DETERMINATION OF RADIONUCLIDES CONTENTS IN SOIL SAMPLES AROUND LAFARGE CEMENT INDUSTRY, SHAGAMU, OGUN STATE

OGUN[illegible] O.

MATRIC [illegible]

JANUARY, 2015

DETERMINATION OF RADIONUCLIDES CONTENTS IN SOIL SAMPLES AROUND LAFARGE CEMENT INDUSTRY, SHAGAMU, OGUN STATE

By

OGUNBANJO, BUSAYO OLUWAKOREDE

MATRIC NO: 12/06/2176

DEPARTMENT OF SCIENCE LABORATORY TECHNOLOGY,
ABRAHAM ADESANYA POLYTECHNIC, IJEBU-IGBO,
OGUN STATE, NIGERIA.

IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF NATIONAL DIPLOMA (ND) IN SCIENCE LABORATORY TECHNOLOGY.

JANUARY, 2015.

CERTIFICATION

This is to certify that this project work was carried out by **OGUNBANJO Busayo Oluwakorede** with matriculation number **12/06/2176** in the Department of Science Laboratory Technology, School of Science, Abraham Adesanya Polytechnic, Ijebu-Igbo, Ogun State, Nigeria.

OKUSANYA A. A. (Mr.)

B Sc. (UNAAB) M Sc. (UI)

Project Supervisor / Departmental Coordinator

DEDICATION

This report work is dedicated to God, the Giver of knowledge and wisdom for sparing my life. The Author and the Finisher of my faith for making my academic pursuit 'a dream come true' and also giving me the grace to undertake and complete my National diploma with success. All glory belongs to Almighty God for the great revolutionalization He has done.

ACKNOWLEDGEMENT

I praise the God Almighty, the Provider of wisdom and knowledge, the Alpha and Omega for His grace and mercy and protection over me throughout my course of study.

I am greatly indebted to my able and hard working supervisor Mr. A.A. Okusanya, whose advice, correction and assistance in course of producing this project is inestimable.

My profound gratitude and special thanks to my parents Mr. and Mrs. J.O Ogunbanjo, for laying the foundation of my academic excellence in highly commendation, never will cease to appreciate their eagerness in provision of my essential needs all through my academic pursuits.

My acknowledgment can not be completed without the appreciation of my wonderful, reliable, peculiar loving, merciful elder sisters and brothers; Mrs Kolawole oluwabunmi, Mr. Oluwaseyi Kolawole, Ogunbanjo Bukonla, Ogunbanjo Kehinde, Oyenusi Olayinka and my younger sisters and brothers; Victoria and Victor Kolawole, for their prayers and supports throughout my National Diploma course, my prayer for them is that; anywhere they find themselves, they will receive favour and blessing of God.

My sincere thanks and gratitude equally go to all my lecturers for wealth of academic they have invested upon my life. May Almighty God bless you all abundantly.

My acknowledgement also extends to my great father in the Lord, Rev. M. O. Ademola for his prayers, counseling, and address in the word of God toward my educational programme

My sincere thanks go to my colleagues in Abraham Adesanya Polytechnic, Ijebu- igbo. May God be with them and bless them all.

To God be the glory, great things He has done.

ABSTRACT

Over the last few decades man has artificially produced several hundreds of radionuclide through industrialization and other man made activities. The presence and estimation of radionuclide contents of soil sample around cement manufacturing company was investigated in order to assess the radiation impact on the people living in the environment. Five (5) soil samples were analyzed for the presence of K- 40, U- 238, and Th – 232. In the five (5) soil samples, it was found that K-40 had 525.76 ± 5.2, 608.47 ± 3.3, 622.96 ± 4.9, 529.74 ± 5.3 and 529.74 ± 5.3 with the mean value 573.58 ± 5.3; U-238 was estimated to be 58.72 ± 2.5, 73.20 ± 2.2, 64.78 ± 2.6, 55.44± 2.8, 53.47 ± 2.2 and mean value of 61.12 ± 4.1 while Th-232 had 43.33 ± 6.5, 47.08 ± 2.8, 46.81 ± 1.9, 53.45 ± 4.2, 50.77 ± 7.3 with mean value of 48.29 ± 4.5. The measurements were taken in $Bqkg^{-1}$. K- 40 was at high value due to the presence of clays and limestone which contain significant amount of Potassium whereas U-238 and Th-232 occurred from the mining activities and other industrial processes in the cement industry.

TABLE OF CONTENTS

CHAPTER ONE

1.0 INTRODUCTION

Soil is the unconsolidated mineral or organic material on immediate surface of the earth that serves as a natural medium for the growth of land plants. It might have been subjected to effects of genetic or environmental factors such as climate (including water and temperature effects), macro and microorganisms, conditioned by relief, acting on parent material over a period of time.

A product – soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics. The chief concerns are radioactively contaminated dust or gaseous radionuclides of exposure depend on how the source is arranged whether the source is concentrated in one place or more evenly distributed.

Apart from the naturally occurring radionuclides, artificial radionuclides such as ^{137}Cs and ^{60}Co have been measured in soil and as well as in atmosphere aerosols. Plants can easily provide possible routes for these artificial radionuclides from the soil to human bodies. This can damage tissues, DNA or other cellular material; leading to cancer or other diseases and mutations called radiation poisoning.

1.1 PURPOSE OF THE STUDY

The radioactive fallouts may be taken up by crops via soil in which they were planted. Radioactive particles can lodge in the lungs and remain for a long time as longs as it remain and continues over a very long time. The emission of ^{137}Cs with half life of 30.2y pose a greater problem to the health of the human populace since this isotope will persist in the environment for many years and even in human bodies.

The purpose of this study is therefore to:

i. Identify the types of radionuclide present in soil samples of environment around cement manufacturing company

ii. Determine gamma activity concentration of ^{40}K, ^{238}U, and ^{232}Th in the soil samples.

iii. Determine the mean value of the gamma activity concentration of the radionuclides i.e. ^{40}K, ^{238}U, and ^{232}Th

1.2 STATEMENT OF THE PROBLEM

The main focus of this study is to identify the radionuclides contents present in the soil samples of environment around cement manufacturing company which causes damage of the tissues and other diseases like cancer and eventually death.

1.3 SIGNIFICANCE OF THE STUDY

This topic of discussion will be very useful and important to everyone that lives in the industrial area especially cement manufacturing environment; in protecting themselves from long term effect of radiation that might grow into nausea, muscle weakness, cancer and eventually to death in some cases.

1.4 SCOPE OF THE STUDY

The study centred on the radionuclides contents in soil samples of environment around Lafarge Cement Company at Shagamu, Ogun State, Nigeria.

1.5 DEFINITION OF TERMS

a) **Electromagnetic radiation:** Is a radiation that take the form of a self-propagating wave of electric and magnetic fields including such phenomena as radio waves and visible light.

b) **Excited state:** These are the arrangements that are so unstable that they have only transient existence before transforming into other states.

c) **Ground state:** This is the most stable arrangement of nucleus.

d) **Ionizing radiation:** Radiation that is of high enough energy to cause atoms to lose or gain electrons, rendering molecules, such as protein, incapable of functioning.

e) **Isotopes:** Are nuclides that belong to the same chemical properties and have the same atomic number but have different neutrons.

f) **Meta stable state:** These states are also unstable but they have vey long-life time before transforming into another state.

g) **Nuclear radiation:** Radiation especially ionizing radiation that emanates from nuclear processes such as radioactive decay.

h) **Radiation poisoning:** This is a form of damage to organ tissue due to excessive exposure to ionizing radiation.

i) **Radioactive decay:** This is the process by which an atomic nucleus of an unstable atom loses energy by emitting ionizing particles.

j) **Radio isotopes:** Is a measure of the tendency of the nucleus to decay or disintegrate

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 BASIC CONCEPT OF RADIOACTIVITY

Radioactivity is the process by which a nucleus of an unstable atom loses energy by emitting ionization radiation. The nuclear properties of an atom depend on the numbers of protons and neutron in the nucleus of an atom (both proton and neutrons are called nucleons).

True nuclear reaction indicates such nuclear changes in terms of mass number and atomic numbers for the reactants and the products. In addition such radioactive nuclei common decay by emission of a certain radiation for example; alpha, beta and gamma etc.

Hence, the radionuclide is experienced when an atom undergoes such nuclear change accompany emission of radiation. Nuclei that are stable never undergoing further reaction, these are naturally stable ^{23}Na, and ^{39}K, others, which are not stable are radioactive or radioisotopes.

The unstable isotopes are able to undergo radioactivity. Beside transformation it can also be brought about artificially through nuclear bombardment.

A radioactivity results when an atom with one type of nucleus, called the parents radioisotope (radionuclide), transforms into an atom with a nucleus I a different state, or with a nucleus containing a different number of protons and neutrons. The product is called the daughter nuclide.

2.2 EARLY HISTORY OF RADIOACTIVITY DISCOVERY

Wilhelm Conrad Roentgen (1845 – 1923): On November 8, 1895, at the University of Wurzburg, Roentgen was working in the laboratory when he noticed a strange fluorescence coming from a nearby table. Upon further observation he found that it originated from a partially evacuated Hittof Crookes tube, covered in opaque black paper which he was using to study cathode rays.

He concluded that the fluorescence, which penetrated the opaque black paper, must have been caused by rays. This phenomenon was later coined x-rays and through the phenomenon of x-rays is not the same as radioactivity but Roentgen opened the door for radioactive discovery. He received the first Nobel Prize in physics for his discovery of x-ray in 1901.

Antoine Henri Becquerel (1852 – 1908): Henri Becquerel, a French scientist learned of Roentgen's discovered of x-rays through the fluorescence that some materials produce. Using a method similar to that of Roentgen, Becquerel surrounded several radiographic plates with black paper and fluorescent salts, with the intention of further advancing the study of x-rays. He intended to place the concealed photographic paper in the sunlight and observe what transpired.

Unfortunately, he had to delay his experiment because the skies of Paris were overcast. He then placed the wrapped plates into a dark desk drawer.

After a few days, Becquerel returned to his experiment, un-wrapped the photographic paper and developed it, expecting only a light imprint from the salts. Instead, the salt left very distinct outlines in the photographic plate suggesting that the salts, regardless of lacking an energy source, continually fluoresced. What Becquerel had discovered was radioactivity.

Henri Becquerel received the Nobel Prize in physics for being the first to discover radioactivity as a phenomenon separate from that of x-ray and recorded the difference between the two.

Pierre Curie (1859 - 1906) and Marie Curie (1867 - 1934): Though, it was Henri Becquerel that discovered radioactivity, but it was Marie Curie who coined out the term. Using a device invented by her husband and brother, that measure extremely low electrical currents, Curie was able to note that uranium electrified the air around it.

Further investigation showed that the activity of uranium compounds depended upon the amount of uranium present and that radioactivity was not as a result of the interactions between the molecules, but rather came from the atom itself. Using Pitchblende and chalcolite, Curie found that Thorium was radioactive as well.

She later discovered two new radioactive elements; Radium and Polonium which took her several years since these elements are difficult to extract and extremely rare. Pierre and Marie Curie were awarded the Nobel Prize in Physics in 1903 for their work on radioactivity. Marie Curie became the first woman to be awarded Nobel Prize and the first person to obtain two Nobel Prizes when she won the Prize in Chemistry for the discovery of Radium and Polonium in 1911.

Ernest Rutherford (1871 - 1937): Ernest Rutherford was considered the father of nuclear physics; with his gold foil experiment he was able to unlock the mysteries of atomic structure. He received the Nobel Prize in Chemistry in 1908.

In 1909 at the University of Manchester, Rutherford was bombarding a piece of gold with Alpha particles and noted that although most of the particles went straight through the foil, one in every eight thousand was deflected back. It was as "if you fired a fifteen inch naval shell at a piece of tissue paper and the shell came back and hit you", Rutherford said.

He concluded that though an atom consists of mostly empty space, most of its mass is concentrated in a very small charged region known as the nucleus, while the electron buzz around on the outside. Rutherford was also able to observe that radioactive elements underwent a process of decay over time which varied from element to element. In 1919, he used Alpha particles to transmutate one element (oxygen) into another element (nitrogen).

2.3 NATURE OF RADIATION

Radiation is energy in the process of being transmitted. It may take such form as light or tiny particles much too small to see. Visible light received from the sun, and transmission signal for television and radio communications are all form of radiation that are common in our daily lives. These are all general referred to as non-ionizing radiation through at least some ultra-violet radiation is considered to be ionizing.

Radiation particularly associated with nuclear energy, along with x-ray is ionizing radiation which means that the radiation has sufficient energy to interact with matter, especially the human body, and produce ion, that is, it can eject an electron from an atom. X-rays from high voltage discharge were discovered in 1895 and radioactivity from the decay of particular isotope was discovered in 1896.

Many scientists then undertook study of these, and especially they are medical applications. This led to the identification of different kind of radiation from the decay of atomic nuclei and understanding of the nature of atoms. Neutrons were identified in 1932, and 1939 atom fission was discovered by irradiation uranium with neutrons. This led unto harnessing the energy released by fission.

2.4 TYPES OF RADIATION

The three most common kinds of radioactive decay could be emitted are alpha, beta and gamma as recognized by the earlier scientists e. g. Rutherford. The nuclear radiation arises from hundreds of different kind of unstable atom while many exist in nature.

Alpha (α) particles: These are radiations now know to be Helium nuclei ($^4{}_2He$). An α-particle is emitted with an energy in the range between 6-16x 10^{-13}J. It penetrates a few centimeter (5-7cm) of air or barrier of a few sheet of paper or a thin metal foil. **α**-particle causes ionization of some molecule as high as 10 MeV, hence it's rated to the highest ionizing power effect. It is positively charged and is defected toward the pole of the electrostatic field.

Beta (β) particles: This is a very energetic emission of radiation. β- Particles travel much faster and have a greater range compared with γ-radiation because they are lighter than γ-radiation. Therefore, the penetrating aluminium barrier is required to stop them. It is found deflected toward the positive pole of the electrostatics field.

Gamma (γ) radiations: This radiation consists of high energy photon or rays i.e. electromagnetic and of a very short length. γ -radiations are neutral neither deflected to the positive nor the negative field. It has highest penetrating power most often stopped by lead sheet and with least ionization effect.

simplifies the impact of radioactive waste, since most of the longer-head activity is usually eliminated through the kidney into the sanitary waste system.

Radioisotopes are much more widely used in industry than is generally recognized and represent a significant component in the man-made radiation environment. The principal application include industrial radiography, radiation gauging, and self-luminous material because most of these application entails the utilization or encapsulated sources, radiation explosive would be expected to occur mainly externally during shipment as transfer maintenance and disposal.

In the decade, radiation exposure in research and industrial application were roughly half these due to medical occupational exposure, hence their contribution to the direct population dose is substantial

In terms of subsequent movement through the environment such encapsulated sources obviously do not represent a significant source term they contribute to specific assessment areas such as transport and waste disposal, and occasionally cause alarm when one is lost or misdirected or even placed in a municipal garbage dump by mistake.

A special problem may exist for long-lived low- level sources that are widely distributed such as 241 an alpha source used in smoke detectors. Individually they pose no hazard and it would require a rather artificial scenario for them to be reconsolidating at a future time in sufficient amount to pose a problem.

Nuclear Explosions: For the last 50 years, everyone has been exposed from fall-out from nuclear weapons. Almost all is the result of atmospheric nuclear explosion carried out to test nuclear weapon. This testing reached two peaks first between 1954 and second, greater inn1961 and 1962.

In 1963, the three countries (USSR, United States, and United Kingdom) signed the partial test ban treaty, undertaking to test nuclear weapon in the atmosphere, and other space. Over next two decades France and China conducted series of much smaller tests, but they stopped too, after 1980.

2.6 UNITS OF RADIOACTIVITY

The international system of units (SI) unit of radioactive activity is the Becquerel (Bq) named in honour of the scientist Henri Becquerel. One Bq is the defined as one transformation.(or decay or disintegration) per second.

The unit of radioactivity is Curie formerly it was considered to be the number of disintegration occurring per second in gram of pure 226 Ra. However, various units have been introduced to report the intensity of Radium source, and the extent of their effect matter.

2.7 MEASUREMENTS OF RADIOCTIVITY

Henri Becquerel detected and measured radioactivity by exposing photographic film to a source of radiation, he gauge the intensity of the radiation by the degree of blanking of developing film. A blackening results from the redox, process as ordinary photography except that initial oxidation of the halide ions is caused by nuclear radiation Ge. The greater the extent of exposure to radiation; the darker the area of the development negativity.

The other devices commonly used are to detect and measure radiation include Geiger Muller counter, Scintillation Counter, Diffusion Closed chamber and Electroscope.

2.7.1 Geiger Muller Counter (Tube)

This is essentially a cylinder containing a low pressure (to have the higher volume of Av) and two electrodes. The operation of GM counter is based on the ionization of matter caused by radiation i.e. the radiation ionizes the atoms in the cylinder and hence allow a brief flow of current between the electrodes.

The ions and electron produces by the ionizing radiation permit conduction or electrical current. The basic design of GM counter consists of a metal tube filled with gas; the cylinder has a window made of a material that can be penetrated by the radiation.

2.7.2 Scintillation Counter

This makes use of the facts that certain substances notable ZnS gives flash of light often exposed to radiation. Such flashes are tiny experience when radiation striker a suitable phosphorus. The flashes are magnified electronically and counted to measure the amount of radiation.

A scintillation detector is a transducer that changes the kinetic energy of an ionizing particle into a flash of light. Crystals of organic and inorganic compounds exhibit this phenomenon.

The modern-day photomultiplier (PM) tube converts the light into an electrical pulse, which may be amplified, sorted by size and counted. Scintillation detectors are widely used for the detection and spectroscopy of gamma-rays and low energy beta-rays.

The detector most frequently used for gamma ray measurement is a sodium iodide crystal activated with thallium (NaI(TI)) optically coupled to the photomultiplier tube. This is because is its density (higher probability for photoelectric interaction as shown in equation 2.2 and high effective atomic number due to iodide).

Sodium iodide crystal is highly hygroscopic which result in the crystal deteriorating when expose to moisture. Therefore, the crystal is hermetically sealed in a light proof covering, usually a light metal, with an optical window through which it is then coupled to a photomultiplier tube.

2.7.3 Gamma ray Spectrometry

Gamma spectrometry is a technique of analyzing the energy of the gamma radiation emitted by a nuclide, to permit conclusion to be drawn on type of nuclide or nuclide mixture.

A gamma spectrometer consists of a detector, preamplifier and detector bias supply, pulse-height analyzer system, data readout capability and shielded sample enclosure. The pulse height analyzer system consists of a linear amplifier, an analogue-to-digital converter (ADC), memory storage and a logic control mechanism.

The logic control capabilities allow data storage in various modes and display or recall of data. All spectrometry measurements made to date use either NaI(TI) or germanium (Ge) detectors.

The fast electrons, which result from three processes, provide very useful information on energy and intensity of the incident gamma-rays. The system γ for the conversion of these fast electrons into flash of light, detected by optically matched electronic system to yield useful information concerning the primary γ -photon contrite scintillation γ -ray spectroscopic system.

The ability of the system to differentiate between radiation energies and hence, identify source in the environment is the basis of its application in this work.

2.8 APPLICATIONS OF RADIOACTIVITY

Radioisotopes have found extensive use in diagnosis and the therapy, and this has given rise to a rapidly growing filed called nuclear medicine. These radioactive isotopes have proven particularly effective as trace in certain diagnostic procedure.

As radioisotopes are identical chemically with stable isotope of the same element, they can take the place the latter in physiological process. Moreover, because of their radioactivity, they can be readily traced even in minute qualities detection device as a gamma ray spectrometer and proportional counter.

2.8.1 In Industry

Foremost among industrial application is power generation based on the released friction energy of uranium.

Gamma Sterilization: Large stable gamma irradiation is used to sterilise disposable medical supplies such as syringes gloves and other instruments that would be damage by heat sterilization. Large scale gamma irradiation of meat was allowed by the United States, and it is now a commonly used for food sterilization method. Small scale irradiates are used for blood transfusion and other medical sterilization procedure.

Gamma Ray Analysis: Gamma ray can be used to determine the ash content of coal, by bombarding stable element are represented in a material. The cause a fluorescence, the energy of fluorescence X-rays can help identity if any element are represented in a material. The intensity of that material, this process is commonly used in element processing plants.

2.8.2 At Home

Most people have radioactive material in their very own home, or at least we would hope so why? Because in most every smoke detector unit today there is a very small amount of Americium241 is present in the detector, while the in oxide from and it emits alpha particles and very low energy gamma rays. The alpha rays are absorbed in the detector while the non-harmful gamma rays are able to escape.

The alpha particle collides with oxygen and nitrogen in the air of the detector ionization chamber producing charged particles or ions .a small electric voltage runs across the chamber which is used to collect these ions and operate a small electric current between two electrodes when a smoke enter the chamber it absorbs the alpha particle disrupting the rate of ionization in the chamber where by turning off the electrical current which sets off the alarm.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 MATERIALS

Soil samples were collected from environment around Lafarge Cement Company at Shagamu, Ogun State, Nigeria.

3.2 METHODS

200 g of the soil sample was weighed into a plastic container with cover, and nylon cello tape was used to seal the container hermitically in order to avoid air entrance into the container. Then paper adhesive was used to label the containers containing samples as A, B, C, D, and E, while an empty container was labelled as background.

Therefore, the sample was allowed to rest for the minimum of 40 days in order for the sample to achieve homologous equilibrium. The sample was then analysed using Scintillation detector with a photo multiplier tube that employs sodium iodide crystal that is activated with Thallium (NaI-Tl). Also Gamma ray spectroscope would later be used for Radioactivity activity reading.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 RESULTS

The three primordial radionuclides ^{40}K, ^{238}U and ^{232}Th have been detected and measured in the five (5) soil samples. Table 4.1 present the results of radioactivity concentration in the soil samples.

Table 4.1 The Results of Radionuclides Contents of Soil Samples

S/N	K-40	U-238	Th-232
Background	115.12 ± 2.5	5.22 ± 1.5	3.42 ± 2.3
Sample A	525.76 ± 5.2	58.72± 2.5	43.33± 6.5
Sample B	608.47 ± 3.3	73.20± 2.2	47.08± 2.8
Sample C	622.96 ± 4.9	64.78± 2.6	46.81± 1.9
Sample D	529.74 ± 5.3	55.44± 2.8	53.45± 4.2
Sample E	580.95 ± 2.6	53.47± 2.2	50.77± 7.3
Mean value	573.58 ± 4.3	61.12 ± 4.1	48.29 ± 4.5

4.2 DISCUSSION

The five soil samples were analysed, and result were presented in Table 4.1 as shown above, Five (5) soil samples were analyzed for the presence of K- 40, U- 238, and Th – 232. In the five (5) soil samples, it was found that K-40 had 525.76 ± 5.2, 608.47 ± 3.3, 622.96 ± 4.9, 529.74 ± 5.3 and 529.74 ± 5.3 with the mean value 573.58 ± 5.3; U-238 was estimated to be 58.72 ± 2.5, 73.20 ± 2.2, 64.78 ± 2.6, 55.44 ± 2.8, 53.47 ± 2.2 and mean value of 61.12 ± 4.1

while Th-232 had 43.33 ± 6.5, 47.08 ± 2.8, 46.81 ± 1.9, 53.45 ± 4.2, 50.77 ± 7.3 with mean value of 48.29 ± 4.5Bqkg^{-1}.All the measurements were taken in Bqkg^{-}1. K-40 value was at high value due to the presence of clays and limestone which contain significant amount of Potassium whereas U-238 and Th-232 occurred from the mining activities and other industrial processes in the cement industry.

Generally, a comparison of the table 4.1 shows that there is highest radioactivity concentration of ^{40}K following ^{232}Th and ^{238}U the least.

This result could be attributed to the fact that potassium was released in the soil during the application of fertilizer to corps especially when applied at rates well above crop requirement. And also, minerals occurring in rocks such as Mica and fields par as they slowly release potassium into the soil slowly through weathering. The primary cause is over application of potassium in manure.

In one long term manure application study soil potassium levels in manure treatments increased by 35% in only 3 years (KarunaKara *et. al.*, 2001). When soil potassium concentration becomes elevated, plants will take up this potassium indirect proportion to its concentration in the soil, far beyond the amount required for normal growth of the crop. This process is often referred to as luxury consumption.

.CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This study provided primordial radionuclide in some tropical wood samples which were ^{40}K, ^{238}U, and ^{232}Th. From the result it shown that there was highest radioactivity concentration ^{40}K in the soils sample analyzed than thorium and uranium. Since ^{40}K is an essential biological element and its concentration in human tissue is under close metabolic (homeostatic) control, while ^{238}U, and ^{232}Th are harmful and can cause damage to body tissues, DNA or other cellular material; leading to cancer or other diseases and mutations called radiation poisoning.

5.2 RECOMMENDATION FOR FURTHER RESEARCH

The work was carried out within the limited scope of the academic research. Further work can be carry out by determining the close rates of the radionuclides. The numbers of soil samples can be increase and samples can be taken from different cement manufacturing companies.

REFERENCES

Agu, B. N. (1965) Observation of Radioactive Fallout in Nigeria up to 1961 Nature.Vol 205, pp 649-651.

Ajayi, I. R, Oresegun, M. O and Babalola, I. A (1996). Absorbed dose rates in air due to U, Th and K in a part of Southerwestern Nigeria. Nig. J. Physcs. Vol 8S, pp 38-40

Beck, H. L. (1980). Exposure rate Conversion factor for Radionuclides deposited on the Ground. USOPE – Report, EML-378.

Beck, H. L. and B. G. (2002) "Historical Overview pf Atmosphere Nuclear Weapons Testing and Estimates of Fallout in the Continental.United states" Health Physics Vol 82, No 5, pp. 591-608.

Beck, H. L and de Plague, G. (1968). The Radiation fiel in air due to Distributed Gamma-ray source in the Ground.USAEC – Report. HASL – 195.

Beck, H. L Condon, W. J. and Lowder, M. W. (1964). Spectrometric Techniques for Measuring Environment Gamma Radiation.USAEC – Report. HASL – 150.

Beck, H. L., De Campo, J. A and Gogolak, C. V (1972). In-situ Ge(Li) and Nal (Ti) Gamma-ray Spectrometry. USAEC –Report. HASL-258.

Birk, J. P. (1964). Theory of Scintillation counting. Pergamon Press London.

Bouville, A, simon, S. L., Miller, C. V., Beck, H .L., Anspaugh, L. R. and Beneth, B. G. (2002) "Estimates of Doses From Global Fallout". Health Physics Vol. 82, no 5, pp. 690-705.

Canberra Industries, Inc Series 10 plus Multi-channel Analyzer Operation Manual 54001 A/B.

Fari, I. P. and Sanni, A. O. (1992). Yearlon Variability of ^{222}Rn in a ground Water System in Nigeria. J. Afri Earth Sci. Vol. 15, pp.399-403.

Harley, N. M., Chittaporn, P., Roman, M. W. and Sylvester, J. (1991). Personal and Home ^{222}Rn and Gamma-ray Exposure Measured in 52 Swellings HealhPhys, Vol61, pp.737-744.

International Atomic Energy Agency (1983). Calibration Gamma Source, set No, -22 reference library (IAEA, Vienna)

International Atomic Energy Agency (1995) "The Safe use of Radiation Source" Training Course Series. No. 6.

Itsumusa, U. and Kousule, K. (1984). Feasibility Study on a Continous Environmental gamma ray monitoring using a NaI (TI) Scintillation Spectrometer. Health Phys. Vol. 3.3 pp 559.

Karunakara, N. Siddapa, K. Soamshekarappa, H. M., Narayana Y. (2001). 226R, 232Th and 40K Concentration in soil Samples of Kaiga of South-west Coast of India. Health physics 80: 470-476.

Lin, P. H., Chen C. J., Weng, C. C., and Lin, Y. M. (1986) "Measurement of Cosmic ray induced Ionizing Intensity" Radiation Protection Dosimetry Vol. 15, N0.2 pp. 185-189.

National Radiological Protection Board (1989) "Living with Radiation" NRPB.

Olomo, J. B., Akinloye, M. K. and Balogun, F. A. (1994). Distribution of gamma Emitting Natural Radionuclides in soils water around Nuclear Research establishments, Ile-Ife, Nigeria. Nucl.Instr.And meth A353, pp 553-557.

Oresugun, M. O. and Babalola, I. A. (1993). Environmental gamma Radiation level of Jobs. Nigerian. Nig. J.Sci. Vol 27, pp 263-268.

Thoman, I. M. G Botter-Jenson, L. Deme, S. Pernicaka F, and Seaz-Vetgera J.C. (1999) "Technical Recommendations on Measurement of External Environment".

United National Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). (1998). Ionizing Radiation: Sources and Biological Effect. New York UNSCEAR Report of the General Assembly.

WHO (1997) "Health and Environment in Sustainable Development – Five Years after the Earth Summit" World Health Organization, Geneva.

Zach, R. Hawkin, J. L., Mayoh, K. R. (1989). Transfer of Fallout Cesium and Natural Potassium-40 in boreal environment. J. Environ. Act., 10: 19-45.