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Probability Health Risk Assessment and Measurement Uncertainty Estimation Related to Internal Exposure to Natural Radionuclides from Soil

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Abstract

The purpose of this paper was to develop methodology and to assess cancer mortality risks with assigned measurement uncertainty related to lifetime internal exposure to natural radionuclides ^{238}U and ^{232}Th from soil. Included exposure pathways were inhalation and direct ingestion of dust particles originating from soil. Total of 80 samples were collected at 23 locations that belong to meteorological stations under control of Republic Hydrometeorological Service of Serbia. Activity concentration of radionuclides was measured using HPGe detector. Probability risk assessment and measurement uncertainty analysis was conducted using Monte Carlo method. For location with highest measured activity concentration, assessed cancer mortality risk for ^{238}U is 0.185 9 10^{-6} with coverage interval of (0.0184–0.702) 9 10^{-6} for ingestion exposure and 0.179 9 10^{-6} with coverage interval of (0.00514–1.33) 9 10^{-6} for inhalation exposure. Mean value for assessed cancer mortality risk for ^{232}Th is 0.582 9 10^{-6} with coverage interval of (0.0222–2.79) 9 10^{-6} for ingestion exposure and 1.11 9 10^{-6} with coverage interval of (0.0319–8.27) 9 10^{-6} for inhalation exposure. Coverage interval contains the value of assessed risk with the probability of 95 %. Assessed risks in this paper have low priority for further investigation because they

are equal or lower than 10^{-6}. Probability risk assessment introduces uncertainty analysis in convenient way and enables researches and decision-makers to improve quality of their results and decisions.

Keywords