

Analysis of the Natural Radioactivity of Raw and Building Materials in Poland in the period 1979-2012

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Abstract

The systematic research of the natural radioactivity of raw and building materials has been performed in Poland since 1979. Based on the results of these studies, carried out both by the Central Laboratory for Radiological Protection (CLOR) and more than 30 other research laboratories in our country, the national database of measurements of natural radioactivity has been set up. The database is supervised by the CLOR and contains the results of the measurements for more than 42 000 analysed samples since 1979 up to now.

At present, the evaluation of raw and building materials in terms of the presence of radioactivity concentration shall apply the criteria published in the Ordinance of the Council of Ministers of 2 January 2007, (Journal of Laws No 4 pos. 29). It is the primary and only act specifying the requirements for raw and building materials used in various types of construction activities.

The regulation classifies the possibility to apply different raw and building materials in various types of housing by specifying two parameters:

- the qualification coefficient f_1 - specifies the content of natural isotopes in the test material and is the coefficient of the gamma radiation exposure to the whole body.
- the qualification coefficient f_2 (Radium Ra-226) - specifies the content of the test material and is the coefficient of the exposure of the epithelium of the lungs to the radiation emitted by the decay products of radon, i.e. alpha particles collected together with air by the human respiratory system.

Depending on the qualification coefficients, the raw and building materials are licensed to be utilized in various constructions.

In addition, the absorbed dose rate at 1 m above ground level, road or facility should not exceed 0.3 $\mu\text{Gy/h}$ for the application of industrial waste to the levelling and the construction of roads, sports and recreational facilities.

Since 1990, there was an increase in the number of qualification measurements of the natural radioactivity of raw and building materials, which due to the economic development of the country. However, during the last years the number of the natural radioactivity tests is reduced, due to the wider usage of the construction materials of foreign origin, which are not subject to the mandatory testing in Poland. The qualification coefficient f_1 is almost constant taking into the account the entire period of the monitoring of the raw and building materials. The highest level of the qualification coefficient f_1 is for the ash and the lowest is for the carbon - it is due to the process of the concentration of the radionuclides by the combustion process.

The concentration coefficient for the combustion is 4.5 on the average. The higher values of qualification coefficient f_1 characterize the materials containing considerable amounts of industrial raw materials such as ash or slag.

The level of qualification coefficient f_1 for the ceramics is approximately twice as lower as for the ash. The average values of f_1 during the study period since 1979 did not exceed (except for the ash in 2011) the limit for the applications in the construction of dwellings ($f_1 < 1.2$).