

Radon-222 Concentration and Potential Risk to Workers of Al-Jalamid Phosphate Mines, North Province, Saudi Arabia

Authors : El-Said. I. Shabana, Mohammad S. Tayeb, Maher M. T. Qutub, Abdulraheem A. Kinsara

Abstract : Usually, phosphate deposits contain ^{238}U and ^{232}Th in addition to their decay products. Due to their different pathways in the environment, the $^{238}\text{U}/^{232}\text{Th}$ activity concentration ratio usually found to be greater than unity in phosphate sediments. The presence of these radionuclides creates a potential need to control exposure of workers in the mining and processing activities of the phosphate minerals in accordance with IAEA safety standards. The greatest dose to workers comes from exposure to radon, especially ^{222}Rn from the uranium series, and has to be controlled. In this regard, radon (^{222}Rn) was measured in the atmosphere (indoor and outdoor) of Al-Jalamid phosphate-mines working area using a portable radon-measurement instrument RAD7, in a purpose of radiation protection. Radon was measured in 61 sites inside the open phosphate mines, the phosphate upgrading facility (offices and rooms of the workers, and in some open-air sites) and in the dwellings of the workers residence-village that lies at about 3 km from the mines working area. The obtained results indicated that the average indoor radon concentration was about 48.4 Bq/m^3 . Inside the upgrading facility, the average outdoor concentrations were 10.8 and 9.7 Bq/m^3 in the concentrate piles and crushing areas, respectively. It was 12.3 Bq/m^3 in the atmosphere of the open mines. These values are comparable with the global average values. Based on the average values, the annual effective dose due to radon inhalation was calculated and risk estimates have been done. The average annual effective dose to workers due to the radon inhalation was estimated by 1.32 mSv. The potential excess risk of lung cancer mortality that could be attributed to radon, when considering the lifetime exposure, was estimated by 53.0×10^{-4} . The results have been discussed in detail.

Keywords : dosimetry, environmental monitoring, phosphate deposits, radiation protection, radon

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