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Observation of efficiency of the decontamination technologies in nuclear power plants

The version of the AP-CITROX technology (pre-oxidation: alkaline potassium permanganate, oxide-solution: blend of oxalic and citric acid) applied in the steam generators of the Paks NPP (Nuclear Power Plant) was not adequately developed considering its chemical, analytic and corrosion aspects. To replace the AP-CITROX procedure, a new, efficient „soft” chemical decontamination technology has been developed at the Institute of Radiochemistry and Radioecology at University of Pannonia.

In the course of the comprehensive characterization of the efficiency of the novel base-technology the chemical composition and morphology of the oxide layer formed on the inner side of the austenitic stainless steel heat exchanger tube specimens before and after the full decontamination process were studied by scanning electron microscopy (SEM), equipped with an energy dispersive X-ray microanalyzer (EDX). The complete decontamination cycle has been performed under laboratory conditions in a pilot plant circulation system elaborated earlier. In different steps of the chemical procedure the concentration of the main alloying components (Fe, Cr, Ni) dissolved from the surface oxide layer into the decontamination solutions was determined by ICP optical emission spectrometric (ICP-OES) method. Based upon the ICP-OES results the average thickness of the oxide layer removed from the surface into the solutions was calculated. When measuring the activity of the removed radionuclides (^{60}Co , ^{58}Co , ^{110}Ag , ^{54}Mn) in the decontamination solutions we drew conclusions concerning the efficiency of certain steps of the technology and depth distribution of the radionuclides on the treated steel surfaces.

Keywords: decontamination, AP-CITROX, corrosion, ICP-OES, γ -spectrometry, SEM-EDX

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