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**PhD Dissertation Defense**

*DETERMINATION OF PRIMORDIAL AND ANTHROPOGENIC RADIONUCLIDES  
CONCENTRATIONS IN AGRICULTURE SOIL OF THE UNITED ARAB EMIRATES USING GAMMA-  
RAY SPECTROMETRY*

By

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Abstract

The United Arab Emirates has initiated the first civilian nuclear power plant, and it will be operating four reactors between (2017- 2020). The establishment of Barakah Nuclear Power Plant, which will employ the nuclear power to generate clean energy, is a significant step forward minimizing the UAE carbon footprint. The present study represents the first research effort in the United Arab Emirates (UAE) to build a database of agricultural topsoil radioactivity concentrations established using standard sampling and analytical procedures. This study determines the primordial radionuclides concentrations obtained from 145 soil samples collected from multiple agriculture farms in the United Arab Emirates. Collected soil samples were analyzed to establish radioactivity concentration levels associated with  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ . The activity concentrations were measured by high-resolution gamma-ray spectrometry. The results indicate that the mean specific activity concentrations (in  $\text{BqKg}^{-1}$ ) were  $15.34 \pm 2.8$ ,  $4.18 \pm 1.4$  and  $310.74 \pm 63.9$  for  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ , and  $^{40}\text{K}$ , respectively. Cesium-137 was detected in a little number of samples with a specific activity of  $1.5 \pm 2.2 \text{ BqKg}^{-1}$ . All study collected sample activities and radiation parameters were found to be below maximal admissible values established in various international recommendations and standards. Also, the present study represents the first documented baseline concentration of UAE soil minerals, trace, and heavy metals contents. The mean values ( $\text{mg Kg}^{-1}$ ) were: Al - 8,539.7, As - 2.17, B - 47.68, Ca - 86,264.5, Cd - 0.35, Co - 10.30, Cr - 111.20, Cu - 14.32, Fe - 9,839.80, K - 2,026.80, Mg - 26,688.30, Mn - 237.40, Mo - 0.02, Na - 470.40, Ni - 60.90, P - 450.60, Pb - 4.25, S - 2,393.50, Si - 795.68, Sr - 593.70, V - 20.90 and Zn - 24.90. Further, study results were compared against international recommended levels. Also, we provided recommendations to UAE concerned entities regarding regulating the concentrations of these elements found in the agricultural soil. Future research recommendations include extending the study scope to cover all the agricultural farms in UAE including organic farms. Study results supported radioactivity concentration and mineral mapping of UAE soils using the Geographic Information System (GIS).

**Keywords:** Agriculture soil, Gamma spectrometry, United Arab Emirates,  $^{238}\text{U}$ ,  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ ,  $^{40}\text{K}$  and  $^{137}\text{Cs}$ , Nuclear, Radioactivity, GIS, ICP-OES, Minerals, Heavy Metals, Global Warming.