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Technological Advancement in effective management of low level radioactive solid wastes

In India, Low Level (LLW) Solid Radio-Active Wastes (RAW) contributes more than 90% of the total RAW generated from regular Operation and Maintenance of a typical Nuclear Fuel Cycle facilities. The volume generated from a typical nuclear facility ranges from 200 to 600 M3 depending on type and number of the facilities at a site. These wastes, in general are segregated as combustible, compressible and non-compactable/compressible based on the processing considerations. Predisposal processing is an essential task for optimal utilization of Near Surface Disposal Facility (NSDF) to contain the radioactivity and isolation from the environment meeting regulatory guidelines. Combustible waste forms viz. Cellulosic. Rubber and Plastics, contributes about 50-60% of the total VLLW and LLW solid wastes. Predisposal steps employed for these combustible radioactive solid wastes are compaction, melt densification and incineration based on type of waste forms. Cellulosic waste is incinerated using oil/diesel fired incinerator. Rubber and plastics wastes are compacted using hydraulic compactor and plastic wastes having thermoplastic behavior is processed through melt densification mode achieving volume reduction factor (VRF) of ,30-40 3-4 and 3-10 respectively. Rubber and plastic wastes mainly PPEs, contributes about 70-80% of the total combustible waste. As advancement in technology with high temperature based processing of these wastes, has certain advantages to nullify formation of toxic compounds like dioxin and Furans. The plasma based process having ease of higher temperature availability, is seen as the promising solution for management for all type of combustible radioactive wastes. To achieve higher volume reduction for rubber and plastic wastes, an engineering scale Plasma pyrolysis based incineration demonstration setup of 25 kg/hr capacity has been commissioned at Bhabha Atomic Research Centre (India) utilizing in-house developed 30 kW DC air plasma source. After lab studies and simulated waste trails, the setup was commissioned with actual radioactive waste. More than 2000 kg waste has been successfully processed through the setup in various trials. VRF achieved for all combustible type of waste forms is ranging from 30-40. The paper highlights waste processing aspects, laboratory scale study for waste decomposition and demonstration of plasma processing of solid RAW.

Keywords: Radioactive Solid waste. Plasma pyrolysis. Incineration, Compaction, Melt Densification. Volume Reduction Factor

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