

MEASUREMENT OF K-40 AND CS-137 ACTIVITY CONCENTRATIONS IN FOOD PACKAGING AND HEALTH RISK ASSESSMENT

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Background: Potassium-40 (K-40) is a naturally occurring radionuclide that can be found in the environment in varying concentrations, unlike cesium-137 (Cs-137), which is an artificial radionuclide resulting from the operation of nuclear power plants and nuclear tests. If these two radionuclides are found in significant concentrations in packaging materials used for food, they can contribute to an increase in the annual gamma radiation dose received by humans above the recommended levels.

Methods and Objectives: Using gamma spectrometry, the activity concentrations of K-40 and Cs-137 were determined in samples of three-layer and five-layer cardboard, five granules used to make food packaging, various types of paper, packaging boxes, and LDPE bags (low-density polyethylene bags). The samples were collected between 2010 and 2023 from packaging product manufacturers and during imports into the Republic of Serbia. Health risk was assessed after measuring the activity concentrations of these two radionuclides in terms of annual effective dose values in accordance with the law regulating this area, which considers food packaging materials as items of general use. The radionuclide content in items of general use must not exceed levels that could contribute to an increase in dose for the population above 1 mSv/year. The aim of this study is to assess the health risk from the use of cardboard and plastic food packaging.

Results: The measured activity concentration values of K-40 for most analyzed samples are below the minimum detectable activity. The maximum measured value for K-40 is 1380 ± 31 Bq/kg in three-layer cardboard. Similarly, for most samples, the measured values of Cs-137 are below the minimum detectable activity, with a maximum value of 8.1 ± 1.7 Bq/kg in three-layer cardboard. The estimated annual effective dose values for all analyzed samples are below 1 mSv/year.

Conclusions: Based on the measured values of K-40 and Cs-137, as well as the estimated values of annual effective doses, it can be concluded that there is no health risk from the use of the tested food packaging materials, considering that all annual values were below the recommended value of 1 mSv/year.

Keywords: potassium-40, cesium-137, annual effective dose, health risk