Restoration**	NDA is restoring 19 sites some with legacy plants in excess of 60 years old. The DNP has eight key sites (section 4 and Annex A). The majority of these sites will be required to provide continued support to the DNP for the foreseeable future.	Both MOD and NDA have sites and facilities to decommission. The decommissioning of submarines in the UK is unique to MOD.
Radioactive Waste **NDA theme: Integrated Waste Management**	MOD wastes constitute 0.1% of the UK total in terms of radioactivity and less than 1.5% in terms of volume (reference 2).	Both MOD and NDA strategies are based on the principles of the waste hierarchy (Figure 6). Radioactive wastes from the DNP are not characteristically unique to the MOD.

1.4 What is the NDA's approach to MOD's nuclear liabilities?

Nuclear Decommissioning Authority

The Energy Act (2004) outlines the NDA's responsibilities for the ownership and management of a large proportion of the UK's civil nuclear liabilities, and provides the NDA with a clear mandate. The NDA was established in 2005 as a non-departmental public body to ensure that the UK's civil public sector nuclear legacy sites are decommissioned and cleaned up. This covers the civil nuclear power stations and includes used nuclear fuels, the nuclear reactors, reactor buildings, associated facilities and the sites.

The NDA owns the UK Low Level Waste Repository (LLWR), a key asset for the management of LLW in the UK, and is leading on the national LLW strategy.

The Department of Energy and Climate Change is responsible for establishing the programme to implement a Geological Disposal Facility (GDF) for disposal of higher activity radioactive wastes; the NDA is responsible for building and operating it. Also, the NDA is working with the Scottish Government to implement its policy for the long term management of Higher Activity Wastes (HAW) in Scotland.

P9 The NDA's second strategy was published in April 2011 (reference 3) under the terms of the Energy Act (2004), which requires the NDA to produce a strategy every five years.

P10 In the development of its strategy, the NDA recognises the need to account for non-NDA liabilities, such as those owned by the MOD and other liability owners. In relation to the MOD, the NDA's strategy acknowledges that:

- NDA site restoration must take account of the MOD's liabilities located on NDA sites.
- The NDA will review the decommissioning plans of its site licence companies to ensure they do not compromise the MOD's ability to deliver its plans.
- There is potential benefit to the UK taxpayer if MOD irradiated fuels and NDA exotic fuels can be managed together.
- A proportion of the uranium inventory managed by the NDA is owned by the MOD, and the NDA will continue to manage this material in line with contractual obligations.
- With respect to integrated waste management, the NDA intends to take a multi-site and UK-wide view to include NDA sites and the operations of waste producers.

P11 The Energy Act (2004) makes provision for a 'nuclear transfer scheme' whereby liabilities not covered by the Act may be transferred to or from the NDA. The NDA has a theme that covers 'non NDA liabilities', which recognises the MOD as a key owner of these (reference 4).

1.5 How is the MOD dealing with its nuclear liabilities?

P12 At the top level there are two broad ways in which we can deal with our nuclear liabilities. These are: dispose as waste, or treat as an asset realising some of the intrinsic value in the materials, as illustrated in Figure 1. To reflect this, the end point of a liability is the point where the recyclable and reusable contents of a liability have been recovered and utilised where reasonably practicable and the waste finally disposed of.

P13 The MOD is a responsible owner of its liabilities and will ensure they are managed to their final end point.

P14 In October 2007, the MOD published its policy for decommissioning and disposal of radioactive waste and residual nuclear materials arising from the DNP (reference 1). The policy sets out the requirement for a strategy, which is addressed by this document.

P15 The MOD's nuclear materials are stored in a safe and secure condition and the strategic inventory of fissile material is maintained at the minimum practical level consistent with the requirements of the DNP. At the end of their life, nuclear weapons are dismantled as soon as reasonably practicable.

P16 To deliver best value for money, the MOD will continue to work with the NDA, developing coherent plans and enabling efficient use of UK facilities, recognising the benefits of collaborative solutions. There is considerable opportunity to share, and make effective use of, UK decommissioning and disposal facilities. The MOD is working with the NDA to explore opportunities and realise the value of liability materials.

P17 MOD irradiated submarine fuel contains a significant amount of U-235 that may be used in the manufacture of new fuel. The MOD will form a balanced judgement of the preferred management approach for irradiated fuel that takes into account all relevant factors, and will work with the NDA on the development of national policies to ensure they accommodate the MOD's liabilities. MOD irradiated fuel is being maintained in safe and secure storage until an end point solution can be implemented.

P18 UK nuclear submarines have been leaving operational service periodically since HMS Dreadnought left service in 1980. They are immediately disarmed, defuelled as soon as reasonably practicable, and de-equipped and prepared for storage. They are stored afloat pending the availability of a dismantling capability.

P19 As of July 2011, seven submarines are stored afloat at Rosyth Dockyard, all of which

are defuelled. There are ten submarines at HM Naval Base Devonport, four of which are defuelled with plans to defuel the other six. Following defuelling, the fuel is transported to Sellafield for storage in a dedicated facility.

Submarine Dismantling Project (SDP)

The SDP has been established to develop a solution for the disposal of the UK's nuclear submarines following a period of storage afloat. The project will include the provision of facilities to dismantle 27 defuelled nuclear submarines of past and current classes.

Most of the material from the submarines will be recyclable but there will be some radioactive and non-radioactive wastes that will need to be dealt with, in keeping with strict legislative and regulatory requirements.

Submarine dismantling activities could take place at Devonport or Rosyth or a combination of both sites. Until a final disposal route is available, ILW from submarine dismantling activities could be stored at a number of possible sites including existing nuclear licensed sites owned by the MOD, the NDA, or industry. The site selection process is ongoing, and includes a strategic environmental assessment and public consultation.

Further information can be obtained from **www.mod.uk/submarinedismantling**

P20 MOD sites and facilities will continue to be managed responsibly and when there is no longer a requirement for them, they will be decommissioned. Facilities will be dismantled and removed as soon as practicable, and sites will be returned to a state commensurate with their next planned use. Decommissioning activities will produce radioactive and non-radioactive wastes that will be segregated and managed in a manner consistent with the waste hierarchy (Figure 6). The MOD will consider the benefits of adopting an integrated multi-site, UK-wide approach to managing its liabilities.

P21 The majority of the key DNP sites (Annex A) will continue to support the DNP for the foreseeable future.

P22 MOD radioactive wastes will continue to be managed in accordance with the waste hierarchy and policies (e.g. references 5 and 6). The aims are to prevent, minimise, reuse, recycle, and responsibly dispose of wastes in that order of preference. Wastes are stored in a safe and secure condition until suitable disposal routes are identified.

P23 Minimisation is an important aspect of the waste hierarchy and the MOD is working to reduce quantities and impacts of future nuclear liabilities by considering dismantling and disposal at early stages of design.

P24 Classification of the MOD's nuclear liabilities as radioactive waste and permanently disposing of them is not always the preferred solution as some of the liabilities include valuable materials or the materials may be regarded as valuable in the future. In the same way, the MOD will not condition materials into a form that would make the subsequent extraction of valuable components difficult or expensive unless there is a safety or security requirement to do so.

P25 The MOD will make use of established disposal routes where available. The MOD's LLW is produced through normal operations and is currently disposed of directly to the LLWR with the exception of LLW from the VULCAN Naval Reactor Test Establishment (NRTE), which is consigned to the LLW facility at Dounreay. Some wastes with very low levels of activity can be classified as VLLW or exempt, and can be treated accordingly, thus minimising the volume of waste sent to LLWR.

P26 A disposal route for HAW is not currently available. It is intended that geological disposal facilities will be used or HAW will be managed in accordance with Scottish Government policy where applicable. The MOD is working with the NDA to ensure that its wastes are considered in the design of disposal facilities and in development of Waste Acceptance Criteria (WAC) for them. Decisions on the most appropriate way to implement the end point for MOD's nuclear materials and

irradiated fuel will be shaped by the ongoing development of storage and disposal concepts.

P27 The enablers that are essential constituents in a framework for delivery of the Strategy are outlined in Section 6

1.6 Are MOD's nuclear liabilities safe and secure?

P28 Yes, and safe and secure storage of the MOD's current and future nuclear liabilities will continue to be of paramount importance. It is recognised that storage does not provide a complete strategy but a robust interim position before the MOD's liabilities can be taken to an appropriate end point. Storage will meet regulatory requirements and will be designed to accommodate delays in the availability of disposal facilities. There may be an enduring requirement for the storage of future liabilities.

P29 The MOD complies with all applicable legislation. In addition, the MOD's safety, health, environmental protection, and sustainable development policy (reference 7) states that where there are exemptions and derogations from either domestic or international law applicable to Defence, the MOD will introduce standards and management arrangements that produce outcomes that are, so far as reasonably practicable, at least as good as those required by legislation.

P30 International Safeguards is the International Atomic Energy Authority's system to verify that nuclear material is not being diverted for use in nuclear weapons or other explosive devices from nominally peaceful applications. MOD uranium and plutonium no longer required for Defence purposes is managed within the International Safeguards system.

P31 The storage, dismantling, decommissioning, and disposal of the MOD's nuclear liabilities is regulated by the statutory and Defence, nuclear safety and environmental protection regulators. Before any decommissioning, dismantling, and disposal activities can commence, the regulators must be satisfied that these activities are necessary and safe, and that the risk to the public, workers and the environment arising from these activities is acceptable and As Low As Reasonably Practicable and that Best Available Techniques are used.

P32 The MOD's sustainable development and sustainable procurement strategies (references 8 and 9) will influence the MOD's decommissioning and disposal approach. These strategies identify the issues that need appropriate consideration including sustainable consumption and production, climate change and energy, and natural resource protection and environmental enhancement.

Nuclear Safety and Environmental Regulation

Defence nuclear activities are regulated by the newly formed Office for Nuclear Regulation (ONR) (reference 10), previously the Health and Safety Executive Nuclear Installations Inspectorate (HSE/NII); the Environment Agency (EA) and the Scottish Environment Protection Agency (SEPA); and by the Defence Nuclear Safety Regulator (DNSR) where there are Defence exemptions. DNSR is the MOD's regulator for nuclear and radiological safety and environmental protection in the DNP. Later in 2011, the Department for Transport's (DfT) radioactive materials transportation team will be incorporated into the ONR. DfT regulates matters relating to civil nuclear transport. DNSR regulate matters relating to Defence nuclear transport.

1.7 What will this cost and how will it be funded?

P33 Some of the MOD's nuclear liabilities are already being decommissioned through funded projects.

P34 The Strategy is at an early stage of development and the range of possibilities to address the MOD's nuclear liabilities is considerable. It is currently not possible to have a complete strategy for some of the MOD's nuclear liabilities as individual approaches continue to develop in line with UK policies and as the options are further examined. The process of cost estimation for individual projects will begin,

and inform option selection once the strategy in a project area reaches a suitable level of maturity.

P35 The MOD will seek solutions that give the best value for money for the UK taxpayer whilst being consistent with this Strategy. The MOD will appropriately investigate the value of materials and where possible will realise their potential value. The MOD will not condition materials into a form that would make the subsequent extraction of the valuable components difficult or expensive unless there is a safety or security requirement to do so.

P36 Funding for Strategy development and implementation is not reliant on income from the realisation of assets.

P37 The civil nuclear liabilities budget will not be used to fund the management of the MOD's nuclear liabilities and the MOD will appropriately fund its use of any UK facilities. The MOD is making a funding contribution to GDF development and has planned for further contributions.

1.8 Why does the MOD not have defined solutions for all of its liabilities?

P38 Some elements of the MOD's nuclear liabilities strategy need to be addressed in the short term, and in these cases, the MOD already has decommissioning projects in place (e.g. SDP) and is working with relevant parties. However, some elements of strategy development are long term activities that cannot predict the outcome of decisions yet to be taken on future nuclear infrastructure in the UK. Developments in the management of civil nuclear materials and spent fuels and the design parameters and timing for storage and disposal facilities will have a bearing on the chosen end points for our liabilities and when they can be implemented. The MOD will develop the modelling of options that will inform future decisions on strategic direction.

1.9 How is MOD developing and implementing its strategy?

P39 In developing this Strategy, the MOD is working with industry partners, other Government departments, non departmental public bodies, and regulators. The MOD will also work with other waste producers and learn from international civil and Defence developments. The MOD will consider public engagement on a case by case basis taking account of Government policy and environmental and planning law.

P40 The MOD is pursuing the development of technical solutions necessary for the delivery of this liabilities management strategy. Work is underway to develop the strategy for nuclear materials and irradiated fuel in conjunction with the NDA as appropriate.

P41 Sites within the DNP are required as part of their licence or authorisation conditions to produce a local decommissioning strategy. Implementation will be on a local basis in accordance with the site strategy and the MOD's project approval process. The decommissioning of facilities has already been successfully carried out across the DNP estate. Collaboration and sharing of best practice across the DNP will therefore continue to be encouraged and supported.

1.10 What is MOD's Strategy for nuclear liabilities in Scotland?

P42 The MOD Strategy is applicable to MOD nuclear liabilities throughout the UK.

P43 Scottish Government policy (reference 11) for HAW is long-term management in near-surface facilities; facilities should be located as near to the site where the waste is produced as possible. The policy for HAW in England and Wales is geological disposal.

P44 Scottish Government policy is only applicable to certain HAW from DNP sites that are subject to regulation under the Radioactive Substances Act 1993 (reference 12). It is neither applicable to waste from the operational nuclear submarine base on the Clyde nor from the waste from decommissioning redundant nuclear submarines if this was undertaken in Scotland.

P45 MOD will determine the long term management strategy for HAW generated in Scotland and will comply with Scottish Government policy where applicable. All long-term waste management options will be subject to robust regulatory requirements and MOD will work with relevant stakeholders to secure approved disposal routes for all its waste.

P46 MOD's LLW in Scotland will be managed in accordance with the UK policy on LLW (reference 5).

P47 MOD's irradiated fuel in Scotland will be taken to the Wet Inlet Facility (WIF) at Sellafield and managed in accordance with the irradiated fuel theme within this Strategy.

1.11 What are the relevant US/UK agreements?

P48 From early in the DNP, the UK has worked with the US exchanging technology and expertise within the confines of international treaties and legal obligations. These exchanges are governed by the 1958 US/UK Mutual Defense Agreement (MDA). The UK's first nuclear propulsion plant was provided by the US under the MDA. Subsequently the UK has manufactured its own nuclear propulsion plant, but continues to work closely with the US. The terms of the agreement will be a key consideration when deciding how to dismantle and dispose of nuclear propulsion plant as there are strict security requirements.

P49 The foundations of the UK's submarine-based nuclear deterrent are vested in the Polaris Sale Agreement (PSA), a government-to-government treaty established in 1963 between the US and the UK. This agreement was subsequently amended in 1982 to enable UK purchase of the Trident missile system.

P50 The PSA now includes a collaborative US/UK agreement to design and build the missile compartment of the UK's Successor nuclear submarine, which will have a high degree of commonality between US and UK systems. Dismantling and disposal are important considerations at the early stages of design.

P51 US/UK exchanges related to the nuclear weapon programme are governed by both the PSA and the MDA.

2. Theme 1: Nuclear Material

2.1 Description

P52 Plutonium and uranium are used for the production of nuclear weapons. Uranium is used as nuclear fuel in submarine reactors. These materials are described individually in sections 2.4.1 and 2.4.2.

2.2 Scope

P53 The scope of this theme is dominated by MOD owned uranium and plutonium that are no longer required for Defence purposes and managed under International Safeguards.

P54 The UK is a recognised nuclear weapon state and the MOD owns a strategic reserve of nuclear materials for Defence purposes, which are held outside International Safeguards. The MOD's strategic reserve of nuclear materials is maintained at the minimum practicable level consistent with the requirements of the DNP.

P55 International Safeguards provides the International Atomic Energy Authority's system for the safe and secure management of nuclear materials under the Non Proliferation Treaty (NPT). MOD materials placed into International Safeguards are internationally auditable to ensure they are not used for Defence purposes.

P56 MOD nuclear materials are subject to stringent controls and accountancy in accordance with relevant legislation e.g. Ionising Radiations Regulations 1999. It is MOD policy to apply the same standards for safe and secure storage of nuclear materials whether inside or outside the system of International Safeguards.

2.3 Strategy

P57 MOD nuclear materials will continue to be stored safely and securely until a realisable strategy for reuse or timely disposal can be implemented.

P58 Where economic to do so, the MOD will realise the potential value of its surplus material and will only consider disposal when there are no other practical alternatives. The MOD will not condition materials into a form that would make the subsequent extraction of the valuable components difficult or expensive unless there is a safety or security requirement to do so.

P59 The MOD will ensure that UK and international security issues and sensitivities are dealt with appropriately. The Strategy will adhere to the principles of the NPT and the MOD will consult with the US in accordance with the terms of the relevant US/UK agreements e.g. the MDA.

P60 The MOD will collaborate with the NDA to explore and realise opportunities for the coherent long term management of materials with similar characteristics.

2.4 Strategy Development

P61 The MOD will continue to work with stakeholders, in particular the NDA, to develop the Strategy for nuclear materials management to ensure a coherent approach and strategic alignment across the civil and Defence programmes as far as is reasonably practicable.

2.4.1. Plutonium

P62 Following the 1998 Strategic Defence Review, a quantity of MOD plutonium was placed into International Safeguards putting it beyond use for Defence purposes. The quantity of MOD plutonium is less than the NDA owned plutonium.

P63 The strategic direction for the MOD and the NDA plutonium will be in line with the UK plutonium management policy that is being developed. The MOD will continue to liaise with the NDA in options development and analysis to identify a preferred option for plutonium.

P64 There are two end points under consideration for MOD plutonium.

P65 One option is to use plutonium as a component in the formulation of Mixed OXide (MOX) fuel for civil nuclear power, which would produce significant quantities of electricity. MOX fuel is a mixture of uranium and plutonium and is used to fuel many civil nuclear reactors. MOX fuel has been manufactured using recovered material from the reprocessing of civil fuel and is a mature technology. MOX manufacture using military grade material would require further development. There are additional benefits to this option associated with the prevention of nuclear proliferation.

P66 Another option is disposal. The plutonium would need to be immobilised and containerised so that it is suitable for storage prior to disposal in a GDF. The technology to immobilise plutonium is relatively immature and a GDF design is still at the concept phase with location and design details still to be finalised. The plutonium cannot be packaged into a disposable form until the GDF WAC have been defined. The MOD is engaged with the NDA regarding the development of the GDF design and its WAC.

P67 MOD plutonium will continue to be safely and securely stored maintaining the viability of the options.

P68 Figure 2 illustrates the routes to the two possible end points for MOD plutonium.

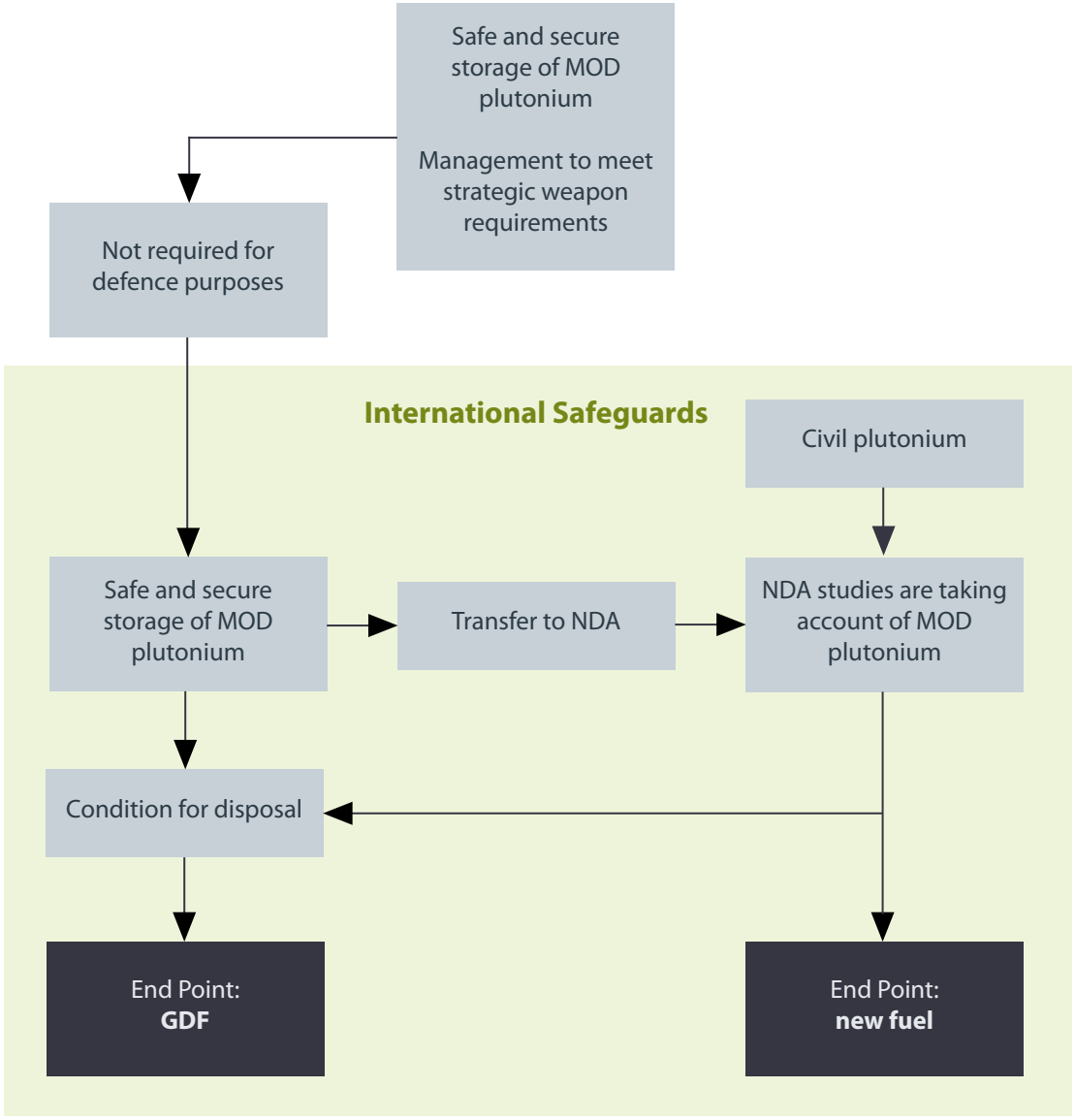


Figure 2: Routes to the Possible Identified End Points for MOD Plutonium

2.4.2. Uranium

P69 The MOD holds an inventory of uranium in a number of forms including solid metal and chemical compounds. Some of this inventory is controlled under International Safeguards and is similar to that being managed by the NDA although the quantities of MOD uranium are smaller.

P70 The strategic direction for MOD and civil uranium will be aligned where possible. The MOD will work closely with the NDA as opportunities for civil uranium continue to be investigated. This will ensure the development of a safe and cost effective solution for MOD uranium.

P71 There are two end points under consideration for MOD uranium.

P72 One option is the sale or transfer for processing into new fuel. The MOD will continue to work closely with the NDA on the identification of commercial opportunities. The MOD will maximise the potential value of its uranium and will consider the sale

of uranium within constraints and when market conditions are favourable.

P73 Another option is disposal. The uranium would need to be immobilised and containerised so that it is suitable for storage prior to disposal in a GDF. The design of a GDF is at the concept phase with location and design details still to be determined. Before a GDF is available the uranium must be stored and this requires packaging consistent with the GDF WAC. It would therefore be prudent to await the definition of the GDF WAC before packaging. The MOD is engaged with the NDA regarding the development of the GDF design and its WAC.

P74 Uranium will continue to be safely and securely stored maintaining the viability of the options.

P75 Figure 3 illustrates the routes to the two possible end points for MOD uranium.

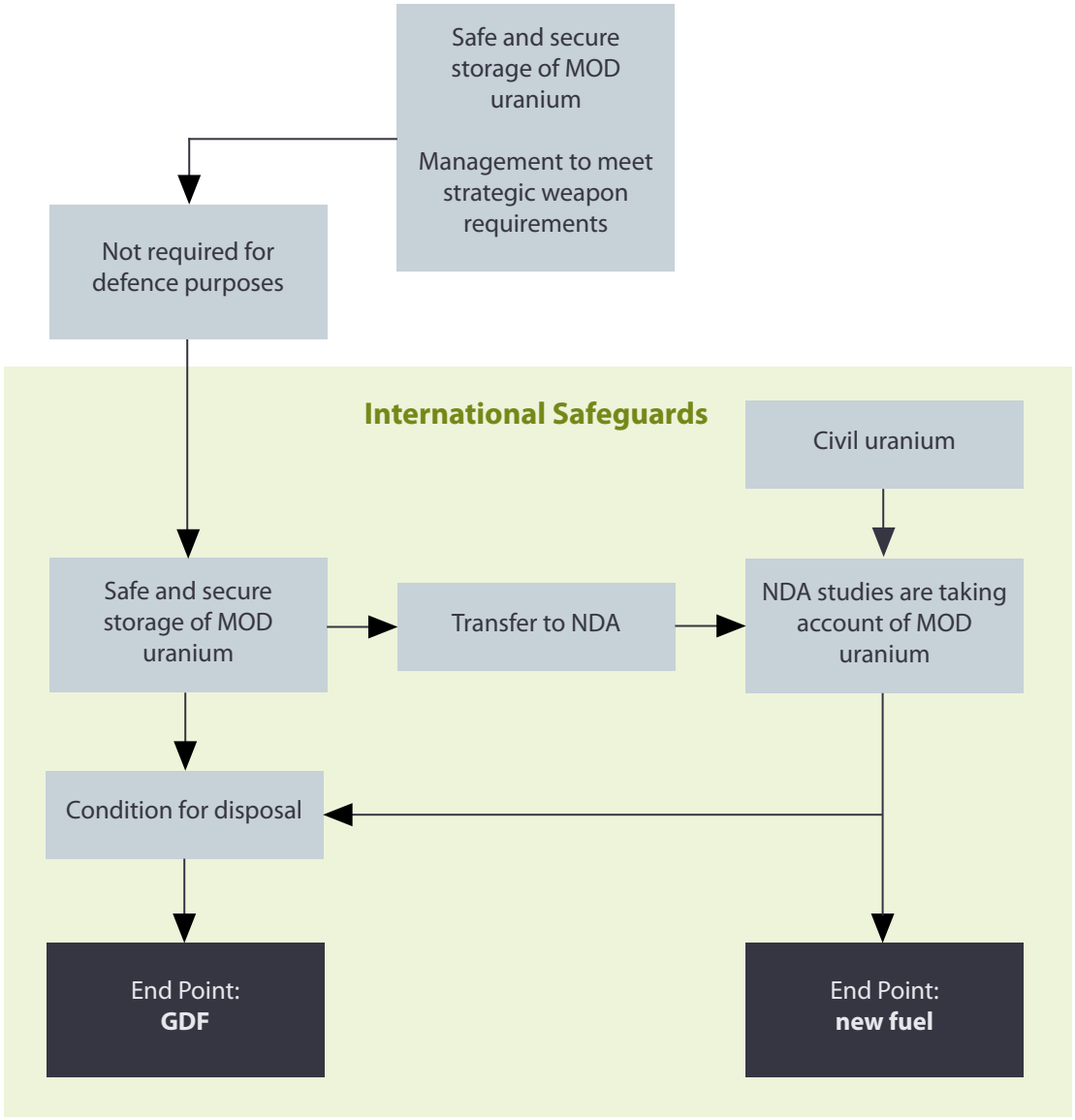


Figure 3: Routes to the Possible Identified End Points for MOD Uranium

3. Theme 2: Irradiated Fuel

3.1 Description

P76 The Royal Navy's submarines have pressurised water reactors where the nuclear fuel is contained within the reactor core. Submarine reactor development has steadily increased reactor core life and the reactor cores currently being manufactured are designed to power a submarine throughout its lifetime.

P77 Submarine fuel produces heat through the fission process as energy is released when U-235 atoms split into smaller atoms called 'fission products'. The heat produces steam that is used to propel the submarine and to generate electricity. Fission products are radioactive and remain in the fuel, contained by a barrier called fuel cladding.

P78 At the end of life, the irradiated fuel is removed from the reactor and stored underwater. This provides shielding and cooling whilst the residual heat that is produced for a number of years after reactor shutdown decays to low levels.

P79 The first submarine cores were placed in Sellafield's First Generation Oxide Storage Pond. In 2003, MOD commissioned a dedicated fuel storage pond at Sellafield called the

WIF that will support the continued safe and secure storage of irradiated fuel until the end of this century. Submarine cores stored in the FGOSP are being progressively transferred to the WIF. The FGOSP and WIF are safe and secure storage facilities that are maintained and safely operated by Sellafield Ltd.

3.2 Scope

P80 This theme includes all fuels that have been produced and irradiated for the purpose of nuclear submarine propulsion including prototype and research assemblies. These fuels are referred to as 'MOD irradiated fuel'.

3.3 Strategy

P81 MOD irradiated fuel will remain in safe and secure storage until an end point solution can be implemented.

P82 There are two possible end points for MOD irradiated fuel. One option is to reprocess to recover the unused U-235. Another option is to condition and dispose. These options are illustrated in Figure 4.

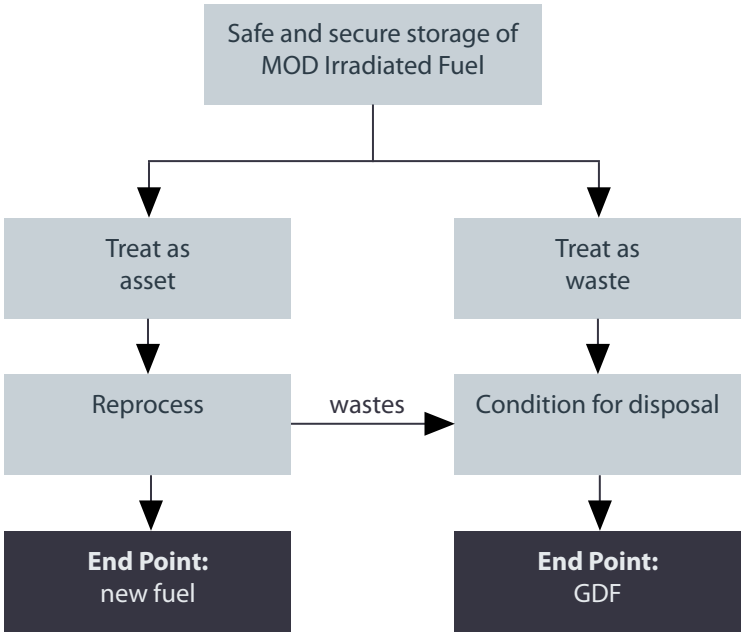


Figure 4: Routes to the Possible Identified End Points for MOD Irradiated Fuel

3.3.1. Reprocessing to Recover the Unused U-235

P83 Reprocessing enables the unused part of the fuel to be recovered. It also extracts radioactive elements that are wastes that would be immobilised and subsequently disposed of to a GDF.

P84 Within MOD irradiated fuel the proportion of fissile material is significant. This valuable material could be recovered through reprocessing and reused in the manufacture of new nuclear fuel. The NDA currently reprocesses Magnox and oxide fuels.

P85 The NDA's reprocessing facilities are not currently suitable for reprocessing MOD irradiated fuel and a special facility would be required. The scale of technical and logistical challenge in order to make reprocessing of MOD irradiated fuel feasible is considered to be substantial.

3.3.2. Conditioning and Disposal

P86 The NDA is designing a GDF that will receive radioactive waste and irradiated fuel. The design will accommodate irradiated civil fuel. The MOD will collaborate with the NDA in developing WAC for the GDF and in determining how the MOD irradiated fuel may need to be conditioned to meet them.

P87 Conditioning of MOD irradiated fuel to meet the WAC may include a process to reduce the concentration of U-235 by mixing with U-238 or depleted uranium. A special facility would be required for this process.

3.4 Strategy Development

P88 In developing a strategy for MOD irradiated fuel, the MOD will satisfy UK national security constraints and comply with all relevant treaties including non-proliferation treaty obligations. The MDA applies constraints on aspects of the naval propulsion system including how MOD irradiated fuel will be managed.

P89 The MOD intends to undertake research and development into taking MOD irradiated fuel to each of the possible end points. This understanding will be crucial when deciding which end point is the most appropriate and when decisions need to be taken.

P90 The NDA has defined a category called 'exotic fuels' comprising non-standard research and development fuel assemblies. There is a potential benefit to the UK taxpayer if MOD irradiated fuel and NDA exotic fuels can be managed together. The MOD will work with the NDA to investigate implementing such a solution.

4. Theme 3: Sites, Facilities and Submarines

4.1 Description

4.1.1. Terms Used

P91 'Sites' refers to DNP nuclear licensed or authorised sites.

P92 'Facilities' are buildings on sites (production and maintenance facilities etc.) and the machinery, tools, equipment and ancillary items.

P93 'Submarines' in this theme excludes nuclear fuel and nuclear weapons.

4.1.2. Sites and Facilities

P94 Not all sites and facilities that support the DNP are owned and operated by the MOD; there are a number of ownership and operator arrangements. The MOD will adopt a generic top-level decommissioning strategy to provide a coherent approach while recognising the varied nature of the sites and facilities and enabling site specific opportunities to be realised.

P95 The DNP is ongoing and it requires sites and facilities to support the programme for the foreseeable future. The MOD's ongoing

management of its sites and facilities is outlined in the facilities' management plans and involves a significant decommissioning element as part of site rationalisation and the provision of new and replacement facilities.

4.1.3. Submarines

P96 Once out of service, the Royal Navy's nuclear submarines are stored afloat at either Devonport or Rosyth where they are maintained for safe storage by the site operator but remain under MOD ownership.

P97 The steps to take sites, facilities and submarines to an end point are illustrated in Figure 5.

4.2 Scope

P98 The key sites and their associated facilities considered by this theme are listed below and are described further in Annex A.

- Atomic Weapons Establishment, Aldermaston and Burghfield, Berkshire (strategic weapons research and manufacturing, decommissioning and dismantling facilities).
- BAE Systems Submarine Solutions, Barrow-in-Furness (submarine production and naval reactor plant initial fuelling, commissioning and critical operations).
- Her Majesty's Naval Base Clyde, Faslane and Coulport, north west of Glasgow (submarine and strategic weapons maintenance and operations).
- Her Majesty's Naval Base Devonport, Plymouth (submarine maintenance and operations, and submarine storage).
- Devonport Royal Dockyard, Plymouth (submarine repair, refit, and refuelling).
- Rosyth Royal Dockyard, north of Edinburgh (storage of ion exchange resin and temporary submarine storage).
- Rolls Royce Marine Power Operations Limited, Derby (naval reactor core production).
- VULCAN NRTE, Dounreay (naval reactor plant evaluation).

P99 There are NDA sites that provide the MOD with a service such as storage of nuclear materials and wastes, or they may accommodate MOD facilities. These NDA sites are not MOD liabilities although the MOD funds its own liability costs.

P100 The out of service submarines stored at Rosyth and Devonport are in the scope of the 'submarines' section of this strategy.

4.3 Strategy

4.3.1. Sites and Facilities

P101 There is an enduring requirement for the majority of MOD operated sites and they are maintained by a process of land quality management. When there are no longer any military or operational requirements for a site, it is decommissioned.

P102 Facilities provide specific operations and services for the DNP. These facilities are updated as appropriate as the DNP continues to develop. Sometimes this requires the facility to be replaced or modified to meet the ongoing requirements. When a facility is to be replaced or it becomes redundant, it is dismantled and decommissioned (including remediation of land and ground water if required) as soon as reasonably practicable.

P103 The prioritisation of decommissioning is based on a range of factors that include: hazard reduction, safety, security, public and worker radiation dose, environmental impact and costs (including ongoing costs of facility care and maintenance). The approach is to reduce hazards in a progressive, systematic and timely manner consistent with decommissioning as soon as reasonably practicable. Care and maintenance of sites and facilities will be part of the considerations between cessation of operations and the start of decommissioning, recognising the potential worker radiation dose benefits. This involves making the facility safe and secure and placing it under routine surveillance.

P104 End points for sites and facilities will be based on site characterisation, contractual arrangements, stakeholder requirements and relevant policy and guidance. The MOD will consider the full lifecycle impacts on people and the environment to ensure the chosen strategy

does not compromise the needs or the welfare of current or future generations. A site end point will be commensurate with next planned use.

P105 Redundant facilities will be dismantled and removed in a timely manner; a staged progression to end points will often be the optimum approach as work to support the DNP at a particular site diminishes. For example, a facility may be temporarily converted to a waste store or decontamination facility before it is finally demolished. In this way, liabilities arising from the decommissioning process will be minimised. Decommissioning will be subject to relevant planning procedures.

P106 Decommissioning and disposal that leads to complete or partial facility or site closure at an early stage, thus reducing operating costs, will be considered. It may be necessary to commission new facilities as part of an optimised Defence nuclear estate.

P107 In some instances, the MOD will need to consider decommissioning timescales in conjunction with other stakeholders. For example, VULCAN NRTE is reliant on the neighbouring Dounreay NDA site for services and there are benefits in coordinating decommissioning activities.

P108 Radioactive waste will be disposed of immediately unless there is no disposal route or there is a benefit in decay storage in terms of worker radiation dose or transition from ILW to LLW. Waste must be securely packaged for storage, transportation, and for disposal. To avoid double handling, waste will be packaged for disposal where appropriate at onset. However, packaging for disposal may preclude subsequent treatment and this is part of the considerations in defining packaging for storage.

4.3.2. Submarines

P109 Before a submarine leaves service, conventional and nuclear weapons are removed. Irradiated fuel is removed as soon as reasonably practicable after the submarine has left naval service. The irradiated fuel is transported for storage in the WIF at Sellafield and is described further in Section 3, 'Irradiated Fuel'. The remaining radioactive material is predominantly irradiated steel (ILW and LLW) and this is contained securely in the reactor compartment of the submarine.

P110 The submarines that are stored afloat are routinely docked for planned maintenance. Whilst stored, there is the benefit of the natural process of radioactive decay but the space constraints and cost of afloat storage are significant.

P111 To date, seventeen nuclear powered submarines have left naval service and are stored safely afloat, seven at Rosyth and ten at Devonport.

4.4 Strategy Development

4.4.1. Sites and Facilities

P112 DNP authorisees/licensees categorise and catalogue nuclear site and facility liabilities as responsible duty holders. The characterisation of nuclear liabilities enables collaboration with the NDA and other stakeholders to explore and realise opportunities, share best practices and techniques and align programmes where practicable. The MOD, site owners and operators and the NDA will work closely to ensure the approach to decommissioning and disposal ensures a reduction in overall radiological and environmental risk and best value for money for the UK taxpayer.

P113 Site plans have the potential to affect local communities and the MOD understands the importance of engagement with local authorities and communities.

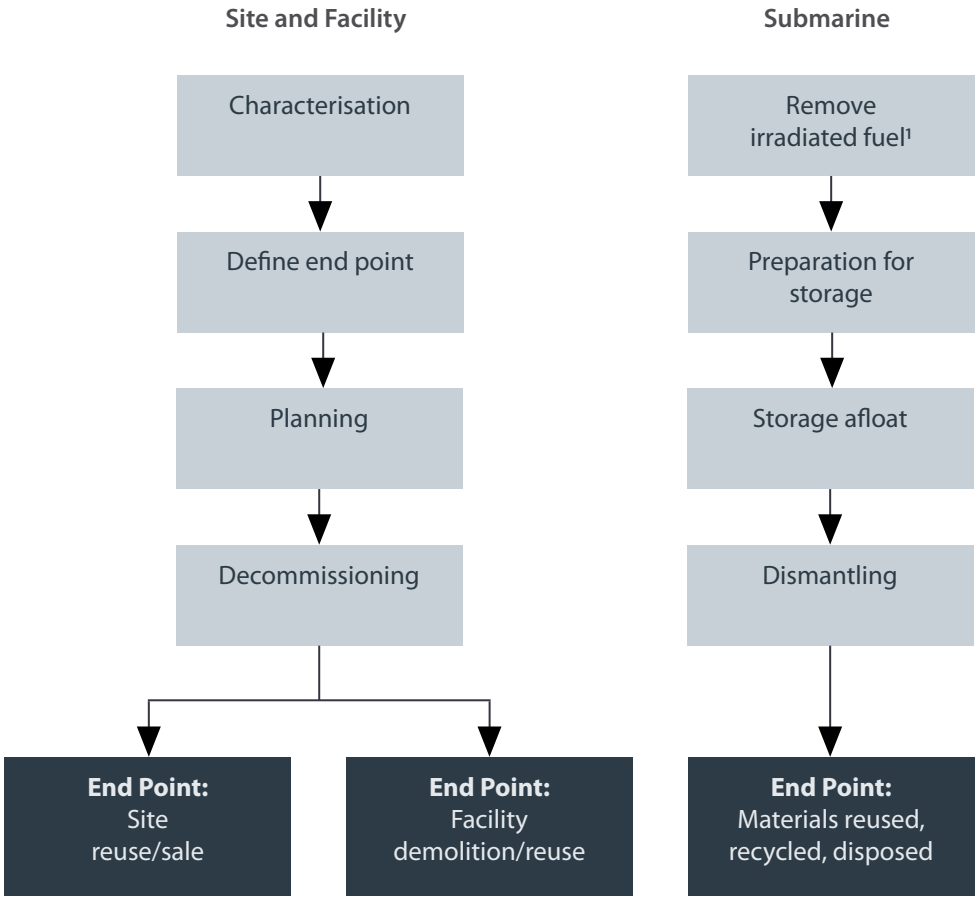
4.4.2. Submarines

P114 The SDP has been established to develop the most effective method to dismantle nuclear submarines and deal with the resultant waste streams.

P115 The SDP is undertaking the characterisation of the defuelled submarines as the first step in the process to determine the quantities of materials for recycling, reuse, disposal or storage. This is in accordance with a wide range of requirements including safety and sustainability policies.

P116 The SDP is assessing sites for the potential initial dismantling of submarines and the storage of the resulting ILW. Devonport Dockyard and Rosyth Dockyard have been identified as candidate sites for initial dismantling. There are a number of generic options under consideration for storage of ILW arising from initial dismantling. These generic options include storage on existing sites owned by the MOD, the NDA, or industry. The selection process is ongoing and includes a strategic environmental assessment. Further information can be obtained from:

www.mod.uk/submarinedismantling .



[1]In some cases fuel is removed following a period of storage afloat.

Figure 5: Routes to End Points for Sites, Facilities and Submarines

5. Theme 4: Radioactive Waste

5.1 Description

P117 Radioactive waste is material that is either radioactive by itself, or is contaminated by radioactivity, for which no further use is envisaged (reference 13).

P118 The DNP produces a range of radioactive wastes including ion exchange resins, activated metal components, filters and soft and hard wastes. The MOD has VLLW, LLW and ILW but currently does not have HLW.

P119 If MOD irradiated fuel is reprocessed to chemically recover the residual 235-U, the waste arisings from this process would be HLW. If MOD irradiated fuel is conditioned for disposal to a GDF this is likely to be as ILW and/or HLW.

5.2 Scope

P120 The Strategy covers the MOD's current and future radioactive wastes that arise from the DNP.

5.3 Strategy

P121 To ensure that the generation of radioactive waste is minimised, the MOD will apply the waste hierarchy approach presented in Figure 6 overleaf

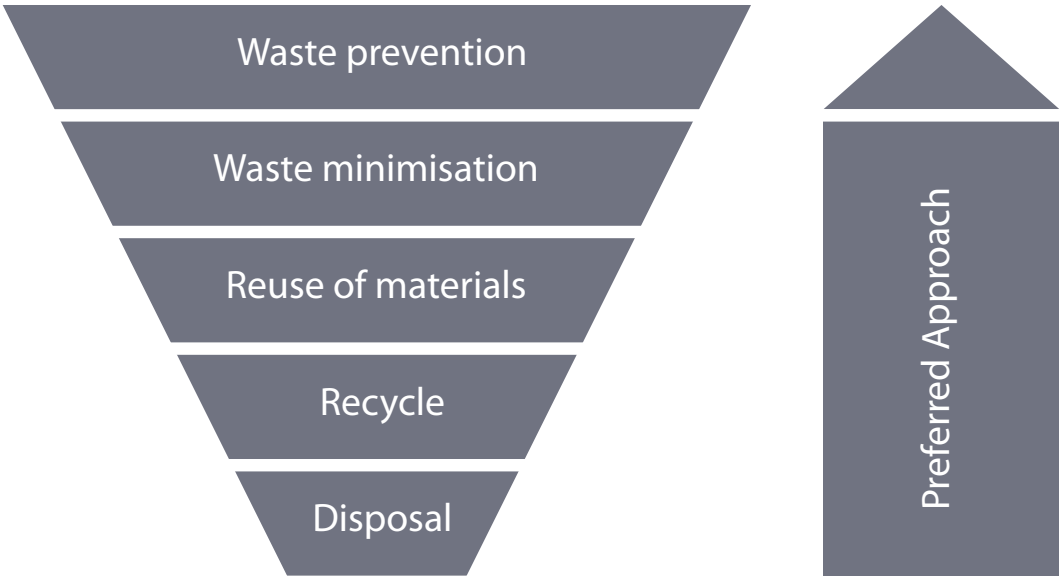


Figure 6: Summary of the Waste Hierarchy

P122 This approach will ensure that:

- Where practicable the generation of waste will be prevented or reduced by design or at source. The MOD will minimise waste by the appropriate design and operation of processes, equipment, and techniques.

- The MOD will consider whether materials can be reused or recycled where appropriate to reduce disposal volumes. Processing used materials into new products reduces the consumption of raw materials, energy, and the need for 'conventional' waste treatment and disposal methods.

- Waste will only be consigned for permanent disposal if reuse or recovery is not reasonably practicable. Waste characterisation, sorting and segregation, volume reduction, decay storage and surface decontamination are all methods that will be used to manage wastes for disposal. Disposal routes for MOD radioactive wastes following application of the waste hierarchy are shown in Figure 7.

P123 After the application of the waste hierarchy, LLW is consigned to a disposal facility at the earliest opportunity, according to UK LLW strategy (reference 5). Some wastes with very low levels of activity can be classified as VLLW or exempt and can be treated accordingly. ILW is safe and securely stored awaiting decay to LLW or availability of a GDF.

P124 The MOD will continue to ensure that all stored waste is safe and secure. Radioactive wastes will be packaged in a form that is physically and chemically stable. Storage is to be robust against delay in a GDF capability.

P125 The wastes will be characterised to determine the appropriate methods for storage and disposal. A variety of techniques will be adopted depending on the waste form, radionuclides involved, and level of detail and accuracy required. Significant opportunities exist to work with the NDA to ensure the application of best practice.

P126 The MOD will ensure that its nuclear wastes are classified and treated to optimise the use of UK facilities. LLWR (and a GDF when built) are recognised as UK assets to be used appropriately.

P127 Decommissioning activities will produce radioactive and non-radioactive wastes. For reasons including practicality and value for money, radioactive and non-radioactive wastes will be segregated and managed in a manner consistent with the waste hierarchy.

5.4 Strategy Development

P128 The MOD will work with the NDA and regulators to ensure that MOD specific requirements are considered in the NDA's waste solutions and acceptance criteria for disposal facilities.

P129 The majority of MOD owned ILW is currently stored at the site where it was generated. The MOD will seek the optimum solution for the storage of ILW that protects people and the environment in a safe and cost effective manner that may include exploring opportunities for shared storage.

P130 The MOD will work with its sites and waste producers to share best practice on waste treatment and storage consolidation solutions. It is possible that the MOD's need for management and disposal facilities would continue beyond the life of the current and planned future facilities. The MOD will work with the relevant authorities for the duration of the DNP.

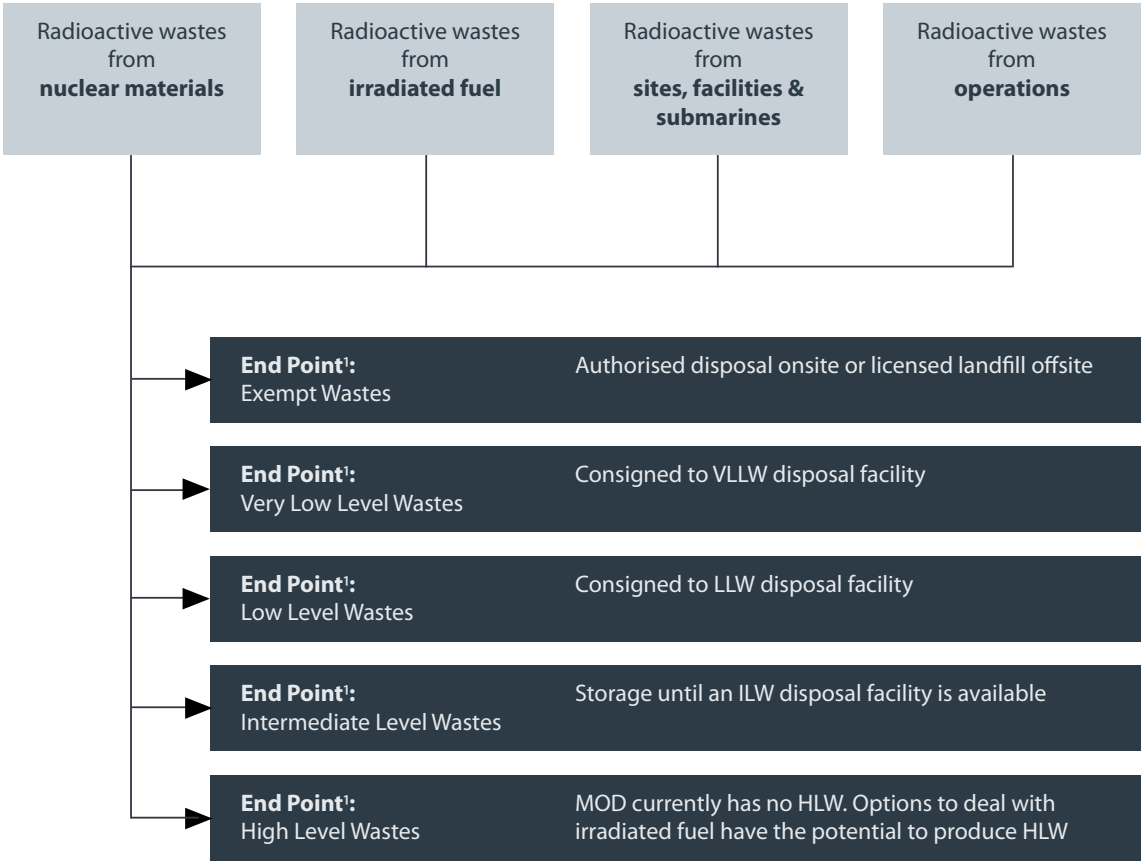


Figure 7: Disposal Routes for MOD Radioactive Wastes

1 These are the disposal end points for MOD radioactive wastes. There are other end points that are assessed through application of the waste hierarchy.

6. Enablers

P131 Delivery of this Strategy is only possible if it is based on well defined responsibilities and strategies that deal with specific issues. These are called enablers and they are used to augment the individual theme strategies. The MOD will continue to develop these enablers, which are consistent with the NDA's "critical enablers".

6.1 Health and Safety, Security and Safeguards, Environment and Sustainability, and Quality

P132 The MOD puts both public and worker safety first, protects the environment, and addresses security issues. Strategy development and implementation will be consistent with MOD policies, legislation, and wider Government strategies e.g. sustainable development.

6.2 People, Skills and Capability

P133 Available Suitably Qualified and Experienced Personnel (SQEP) are essential to the MOD and its industrial partners and supply chain to deliver successful liability management, and decommissioning and disposal projects. The MOD's SQEP initiatives support the development and implementation of this Strategy.

6.3 Funding

P134 Expenditure on managing the MOD's nuclear liabilities will be appropriately prioritised within the Defence budget. Funding for strategy development and implementation is not reliant on income from the realisation of assets' values.

6.4 Intrinsic Value

P135 The MOD will seek solutions that give the best value for money for the UK taxpayer whilst being consistent with Government policies and constraints. The MOD will appropriately investigate the value of liability materials and where possible will realise their potential value. The MOD will not condition materials into a form that would make the subsequent extraction of the valuable components difficult or expensive unless there is a safety or security requirement to do so.

6.5 Information and Knowledge Management

P136 The MOD recognises the long programme timescales associated with implementation of this strategy; the MOD's system of information and knowledge management is essential for the effective retention of information and for maintaining continuity between projects.

6.6 Competition, Contracting and Incentivisation, Supply Chain Development

P137 The development and maintenance of the services that the MOD's industrial partners and the MOD's supply chain provide is of critical importance to the effective delivery of decommissioning and disposal. The MOD's performance programme initiatives support the development and implementation of this strategy.

6.7 Socio-economics, Public and Stakeholder Engagement and Communications

P138 The MOD's decommissioning and disposal activities have potential to be of concern to the communities in which they take place. The MOD will address this in accordance with established policies and practices. The MOD understands the importance of these activities to local communities and will consider public engagement on a case by case basis taking account of Government policy and environmental and planning laws. The MOD will support the NDA on public consultation on issues that relate to the DNP.

6.8 International Relations

P139 The MOD is addressing nuclear liability management issues that are similar to those being considered by other nations. UK Defence information has a substantial security aspect, but this does not preclude the potential for beneficial international collaborations. The MOD will develop international relations to explore possible opportunities for collaboration or for sharing experiences.

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8. Abbreviations and Glossary

8.1 Acronyms and Abbreviations

ALARP	As Low As Reasonably Practicable
AWAF	Active Waste Accumulation Facility
AWE	Atomic Weapons Establishment
BAT	Best Available Technique
DfT	Department for Transport
DNSR	Defence Nuclear Safety Regulator
DRDL	Devonport Royal Dockyard Limited
EA	Environment Agency
GDF	Geological Disposal Facility
HAW	Higher Activity Waste
HLW	High Level Waste
HMNB	Her Majesty's Naval Base
HSE	Health and Safety Executive
ILW	Intermediate Level Waste
LLW	Low Level Waste
LLWR	Low Level Waste Repository
MDA	The 1958 US/UK Mutual Defense Agreement

MOD	Ministry of Defence
MOX	Mixed OXide fuel
NDA	Nuclear Decommissioning Authority
NIA	Nuclear Installations Act (1965)
NII	Nuclear Installations Inspectorate
NPT	Non Proliferation Treaty
NRTE	Naval Reactor Test Establishment (VULCAN)
ONR	Office for Nuclear Regulation
PSA	Polaris Sale Agreement
RRDL	Rosyth Royal Dockyard Limited
RRMPOL	Rolls Royce Marine Power Operations Ltd
SDP	Submarine Dismantling Project
SEPA	Scottish Environment Protection Agency
SQEP	Suitably Qualified and Experienced Personnel
U-235	Uranium-235
U-238	Uranium-238
VLLW	Very Low Level Waste
WAC	Waste Acceptance Criteria
WIF	Wet Inlet Facility

8.2 Glossary

1958 US – UK Mutual Defense Agreement (MDA)

The 1958 US/UK MDA is a bilateral agreement between the United States and the United Kingdom for the exchange of information and materiel for mutual defence purposes.

Activated

A material that has become radioactive through changes to the material at an atomic level due to the effect of nuclear particles is referred to as 'activated' for example nuclear reactor components can be activated by neutrons from the fission reaction.

As Low As Reasonably Practicable (ALARP)

To satisfy this principle, measures necessary to reduce risk must be taken until the cost of the measures whether in money, time or trouble, is disproportionate to the reduction of risk.

Authorisation

Authorisation is the MOD nuclear safety regulatory system operated by DNSR. Authorisation by DNSR is akin to nuclear site licensing by the newly formed ONR (previously HSE/NII). DNSR's Authorisation Conditions mirror the ONR's nuclear site Licence Conditions.

Separately, SEPA grant authorisations under Radioactive Substances Act 1993.

Authorisee

DNSR's regulation is focussed on the individuals who are in effective day-to-day control of Defence nuclear activities. These are termed Authorisees, and subject to the process of Authorisation.

Atomic Weapons Establishment (AWE)

See Annex A.

Best Available Technique (BAT)

BAT means to prevent and, where that is not practicable, minimise waste generation and discharges to the environment. The application of BAT is broadly equivalent to best practicable means and best practicable environmental option (BPEO), which were terms previously used in England and Wales and still in use in Scotland.

Best Practicable Environmental Option (BPEO)

BPEO is a procedure that establishes, for a given set of objectives, the option that provides the most benefits, or the least damage to the environment as a whole, at acceptable cost, in the long term as well as the short term. The options are reviewed through a systematic consultation and decision-making process which emphasises the protection and conservation of the environment. This term is used in Scotland and is broadly similar to the term Best Available Technique, which has replaced BPEO in England and Wales.

Characterisation

Characterisation involves the on-site investigation of a facility to determine the extent and types of contamination present. This information is used to establish the need for further treatment, conditioning, or its suitability for further handling, processing, storage, or disposal.

Condition/Conditioning

Conditioning involves transforming radioactive waste into a form that is suitable for handling, transportation, storage, and disposal. This might involve immobilisation of radioactive waste, placing waste into containers or providing additional packaging (reference 14).

Committee on Radioactive Waste Management (CoRWM)

CoRWM is a group of independent experts appointed by Government. CoRWM provides independent scrutiny and advice to the UK Government on the long term management of higher activity radioactive wastes.

Decay Storage

Decay storage is the storage of radioactive materials to allow the natural process of radioactive decay to occur, which results in a less

radioactive material. Decay storage is particularly suitable for materials with short half lives.

Decommissioning

Decommissioning is a staged process during which a nuclear facility (or a submarine), after normal operations have ceased, is taken out of service including full or partial dismantling of facilities and their contents. It may include decontamination of buildings that are not to be dismantled and the remedial treatment or restoration of the land under and around the facility.

Defence Nuclear Programme (DNP)

The DNP comprises the nuclear submarine programme (including nuclear propulsion aspects), and the nuclear weapon programme.

Defence Nuclear Safety Regulator (DNSR)

DNSR is the MOD regulator for nuclear and radiological safety and environmental protection in the DNP. In line with equivalent statutory practice in the civil sector, emanating from the Nuclear Installations Act, DNSR operates a non-prescriptive, goal setting, authorisation regime.

Department for Transport (DfT)

DfT regulates matters relating to civil nuclear transport. It is the Government's intention that the Radioactive Materials Transport Team will be incorporated into the ONR in 2011.

Depleted Uranium

Naturally occurring uranium comprises U-238 and U-235; the proportion of U-235 is 0.7%. If the proportion of U-235 is reduced, then it is called depleted uranium.

Devonport Royal Dockyard Limited (DRDL)

See Annex A.

Disposal

In radioactive waste management the term 'disposal' is used to mean placing radioactive waste in an appropriate facility with no intention of retrieving it.

End Point

The end point of a liability is the point where the recyclable and reusable contents of a liability have been recovered and utilised where reasonably practicable and the waste finally disposed of.

Environment Agency (EA)

The EA is the environmental regulator for England and Wales. It is an executive non-departmental public body responsible to the Secretary of State for Environment, Food and Rural Affairs and an Assembly sponsored public body responsible to the National Assembly for Wales. The EA has broad environmental regulatory interests but in the context of this Strategy oversees the disposal of radioactive waste by granting site permits to the operators who run them.

Exempt Waste

Exempt wastes are wastes that contain naturally occurring or extremely low levels of radioactivity (below VLLW levels). They are controlled by Exemption Orders under Radioactive Substances Act 1993/ Environmental Permitting Regulations 2010 (references 12 and 14). The Exemption Order regime is currently under review.

Fissile Material

Fissile material is material that is capable of sustaining a chain reaction of nuclear fission with low energy neutrons.

Geological Disposal Facility (GDF)

A management option involving the emplacement of radioactive waste in an engineered underground geological facility or repository, where the geology (rock structure) provides a barrier against the escape of radioactivity. There is no intention to retrieve the waste once the facility is closed.

Hazard

The potential for harm arising from an intrinsic property or disposition of something to cause detriment.

High Level Waste (HLW)

HLW is radioactive waste that generates enough heat to significantly increase its temperature and the temperature of its surroundings. This means that heat dissipation has to be taken into account when designing storage and disposal facilities.

Higher Activity Waste (HAW)

HAW is a term that encompasses HLW, ILW and some LLW that is not suitable for disposal in the LLWR.

Intermediate Level Waste (ILW)

ILW has radioactivity levels exceeding the upper boundaries for LLW but which do not need heating to be taken into account in the design of storage or disposal facilities.

International Atomic Energy Agency (IAEA)

The IAEA is an independent intergovernmental, science and technology-based organisation that is part of the United Nations. This serves as the global focal point for nuclear cooperation. The IAEA works with its member states and multiple partners worldwide to promote safe, secure, and peaceful nuclear technologies.

International Safeguards

International Safeguards is the IAEA's system to verify that nuclear material is not being diverted for use in nuclear weapons or other explosive devices from nominally peaceful applications.

Ion Exchange Resin

Ion exchange resin is an insoluble polymer with an electrically charged surface. It is used to remove radioactive material from a fluid.

Irradiated

An item becomes irradiated when it is exposed to radiation and altered at atomic level.

Irradiated Fuel

MOD submarine fuels that have been produced and irradiated for the purpose of nuclear submarine propulsion including prototype and research assemblies.

Isotope

Isotopes occur when an element's atoms exist with different numbers of neutrons. As a result, an element's isotopes differ in mass. This difference in mass allows isotopes to be separated. For example, U-235 and U-238 are different isotopes of uranium.

Isotopic Composition

Isotopic composition describes the isotopes present and their relative proportion in an element.

Licensee

The body corporate that has been granted a Nuclear Site Licence under the Nuclear Installations Act 1965 (as amended), which permits it to carry out a defined scope of activities on a delineated site.

Licensing

Licensing is the process by which a site is granted a Nuclear Site Licence by HSE under the Nuclear Installations Act 1965 (as amended).

Low Level Waste (LLW)

LLW contains radioactive materials other than those suitable for disposal with ordinary refuse, and have radiation levels that fall within defined bounds. These are wastes that can be accepted for authorised disposal at the LLWR.

Mixed OXide Fuel (MOX)

Fuel in a nuclear reactor includes a proportion of U-238 that can be turned into plutonium. Plutonium is fissile and its fission contributes a significant proportion of the reactor's power.

At the end of its life nuclear fuel has a quantity of unused uranium and plutonium. These materials can be recovered through reprocessing and subsequently mixed with new uranium to make fuel. Since this fuel will include uranium and some plutonium it is called MOX.

Nuclear Non-Proliferation Treaty (NPT)

An international treaty to limit the spread of nuclear weapons and includes control on the use and movement of nuclear materials.

Nuclear Decommissioning Authority (NDA)

The NDA was established in 2005 as a non-departmental public body to ensure that the UK's civil public sector nuclear legacy sites are decommissioned and cleaned up.

Nuclear Installations Inspectorate (NII)

Before 1 April 2011, the NII, on behalf of the HSE, regulated nuclear safety and radioactive waste management in accordance with applicable legislation e.g. Health & Safety at Work Act (1974), Nuclear Installations Act (1965), and Ionising Radiations Regulations (1999). The NII administered the legal licensing regime stipulated by the Nuclear Installations Act. From 1 April 2011, the NII along with other statutory bodies has been incorporated into the new Office of Nuclear Regulation.

Nuclear liabilities

The MOD's nuclear liabilities are the nuclear materiel used in the DNP for which the MOD is ultimately responsible. These liabilities are: the nuclear materials that are no longer required for Defence purposes; the irradiated fuel that has fulfilled its purposes for submarine propulsion; the site, facilities, and submarines; and the resultant radioactive wastes.

Nuclear Submarine

A submarine that uses nuclear propulsion. Some nuclear submarines carry nuclear weapons, others only carry conventional weapons.

Nuclear Submarine Programme

The nuclear submarine programme manages nuclear submarines, including the nuclear propulsion aspects, from initial design and manufacturing through support in service to decommissioning, dismantling, and disposal.

Nuclear Weapons Programme

The nuclear weapon programme manages all aspects of nuclear weapons from initial design and manufacturing through support in service, to decommissioning, dismantling, and disposal.

Office for Nuclear Regulation (ONR)

Defence nuclear activities are regulated by the newly formed ONR, previously the Health and Safety Executive (HSE) Nuclear Installations Inspectorate (NII). The nuclear safety performance of all operators of UK sites licensed under the Nuclear Installations Act 1965 (as amended) is regulated by the ONR, formed on 1st April 2011 as an Agency of the HSE. The ONR incorporates all the functions that were previously delivered by HSE's Nuclear Directorate, including the NII and Office of Civil Nuclear Security. It is the Government's intention that from late 2011, it will also include the DfT's Dangerous Goods Division that deals with regulating civil nuclear transport.

Plutonium

Plutonium does not occur naturally but is created in a nuclear reactor from U-238 There are numerous isotopes of plutonium, some of which are fissionable. Its chemical symbol is Pu. See also Mixed OXide Fuel (MOX).

Radioactive Waste

Radioactive waste is material that is either radioactive by itself or is contaminated by radioactivity, for which no further use is envisaged (reference 14).

Rosyth Royal Dockyard Limited (RRDL)

See Annex A.

Risk

A risk is the chance that someone or something is adversely affected in a particular manner by a hazard.

Scottish Environment Protection Agency (SEPA)

SEPA is Scotland's environmental regulator; a non-departmental public body, accountable through Scottish Ministers to the Scottish Parliament. SEPA has the responsibility to grant authorisations under the Radioactive Substances Act 1993 and permits under other environmental legislation to regulate the treatment, storage and disposal of radioactive and non-radioactive wastes.

Storage

Storage is one of the steps in the management of HAW. Currently, such waste is stored in surface stores. Due to the time required to implement geological disposal, HAW will need to be stored for decades. During this period the waste will remain retrievable and in a good condition suitable for final disposal. Storage has been demonstrated to be safe and effective.

Submarine Dismantling Project (SDP)

The MOD's SDP aims to develop a solution for the disposal of the UK's nuclear submarines following a period of storage afloat.
The project will include the provision of facilities to dismantle 27 defuelled nuclear submarines of past and current classes.

Uranium

Uranium is a metallic element with atomic number 92. There are six uranium isotopes; the most common are uranium-235 and uranium-238 that occur in nature and can be used to make reactor fuel. The chemical symbol for uranium is U. Natural uranium is 0.7% U-235 and 99.3% U-238. See also Mixed Oxide Fuel (MOX).

Very Low Level Waste (VLLW)

VLLW is a category of waste that contains significantly less radioactivity than LLW. There are a number of strict criteria that the waste must meet including: the radioactive elements present, the volume, and the source of the waste. VLLW can be disposed to landfill where the landfill site and the waste producer are permitted to do so by the relevant environmental regulator.

Waste Acceptance Criteria (WAC)

WAC are the criteria that a waste package must comply with ito be accepted into a disposal facility such as the LLWR or a GDF.

Waste Hierarchy

The waste hierarchy describes the way to manage waste by first reducing the amount of waste produced, then by reusing wastes, then recycling wastes, then finally disposing responsibly of the wastes that are left. See Figure 6.

Wet Inlet Facility (WIF)

The WIF is a dedicated facility for the underwater storage of MOD irradiated fuel at NDA Sellafield.

Annex A: Key Defence Nuclear Programme Sites

Atomic Weapons Establishment (AWE) Aldermaston and Burghfield

BAE Systems Submarine Solutions, Barrow-in-Furness

Her Majesty's Naval Base (HMNB) Clyde

Her Majesty's Naval Base (HMNB) Devonport

Devonport Royal Dockyard

Rosyth Royal Dockyard

Rolls Royce Marine Power Operations Limited

VULCAN Naval Reactor Test Establishment

A.1 Atomic Weapons Establishment (AWE) Aldermaston and Burghfield

Introduction

The AWE in Berkshire conducts research, design, and manufacturing activities in support of the UK's nuclear warhead stockpile. It retains the capability for the design and implementation of potential replacement warheads. AWE provides safe and secure storage for plutonium and enriched uranium.

The Aldermaston site (formerly a wartime airfield) was established in 1950 as the principal research, design, and manufacturing facility supporting the UK's nuclear weapons programme. It is now a sophisticated centre providing advanced research, design, and manufacturing facilities.

The Burghfield site was a royal ordnance (munitions) factory that was redeveloped in 1954 to support the nuclear weapons programme. It formally became part of AWE in 1987. The Burghfield site is responsible for the complex final assembly and maintenance of the UK's nuclear warheads while in service, as well as their decommissioning.

Both AWE Aldermaston and Burghfield are licensed by the ONR (previously NII) under the Nuclear Installations Act (NIA) (1965). Both the ONR and the EA regulate AWE in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Environmental Permitting Regulations (2010). DNSR authorises and regulates specific nuclear activities, primarily those exempt from the licensing requirement of the NIA.

Decommissioning Related Activities

AWE is undertaking a major refurbishment programme to replace obsolete facilities and supporting equipment. A number of the radioactive facilities are being removed from buildings and some buildings are being decommissioned and demolished. Decommissioning activities at AWE are being managed as a coherent programme.

AWE is implementing a portfolio of ILW conditioning projects that will enable ILW to be stored in a safe and secure condition pending availability of a GDF.

Sharing of best practice and investigation of opportunities are important activities that are undertaken to improve safety, reduce costs and reduce timescales.

Ownership and Operator

AWE is MOD owned but since 1993 has been managed under a Government Owned Contractor Operated arrangement. The current operator is AWE Management Ltd, a consortium comprising Lockheed Martin Corporation, Jacobs Engineering Group Inc, and Serco Group plc.

End Point

AWE will continue to support the DNP for the foreseeable future.

A.2 BAE Systems Submarine Solutions, Barrow-In-Furness

Introduction

The BAE Systems Submarine Solutions facility at Barrow-in-Furness, Cumbria provides shipbuilding facilities for both the submarine and the surface fleet.

The Vanguard class of submarine was built at Barrow and the Astute class is currently being built there. It is planned that the future Trident successor submarines will also be built at Barrow.

The site has shipbuilding roots dating from 1871. Britain's first nuclear powered submarine HMS Dreadnought (commissioned in 1963) and Britain's first Polaris-armed ballistic nuclear powered submarine HMS Resolution (commissioned in 1967) were both built in Barrow.

The submarine facilities are centred on the Devonshire Dock Hall that provides covered facilities (the largest in Europe) for the construction and assembly of submarines.

The Barrow site is licensed by the ONR (previously NII) under the NIA(1965) for nuclear fuel storage and handing. Both the ONR and the EA regulate BAE Systems Submarine Solutions, Barrow, in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Environmental Permitting Regulations (2010). DNSR authorises and regulates specific nuclear activities, primarily those exempt from the licensing requirement of the NIA; these include initial testing of the nuclear reactor.

Decommissioning Related Activities

The Barrow site contains only a small number of facilities that constitute nuclear liabilities and the radioactive inventory at the time of decommissioning is expected to be low. These facilities support the production of nuclear submarines; no decommissioning is currently planned.

Ownership and Operator

The site is commercially owned; BAE Systems Submarine Solutions is the site operator.

End Point

The Barrow site will continue to support of the DNP for the foreseeable future. The end point will be at the owner's discretion (subject to contracts) but is likely to be continued Defence, industrial, or maritime use.

A.3 Her Majesty's Naval Base (HMNB) Clyde

Introduction

HMNB Clyde, north west of Glasgow, Scotland, provides facilities for the operation, maintenance, and repair of all classes of UK submarine.

HMNB Clyde is the operational base for the UK's strategic nuclear deterrent. The Naval Base comprises separate sites at Faslane and Coulport.

The Faslane site provides a range of nuclear submarine support capabilities including facilities for the maintenance and repair of submarines. The Coulport site undertakes the storage, processing, maintenance and issue of the Trident Weapon System and the ammunitioning of all submarine embarked weapons. HMNB Clyde is the base port for the Vanguard class and the Astute class of submarine, and will be the base port for all remaining Trafalgar class submarines from 2018.

Nuclear activities on HMNB Clyde are authorised and regulated by DNSR. The ONR (previously NII) regulate the Naval Base in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999). SEPA regulate the Naval Base by agreement in accordance with the Radioactive Substances Act (1993).

Decommissioning Related Activities

The majority of facilities will remain in operation until at least 2030. The effluent treatment barge is in the process of being decommissioned. The Radioactive Effluent Disposal Facility and Active Processing Facility will be decommissioned following the commissioning of replacement facilities.

Ownership and Operator

HMNB Clyde is owned and operated by the MOD. The Naval Base is supported by the principal Clyde operating contractor, Babcock Marine Ltd.

End Point

HMNB Clyde will continue to support the DNP for the foreseeable future.

A.4 Her Majesty's Naval Base (HMNB) Devonport

Introduction

HMNB Devonport in Plymouth, Devon is home to some of the Royal Navy's Trafalgar class nuclear submarines although all Royal Navy submarines will be base ported at HMNB Clyde from 2018. The Naval Base can be used by any of the Royal Navy's submarines for visits, replenishment of stores, planned maintenance operations, and for defect repair.

The Naval Base is part of the Devonport site, and has been providing support to the Royal Navy since the 1690s. The site is jointly shared with Babcock Marine (Devonport), a division of the Babcock International Group. Nuclear activities on the Naval Base are conducted on the tidal submarine berths, supporting facilities, and the basin facilities are used for berthing out-of-service nuclear submarines. Ten out-of-service submarines are currently stored afloat at HMNB Devonport.

Nuclear activities on HMNB Devonport are authorised and regulated by DNSR. Both the ONR (previously NII) and the EA regulate the Naval Base in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Environmental Permitting Regulations (2010).

Decommissioning Related Activities

The Submarine Dismantling Project will address nuclear submarines that have left service and are stored at Devonport.

The MOD's decommissioning liabilities at the tidal berths is small and limited to supporting facilities, some of which are held in a care and maintenance regime pending decommissioning.

The potential for consolidation and optimisation of nuclear and radiological facilities on the Naval Base and dockyard sites is being examined. Decommissioning activities at the Naval Base and the dockyard will be coordinated and prioritised to optimise the reduction of risk across both sites.

Ownership and Operator

HMNB Devonport is owned and operated by the MOD and is supported by Babcock International Group plc Marine & Technology Division.

End Point

HMNB Devonport will continue to support the DNP for the foreseeable future.

A.5 Devonport Royal Dockyard

Introduction

Devonport Royal Dockyard in Plymouth, Devon provides the Royal Navy's repair and refitting facilities for the UK's nuclear submarines. These facilities include submarine refuelling capability.

The dockyard has been providing support to the Royal Navy since the 1690s. It is the only site in the UK equipped to conduct nuclear submarine refits including those for the Vanguard class.

The nuclear site at Devonport Dockyard is licensed to Devonport Royal Dockyard Ltd (DRDL) by the ONR (previously NII) under the NIA (1965). Both the ONR and the EA regulate DRDL in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Environmental Permitting Regulations (2010). DNSR authorises and regulates specific nuclear activities, primarily those exempt from the licensing requirement of the NIA.

Decommissioning Related Activities

There are a number of nuclear facilities on site that are maintained as part of DRDL's ongoing support to the DNP. However, there are a number of redundant facilities that will be decommissioned. They include:

- A storage facility for new fuel and a refuelling test and training rig – no longer required as submarines are now designed to be fuelled for life.
- A storage facility for the temporary storage of irradiated fuel removed from submarines prior to consignment to Sellafield. A new facility has been built to deliver this capability.
- A facility for the decontamination of submarine reactor primary circuits – a new facility has been built that now delivers this capability.
- Two obsolete Alternative Core Reactor Cooling units for decay heat removal and chemistry control.

The potential for consolidation and optimisation of nuclear and radiological facilities on the Naval Base and dockyard sites is being examined. Decommissioning activities at the Naval Base and the dockyard will be coordinated and prioritised to optimise the reduction of risk across both sites.

Devonport Dockyard has been identified by the SDP as a candidate site for initial dismantling of submarines. Initial dismantling is the process whereby the radioactive materials are removed from the submarine, leaving the rest of the submarine free to be dismantled via conventional ship recycling at a separate ship recycling facility. Initial submarine dismantling activities could take place at Devonport, Rosyth or a combination of both sites. ILW from submarine dismantling activities could be stored at a number of possible sites including existing nuclear licensed sites owned by the MOD, the NDA, or industry. The site selection process is ongoing, and includes a Strategic Environmental Assessment and public consultation.

Ownership and Operator

Devonport Dockyard is commercially owned; DRDL (a subsidiary of Babcock International Group plc) is the site operator.

End Point

The site will continue to support the DNP for the foreseeable future. The site end point will be at the owner's discretion (subject to contracts) but is likely to support ongoing non-nuclear maritime Defence and industrial activities.

A.6 Rosyth Royal Dockyard

Introduction

Rosyth Royal Dockyard to the north west of Edinburgh in Fife primarily undertakes refitting of Royal Navy surface vessels and will assemble the future aircraft carriers.

The dockyard first started construction in 1909 and has fulfilled a number of roles in support of Defence including submarine maintenance. In-service submarine maintenance activities have now ceased but seven out-of-service defuelled nuclear submarines are stored afloat at Rosyth.

Part of the site remains licensed to Rosyth Royal Dockyard Ltd (RRDL) by the ONR (previously NII) under the NIA (1965). Nuclear work on the licensed site has reduced significantly in the past 10 years and is now largely confined to the Active Waste Accumulation Facility (AWAF). This facility was purpose built for the safe and secure storage of legacy ion exchange resin from submarine operation and maintenance activities. Both ONR and SEPA regulate RRDL in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Radioactive Substances Act (1993). DNSR authorises and regulates specific nuclear activities, primarily those exempt from the licensing requirement of the NIA.

Decommissioning Related Activities

The Submarine Dismantling Project will address nuclear submarines that have left service and are stored at Rosyth Dockyard.

The main site restoration programme has completed. Some radioactive facilities remain, to be used to support the remaining programme. All liabilities that are not required have been decommissioned.

A study is underway to determine the best practicable environmental option for the disposal of the ion exchange resin stored in the AWAF and its eventual decommissioning.

Further remediation projects are ongoing.

Rosyth Dockyard has been identified by the SDP as a candidate site for initial dismantling of submarines. Initial dismantling is the process whereby the radioactive materials are removed from the submarine, leaving the rest of the submarine free to be dismantled via conventional ship recycling at a separate ship recycling facility. Initial submarine dismantling activities could take place at Rosyth, Devonport or a combination of both sites. ILW from submarine dismantling activities could be stored at a number of possible sites including existing nuclear licensed sites owned by the MOD, the NDA, or industry. The site selection process is ongoing, and includes a Strategic Environmental Assessment and public consultation.

Ownership and Operator

Rosyth nuclear site is owned by and licensed to RRDL and operated by Babcock International Group plc. Marine and Technology Division.

End Point

Decommissioning of the remaining nuclear infrastructure and removal of the AWAF will enable site delicensing subject to decisions that are taken on the SDP. The site will continue to support ongoing non-nuclear maritime Defence and industrial activities.

A.7 Rolls Royce Marine Power Operations Limited

Introduction

Rolls Royce Marine Power Operations Limited (RRMPOL), a subsidiary of Rolls Royce plc, operates two nuclear licensed sites in Derby. The sites are used for manufacture and testing of nuclear reactor fuel, reactor cores, and other associated nuclear propulsion components for the Royal Navy's submarines.

The RRMPOL manufacturing site was licensed in 1960 and undertakes the processing of uranium fuel and the fabrication of submarine nuclear reactor cores. The Neptune site accommodates a zero power reactor used to test materials to support the design of future submarine reactors.

The RRMPOL nuclear sites are licensed and regulated by the ONR (previously NII) under the NIA (1965). Both the ONR and the EA regulate RRMPOL in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999) and Environmental Permitting Regulations (2010).

Decommissioning Related Activities

It is planned that the current submarine reactor manufacturing facility will undergo refurbishment or regeneration to sustain the UK capability to manufacture submarine reactors. It is planned that the work will take place entirely within the established nuclear licensed site and the refurbished facility will occupy a similar area.

Ownership and Operator

The site is commercially owned, RRMPOL is the site operator.

End Point

RRMPOL will continue to support the DNP for the foreseeable future. RRMPOL will continue to supply nuclear reactor cores for Astute class submarines and the successor to the Vanguard class.

A.8 VULCAN Naval Reactor Test Establishment

Introduction

The VULCAN NRTE in Thurso, Caithness, Scotland is the site that prototypes naval nuclear reactors for UK submarines.

The first prototype reactor was commissioned in 1963 and become operational in 1965. The current Shore Test Facility was commissioned in 1987 and the prototype reactor is currently proving the design of the latest submarine core.

The VULCAN NRTE site is adjacent to the Dounreay civil nuclear facility that is being decommissioned by the NDA.

Nuclear activities at VULCAN NRTE are authorised and regulated by DNSR. The ONR (previously NII) regulate VULCAN in accordance with applicable legislation e.g. Ionising Radiations Regulations (1999). SEPA regulate VULCAN by agreement in accordance with the Radioactive Substances Act (1993).

Ownership and Operator

The VULCAN NRTE site is owned by the NDA on behalf of the Government and is leased to and operated by the MOD. The site is supported by the principal VULCAN operating contract with Rolls Royce Power Engineering under a Government Owned Contractor Operated arrangement.

Decommissioning Related Activities

VULCAN NRTE will continue operations until such time as it is no longer required to support the nuclear submarine programme; at that point it will be decommissioned and disposal activities undertaken.

End Point

The end point of VULCAN NRTE will be commensurate with the next planned use and decided in agreement with the NDA.

Published by the Ministry of Defence UK

Designed by DMC Secretariat Graphics
Ref - DMC 00307 11/12

Sponsored by DE&S Submarine Chief Engineer Team