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Activity concentration and annual effective dose estimation of ^{210}Pb, ^{40}K and ^{137}Cs in surface soil samples from southern Algeria

The level of radioactivity from naturally occurring radioactive material (NORM) depends on geological conditions and geographical locations. NORM may be present in water, food, soil, rocks, concrete, and other building materials in considerable amounts. The origin of natural radioactivity in rocks and building material is the earth's crust, while the soils' radioactivity often originates from soil minerals containing natural ^{238}U and ^{232}Th parent series and natural ^{40}K. Further sources of radioactivity in nature are technically enhanced natural occurring radioactive material (T-NORM), mineral extraction facilities, extensive use of phosphorus rich fertilizers in agriculture, releases from installations of the nuclear fuel cycle, use and tests of nuclear weapons, and fallout from nuclear accidents. The specific levels of terrestrial environmental radiation are related to the geological composition of each pathologically separated area, and to the content of natural radionuclides in rocks from which the soils originate in each area. Man-made radionuclides have been introduced in the environment since the beginning of the 20th century, but more significant since 1940 with the first nuclear weapon tests and after the 60s from a variety of other nuclear activities. In the early 1960s, France conducted a series of nuclear tests in the Sahara Desert of south Algeria. During these tests, radioactive materials were released to the environment. Several observations of have shown that ^{137}Cs deposition reached a peak of about 4.8 GBq/km^2 during 1965–1966. The radionuclides deposited on the soil by radioactive fallout due to nuclear weapon tests or nuclear accidents can enhance the radiation dose to human directly via external radiation and indirectly by ingestion of plants which were contaminated due to uptake of radionuclides from soil through roots. Understanding the mechanisms of sorption and migration of radionuclides in the soil and their transfer into the food chain is necessary in order to reduce effectively the external and internal exposure of human. The long-term transfer of radionuclides from fallout via terrestrial pathways depends considerably on the residence time of radionuclides in the root zone of agricultural and grassland sites. The radionuclides that are deposited in the sandy soil of the desert are brought to the surface by the movement of the dunes and could be re-suspended by wind. Some detection of high concentrations of ^{137}Cs and ^{40}K in the Mediterranean area were related to winds coming from Africa. A high level dose can cause deterministic and stochastic effects in short and long exposure times respectively. This study determines the activity concentration and estimate the dose of 16 sand samples collected from two different nuclear test sites. Radionuclides were determined in Algerian soil samples from different regions where the highest activity concentration of ^{210}Pb was detected for the highest value in sample three and the minimum value in sample eight, the highest activity concentration of ^{40}K was detected in sample two and the lowest value in sample 11 and finally, the highest concentration of ^{137}Cs was detected in sample 15 and the lowest value in sample 13. The soil surface and soil properties differently affect mobilization of natural radionuclides.

Biography

Mohammad Nadri is an assistant professor in Physics Department, ENS, Algeria, from 2006 till now. Currently, he is preparing for his PhD degree in Environmental Physics, Aristotle University of Thessaloniki, Physics Department, Nuclear Physics Laboratory, Thessaloniki 54124, Greece. He has completed his Master's degrees in Nuclear Physics from Physics Department, Baghdad University Iraq and Alexandria University Physics Department, Egypt. His projects include: Development of Traditional Poultry Farming Sahara Young's People Algeria; Culture of Medicinal Plants Sahara Young's People Algeria and Plant Medicinal and Asian Vegetables in Algeria.

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