EFFECTS OF SOME RADONUCLIDES ON THE ENVIRONMENT

By

AHMED ABDELSALAM ALI EASA

B.Sc. Agric. Sc. (Biochemistry), Ain Shams University, 1999
M.Sc. Agric. Sc. (Biochemistry), Ain Shams University, 2007

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Under the supervision of:

Dr. Farouk Guindi Moawad

Prof. Emeritus of Biochemistry, Department of Agricultural Biochemistry, Faculty of Agriculture, Ain Shams University (Principal Supervisor)

Dr. Nagah El Shahat Ali El-Said

Prof. Emeritus of Agricultural Biochemistry, Department of Agricultural Biochemistry, Faculty of Agriculture, Ain Shams University

Dr. Sawsan Gamal Abdel Samie

Prof. of Isotope Hydrology, Nuclear and Radiation Control Authority, The Presidency of The Cabinet of Ministers, Cairo

ABSTRACT

Ahmed Abd El-Salam Ali Easa: Effects of some Radionuclides on the Environment. Unpublished Ph.D. Thesis. Department of Agricultural Biochemistry, Faculty of Agricultural, Ain Shams University, 2014.

Abu Zaabal is one of the areas in Egypt that could be subjected to contaminants release from industrial activities to air or water with traceable amounts of trace elements and/or radionuclides. The main activities in the area that causes such releasewhere our study is focus on; are Phosphate Fertilizer Factory, and the Nuclear Research Reactor in Inchas area.

Twenty soil samples and its corresponding plants (20 samples) were collected and examined for trace elements (Cu, Co, Cd, Cr, Mn, Ni, Pb, Fe, V, and Zn). Contour maps were plotted for the distribution of these elements within the study area.

Natural radioactivity of three radionuclide (R-226, Th-232, K-40) and one artificial (man-made) radionuclide (Cs-137) was measured in the collected soil and plant samples in order to study the effect of these radionuclides on the environment (soil, plant).

To study the impact of radionuclides; radiation hazard indices were calculated including the annual effective dose rate, the external and internal dose rate.

The obtained results of trace elements concentration in soil samples showed that the detected elements are lower than the worldpermissible limits for soil samples. Whereas, in plant samples the accumulation differ from element to element specially in copper and vanadium which showed higher concentration in comparison with the permissible limits of world ranges for plants.

Natural radioactivity concentrations in soil samples lie in the

average ranges 18.7±2.4, 13.8 ± 1.9, and 190±1.9 Bq/Kg for Ra-226, Th-232 and K-40 respectively. These concentrations are considered safe to human and environment.

The man made radionuclide Cs-137 concentration in soil samples is very low, ranged from 0.14 ± 0.03 to 0.84 ± 0.12 Bq/Kg.

In plant samples the obtained data showed that R-226 and Th-232 concentration was low in comparison with its soil.On the other side, the concentration of K-40 in plant samples the av. concentration reaches 740 ± 21 Bq/Kg. This value is found to be 3 times greater than its soil. Cs-137 can't reach the detection limits of the instrument for all plant samples which mean that it absent or in concentration can't be traced.

The gamma-ray radiation hazards due to the specified radionuclides were assessed by three indices, *i.e.*, the radium equivalent activity, Ra_{eq}, the representative level index, I_r, and the external hazard index, H_{ex}.

The highest value of radium equivalent in soil samples was 89.57 Bq/Kg and the lowest Ra_{eq} value was 18.14 Bq/kg with mean concentration 53.12 Bq/kg.

Absorbed dose rates, *D* ranged from 8.8–42.38 nGy/h with average values 25.32 nGy/h which considered lower than the world average rate (55 nGy/h).

The highest annual effective dose rate value found to be 52 µSv/year. Whereas, its lowest value reached 10.8 µSv/year. The world average annual effective dose equivalent (AEDE) from outdoor terrestrial gamma radiation is 460µSv/year (UNSCEAR 2000).

This means that the external and internal hazards indices were lower than unity which considered being safe for public.

The present study showed that the soil collected from Abu Zaabal area had various radionuclide contents within the average world values. The effect of phosphate fertilizer factory is almost safe. The corresponding gamma radiation hazard indices and annual effective dose were below those of the limits considered acceptable.

Regarding to the obtained data we can concluded that, the study area is considered to be safe in the context of public health with respect to radioactivity. The obtained results can be used as data base radioactivity background at Abu Zaabal area.

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Ahmed Easa

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INTRODUCTION

Great amounts of heavy metals and other chemicals produced by industrial residues and mining are often released into the atmosphere, soil and water. Heavy metals easily accumulate in large quantities in soil and transfer to plant tissues, with no visible phyto-toxicity but exceeding human and animal tolerance. There is an increase concern with respect to the effects of these elements in the food chain. In addition to phosphate fertilizer industries which are widely used in agriculture are considered to be a potential source of natural radionuclide contamination. Their radioactivity is leading to health problems from radiation at the level of the industrial processes which involves mining and transportation of phosphate ores and production of fertilizers. At the usage level, when fertilizers dispersed into the geo and biospheres, have a potential to transfer to living beings. Leaching of the minerals and wastes is another potential source of radioactivity dissemination which may contribute to enhanced exposure of workers, public and the environment to these radionuclides.

Because of increased public concern and awareness about radioactivity in the environment, this study has been carried out to measure the amount of radioactivity for the assessment of radiation dose from ingestion of some selected plant, growing in surrounding of the phosphate fertilizer factory in Abu Zaabal and the corresponding soil sample.

Though, the aim of this study is to evaluate the pollution level, the impact of trace elements and radionuclides on soil, plants and the calculation of activity concentration in Abu Zaabal area.

For that purpose 20 samples of plant and their corresponding soil were collected and prepared for analysis.