Proporcingumo daugiklių metodo taikymai metalinių radiaktyviųjų atliekų charakterizavimui PREDIS projekte

Scaling factors approach applications for metallic radioactive waste in PREDIS

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The WP4 in PREDIS project is devoted to metallic radioactive waste (MRW) characterization and classification, treatment and conditioning and also volume reduction activities. The methodology for characterization of the metallic waste is similar to all reactor types and is usually based on measurements, modeling and scaling factor (SF) application. Pre-dismantling classification of MRW using modelling allows preliminary evaluation of the size of controlled areas and expected activities, while SF approach is used for classification of the low activity waste and materials (LLW, VLLW, Exempt Waste) [1]. Many of the important long-lived radionuclides contained in MRW are difficult to measure (DTM) low energy gamma, beta or alpha emitting nuclides. Identification of DTM nuclides using complex radiochemical analysis is costly, time consuming and not practical for large numbers of waste packages. SFs between the DTM nuclides and easy to measure (ETM) nuclides can be applied for evaluation of the radioactive inventory. Briefly, the SF is based on the empirical dependence between specific activities of nuclides in the investigated sample when the main pollution source is the same: $k_{i} = A_i/A_{key}$, where A_i is the specific activity of the DTM radionuclide, A_{key} is the specific activity of the ETM key radionuclide, k_i is a constant called the scaling factor. The scaling factors of DTM radionuclides are determined by the measurement runs, statistically processing the results according to the correlation of the investigated radionuclide with the key nuclides. After establishing of SF, the inventory of the DTM nuclides in a waste package can be derived based upon external gamma radiation measurements of ETM. Usually the ^{60}Co is used as the key nuclide. The activity concentrations of the DTM nuclides are then calculated according to the functional relationship established between the activity concentration of ^{60}Co and the DTM nuclides (such as for example ^{63}Ni). For fission products (FPs) there was no choice possible other than ^{137}Cs. Alternatives, such as ^{94}Nb could be used in some metallic waste. A suitable ETM for alpha emitters is ^{241}Am, which usually is used as key nuclide for alpha emitters and transuranium elements. Optimized Nuclide Vector (NV) – the result of SF application for MRW stream for selected disposal site is obtained by analyzing and systemizing the information about MRW streams, identifying the optimal list of relevant radionuclides, describing inter-correlations between ETM and DTM nuclides including multivariate analysis of the already measured data at the sites and numerical analysis of activation and contamination parts as shown in Fig. 1. Finally, according to the level of MRW activation the waste management route can be selected: management as radioactive waste, unconditional clearance, clearance after decontamination e.g. sand blasting, clearance and melt, melt and clearance etc. [2].

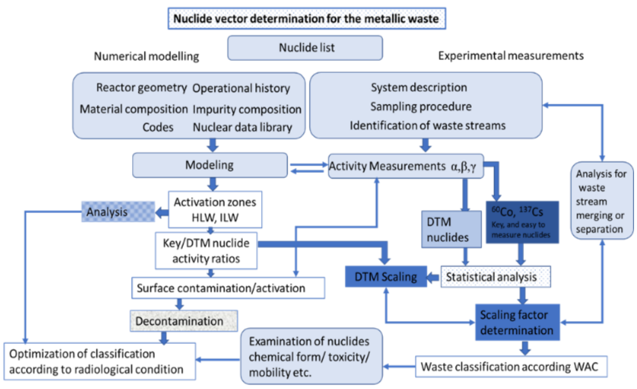

Fig 1. Optimized scheme of Nuclide Vector determination.

Keywords: metallic radioactive waste, scaling factors, nuclide vector, easy-to-measure (ETM) radionuclides, difficult-to-measure (DTM) radionuclides.

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Reference

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