



Radioactive Waste Management: Types and Treatment

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Received: 02-Jan-2023, Manuscript No. JNPGT-23-89878;

Editor assigned: 04-Jan-2023, PreQC No. JNPGT-23-89878(PQ);

Reviewed: 19-Jan-2023, QC No. JNPGT-23-89878;

Revised: 27-Jan-2023, Manuscript No. JNPGT-23-89878(R);

Published: 03-Feb-2023 DOI: 10.35248/2325-9590.22.12.100032

Description

Radioactive waste is produced during the various operations of the nuclear fuel cycle, as well as the production and use of radionuclides for a variety of societal applications. Mining and processing of uranium ore, fabrication of nuclear fuel, generation of power in nuclear reactors, processing of spent nuclear fuel, management of radioactive waste, production and use of radionuclides for various industrial and medical applications, research involving radioactive material, and other activities generate various types of radioactive waste. Radioactive waste can be in gas, liquid, or solid form, with varying levels of radioactivity. All stages of the nuclear fuel cycle generate some radioactive waste, and the cost of managing and disposing of this waste is included in the cost of electricity. All toxic waste, not just radioactive waste, must be handled safely, and in countries with nuclear power, radioactive waste accounts for a very small proportion of total industrial hazardous waste generated.

Nuclear power is distinguished by the large amount of energy produced from a small amount of fuel, as well as the small amount of waste produced during the process. However, because much of the waste produced is radioactive, it must be handled with caution as a hazardous material. All stages of the nuclear fuel cycle generate some radioactive waste, and the cost of managing and disposing of this waste is included in the cost of electricity (i.e. it is internalised and paid for by the electricity consumers). All toxic waste, not just radioactive waste, must be handled safely, and in countries with nuclear power, radioactive waste accounts for a very small proportion of total industrial hazardous waste generated.

The nuclear fuel cycle is not the only source of radioactive waste. Medicine, agriculture, research, manufacturing, non-destructive testing, and mineral exploration all make extensive use of radioactive materials. Unlike other hazardous industrial materials, the level of hazard associated with radioactive waste - its radioactivity - decreases over time. Low Level Waste (LLW), Intermediate Level Waste (ILW), and High Level Waste (HLW) are the three types of radioactive waste based on their radioactivity and the length of time they remain hazardous (HLW). The disposal of LLW and the majority of ILW is well established, and the majority of HLW is safely stored in dedicated facilities.

Radioactive waste classifications

Low-level waste

Low Level Waste (LLW) has a radioactive content of no more than four Giga Becquerels per tonne (GBq/t) of alpha activity or 12 GBq/t of beta-gamma activity. Hospitals, industry, and the nuclear fuel cycle all produce LLW. It is made up of paper, rags, tools, clothing, filters, and other items that contain trace amounts of mostly short-lived radioactivity. LLW is frequently compacted or incinerated before disposal to reduce its volume. LLW accounts for approximately 90% of the volume but only 1% of the radioactivity of all radioactive waste.

Waste at the intermediate level

Intermediate Level Waste (ILW) is more radioactive than Low Level Waste (LLW), but the heat it produces (2 kW/m³) is insufficient to be considered in the design or selection of storage and disposal facilities. ILW necessitates some shielding due to its higher levels of radioactivity.

ILW is typically made up of resins, chemical sludges, metal fuel cladding, and contaminated materials from reactor decommissioning.

High level waste

Smaller items and non-solids can be solidified in concrete or bitumen and disposed of. It accounts for 7% of the total volume and 4% of the radioactivity of all radioactive waste. High Level Waste (HLW) contains both long-lived and short-lived components, depending on how long it takes for the radioactivity of specific radionuclides to decrease to levels considered safe for people and the environment. If short-lived fission products can be distinguished from long-lived actinides, this distinction becomes critical in the management and disposal of HLW.

Citation: Kim D (2023) Radioactive Waste Management: Types and Treatment. *J Nucl Ene Sci Power Generat Technol.* 12:1