

Comparative analysis of the final volume of waste generated in nuclear plants after treatment through two methods of immobilization

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Waste generated in nuclear power plants, classified as Intermediate and Low Level Waste, can be stored for hundreds of years, taking up space in the initial and final deposits, increasing transport and deposition costs. It makes essential to reduce volume not only in generation of raw waste, but also in its treatment. In order to identify a method that produces the smallest volume of waste product, two immobilization methods were compared: cementation and bituminization. For each method, a simulation based on the waste generation from a PWR plant was performed [1]. The selected wastes were evaporator concentrate and exhausted ion exchange resins from the primary system. To perform this simulation, data from the incorporation of plants using these two methods were obtained in the literature. The CNEN norm [2] establishes that liquid waste (including evaporator concentrate) and ion exchange resins from the primary system must be incorporated into a matrix, forming a monolithic product. The criterion for choosing cementation and bituminization was the fact that these techniques are already applied in Brazilian plants, Angra 1 and 2 respectively. Cements are inorganic compounds that have the ability to react with water under ambient conditions to form a product of high hardness and water resistance. The most common cements used for the immobilization of radioactive waste are based on calcium silicates, such as Portland-type cements [3]. Bitumen is a generic term used to describe a range of high molecular weight organic compounds. Bituminous materials have been used by the industry for many years, and there is evidence of the use of bitumen in construction in 3800 BC, due to its adhesive and hydrophobic properties [3]. As a model, the annual generation of waste from a typical PWR plant, with a generation of 1300 MWe, was used. The graph in Figure 1 shows the comparison between the two immobilization methods. Table

1 shows the proportions between the volume of waste generated without treatment and the volume of waste processed for the two methods analyzed according to the types of waste.

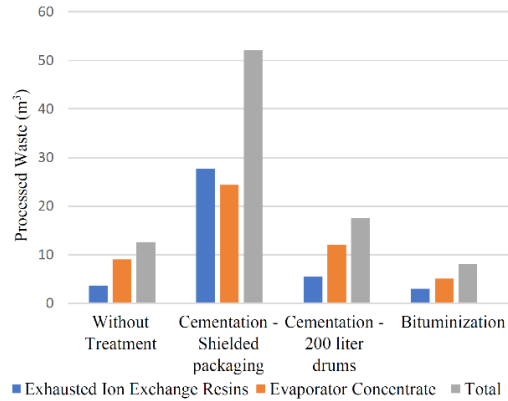


Figure 1. Annual generation of waste processed in a typical PWR plant in different immobilization methods.

Table 1 - Proportions between the initial and final volumes for the different methods analyzed according to the types of waste.

Types of Waste Immobilization	Primary Resins	Evaporator Concentrate
Cementation - Shielded packaging	1:7,7	1:2,7
Cementation - 200 liter drums	1:1,5	1:1,3
Bituminization	1:0,8	1:0,6

The results showed that the bituminization method is the most advantageous from the viewpoint of minimizing waste when compared to the cementation, in addition, the betuminização can reduce the initial volume of waste.

References

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