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RADIOACTIVITY AND ELEMENTAL COMPOSITION OF PHOSPHOGYPSUM IN THE PHILIPPINES

Since the start of operation of the largest fertilizer producing company in the Philippines, huge amount of phosphogypsum with an estimated total volume of 10 Million tons has accrued and stored in a 56 ha of land. The Philippine Nuclear Research Institute in collaboration with the Philippine Phosphate Fertilizer Company is currently conducting a project to assess and characterize the phosphogypsum stacks with the aim of turning this by-product waste into a secondary resource. The activity concentrations of naturally occurring radionuclides, U-238, Th-232, K-40 and Ra-226 are determined in the collected phosphogypsum samples. Preliminary Ra-226 activity measurements by high-purity germanium (HPGe) gamma spectrometry reveal Ra-226 activity that range from 0.19 to 1.41 Bq/g with an average value of 0.75 ± 0.24 Bq/g. The equivalent activity concentrations of U, Th, and K obtained from gridded in-situ radiometric signature survey using a portable gamma ray spectrometer on the eight phosphogypsum stacks are 51 to 62 ug/g, 2.85 to 4.84 ug/g, and 0.24 to 0.39 %, respectively, while the calculated annual dose rates range from 2.99 to 3.84 mSv/yr. These figures are considerably higher than the global average concentrations in soil (0.032 Bq/g Ra-226, 3 –11 ug/g U) and the annual dose rate exceeds the 1 mSv/yr regulatory dose rate limit of the public. Further to this, the phosphogypsum contains potentially hazardous heavy metals (49 –246.20 ug/g Pb, 9.35 –24.87 ug/g Ni, 1.45 –90.75 ug/g Cu, 5.03 –29.17 ug/g Cr and 1.86 –13.16 ug/g Cd) and strategic rare earth elements (185.7 ± 86.29 to 279.6 ± 167.5 ug/g total REE). The radioactivity concentrations and elemental compositions of phosphogypsum vary greatly from each stack due to the use of different types and sources of phosphate rocks for fertilizer production. This study will present the results achieved to date on the radioactivity and elemental assessment that is important for the safe and sustainable management and use of phosphogypsum by-product waste.

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