



Method for Evaluating the Homogeneity of Cemented Radioactive Waste

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1. Introduction

Radioactive waste is generated in research activities and medical, industrial, and military applications of nuclear technology. By definition, radioactive waste is any material resulting from human activities, which contains radionuclides in concentrations above the clearance limits established by the regulatory body and for which no use is foreseen.

The management of these waste is designed to assure an acceptable level of safety, aiming to protect human health and the environment, considering the present and the next human generations.

The final destination of radioactive waste, as defined by current management practices, is to place them in a final disposal facility, also called repository. To be accepted into repositories, waste must perform minimally against a set of requirements known as waste acceptance criteria (WAC).

For example, for liquid waste to be accepted into a repository, it must be converted to a solidified form by mixing it with an appropriate immobilization matrix, which prevents to some extent the dispersion of the radionuclides contained in the waste, and keep the radionuclides fixed inside the waste form, until they decay to safe levels of radioactivity. Therefore, it is indispensable that the immobilization matrix is compatible with the liquid waste and the process of solidification is not reversible.

Some of these WAC are specified as a minimum mechanical resistance, a maximum leaching rate and porosity, and homogeneity.

In Brazil, CNEN established reference values for mechanical resistance and leaching rate. However, the regulation requires that the product is homogeneous, without indicating the minimum performance required in this respect, nor establishing test methods to verify the homogeneity.

The International Atomic Energy Agency (IAEA), like CNEN, states in its recommendations that the immobilized waste must be homogeneous in respect to mechanical and physico-chemical properties, but does not establish values or criteria.

The aim of this paper is to make a survey of the acceptance criteria of different countries and regulatory agencies, observing what they say in relation to the homogeneity of the immobilization product. Additionally, a search is made on different methods and criteria for homogeneity evaluation of solid mixtures and the mathematical models that are used to assess the homogeneity of a variety of products, and thus suggest criteria and methods for the standardization of homogeneity of waste forms.

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