

Opinion Article

Role of Radioactive Waste and its Types

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Description

Radioactive waste is a dangerous waste that contains radioactive material. Nuclear medicine, nuclear research, nuclear power generation, rare-earth mining, and nuclear weapons reprocessing are just a few of the activities that generate radioactive waste. Government agencies regulate the storage and disposal of radioactive waste to protect human health and the environment. The thermal generation of electricity, like all industries, generates waste. Whatever fuel is used, waste must be managed in ways that protect human health while minimizing environmental impact. The nuclear industry has developed and implemented the majority of the technologies required for the final disposal of all of the waste it generates. The final hurdle is one of public acceptance, not technological feasibility.

In comparison to other industrial activities, the nuclear power industry produces very little waste. 97% of waste generated is classified as Low- or Intermediate-Level Waste (LLW or ILW). For many years, such waste has been widely disposed of in near-surface repositories. The amount of HLW produced during nuclear production is small; a typical large reactor (1 GWe) produces about 25-30 tons of spent fuel per year. About 400,000 tons of spent fuel has been disposed from reactors worldwide and about a third has been reprocessed. Unlike other toxic industrial waste, the main hazard associated with HAA, radioactivity, decreases over time. Currently, Interim Storage provides a suitable environment to contain and manage existing waste, and the thermal and radioactive decomposition over time provides a strong incentive to store HAA for a period of time prior to final disposal. In fact, after 40 years, the radioactivity of spent fuel elements has dropped to about a thousandth of the initial level. Interim storage also allows a country to store its spent fuel until it has produced sufficient quantities to make the development of a repository economical.

Radioactive Waste

Radioactive waste includes all materials those are inherently radioactive or have been contaminated by radioactivity and for which no other use applies. Government policy dictates whether certain materials such as spent nuclear fuel and plutonium are classified as waste. Every radionuclide has a half-life. The time it takes for half of its atoms to decay and therefore half of its losing radioactivity. Radionuclides with long half-lives tend to be alpha and beta emitters, making them easier to work with, while those with short half-lives tend to emit more penetrating gamma rays. Eventually all radioactive waste breaks down into non-radioactive elements. An isotope degrades more rapidly the more radioactive it is. Radioactive waste is generally classified as Low-Level Radioactive (LLW), Intermediate-Level Radioactive (ILW), or High-Level Radioactive (HLW) based on its level of radioactivity.

Treatment and conditioning: Treatment includes operations aimed at changing the properties of the waste streams to improve safety or economy. Treatment techniques may include compaction to reduce volume, filtration or ion exchange to remove radionuclide content, or precipitation to produce compositional changes. Conditioning is performed to convert the waste



into a form suitable for handling, Transportation, storage and security and elimination. This step usually involves the immobilization of waste containers. LLW and ILW fluids are typically solidified in cement while HLW fluids are calcined/dried and then vitrified in a glass matrix. Immobilized waste is deposited in a container suitable for its nature.

Storage and disposal: Waste storage can take place at any stage of the management process. In storage, the waste is preserved in a way that allows it to be utilized while ensuring that it is isolated from the outside environment. The waste can be stored to facilitate the next stage of management (e.g. by allowing decaying its natural radioactivity). Storage facilities are usually located on the power plant premises, but may also be separate from the facility where it was produced. Waste disposal occurs when there is no other foreseeable use for it and in that of HAA when the radioactivity has decayed to a relatively low level after about 40-50 years.