NATURAL RADIACTIVITY FROM BUILDING MATERIALS IN SPAIN

Manuel Pérez Martínez, Concepción Dueñas Buey, Carmen Fernández Jiménez, Rafael Ruiz Cruces, Esperanza Liger Pérez, Elisa Gordo Puertas, Sergio Cañete Hidalgo, María Cabello

University of Malaga, Malaga, Spain

Section: Radiation Measurements

The industrial construction sector is very important in Spain. Building materials used in this industry are sources of radiation from natural radionuclides they contain. The European Commission published some recommendations to facilitate the trade of these materials in the E.U. The studies about this subject have increased notably during last years. This, probably, can be associated with the increase interest from natural radiation radiological risk on indoor exposure.

The activity concentration of building materials must meet the basic standard specified in Directives of E.U. as well as specific aspects of NORM industries.

The evaluation of environmental impact caused from the radionuclides of building materials is made by the Nuclear Safety Council (C.S.N.), CIEMAT and some radioactive environmental laboratories. The University of Malaga is developing the ARMAC Project to analyze the composition and the radioactivity of the materials used in building. The samples were supplied by manufacturers and it has been made a physic-chemical characterization of the samples received. The chemical composition of the samples of cement, brick, ceramic and roofing tile has been made using ICP-MS and XRPD. XRPD is a powerful tool for material characterization in general, and cements materials in particular. The use of the Rietveld method has allowed quantifying the clinkers and cements measured by laboratory x-ray powder diffraction (LXRPD) giving their accurate phase assemblage. The results of these analyze shows near 72 different elements. The higher concentrations are of Na, K, Ca, Al, Fe and Si.

All building materials have varying amounts of natural radionuclides. They belong to natural radionuclides of uranium (^{238}U) and thorium (^{232}Th) series, together with the radioactive isotope of potassium (^{40}K). The concentration of the natural radioactivity in the selected cements and ceramics were conducted with a coaxial ReGe detector. The energy an absolute efficiency calibration of the spectrometer was made using a sample certificated by IAEA-312 and IAEA-385. Software use to analyze the spectrum is the Cenie-2000 v.2.0 Canberra Nuclear.The activity concentrations are ranged between 67.4, 29.1 and 267.1 Bq/Kg from ^{226}Ra, ^{232}Th and ^{40}K respectively from samples of Portland cements.

To compare the radiological effects of the materials used in the building which contain ^{226}Ra,^{232}Th and ^{40}K, a common index is required to obtain the sum of activities and according to RP 112 the absorbed dose in air can be calculated. Some indices dealing with the assessment of the excess gamma radiation arising from building materials such as external and internal hazard indices and gamma -concentration indices, In this study the gamma -index is calculating as proposed by the European Commission $I_\gamma = I\ (C_{Ra}, C_{Th}, C_K)$ where C_{Ra}, $C_{Th}$and C_K are the activity concentrations of ^{226}Ra, ^{232}Th and ^{40}K in $Bq.kg^{-1}$, varying between 0.17 and 0.29.