Title: ***Spatial distribution and radiological hazard profile in the soils surrounding the 115 MW EPVTL oil-fired thermal power plant***

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Abastact: A pioneering investigation characterised the spatial distribution of ^{226}Ra, ^{232}Th, and ^{40}K, along with their associated radiological hazard parameters, in soil samples collected around an oil-fired thermal power plant, with precise quantification performed using a high-purity germanium (HPGe) detector. The mean activity concentrations of ^{226}Ra, ^{232}Th, and ^{40}K were determined to be 31, 38, and 411 Bq/kg, respectively, with observed ranges of 21–40, 30–50, and 310–510 Bq/kg, reflecting the inherent spatial variability in soil radioactivity around the study area. Enhanced radioactivity above the global average was recorded to be within 0–50 m of the power plant, which can be attributed to the enrichment factor mainly due to plant emissions and natural geochemical processes. The multivariate statistical analysis validated that ^{226}Ra and ^{232}Th were the major contributing factors in defining the hazard profile in the radiological environment, and this was further reinforced by the strong correlation between these radionuclides in terms of principal component loadings and cluster analysis. This study indicates considerable spatial heterogeneity in radionuclide distributions, primarily being driven by spatial associations with the sources, and providing an initial basis for the risk-informed environmental monitoring network around thermal power plants.

Keywords: **Soil radioactivity γ-ray detector hazard parameters multivariate statistical analysis variance analysis oil-fired thermal power plant**

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