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Physical Characteristics and Evaluation of Natural Radioactivity in Lake Qarun , Egypt

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

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ABSTRACT

The present study aims mainly to investigate physical limnology and the natural radioactivity, dose rate and the environmental impacts in Lake Qarun. In addition, natural radioactivity in the soil samples from its surrounding area was also determined.

The present study deals with the physical and chemical characteristics of the water of Lake Qarun. Determination of physical parameters (air and water temperatures, transparency, electrical conductivity, salinity, and total dissolved solids) and chemical parameters (pH, chlorinity, water density and dissolved oxygen) were carried out to identify the nature and quality of the water of Lake Qarun. Concentration of radioactivity levels and heavy metals was measured in sediments of Lake Qarun during winter and summer seasons. Gamma-radiation measurements were performed using high resolution (HPGe) detector, while the concentration of heavy metals was determined by Atomic Absorption Spectrometry (AAS). Heavy metals and major elements concentrations of the sediments were found decreasing in sequence of $\text{CaCO}_3 > \text{Fe} > \text{P} > \text{Mn} > \text{Pb} > \text{Cu} > \text{Cd}$. The environmental measurements of gamma-ray showed that the activity concentrations of ^{232}Th and ^{40}K in the sediments samples are within the average world value. The activity concentration of ^{238}U was found to be higher than that of the average world. ^{137}Cs was observed in all the samples, ranging from 0.28 to 4.96 Bq Kg^{-1} during winter, while in summer, it varies from 0.09 to 5.37 Bq Kg^{-1} . Correlation analysis between radionuclide isotopes and heavy metal was determined, using the Pearson correlation coefficients.

The radium-equivalent; dose rate in air, external hazard index and annual effective dose rate were evaluated. The mean activity concentrations of the gamma-emissions from radionuclides in Lake Qarun were relatively low.

The activity concentrations of ^{238}U , ^{232}Th , ^{40}K and ^{137}Cs for surrounding area of Lake Qarun are fluctuated (0-74.6) Bq kg^{-1} , (5.4-28.2) Bq kg^{-1} , (100.9-372.4) Bq kg^{-1} and (0.04-2.9) Bq kg^{-1} during winter, respectively. But during summer, the activity concentrations are ranged (10.2-65.4) Bq kg^{-1} , (2.7-22) Bq kg^{-1} , (36.4-296.7) Bq kg^{-1} and (0.03-1.8) Bq kg^{-1} respectively. This activity is in agreement with the recommended values except the average activity concentration of ^{238}U is relatively high. The worldwide average values are 35, 30 and 400 for ^{238}U - ^{226}R series, ^{232}Th series and ^{40}K respectively.

The estimated dose rates, annual effective dose, mean radium equivalent activity and external hazard index in all locations surrounding area of Lake Qarun are lower than the recommended values. Therefore, this region is safe for human beings.

A decorative border on the left and right sides of the page, featuring dark brown, stylized tree branches with several bright pink, five-petaled flowers. The branches curve upwards and outwards, framing the central text.

Dedication

For my Father, my mother

Mercy of God

And my Gig Brother,

Mahmoud, and my sisters

And my Brothers



الْحَمْدُ لِلَّهِ الَّذِي هَدَانَا لِهَذَا
وَمَا كُنَّا لِنَهْتَدِيَ لَوْلَا أَنْ هَدَانَا اللَّهُ

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Contents

Acknowledgement

Abstract

Contents.....i

List of Figures.....v

List of Tables.....x

CHAPTER 1 **INTRODUCTION AND LITERATURE** **REVIEW**

	<i>Page</i>
1.1 General	1
1.2 Sources of Natural Background Radiation	2
1.2.1 Primordial Natural Radionuclides.....	2
1.2.1.1 Series Radionuclides.....	3
1.2.1.2 Non Series Primordial Radionuclides.....	8
1.2.2 Secondary Occurring Natural Radionuclides.....	9
1.2.3 Cosmogenic Radionuclides.....	10
1.2.4 Man-Made Sources of Radiation.....	12
1.2.4.1 Medical Radiation Sources.....	13
1.2.4.2 Nuclear Weapons Tests.....	13
1.2.4.3 Nuclear Power.....	13
1.2.4.4 Consumer Products.....	14
1.3 Different Factors Affecting the Radiation Background	
Levels in Aquatic Ecology	14
1.3.1 Meteorological Effect.....	16
1.3.2 Hydrological Condition of Lake Qarun.....	17
1.3.2.1 Surface Area and Water Storage.....	17

1.3.3 The Physico-Chemical Properties of Biosphere Aquatic Ecology.....	18
1.3.4 Impact of Human Activities and Radioactivity Waste on the Hydrosphere.....	20
1.4 Lake Qarun History.....	21
1.4.1 Lake Qarun Morphology.....	22
1.4.2 Geology of the Lake Qarun.....	24
1.5 Literature Reviews.....	25
1.6 Aim and Scope of the Present Study.....	45

CHAPTER 2

RADIOACTIVITY IN THE ENVIRONMENT

2.1 Discovery of Radioactivity.....	46
2.2 Behavior of Radioactive Substances in Different Ecological Systems.....	47
2.2.1 Behavior in the Air	49
2.2.2 Behavior in Aquatic Systems.....	50
2.2.3 Behavior in Sediment	53
2.2.4 Behavior in Soil.....	55
2.3 Radionuclides Released into the Environment.....	57
2.3.1 Naturally Occurring Radioactive Materials (NORM).....	58
2.3.2 Technologically- Enhanced Naturally Occurring Radioactive Materials (TENORM).....	59
2.3.2.1 Phosphate Industries.....	59
2.3.2.2 Mining Industries.....	60
2.3.2.3 Combustion.....	61
2.4 Radioactive Equilibria.....	62
2.4.1 Secular Equilibrium: ($\tau_1 \gg \tau_2$).....	62
2.4.2 Transient Equilibrium: ($\tau_1 \geq \tau_2$).....	63
2.4.3 Non-Equilibrium: ($\tau_1 < \tau_2$).....	65
2.5 Equilibrium in Radioactive Series.....	65

2.6 Radiation Quantities and Units.....	66
2.6.1 Exposure	67
2.6.2 Doses and Its Units.....	67
2.6.3 Absorbed Dose Rate.....	68
2.6.4 Annual Effective Dose.....	69
2.6.5 Radium Equivalent Activity.....	70
2.6.6 External Hazard Index.....	70
2.6.7 Internal Hazard Index.....	70
2.6.8 Dose in the Environment.....	71
2.7 Statistical Treatment of Radioactivity Measurement..	72
2.7.1 Errors.....	73
2.7.2 Error Calculations.....	73

CHAPTER 3

EXPERIMENTAL TECHNIQUES

3.1 Sampling and samples preparation.....	75
3.1.1 Sampling.....	75
3.1.2 Samples Preparation.....	77
3.1.2.1 Physico-Chemical Parameters	77
3.1.2.2 Chemical Analysis of Lake Qarun Sediment....	80
3.1.2.3 Radiometric Analysis.....	83
3.2 Germanium Gamma-Ray Detectors.....	84
3.3 Experimental Set-Up.....	89
3.7.1 Hyper Pure Germanium Detector (HpGe).....	89
3.4 Energy and Efficiency Calibration of the Electronic Systems.....	96
3.4.1 Energy Calibration.....	98
3.4.2 Efficiency Calibration.....	99
3.5 Specific Activity Measurements.....	100
3.6 Detection Limits.....	103

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction.....	105
4.2 Part (A): Inside Lake Qarun.....	105
4.2.1 Physico-Chemical Parameters.....	105
4.2.1.1 Temperature.....	106
4.2.1.2 Hydrogen Ion Concentration (pH).....	107
4.2.1.3 Transparency.....	110
4.2.1.4 Chlorinity.....	113
4.2.1.5 Electrical Conductivity (EC).....	114
4.2.1.6 Total Dissolved Solids (TDS).....	115
4.2.1.7 Salinity.....	118
4.2.1.8 Water Density.....	119
4.2.1.9 Dissolved Oxygen (DO).....	121
4.2.2 Statistical Analysis for Physico-Chemical Parameters.....	123
4.2.3 Chemical Analysis.....	125
4.2.3.1 Heavy Metals Concentrations	125
4.2.3.2 Major Elements.....	136
4.2.4 Radioactive Measurements.....	140
4.2.5 Environmental Impact of Sediment Samples.....	157
4.2.6 Statistical Analysis for Radionuclide Isotopes.....	163
4.2.6.1 Statistical Analysis for Radionuclide Isotopes And Physico -Chemical Parameters.....	163
4.2.6.2 Statistical Analysis for Radionuclide Isotopes, Heavy Metals and Major Elements.....	166
4.3 Part (B): Outside Lake Qarun.....	170
4.3.1 Radioactive Measurements.....	170
4.3.2 Environmental Impact of Soil Samples.....	197
4.3.3 Statistical Analysis for Radionuclide Isotopes and Hazard Parameters.....	203

Conclusions	205
References	208
Arabic Summary	

LIST OF TABLES

<i>Table No.</i>	<i>Page No.</i>
(1-1) Primordial natural radio nuclides, half-lives, isotopic abundance and type of decay (α , β , γ and electron capture Ec).....	3
(1-2) Natural radionuclides produced by cosmic radiation.....	11
(1-3) Average hydrometeorological data during (1996-2005).....	17
(3-1) Coordinates of sampling points in Lake Qarun and surrounding area.....	77
(3-2) Radionuclides used for energy calibrations....	97
(3-3) The gamma transition used to determine the concentrations of (^{238}U , ^{232}Th , ^{40}K and ^{137}Cs)..	103
(3-4) The lowest limit of detection (LLD) for radionuclides of ^{40}K , ^{238}U , ^{232}Th , ^{235}U and ^{137}Cs	104
(4-1) Seasonal variation of air temperature, water temperature and pH in Lake Qarun.....	108
(4-2) Seasonal variation of transparency, chlorinity and electrical conductivity in Lake Qarun....	112
(4-3) Seasonal variation of T.D.S and salinity in Lake Qarun.....	117
(4-4) Seasonal variation of water density and dissolved oxygen in Lake Qarun.....	120
(4-5) Pearson correlation coefficients for mean physicochemical parameters in four seasons.....	124
(4-6) Concentrations of heavy metals in sediment of Lake Qarun in (ppm) during two seasons.....	128

<i>Table No.</i>		<i>Page No.</i>
(4-7)	Comparison of heavy metals Cd, Cu, Pb, Fe and Mn in sediment samples of different Lakes with that of the present work.....	135
(4-8)	Sediment criteria which proposed by EPA.....	136
(4-9)	Concentrations of major elements in sediment of Lake Qarun during two seasons.....	137
(4-10)	The measured activity concentrations for radionuclide isotopes of natural U-238, Ra-226, Th-232 series in (Bq Kg ⁻¹) for different collected samples of the studied Lake during winter	142
(4-11)	The measured activity concentrations for radionuclide isotopes of natural U-238, Ra-226 and Th-232 series in (Bq Kg ⁻¹) for different collected samples of the studied Lake during summer.....	143
(4-12)	The measured average activity concentrations of ²³⁸ U, ²³² Th, ⁴⁰ K, ²³⁵ U, ¹³⁷ Cs in (Bq kg-1) and ²³⁸ U/ ²²⁶ Ra ratio for different collected samples of the studied Lake during winter.....	144
(4-13)	The measured average activity concentrations of ²³⁸ U, ²³² Th, ⁴⁰ K, ²³⁵ U, ¹³⁷ Cs in (Bq kg-1) and ²³⁸ U/ ²²⁶ Ra ratio for different collected samples of the studied Lake during summer.....	145
(4-14)	Summary of some measurement activity concentration of ²³⁸ U, ²³² Th, ⁴⁰ K, ²³⁵ U, ¹³⁷ Cs in (Bq kg ⁻¹ dry weight) in sediment samples of worldwide.....	154