



The distribution of indoor radon in Transylvania (Romania) - influence of the natural and anthropogenic factors

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Exposure to radon in homes and workplaces is now recognized as the most important natural factor in causing lung cancer. Radon activity is usually higher in buildings than in the outside atmosphere, as it may be released from building materials and soil beneath the constructions, and the concentration builds-up indoor, due to the low air renewal rates. Indoor radon levels can vary from one to multiple orders of magnitude over time and space, as it depends on several natural and anthropogenic factors, such as the radon concentration in soil under the construction, the weather conditions, the degree of containment in the areas where individuals are exposed, building materials, outside air, tap water and even city gas, the architecture, equipment (chimney, mechanical ventilation systems, etc.), the environmental parameters of the building (temperature, pressure, etc.), and on the occupants' lifestyle.

The study presents the distribution of indoor radon in Transylvania, Romania, together with the measurements of radon in soil and soil water. Indoor radon measurements were performed by using CR-39 track detectors exposed for 3 months on ground-floor level of dwellings, according to the NRPB Measurement Protocol. Radon concentrations in soil and water were measured using the LUK3C device.

A complete map was plotted at the date, based on 3300 indoor radon measurements, covering an area of about 42% of the Romanian territory. The indoor radon concentrations ranged from 5 to 3287 Bq m⁻³, with an updated preliminary arithmetic mean of 179 Bq m⁻³, and a geometric mean of 122 Bq m⁻³. In about 11% of the investigated grid cells the indoor radon concentrations exceed the threshold of 300 Bq m⁻³. The soil gas radon concentration varies from 0.8 to 169 kBq m⁻³, with a geometric mean of 26 kBq m⁻³. For water samples, the results show radon concentrations within the range of 0.3 – 352.2 kBq m⁻³, with a geometric mean of 7.7 Bq L⁻¹. A weak correlation between the three sets of values (residential, soil, water) was observed, both as individual values, average values over the grid or county level. The highest concentrations of indoor radon were found in Bihor, Mures, Brasov, and Cluj. In these regions further investigation is needed on the factors influencing the accumulation of radon in high concentrations in indoor air, such as soil type and geology, ventilation, or constructive and architectural features.

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