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7-th International Symposium on
IN Situ NUclear METrology as a tool for radioecology – INSINUME 2017

BOOK OF ABSTRACTS

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24–28 April 2017
Ohrid, Macedonia

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International Symposium on

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Investigation of the cultivation influence on the levels of natural radionuclides in soil from the surrounding of the city of Skopje

Paper S4
O-31

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The soil, as the first link of the ecological chain land-food-human, has an important role in the distribution and the transfer of radionuclides. The knowledge about the concentration of natural radioactivity in our environment is essentially important for the dose assessment that accumulates in the population. The activity concentrations for the natural radionuclides could be used for establishing of database for the level of natural radioactive pollution and assessment of the possible future pollution in the environment. The aim of this investigation was focused on assessment of soil cultivation on increased levels of natural radionuclides, by comparison of the activity concentrations of ^{226}Ra , ^{232}Th , and ^{40}K in samples of cultivated and uncultivated soil samples. From the same 14 locations in the surrounding of the city of Skopje, cultivated and uncultivated soil samples were taken at three different depths in triplicate. The sampling was performed in accordance with IAEA recommendations. A gamma-spectrometer Canberra Packard with high-purity germanium detector was used for sample measurement, and the obtained spectra were analyzed using the GENIE 2000 program. On the basis of the performed investigations, the data showed that the mean value of ^{232}Th activity was $43.74 \pm 4.99 \text{ Bq kg}^{-1}$ for cultivated soil, while for uncultivated one it was $35.70 \pm 5.65 \text{ Bq kg}^{-1}$. The ^{226}Ra activity had a mean activity value of $34.09 \pm 6.53 \text{ Bq kg}^{-1}$ and $28.30 \pm 5.54 \text{ Bq kg}^{-1}$, for cultivated and uncultivated soil, respectively. The activity concentration of ^{40}K from all locations was higher than the one of ^{232}Th and ^{226}Ra for all samples tested, and for cultivated soil it was $608.12 \pm 70.43 \text{ Bq kg}^{-1}$, while for uncultivated the revealed average value was $506.54 \pm 59.96 \text{ Bq kg}^{-1}$. It could be easily concluded that the activity of all natural radionuclides in uncultivated soil was significantly lower than in cultivated one. Additionally, the significance of obtained data was confirmed by the statistical test, at $p < 0.05$. Obviously, this is due to application of various fertilizers to agricultural fields in quantities which have increased natural radioactivity in soils for approximately 20 %. On basis of activity concentrations, the parameters important for estimation of the environmental radiation safety for the population were calculated. Thus, the average value of the radiation risk index (H_{eks}) for cultivated soil was 0.40, which is still below the maximum acceptable value set at < 1 . Nevertheless all radium equivalent (Ra_{eq}) values for cultivated soils were below the the maximum recommended limit, of 370 Bq kg^{-1} , ranging between 114.30 and $162.63 \text{ Bq kg}^{-1}$. Regardless the composition and degree of soil treatment, all measured values for the specific activity, and the calculated data for H_{eks} and Ra_{eq} have not exceeded the safety limits, stressing the insignificant risk arising from naturally occurring soil radionuclides. The data from this study could be used as basis for further more systematical investigation of the area of interest, and thus completing the radiological map for this region in which the highest population density is present.

Keywords: soil cultivation, natural radionuclides, gamma spectrometry, radiological risks.