

The Influence of Phosphate Fertilizers on Radiological Situation of Cultivated Lands: ^{210}Po , ^{226}Ra , ^{232}Th , ^{40}K and ^{137}Cs Concentrations in Soil

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Abstract : In 1996, the European Council Directive 96/29/EURATOM pointed phosphate fertilizers to have a potentially negative influence on the environment from the radiation protection point of view. Fertilizers along with irrigation and crop rotation were the milestones that allowed to increase agricultural productivity. Firstly based on natural materials such as compost, manure, fish processing waste, etc., and since the 19th century created synthetically, fertilizers caused a boom in crop yield and helped to propel global food production, especially after World War II. In this work the concentrations of ^{210}Po , ^{226}Ra , ^{232}Th , ^{40}K , and ^{137}Cs in selected fertilizers and soil samples were determined. The results were used to calculate the annual addition of natural radionuclides and increment of the external radiation exposure caused by the use of studied fertilizers. Soils intended for different types of crops were sampled in early spring when no vegetation had occurred yet. Analysed fertilizers were those with which the soil was previously fertilized. For gamma radionuclides, a high purity germanium detector GX3520 from Canberra was used. The polonium concentration was determined by radiochemical separation followed by measurement by means of alpha spectrometry. The spectrometer used in this study was equipped with 450 cm² PIPS detector from Canberra. Obtained results showed significant differences in radionuclide composition between phosphate and nitrogenous fertilizers (e.g. the radium equivalent activity for phosphate fertilizer was 207.7 Bq/kg in comparison to <5.6 Bq/kg for nitrogenous fertilizer). The calculated increase of external radiation exposure due to use of phosphate fertilizer ranged between 3.4 and 5.4 nG/h, which represents up to 10% of the polish average outdoor exposure due to terrestrial gamma radiation (45 nGy/h).

Keywords : ^{210}Po , alpha spectrometry, exposure, gamma spectrometry, phosphate fertilizer, soil

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