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Radioactivity concentrations and exposure rates near a coal power plant in Greece

Coal-fired power plants are the main source of electricity in Greece. Four thermal power stations with more than 4000 MW total installed capacity are located in Northern Greece, producing more than 70% of the country' s power requirements.
About 64 Mt of lignite are produced annually by opencast mining in four mines and are transported to the power stations by rail trucks and conveyor belts. Given that, around 15% of the fuel is converted to ash, and assuming 99.9% collection efficiency for the electrostatic precipitators, the amount of fly ash expected to be released annually into the basin's atmosphere is nearly 9.6 kt.
A survey around the Coal Power Plant has been conducted by using portable gamma ray spectrometers, studying an area of 25000m2 in a grid of 500x500 m in places that were accessible and 1000x1000 at non-accessible places. Two different instruments have been used (a) Saphymo-Stel 1"NaI(Tl), Type S.P.P. 2NF and (b) Identifier, target system electronic gmbh. Direct measurement on the level of 1 m above the ground detected the dose rate in each sampling point.
Thirty six (36) soil samples have been collected and analyzed by gamma-spectrometry in the laboratory for validation of the obtained in-situ measurements. Concentrations of 226Ra, 232Th, 40K and 137Cs ranged between 20-42 Bq kg-1, 13-43 Bq kg-1, 260-520 Bq kg-1 and 20-28 Bq kg-1 respectively.
The estimated dose rate were calculated by the following equations:
D=0.0414 A(40K)+0.623 A(232Th) +0.461 A(226Ra)
D=0.0414 A(40K)+0.623 A(232Th) +0.461 A(226Ra)+1.72 F(137Cs)

where,
D, is the absorbed dose rate in air in nGy h-1 per Bq kg-1
A, the activity concentrations in Bq kg-1 of each one radionuclide in soil
137Cs 1.72 nSv h-1 per kBq m-2
F, the 137Cs activity concentrations in soil in Bq m-2
A coefficient of 0.7 Sv Gy-1 converts absorbed doses in air to effective dose equivalent
Prevailing winds are weak to moderate, blowing mostly along the NW/SE axis of the basin resulting in higher concentrations at this direction.
The measured external doses are in agreement with the estimated external doses. The observed external doses 30-93 nSv h-1 are in agreement with the population-weighted average absorbed dose rate in air from terrestrial gamma radiation 57 nGy h-1 and the reported in Greece average absorbed dose rate in air from terrestrial gamma radiation 42 nGy h-1.
The results can be used as a reference point for radiological mapping of the studied area.

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