Managing Radioactive Waste

Factsheet:// 7

This factsheet describes the radioactive waste that will be created by submarine dismantling. It explains how the waste that cannot be disposed of immediately will be stored until disposal is possible.

Introduction

Radioactive materials must be carefully managed to minimise the risk they pose to people and the environment. After a nuclear powered submarine has been defuelled, there will still be some remaining components which became radioactive while the reactor was operating and need to be disposed of safely.

Types of Radioactive Waste

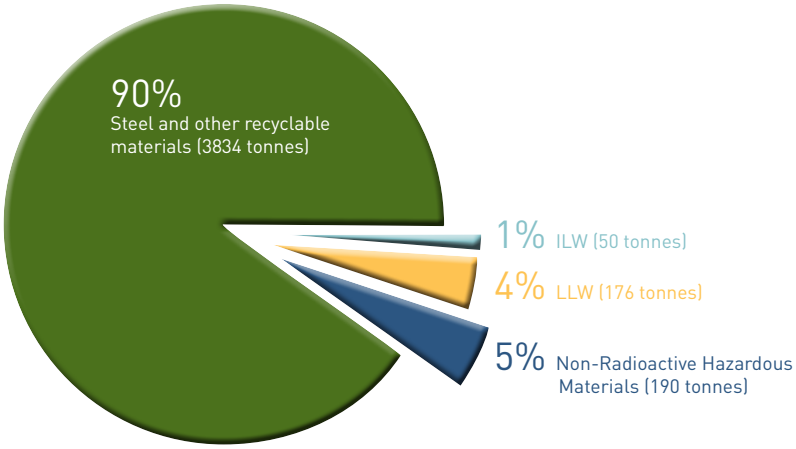
Solid radioactive waste is categorised according to its radioactive content and the heat it produces. Each of these categories is managed in a different way.

- High Level Waste (HLW) is waste in which the temperature may rise significantly as a result of its radioactivity. Most HLW is currently stored at Sellafield in Cumbria. **SDP will not generate any HLW**
- Intermediate Level Waste (ILW) has lower levels of radioactivity than HLW and does not generate sufficient heat for this to have to be taken into account in the design of storage or disposal facilities. There is no disposal route currently available for ILW so it must be stored until the UK's proposed Geological Disposal Facility (GDF)[1] is available.
- Low Level Waste (LLW) has lower levels of radioactivity than ILW. There are existing facilities for the disposal of LLW, such as the LLW Repository in Cumbria.

Waste from defuelled submarines

Around 90% of the materials on the submarines, such as steel and other metals, can be recycled. There will also be some non-radioactive hazardous waste (such as asbestos), which will be disposed of through existing routes, and some other waste materials that cannot be recycled.

The radioactive waste on the defuelled submarines includes LLW, such as contaminated pipework, and ILW, most of which is steel in the Reactor Pressure Vessel that has become radioactive as a result of its exposure to radiation. **There is no HLW in the submarines.** The pie chart below shows the estimated amount of each material or waste resulting from dismantling a Trafalgar Class submarine.



Interim ILW storage

Submarines weigh between 5000 and 16000 tonnes, of which up to 50 tonnes will be ILW (for comparison, a fully-loaded articulated lorry weighs up to 44 tonnes). The total volume of ILW produced from all 27 submarines is expected to be about 0.2% of the UK's total ILW inventory from all sources. For comparison, this is less than 10% of the volume of ILW generated by a single civil nuclear power station over its lifetime[2].

ILW must be stored safely and securely until the proposed GDF is available for its disposal, so SDP must provide interim storage for the ILW from the submarines.

[1] Scottish Government policy for ILW differs from the policy in England and Wales and is for long-term management in near-surface, near-site facilities. This policy is not, however, applicable to waste arising from the decommissioning of out-of-service nuclear submarines.

[2] Based on packaged waste at the point of disposal in the proposed GDF

MINISTRY OF DEFENCE

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Submarine Dismantling Project (SDP)

Fact Sheet

ILW storage for SDP

There are three options for removing the radioactive material from a submarine being considered (these are described in the **factsheet Initial Dismantling**). The type of facility required for interim storage of ILW will depend on the initial dismantling method chosen and the form in which ILW is to be stored. Interim storage facilities are required to be located on secure nuclear licensed or authorised sites, regulated by the appropriate government agencies. The store and its contained packages will be continuously monitored throughout the store's life (up to 100 years) to ensure that they are safe.

Glossary

RC =	Reactor Compartment
RPV =	Reactor Pressure Vessel
Radionuclide =	A radionuclide (or radioisotope) is any chemical element that has an unstable nucleus. This causes the radioactive material to decay and emit radiation.
Half-life =	The time taken for a particular type of radioactive element to decay away by half. Can be a fraction of a second or many thousands of years depending on the element.

Option	Storage (per submarine)	Store size*
Separate RC and store intact 'RC Separation'	• The Reactor Compartment (RC) provides the necessary radiation shielding and containment; no additional packaging would be required other than metal plates welded on to both ends of the RC. Approximately 700 tonnes in weight.	Approx. 11,600m^2
Remove RPV and store intact 'RPV Removal'	• The RPV would be enclosed in an outer package to provide containment and additional shielding. Approximate packaged weight: 80 tonnes.	Approx. 800m^2
Cut-up RPV and store as 'Packaged Waste'	• The ILW would be packaged in approximately six standard containers. • Approximate packaged weight: 72 tonnes.	Approx. 1000m^2

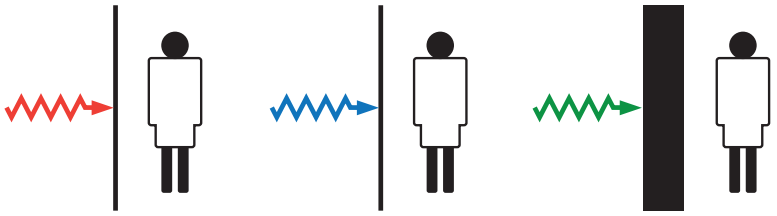
* For comparison, a professional football pitch is about 7,140m^2 and an Olympic swimming pool is about 1250m^2

Impact of Radioactive Decay

The rate and type of decay varies depending on the different radioactive elements present (called radionuclides). The three main radionuclides of interest in the ILW removed from submarines will be Cobalt 60, Nickel 59 and Nickel 63.

Cobalt 60 is a Gamma radiation emitter and it is relatively short-lived, losing half its radioactive energy every 5.27 years (this is called its 'half-life'). This means that it decays relatively quickly so, after a period of interim storage, the gamma radiation, which requires heavy shielding, will have significantly reduced.

Nickel 59 and Nickel 63 are Beta radiation emitters but have much longer half-lives of 76,000 years and 100 years respectively. This means that Beta radiation would take many thousands of years to reduce significantly so, for all practical purposes, a quantity of ILW will always remain but, because beta is less penetrating, it will require progressively less shielding over time.



Alpha radiation can be stopped by paper, clothing etc

Beta radiation can be stopped by a few millimetres of alluminium or a thin piece of lead

Gamma radiation can be stopped by several centimetres of lead or metres of concrete

The proposed Geological Disposal Facility

The UK policy for managing ILW and HLW was developed following a thorough review by a group of independent experts, the Committee on Radioactive Waste Management (CoRWM). CoRWM took the view that geological disposal, where the waste is isolated deep below ground, inside a suitable type of rock to ensure that significant quantities of radiation never reach the surface, was the best available long-term approach. CoRWM also recommended that interim stores should be designed to allow for a period of storage of at least 100 years while geological disposal is being implemented.

The UK Government is taking this policy forward through the 'Managing Radioactive Waste Safely' (MRWS) programme. **Further information is available at: mrws.decc.gov.uk**