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Radiological assessment of natural and artificial radionuclides in attic dust and urban soil samples in a former heavy industrial city (Salgótarján, Hungary)

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This study deals with assessment of potential exposure of natural (^{238}U, ^{232}Th, ^{40}K) and artificial radionuclide (^{137}Cs) around a former coal fired power plant using long-term accumulated attic dust material, (considered as undisturbed) and urban soil (considered as disturbed) from northern part of Hungary in city of Salgótarján. Radionuclide activity measurements of 36 attic dust, 20 urban soil samples and a fly-ash slag were performed on an area of 98 km^2 around the coal fired power. Sampled houses were built between 1890 and 1990 considered as representative samplings for long-term accumulations (if there is no regular cleaning and reconstruction) and urban soil were collected nearby houses at depth of 0-10 cm in August 2016. Activity concentrations (Bqkg^{-1}) of ^{238}U, ^{232}Th, ^{40}K an ^{137}Cs in attic dust and urban soil samples were determined by low background iron chamber with a well-type HPGe and with an n-type coaxial HPGe detector. The obtained values show that mean ^{238}U, ^{232}Th, ^{40}K an ^{137}Cs (Bqkg^{-1}) activities for attic dust and urban soils are 43, 34, 534, 88 and 25, 32, 386, 5, respectively. A significant difference observed between attic dust and urban soil radionuclide activities that derived from pollution sources. We assume that attic dust preserves past records of fingerprint and components of atmospheric deposition. Besides Analysis of Variance (ANOVA), Principal Component Analysis (PCA) and kriging mapping have been used to experimental dataset allowing us to find the existence distribution around the former coal fired power plant. It appears that the coal power plant has no significant impact on the spatial distribution of natural radionuclides in the studied urban soil, with mean annual outdoor effective dose equivalent (*E*) 0.06 mSv, very close to the average UNSCEAR value of 0.07mSv. However, attic dust mean annual indoor effective dose is 0.36 mSv, confirming the technologically enhanced natural radioactivity in the attic dust as a consequence of the coal-fired power plant operation. This area was identified approx. 3 km distance from the coal power plant.