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Determination of the impurities of reactor core graphite with neutron activation analysis, X-ray fluorescence and mass spectrometry techniques for graphite waste modeling

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In nuclear energetics is very important to handle radioactive waste properly. After closing nuclear facility significant amounts of radioactive waste will occur, which disposal will depend on their activity. The main source of radioactivity in the NPP's equipment are the neutron activation products. Their amounts depend on the elemental composition of materials used for building a nuclear facility. In the cores of channel and gas cooled reactors huge amounts of high purity graphite is used as a moderator. Because being in an intensive neutron flux for a long irradiation period minor graphite impurities such as Cs, Sr, Eu, U, Cd, U, Th play the major role in the formation of medium and long-lived radioactive nuclides. As graphite is difficult to dissolve, advanced measurement techniques must be used. In this work measurement methods of neutron activation analysis, X-ray fluorescence and mass spectrometry for the evaluation of minor graphite impurities will be presented and their results critically compared. We show a good agreement between results of an expensive neutron activation analysis and rapid mass spectrometric measurements. We have found that minor graphite impurities of interest are in 10 ppm –10 ppt concentrations range. These results will be used for the Ignalina NPP graphite decommissioning.

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