



Nuclear Waste

What is nuclear waste?

Nuclear waste is either solid or liquid waste that contains radioactive isotopes at levels greater than considered to be acceptable for disposal in general waste.

The most widely known radioactive wastes are those produced by the nuclear power industry. Other sources of radioactive waste include radioactive materials produced for medical, research, and industrial applications, and the contaminated sections of dismantled nuclear facilities.

ANSTO's HIFAR research reactor and the new OPAL research reactor are small compared to the larger commercial power reactors. They produce only small amounts of low level waste (LLW) and intermediate level waste (ILW) as compared to a nuclear power reactor, which produces larger volumes of LLW and ILW, as well as high-level waste.

How harmful can nuclear waste be if it is not disposed of properly?

Radioactive waste is not harmful if handled and stored satisfactorily. Radioactive materials – like a range of other hazardous materials - can be harmful if dispersed and the radioactive particles enter the body or the environment. The degree of harm would depend on the level of radioactivity.

Are there different kinds of nuclear waste?

There are different classifications of radioactive wastes. Generally, radioactive wastes are either solid or liquid and are classified by their activity levels. Waste of sufficiently low activity, which does not require shielding, is classified as Low Level Waste. Low Level Waste contains enough radioactive material to require action for the protection of people, but not so much that it requires shielding in handling, storage or transportation. Such waste has a radiation dose rate of 2,000 microsieverts/hour, measured on contact with the waste package. If the dose rate is above this level, the waste will require shielding and is classified as Intermediate Level Waste. If the dose rate is above this threshold and the item produces significant heat as well, it is classed as high level waste. No high level waste is produced in Australia.

How has nuclear waste been disposed of in the past?

Radioactive waste is generally stored at the site of origin or in centralised storage facilities. Numerous countries have developed low level waste repositories for disposal of conditioned and packaged low-level solid radioactive waste. The repositories are near-surface disposal facilities comprising trench type, concrete vault enclosures or other suitable underground location such as boreholes. Near surface repositories in operation today include Centre de l'Aube in France, Rokkasho-mura in Japan, El Cabril in Spain, Drigg in the United Kingdom, Barnwell and Richland in the United States, Vaalputs in South Africa and Dukovany in the Czech Republic. There have been no incidents at such facilities which have caused any damage to human health or the environment.

Conditioned (or packaged) intermediate level waste is generally stored in engineered above-ground facilities.

A number of countries are moving ahead with the development of geological disposal facilities for the disposal of spent fuel and high-level radioactive waste. This is a more effective means of creating extensive barriers between the waste and the environment.

What are the safest existing methods for disposing of nuclear waste?

The safest methods for disposing of radioactive waste involve the containment and immobilisation of the radioactivity and isolation in storage. The choice of methods depend on the level and type of activity of the waste. Low level and short-lived radioactive waste can be disposed of in drums, and may be capped or encased with cement. As noted above, these items can be disposed of in a suitable repository site.

Intermediate level waste requires a higher degree of containment or immobilisation. Techniques include encapsulation in cement, incorporating it in a glass form or in a bitumen material, or immobilisation into Synroc, a synthetic rock formulation process developed in Australia.

Are there any new technologies under development for nuclear waste disposal?

New technologies for treating low-level radioactive waste include vitrification, plasma arc furnace treatment, and molten metal treatment. All three use very high temperatures. At these temperatures, water is evaporated, and dry materials such as paper, wood, and plastic are vaporised. What is left is a small volume of residue containing radioactive materials and a much larger volume of gases. The gases are collected, sampled, treated if necessary, and then released. The filters and purifiers used to treat the gases capture radioactive materials and must eventually be disposed of as low-level radioactive waste.

The Synroc (ANSTO) technology has evolved to treat a variety of wastes and lock up the radionuclides in a highly stable matrix.

Research is also being conducted overseas into what is called "partitioning and transmutation". Simply put, such a process would see the most active and long-lived components of radioactive waste physically changed into less hazardous materials. It will be some time before it is clear whether such technologies offer a realistic and practical way of handling radioactive wastes.