

Radioactivity levels of ^{238}U and ^{232}Th decay series and related dose rates in the surroundings of a coal power plant using high resolution γ -spectrometry

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Abstract. Gamma radiations measurements were carried out in the vicinity of a coal-fired power plant located in the southwest coastline of Portugal. Two different gamma detectors were used to assess the environmental radiation within a circular area of 20 km centred in the coal plant: a scintillometer (SPP2 NF, Saphymo) and a high purity germanium detector (HPGe, Canberra). Fifty urban and suburban measurements locations were established within the defined area and two measurements campaigns were carried out. The results of the total gamma radiation ranged from 20.83 to 98.33 counts per second (c.p.s.) for both measurement campaigns and outdoor doses rates ranged from 77.65 to 366.51 $\mu\text{Gy/h}$. Natural emitting nuclides from the U-238 and Th-232 decay series were identified as well as the natural emitting nuclide K-40. The radionuclide concentration from the uranium and thorium series determined by gamma spectrometry ranged from 0.93 to 73.68 Bq/kg, while for K-40 the concentration ranged from 84.14 to 904.38 Bq/kg. The obtained results were used primarily to define the variability in measured environmental radiation and to determine the coal plant's influence in the measured radiation levels. The highest values were measured at two locations near the power plant and at locations between the distance of 6 and 20 km away from the stacks, mainly in the prevailing wind direction. The results showed an increase or at least an influence from the coal-fired plant operations, both qualitatively and quantitatively.

Keywords: Coal-fired power plant, gamma radiation, radionuclides concentration, dose rates