Gamma Radiation Measurements and Dose Rate Calculations of Soil Samples within and around Ras Muneef, Jordan

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in the Department of Physics, Yarmouk University, Irbid, Jordan

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May, 2008
Abstract

Almomani, Ali Mohammed. Gamma Radiation Measurements and Dose Rate Calculations of Soil Samples within and around Ras Muneef, Jordan. Master of Science Thesis, Department of Physics, Yarmouk University, 2008 (Supervisor: Dr. Anas Mohammed Ababneh).

Soil is considered as the main reservoir of both natural and artificial radionuclides, which are transported to the human body through the food chain. Thus, an assessment of the level of radioactivity in soil and the associated dose is of crucial importance. Artificial radionuclide concentrations in soil depend heavily on rainfall and weather conditions. In this study, the soil from the Ras Muneef region, which has the highest rainfall in Jordan, was collected from four towns (Ras Muneef, Sekhra, Ebeen, and Al-Mraijam) with fifty nine samples at different depths. These were analyzed for their radioactive content, both natural and artificial. The soil was divided into three categories depending on the type of soil use: Intact (Undisturbed), Agricultural (Cultivated), or Residential (Populated). Measurements of the activity concentrations have been made using a gamma ray spectrometer based on HPGe coaxial detector. The results were analyzed using Genie® 2000 software.

The specific activity of $^{238}U$, $^{235}U$, $^{226}Ra$, $^{232}Th$, $^{137}Cs$, and $^{40}K$ were found to be in the range (in Bq/kg): 8 – 81, 0.79 – 5.36, 17 – 66, 5 – 34, 0.64 – 18.55, and 102 – 339, respectively and the corresponding mean values were (in Bq/kg ± standard deviation): 26 ± 17, 2.30 ± 1.01, 34 ± 10, 26 ± 8, 5.18 ± 3.75, and 260 ± 67. The obtained concentrations were then used to calculate the external absorbed dose rate. The annual effective dose was found to range from 40.84 to 120.89 μSv/y with an average of 100.77 μSv/y which falls within the worldwide ranges.
Keywords: Soil; Gamma Ray Spectrometry, Environmental Radioactivity; Ras Muneef, Caesium-137; Effective Dose Rate; Radium Equivalent; Hazard Index.