Title: Radiological Assessment and Hazard Evaluation of Natural Radionuclides in Cement Manufactured in Iraq

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Abastact: Comprehensive radiological assessment of cement products manufactured and commercially available in diff erent regions of Iraq was made. Eighteen cement samples were collected and analyzed using gamma-ray spectrometry to determine the activity concentrations of the naturally occurring radionuclides 226Ra, 232Th, and 40K. The measured mean activity concentrations were 25 ± 6, 14 ± 5, and 163 ± 70 Bq/kg, respectively, all of which are below the worldwide average values recommended by UNSCEAR. Radiological hazard parameters, including radium equivalent activity (Raeq), absorbed gamma dose rate (Dγ), annual eff ective dose equivalent (AEDE), external and internal hazard indices (Hex and Hin), and excess lifetime cancer risk (ELCR), were evaluated to assess potential health risks associated with the use of cement as a building material. The obtained mean Raeq (56.8 Bq/kg) and Dγ (26.6 nGy/h) values are signifi cantly lower than the recommended safety limits, indicating the low level of radiological exposure. The estimated AEDE was 0.28 mSv/year, while ELCR values remained well within acceptable limits. Correlation analysis revealed strong positive relationships between 226Ra, 232Th, and 40K, suggesting a common geochemical origin of these radionuclides in cement raw materials. One sample exhibited relatively elevated 40K activity, likely attributable to local geological characteristics or raw material composition

Keywords: environmental safety, radiation hazards, natural radioactivity, specifi c activity, cement

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