

Wastes from Defence Activities

Overview

Defence activities produce radioactive wastes that are broadly similar in type to those produced from civilian nuclear power. The total amount of waste produced is, however, much less.

The largest volumes of radioactive waste arise within the Royal Navy during operation, maintenance and decommissioning of nuclear powered submarines.

Other radioactive wastes are produced during activities to maintain the UK's strategic nuclear weapons capability, and from clean-up of disused military sites.

Submarine operation

All of the current fleet of Royal Navy submarines are powered by pressurised water nuclear reactors (PWRs). These reactors work in much the same way as a civil nuclear power reactor, but on a smaller scale and using more highly enriched nuclear fuel. These differences are reflected in the wastes that are produced.

Radioactive wastes are produced during normal operations. These include items such as used protective clothing, ion exchange resins used to decontaminate liquids and redundant equipment.

Additional wastes are produced during the periodic refit of the submarines and refuelling of the reactors.



Image: The nuclear-powered submarine HMS Vengeance at Devonport dockyard during a periodic refit and refuelling operation. Source - Ministry of Defence



Submarine Decommissioning

Once a submarine has reached the end of its operational lifespan it will need to be decommissioned.

Decommissioning is undertaken in stages, with the first stage being defuelling. Spent fuel from submarines is removed and sent to Sellafield where it is stored in a cooling pond for several years.

The reactor compartments are the only part of the submarine structure to contain radioactive materials. During operations, the metallic parts of the reactor compartment will become radioactive due to neutron activation.

Out of service nuclear powered submarines are kept at the naval dockyards at Rosyth in Fife and Devonport near Plymouth. It is proposed that these submarines will be dismantled and the reactor compartments will be disposed as radioactive waste.

Nuclear deterrent

The UK has maintained a nuclear deterrent for over 70 years. During this time there have been many changes in the number, design and manufacturing techniques of nuclear weapons. Operational radioactive waste is produced from the manufacture and maintenance of nuclear weapons, as well as the dismantling of old ones. The radioactive waste is broadly similar to that produced in civil nuclear operations (e.g. PPE and filters), but a much smaller volume.

A more significant volume of waste has been produced from the management and decommissioning of old production facilities at the Atomic Weapons Establishment (AWE) site in Berkshire. As with the civil nuclear industry, the understanding of radioactivity and contamination migration has evolved over time, with earlier facility design and management practices resulting in a greater legacy in need of careful decommissioning and demolition.

Defence wastes are typically plutonium and uranium contaminated and have not been irradiated in a reactor, so unlike civil wastes, the majority has no significant gamma component (e.g. from fission products). For this reason, maintaining suitable containment of the waste is more important than shielding, particularly due to the high radiological and chemical toxicity of plutonium.

Several programmes of work are being undertaken at AWE to manage both the legacy and future operational requirements. In recent years, AWE has managed the

clean-up and removal of redundant buildings, including the removal of redundant effluent treatment plants and radiochemistry laboratories, as well as other support buildings no longer needed.

Further, AWE is working on a national level with NDA, Sellafield Limited and the LLWR to realise opportunities for off-site treatment, conditioning and storage of their accumulated ILW. They are also looking inwards to the rationalisation of their inventory, identifying opportunities to characterise their ILW holdings that have lower fissile inventory, and where suitable, re-categorise it to LLW for vault disposal at the LLWR.

Clean-up of disused military sites

Many old military sites are no longer needed, and so are being cleaned-up so that they can be made available for other uses. Some of these sites are contaminated with radioactive substances, such as radium that was used on luminous dials in aeroplane cockpits. Clean-up of these sites can produce wastes such as contaminated soils

Radioactive Wastes Produced by Defence Activities

In summary, wastes produced from manufacturing, maintenance, operation and decommissioning of nuclear submarines, nuclear weapons, and associated support facilities include:

- contaminated personal protective equipment (PPE) and filters from operation and decommissioning of associated weapons manufacturing and maintenance facilities
- redundant production facilities with contaminated building services and fabric
- used filters and resins from submarine reactor operations, decontamination of pond water and liquid treatment
- metallic reactor components from development, testing and decommissioning submarine reactors
- depleted uranium ammunitions, contaminated targets and ground from weapons testing
- contaminated land from the clean-up of disused military sites to make them available for reuse