

ASSESSMENT OF NATURAL RADIATION LEVELS IN SIWA OASIS, WESTERN DESERT

Submitted By

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B.Sc. of Science (Biochemistry/Chemistry), Faculty of Science,
Ain Shams University, 1999

A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
Ain Shams University

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ABSTRACT

A survey was conducted to determine the activity concentrations of ^{226}Ra , ^{232}Th (^{228}Ra) and ^{40}K and related external and internal radiation health hazard indices in water and soil of Siwa Oasis, Western Desert of Egypt. A total of 59 water and 58 soil samples were collected. The presence of natural radionuclides subsequently being assessed by HPGc γ -ray spectrometry. The obtained data were statistically treated by applying regression analysis, Pearson correlation and cluster analysis to investigate the influence of physico-chemical parameters on the distribution of the examined radionuclides in water and soil samples.

It was found that all the Nubian Sandstone Aquifer System (NSAS) water samples have ^{226}Ra and combined ^{226}Ra and ^{228}Ra activity concentrations values higher than the recommended level for drinking water. On the other hand, the activity concentrations of ^{40}K in 67.79 % of the collected samples higher than recommended level for safe drinking water. For cultivated and uncultivated soil types, the activity concentrations of the radionuclide have the order of $^{40}\text{K} > ^{226}\text{Ra} > ^{232}\text{Th}$. The mean values of ^{226}Ra , ^{232}Th and ^{40}K were 27.55 ± 1.79 , 16.24 ± 2.49 and $254.22 \pm 13.44 \text{ Bq kg}^{-1}$; respectively for the cultivated soils and 15.08 ± 1.03 , 10.32 ± 0.70 and $130.20 \pm 6.90 \text{ Bq kg}^{-1}$; respectively for the uncultivated soils.

The mean value of total the Annual Effective Dose (AED) for infants (0-1 yr) and toddlers (1-2 yr) significantly exceeded the WHO recommended dose of $0.1 \text{ mSv year}^{-1}$. The mean values of total AED for infant were 0.872 , 0.388 and $0.498 \text{ mSv yr}^{-1}$ while those for toddlers were 0.390 , 0.249 and $0.275 \text{ mSv yr}^{-1}$ due to consumption of NSAS, bottled and tap water; respectively. Also, total AED mean values for age groups 2-7 yr, 7-12 yr and 14-17 yr significantly exceeded that recommended dose

due to consumption of NSAS water. All other total AED mean values for different age group were a little higher the WHO recommended dose, except those for age group > 17 year due to consumption of bottled water.

The mean calculated the Radium Equivalent Activity Index (Ra_{eq}), the External Hazard Index (H_{ex}), the Absorbed Dose Rate (D_{ex}) values were far lower than the safe maximum value and so does not pose a radiological hazard to humans. the External Annual Effective Dose (AED_{ex}) mean were higher than the worldwide average for external outdoor exposures for regions of natural radiation background in 62.5 % of the studied cultivated soils samples, and in only one samples (5.5 %) of the uncultivated soils. the Excess Lifetime Cancer Risk (ELCR) mean values were 0.28×10^{-3} and 0.16×10^{-3} for the cultivated and uncultivated soils; respectively.

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Chapter 1

INTRODUCTION