Ain Shams University
Faculty of Women for Art,
Science and Education,
Physics Department

Evaluation of Natural Radioactivity and Heavy Metals Along the Bahr El Baqar Canal, Egypt

Thesis submitted for the partial fulfillment of master degree in physics (Nuclear physics)

Presented by:

Manar Rafih Mohamed Ahmed

B. Sc. in Physics, 2004

Supervised by

Prof. Dr. Abou Bakr Abd El-Mnam Ramadan

Professor of Radiation and Environmental
Measurements, Nucleur and Radiological
Regulatory Authority

Dr. Thanaa M. Abd El-Maksoud

Ass. Prof. of Nuclear Physics
Physics Department
Faculty of Women for Art,
Science and Education,
Ain Shams University

Dr. Afaf Abd El-Lateef Nada

Ass. Prof. of Nuclear Physics
Physics Department
Faculty of Women for Art,
Science and Education,
Ain Shams University

2013

Ain Shams University
Faculty of Women for Art,
Science and Education,
Physics Department

Evaluation of Natural Radioactivity and Heavy Metals Along the Bahr El Baqar Canal, Egypt

Thesis submitted for the partial fulfillment of master degree in physics (Nuclear physics)

A thesis presented by:

BY

Manar Rafih Mohamed Ahmed

B. Sc. in Physics, 2004

For

M. Sc. Degree in science

(Physics – Nuclear Physics)

Supervisors

Prof. Dr. Abou Bakr Abd El-Mnam Ramadan

Dr. Thanaa M. Abd El-Maksoud

Dr. Afaf Abd El-Lateef Nada

Approval Stamp

/ /2013

Date of Approval

/ /2013

Approval of Faculty Council

/ /2013

Approval of University Council

/ /2013

Acknowledgement

First, I thank (Allah) the Beneficent, the Merciful, for my success in completing this work.

I would like to express my thanks to:

Prof. Hosnia Mohamed Abu-Zeid, Professor of Nuclear Physics at Physics Department, Faculty of Women for Art, Science, and Education, Ain Shams University, for her supervision , honest guidance, continuous encouragement and trustful help through the experimentation and writing the manuscript.

***Prof.* Dr. Abou Bakr Ramadan,** Professor of Radiation and Environmental Measurements,Nucleur and Radiological Regulatory Authority, for his supervision , honest guidance, continuous encouragement and trustful help through the experimentation and writing the manuscript.

Dr. Thanaa M. Abd-El-Maksoud Assistant Professor of Nuclear physics at Physics Department, Faculty of Women for Art, Science and Education, Ain Shams University, for her supervision and encouragement.

Dr. Afaf Abd El-Lateef Nada, Assistant professor of Nuclear Physics at Physics Department, Faculty of Women for Art, Science and Education, Ain Shams University, for her advises in supervising the manuscript, generous assistance and continuous helpful discussions leading always towards more perfection and achievement of this work.

My husband for his patience, encouragement and understanding of my dedication to completing my Ph.D.

My family for her continuous support and encouragement during this work. I would also like to thank faculty members who provided guidance and support in completing this research.

ABSTRACT

The present study aims mainly to investigate physical and chemical analyses for water samples and the radioactivity concentrations for water and sediment samples collected from Bahr El-Baqar Drain.
The present study divided into two parts according to the studied areas the first part is Qalubeya drain and the second part is Bilbis drain.

Part (A): Qalubeya drain

The present study deals with the physical and chemical characteristics of the water samples collected from Qalubeya drain. Determination of physical and chemical parameters (Water temperatures, pH, dissolved oxygen, electrical conductivity) were carried out to identify the nature and quality of the water of Qalubeya drain. Concentration of radioactivity levels and heavy metals was measured in water of Qalubeya drain. Gamma-radiation measurements were performed using high resolution ($HPGe_1$) detector. Total uranium concentration was measured by a laser fluorimeter, while the concentration of heavy metals was determined by Atomic Absorption Spectrometry. The concentrations in the drain water were found to be below the detection limit. The specific activities of ^{238}U, ^{226}Ra series, ^{232}Th and ^{40}K in water samples using ($HP\text{-}Ge_1$) representing the different collection sites were in the range of 0.78 to 3.5, 0.1 to 2.7, 0.1 to 2.1and

0.4 to 1,2 Bq/L for ^{238}U, ^{226}Ra series, ^{232}Th series and ^{40}K, respectively. Total uranium concentration was measured by a laser fluorimeter The specific activity concentration was detected in all samples. It ranges from 0.20 ppm (2.53 Bq/L) to 0.46 ppm (5.57 Bq/L).where The lowest value was found in samples collected from Safet El Kanter while the highest value was found in samples collected from Qaha. Correlation analysis between radionuclide isotopes and heavy metal, cations, anions was determined, using the Pearson correlation coefficients. The specific activities of ^{238}U, ^{226}Ra series, ^{232}Th series,^{40}K and^{137}Cs in sediment samples using (HP-Ge_2) have a mean of values 47.86±8.273, 13.709±0.785, 14.108±1.433, 291.59±3.78 and 1.304±0.174 Bq/kg respectively. The dose rate in of the sediment samples of the Qalubeya drain has an average of 38.25nGy/h. The annual effective dose and hazard index have averages of 0.05 mSv and 0.15, respectively. The Ra_{eq} has the average of 56.34Bq/kg. It is noticed that all the hazards values are considered very low compared to the recommended limits applied in UNSCEAR 2000. Except in Qaha location.

Part (B): Bilbis Drain

The present study deals with the physical and chemical characteristics of the water samples collected from Bilbis Drain. Determinations of physical and chemical parameters (water temperatures, pH, dissolved oxygen, electrical conductivity) were carried out to identify the nature and quality of the water of Bilbis drain. Concentration of radioactivity levels and heavy metals was measured in water of Bilbis drain. Gamma-radiation measurements were performed using high resolution ($HPGe_1$) detector. Uranium Content in water samples collected from Bilbis - Bahr El-Baqar drain was carried out using alpha spectrometry. While the concentration of heavy metals was determined by Atomic Absorption Spectrometry. the concentrations in the drain water were found to be below the detection limit . The specific activities of ^{238}U, ^{226}Ra series, ^{232}Th and ^{40}K in water samples using($HP\text{-}Ge_1$) representing the different collection sites were in the range of 0.82 to 2.4, 0.7 to 1.4 , 0.96 to 2.1 and 0.6 to 1,2Bq/L respectively. For uranium analysis the results show that the uranium level obtained is in the normal range of the natural radioactivity. At the beginning of the Bilbis drain the uranium concentration was about 3 ppm decreasing down to about 0.8 ppm at Safet El kanter area. Correlation analysis between radionuclide isotopes and heavy metal, cations, anions was determined, using the Pearson correlation coefficients. The specific activities of ^{238}U, ^{226}Ra series, ^{232}Th series, ^{40}K and ^{137}Cs in sediment samples using ($HP\text{-}Ge_2$) have a mean of 36.92±8.31, 13.58±0.88, 14.92±1.47, 280.77±4.14 and 0.947±0.117 Bq/kg respectively, the dose rate in the sediment samples of the Bilbis drain has an average of 34.59nGy/h.

The annual effective dose and hazard index have averages of 0.04 mSv and 0.15, respectively. The Ra_{eq} has the average of 56.55Bq/kg. It is noticed that all the hazards values are considered very low compared to the recommended limits applied in UNSCEAR 2000. Except in El khsous location .

Contents

Chapter 1
Introduction and Literature Review

Page

CHAPTER 2
Aquatic Systems and Heavy Metals

CHAPTER 3
Experimental Techniques

CHAPTER4

Results and Discussion

LIST OF FIGURES