

## FACTSHEET:

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### Radioactive wastes

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#### What is radioactive waste?

Waste is any substance or object which the holder intends to or is required to discard. A 'radioactive waste' also contains radioactivity above certain levels defined in legislation.

Some radioactive substances or objects are not considered to be wastes because they have potential value and could be used in future. This includes uranium and plutonium, which could be used to make nuclear fuel. This also includes spent nuclear fuels, which could be reprocessed and reused. These are called radioactive materials.

At present, these materials are being safely stored in case they are needed in future. If Government decides that these materials have no future use, they would then be reclassified as waste. The Government will make this decision based on economic, environmental and safety grounds.

Naturally-occurring radioactive materials (NORM), such as rocks and minerals, are not considered to be radioactive waste when they are in their natural state. NORM wastes arise when these materials are concentrated through industrial activities, for example mining and mineral processing, or drilling for oil.

#### How do wastes become radioactive?

Radioactive wastes are produced as a by-product from many important industrial, medical, research and defence activities. The nuclear industry as a whole works hard to reduce the amount of radioactive waste it produces, but some waste production is unavoidable.

When we use radioactive materials, some radioactive material will inevitably be transferred to the things they come into contact with, causing them to become 'contaminated'. This leads to radioactive wastes being generated. These wastes include everyday items such as equipment and tools, water and air filters, and the protective clothes that workers wear. In nuclear reactors, most of the internal components (such as tanks and pipes) will come into contact with radioactive materials during normal operations and will become contaminated.

Another way that items can become radioactive is if a material is in contact with (or close to) a source of neutron radiation. The free neutrons interact with the nuclei of other atoms to form new isotopes. These isotopes may be unstable, undergo radioactive decay and release further radiation. Items that have been subjected to neutron radiation and have become radioactive as a result are said to have been 'activated' by radiation.

This can occur in the core of a nuclear reactor when free neutrons are released by the fission (splitting apart) of uranium in fuel. A common example is when stable cobalt (cobalt-59), which is added to steel to make it corrosion resistant, becomes activated to form radioactive cobalt-60.

One important difference between contamination and activation is that contamination tends to occur only on the surfaces of materials but activation also occurs inside materials. A second important difference is that contamination can potentially occur where ever there are radioactive materials, but activation can only occur in the presence of a strong neutron emitter.

Many of these contaminated and activated components will be classed as radioactive waste when the facility is eventually shut down and decommissioned. These 'decommissioning wastes' form the greatest amount of radioactive waste in the UK.

## What is radioactive waste made from?

Most radioactive waste produced in the UK is solid and made from a variety of materials and items, including discarded protective clothing used by workers, redundant tools and equipment, or concrete and steel from dismantled buildings.

Some radioactive wastes are liquids or sludges but these are usually turned into solids by drying them or incorporating them into a solid matrix (usually cement or glass) to make them more stable and easier to contain.

A few types of radioactive waste gases are produced, such as radon, but only in relatively small amounts.

## How radioactive waste is classified

In the UK, radioactive wastes are classified according to the type and quantity of radioactivity they contain and how much heat that this radioactivity produces.

**High level wastes (HLW)** are those wastes where the temperature may rise significantly as a result of their radioactivity, so this factor has to be taken into account in the design of waste storage or disposal facilities.

HLW arises as a liquid from the reprocessing of spent nuclear fuel. These liquids are subsequently treated to form solid glass blocks.

**Intermediate level wastes (ILW)** are those exceeding the upper boundaries for LLW that do not generate sufficient heat for this to be taken into account in the design of waste storage or disposal facilities.

The major components of ILW are metal items such as nuclear reactor components, graphite from nuclear reactor cores and sludges from the treatment of radioactive liquid effluents.

**Low level wastes (LLW)** are those which contain relatively low levels of radioactivity. More specifically, wastes where the radioactive content does not exceed 4 GBq (gigabecquerels) per tonne of alpha, or 12 GBq per tonne of beta/gamma activity.

Most LLW comes from the operation and decommissioning of nuclear facilities, and is mainly scrap metal items, paper and plastics. Some smaller amounts of LLW also come from hospitals and universities.

**Very low level waste (VLLW)** is a sub-category of LLW with specific activity limits. VLLW includes small volumes of waste, principally from hospitals and universities that can be safely disposed of with household, commercial or industrial waste (either directly or after incineration), and larger volumes of waste from nuclear sites that can be disposed to appropriately permitted landfill facilities. The major components of VLLW from nuclear sites will be building rubble, soil and steel items arising from the future dismantling and demolition of nuclear reactors and other nuclear facilities.