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Radionuclide Distribution in Soils of a Brazilian State

The world population has been subjected to natural radiation at a relatively constant rate over a relatively long period of time. Certain practices, however, may contribute to an increase in the concentration of natural radionuclides (NORM), especially with the exploitation of minerals, among them, rare earth elements (ETR), whose inadequate disposal of tailings resulting from the mining process and processing, contribute to a dose increase in certain population groups at levels deemed to be harmful to human health. For the determination of natural values, without introducing anthropic activities, it is necessary to know the contents of the elements of interest and their variability, essential for the construction of legislation focused on monitoring and legal intervention in keeping with the local reality, avoiding inadequate interventions that incur financial and social losses. In this context, the main objective of this work was to determine and map the natural levels of rare earth elements and radionuclides (238U, 232Th, 226Ra, 228Ra and 210Pb) in soils representative of the State of Minas Gerais, establishing Quality Guidance Values (VRQs) in Soil from Minas Gerais to naturally occurring radionuclides, in addition to evaluating the relationship between the activity concentration values of natural radionuclides, with minerology, soil classes, geological domains and classes climate change. Moreover, cluster analysis was performed in geographic regions according to the levels of 238U, 232Th, 226Ra, 228Ra and 210Pb, in order to identify the anomalous areas of the State of Minas Gerais and to evaluate the regionalization of the VRQs for the radionuclides. The following reference values were obtained for soil quality in the State of Minas Gerais: 47.1 Bq kg-1 for 238U, 67.1 Bq kg-1 for 226Ra and 77.9 Bq kg-1 for 210Pb, 99.6 Bq kg-1 for 232Th and 93.8 Bq kg-1 for 228Ra. The clustering of soil samples in geographic regions, according to the levels of 238U, 232Th, 226Ra, 228Ra and 210Pb, did not reflect any correspondence with the geological domains or the soil classes of the State. On the other hand, there was a slight indication of correpondence with the climatic classes. A significant area of the state presented error probabilities greater than 50% in the extrapolation of the VRQs established for 238U and 232Th. In this way, the current study presented a strong indicative for the adoption of the regionalization of the Soil Quality Reference Values for the state of Minas Gerais.

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