Introduction to By-BM database built for characterization of industrial by-products from the environmental radioactivity content point of view

Z. Sas[1,*], W. Schroeyers[2], M. Soutsos[1], W. Sha[1], R. Doherty[1], T. Kovacs[3]

[1]School of Natural and Built Environment, Queen's University Belfast, David Keir Bldg., 39-123 Stranmillis Rd, Belfast BT9 5AG, United Kingdom

[2]Faculty of Engineering Technology, Hasselt University, Campus Diepenbeek, Agoralaan Bldg. H, B-3590, Diepenbeek, Belgium

[3]Institute of Radiochemistry and Radioecology, University of Pannonia, 10 Egyetem str, Veszprem H-8200, Hungary

*Corresponding author: z.sas@qub.ac.uk

Abstract

To get an insight into the radiological features of potentially reusable by-products in building materials industry, a review of the reported scientific data is necessary. This study is based on the continuously growing database of the By-BM (H2020-MSCA-IF-2015) project (geopolymers from industrial by-products). This project also provides information to the NORM database of COST TU1301 NORM4Building Action. The By-BM database contains individual data of about 770 industrial by-products from 30 countries. It was found that the natural isotope content varied between Ra-226: 8-27885 Bq/kg (average: 796 Bq/kg, median: 172 Bq/kg); Th-232: 2-1350 Bq/kg (average: 128 Bq/kg, median: 84 Bq/kg); K-40: 5-4001 Bq/kg (average: 366 Bq/kg, median: 300 Bq/kg). Compared with world average values reported in UNSCEAR 2008 (32 Bq/kg for Ra-226, 45 Bq/kg for Th-232 and 412 Bq/kg for K-40), the averages of Ra-226, Th-232 and K-40 were 23.6 times, 2.8 and 0.88 times higher, respectively. The calculated I-index – defined in Annex 7 of EU-BSS – ranged between 0.06 and 93.45 (average 3.40, median 1.39). Altogether, 65.5% of the calculated I-indexes were higher than 1.0 value (recommended upper level for bulk amount inbuilt) which clearly proves that the bulk amount inbuilt of these materials can cause elevated gamma exposure on residents. Only 6.1 % of the samples had higher index value than 6.0 which is the criteria for superficial materials (e.g. tiles). The By-BM database was visualized with dynamic filters to create a practical tool to demonstrate the distribution of a large dataset.