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Master Thesis Defense

Entitled

APPLICATION OF NATURAL RADIOACTIVITY FOR HYDROGEOLOGICAL AND ENVIRONMENTAL ASSESSMENT OF GROUNDWATER IN RAS AL-KHAIMAH, UAE

by

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Abstract

Groundwater includes a certain concentration of natural radioactive isotopes of uranium (U) and its decay products (daughters) like radon (Rn). Defining the concentration levels, spatial distribution, and possible environmental impact of these isotopes in groundwater is vital for sustainable groundwater resources in the United Arab Emirates (UAE). This dissertation focuses on documenting the distribution and determining the probable environmental impact and sources of Uranium-235 (^{235}U), Uranium-238 (^{238}U), and Radon-222 (^{222}Rn) in groundwater in the Northern part of the UAE and specifically in the Wadi Al Bih aquifer in Ras Al Khaimah Emirate. The sampled wells occur at different distances from the coast, where some are very close to the coastal line, and some exist in the center of Wadi Al Bih. A variety of techniques including ICP-MS, ICP-OES, and RAD7, were used for the analyses. The results reveal comparable activity concentration in the measured radioactivity in terms of spatial and local variability. All the ^{235}U, ^{238}U, and ^{222}Rn concentrations in the measured groundwater samples are below the World Health Organization permissible limit for drinking water. The occurrence of ^{235}U, ^{238}U, and ^{222}Rn in the measured samples suggest a geochemical interaction between the aquifer's lithology and water. In some wells, seawater intrusion is expected to be an additional source of uranium and elevated total dissolved solids (TDS). The calculated radioactivity annual effective doses of inhalation and ingestion were below the maximum permissible annual dose limits defined by the WHO. The probable -uranium-related- cancer mortality and morbidity were also calculated and found to be not hazardous following the permissible limits determined by the United States Environmental Protection Agency (EPA) and International Commission on Radiological Protection (ICRP).

Keywords: radioactive isotopes, carbonate aquifer, uranium, radon, UAE